MYANDAWEI
INDUSTRIAL ESTATE
COMPANY LIMITED

Final Report

Environmental and Social Impact Assessment of Dawei SEZ Initial Industrial Estate Project

Prepared By

IEC International Engineering Consultants in association with UAE UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

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ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ

သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန

ပြည်ထောင်စုဝန်ကြီးရုံး

စာအမှတ် (သစ်တော) ၃(၂)/၁၆(ဃ)(၃၆၂၀/၂၀၁၇)

ရက်စွဲ ၂၀၁၇ ခုနှစ် ၊ နိုဝင်ဘာလ ၉ ရက်

သို့

ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ

အကြောင်းအရာ။ **ထားဝယ်အထူးစီးပွားရေးဇုန် ကနဦးအဆင့်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် ကနဦးစက်မှုဇုန်စီမံကိန်း (Initial Industrial Estate Project) နှင့်ပတ်သက်၍ ပြန်လည်တင်ပြလာသော EIA အစီရင်ခံစာအပေါ် သဘောထားမှတ်ချက်ပြန်ကြားခြင်း**

ရည်ညွှန်းချက် ။ ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ၏ ၁-၆-၂၀၁၇ ရက်စွဲပါ စာအမှတ်၊ ထဝ-၁၆/DSEZ/၂၀၁၇

ထားဝယ်အထူးစီးပွားရေးဇုန်အတွင်း Myandawei Industrial Estate Co., Ltd. မှ အကောင်အထည်ဖော်ဆောင်ရွက်မည့် ကနဦးစက်မှုဇုန်နယ်မြေစီမံကိန်း(Initial Industrial Estate)၏ တတိယအကြိမ် ပြန်လည်တင်ပြလာသည့် ပတ်ဝန်းကျင်နှင့်လူမှုရေးထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ (Revised Environmental and Social Impact Assessment-ESIA) အား အစီရင်ခံစာစိစစ်သုံးသပ်ရေးအဖွဲ့၏ သဘောထားမှတ်ချက် အကြံပြုချက်များနှင့်အညီ ပြည်လည်တင်ပြလာသည့် ကိစ္စနှင့်ပတ်သက်၍ အဆိုပါအစီရင်ခံစာသည် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်းနှင့်ကိုက်ညီမှုရှိကြောင်း စိစစ်တွေ့ရှိရပြီး ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ၏ ဖော်ပြပါရှိချက်များအရ ကတိကဝတ်များအရ Myandawei Industrial Estate Co., Ltd. မှ ထားဝယ်စီးပွားရေးဇုန်ကနဦးအဆင့်တွင် ကနဦးစက်မှုဇုန်နယ်မြေ (Initial Industrial Estate) စီမံကိန်းကို အကောင်အထည်ဖော်ဆောင်ရွက်ရာတွင် အောက်ဖော်ပြပါအချက်များကို အလေးထားလိုက်နာဆောင်ရွက်ရန် လိုအပ်ပါကြောင်း ပြန်ကြားအပ်ပါသည်-

(က) စီမံကိန်းကြောင့် ထိခိုက်နိုင်သည့်ဒေသများ (Project Affected Households-PAHs) အတွက် ဝင်ငွေပြန်လည်ပေးရေးစီမံချက် (Income Restoration Programme-IRP)တွင်ပါဝင်သည့် ပြန်လည်နေရာချထားရေး စီမံချက်မူကြမ်း (Draft Resettlement Action Plan (2017) ကို နောက်ဆက်တွဲ(၉-၃)၌

14.11.2017

ဖော်ပြထားသည်ကို စိစစ်တွေ့ရှိရပြီး ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှု ကော်မတီ၏ စီမံကြီးကြပ်ကွပ်ကဲမှုဖြင့် စီမံကိန်းအကောင်အထည်ဖော်ဆောင် မည့်သူမှ အပြည့်အဝတိကျစွာ လိုက်နာအကောင်အထည်ဖော် ဆောင်ရွက်သွား ရန်နှင့် ထိုသို့ဆောင်ရွက်ရာတွင် စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်မည့် သူသည် မြေငှားရမ်းခြင်း သဘောတူညီချက် (Land Lease Agreement)ကို လက်မှတ်ရေးထိုးပြီးပါက PAHs များအတွက် ဝင်ငွေပြန်လည်ထူထောင်ရေး အထောက်အပံ့များကို ကူညီထောက်ပံ့သွားရမည်ဖြစ်ကြောင်း စိစစ်တွေ့ရှိရပါသည်။ သို့ဖြစ်ပါ၍ စီမံကိန်းအကောင်အထည်ဆောင်ရွက်မည့်သူသည် PAHs များအတွက် မြေယာလျော်ကြေးနှင့် ဝင်ငွေဆုံးရှုံးရခြင်းအတွက် အထောက်အပံ့ပေးခြင်းဆိုင် ရာ သဘောတူညီချက်အရ ပြန်လည်နေရာချထားရေးလုပ်ငန်းများအားလုံးနှင့် PAHs များအသုံးပြုလျက်ရှိသည့် အများပိုင်(ပြည်သူပိုင်) အဆောက်အဦများ ဖြစ်သည့် မူလတန်းကျောင်း(၃)ကျောင်း၊ အထက်တန်းကျောင်း(၃)ကျောင်း၊ ဘုန်းကြီးကျောင်း(၆)ကျောင်း၊ ရုံး(၄)ရုံးနှင့် သုသာန်(၅)ခုကိုလည်း ပြီးစီးအောင် ဆောင်ရွက်ပြီးနောက် အပြီးသတ်အစီရင်ခံစာတွင် ဖော်ပြထားသည့် ဇရိယာ အတွင်း တည်ဆောက်ရေးလုပ်ငန်းများကို ဆောင်ရွက်ရန်၊

(ခ) စီမံကိန်းကို အကောင်အထည်ဖော်ဆောင်ရွက်မည့် Myandawei Industrial Estate Co., Ltd. မှ ထားဝယ်အထူးစီးပွားရေးဇုန်ကနဦးအဆင့်တွင် အကောင် အထည်ဖော်ဆောင်ရွက်မည့် ကနဦးစက်မှုဇုန်ဇရိယာအတွင်း ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးဆိုင်ရာကိစ္စရပ်များ ဆောင်ရွက်ရန်အတွက် Environmental and Safety Health Section ဖွဲ့စည်းထားရှိမည်ဖြစ်ကြောင်းနှင့် တာဝန်ယူဆောင်ရွက် မည့်ဝန်ထမ်းများ၏ အခန်းကဏ္ဍနှင့်တာဝန်ဝတ္တရားများ (Role and Respons -ibilities) ကို ဖော်ပြထားပါသဖြင့် စနစ်တကျဖွဲ့စည်းဆောင်ရွက်ရန်၊

(ဂ) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်(Environmental Management Plan-EMP)သည် ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံကိန်း၏ ကနဦးအဆင့်တွင် စက်မှုဇုန် ဇရိယာအတွင်း လာရောက်ရင်းနှီးမြှုပ်နှံမည့် လုပ်ငန်းအမျိုးအစားနှင့် ပမာဏ တို့ကို လက်ရှိအချိန်တွင် တိတိကျကျ မသိရှိနိုင်မှုကြောင့် အခြေခံအဆောက်အဦ များအပေါ်တွင်သာ အခြေခံ၍ ထည့်သွင်းစဉ်းစားထားကြောင်း စိစစ်တွေ့ရှိရပြီး မမျှော်လင့်သော သဘာဝဘေးအန္တရာယ်များ ကျရောက်ခြင်းကြောင့်သော်လည်း ကောင်း၊ ရင်းနှီးမြှုပ်နှံ လုပ်ငန်းအမျိုးအစားများကြောင့်သော်လည်းကောင်း ပတ်ဝန်းကျင်နှင့်လူမှုရေးထိခိုက်မှုအခြေအနေ ပြောင်းလဲနိုင်သဖြင့် ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှုအစီ အစဉ်ကို လုပ်ငန်းအဆင့်တိုင်းတွင် လိုအပ်သကဲ့သို့ ပြန်လည်

ပြင်ဆင်ရေးဆွဲ၍ ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီနှင့် ဤဝန်ကြီး ဌာနသို့ တင်ပြသွားရန်၊

(ဃ) Final EIA Report တွင် မီးဘေးလုံခြုံရေး၊ ဓာတုဗေဒပစ္စည်းများအန္တရာယ်မှ လုံခြုံရေး၊ ရေကြီးခြင်း၊ ငလျင်လှုပ်ခြင်းစသည့် သဘာဝဘေးအန္တရာယ်များ ကျရောက်ပါက အရေးပေါ်တုံ့ပြန်မည့်အစီအစဉ်များနှင့်ပတ်သက်၍ Emergency Response Plan ကို ရေးဆွဲဖော်ပြထားသော်လည်း ဖြစ်ပေါ်ပြောင်းလဲနေသည့် သဘာဝအခြေအနေပေါ်မူတည်၍ လိုအပ်သလိုပြန်လည်ပြင်ဆင်ရေးဆွဲ၍ စီမံခန့်ခွဲမှုကော်မတီနှင့် ဤဝန်ကြီးဌာနသို့ တင်ပြသွားရန်၊

(င) စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်ရာတွင် Community Support Prog -ramme အတွက် ပြည်သူ့ကျန်းမာရေးစောင့်ရှောက်မှု၊ ဒေသခံများအတွက် လမ်း၊ လျှပ်စစ်မီး၊ရေရရှိမှုစသည့် အခြေခံအဆောက်အဦလိုအပ်ချက်များနှင့်ဘေးအန္တရာယ်ကင်းရှင်းရေး ဆောင်ရွက်ချက်များနှင့်ပတ်သက်၍ အကောင်အထည်ဖော်ဆောင်ရွက်မှု၏ ရလဒ်များကို စောင့်ကြပ်ကြည့်ရှုခြင်းအစီရင်ခံစာ (Monitoring Report)တွင် ထည့်သွင်းဖော်ပြ၍ စီမံကိန်းတည်ဆောက်သည့်ကာလ၊ လုပ်ငန်းလည်ပတ်သည့်ကာလနှင့် ပိတ်သိမ်းမည့်ကာလတို့အတွင်း ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီနှင့် ဤဝန်ကြီးဌာနသို့ တင်ပြသွားရန်၊

(စ) ထားဝယ်အထူးစီးပွားရေးဇုန်၏ စက်မှုဇုန်ဧရိယာအတွင်း ပတ်ဝန်းကျင်နှင့် လူမှုရေးအခြေအနေ တိုးတက်ကောင်းမွန်ရေးအတွက် လူထုနှင့်စဉ်ဆက်မပြတ် ဆွေးနွေးညှိနှိုင်းမှုများဆောင်ရွက်ခြင်း၊ ဆွေးနွေးညှိနှိုင်းမှုများအပေါ် အကောင်အထည်ဖော်ဆောင်ရွက်မှု၊ ရရှိသည့်အကျိုးရလဒ်များကို Monitoring Report တွင် ထည့်သွင်းဖော်ပြ၍ ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီနှင့် ဤဝန်ကြီးဌာနသို့ တင်ပြသွားရန်၊

(ဆ) စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်မည့်သူသည် စီမံကိန်း၏ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာတွင်ပါဝင်သည့် လိုက်နာရန်ကတိကဝတ်များအတိုင်း လိုက်နာဆောင်ရွက်သွားရမည့်အပြင် အကြိုတည်ဆောက်ရေးကာလ၊ တည်ဆောက်ရေးကာလ၊ လုပ်ငန်းလည်ပတ်စဉ်ကာလနှင့် လုပ်ငန်းပိတ်သိမ်းမည့်ကာလများအတွင်း ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့် လူမှုရေးထိခိုက်နိုင်မှုအခြေအနေများကို စောင့်ကြပ်ကြည့်ရှုစစ်ဆေးခြင်း၊ သက်ဆိုင်ရာဌာနများသို့ အစီရင်ခံတင်ပြခြင်းတို့ကို မပျက်မကွက်ဆောင်ရွက်သွားရမည့်အပြင် စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်သူနှင့် ပြည်သူလူထုအကြား ပွင့်လင်းမြင်သာမှုရှိစေရေးအတွက် ပတ်ဝန်းကျင်နှင့်လူမှုရေးကိစ္စရပ်များ ဆောင်ရွက်ရာတွင် စဉ်ဆက်မပြတ်

ဆွေးနွေးညှိနှိုင်းမှုများ ဆောင်ရွက်ရန်နှင့် ဆောင်ရွက်မှုရလဒ်များကို စောင့်ကြပ်ကြည့်ရှုသည့်အစီရင်ခံစာတွင် ထည့်သွင်း၍ ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီနှင့် ဤဝန်ကြီးဌာနသို့ တင်ပြရန်၊

(ဆ) စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်သူသည် ဤဝန်ကြီးဌာနမှ ထုတ်ပြန်ထားသည့် တည်ဆဲပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ၊ နည်းဥပဒေနှင့်ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်းကိုလည်းကောင်း၊ ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ၏ ညွှန်ကြားချက်များ/စည်းမျဉ်းစည်းကမ်းများနှင့် ဆက်လက်ထုတ်ပြန်မည့် သက်ဆိုင်ရာလုပ်ထုံးလုပ်နည်းများကို လိုက်နာဆောင်ရွက်သွားရန်၊

(ဇ) စီမံကိန်းအဆိုပြုသူသည် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်၊ စီမံကိန်း၏ ကတိကဝတ်အားလုံးနှင့် စည်းကမ်းချက်များကို အပြည့်အဝအကောင်အထည်ဖော်ရမည့်အပြင် ယင်း၏ကိုယ်စား စီမံကိန်းကို ဆောင်ရွက်ပေးသူကန်ထရိုက်တာနှင့် လက်ခွဲဆောင်ရွက်ပေးသူ ဆပ်ကန်ထရိုက်တာများအားလုံးက စီမံကိန်းအတွက် လုပ်ငန်းများဆောင်ရွက်ရာတွင် သက်ဆိုင်ရာဥပဒေ၊ နည်းဥပဒေများ၊ လုပ်ထုံးလုပ်နည်း၊ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် စည်းကမ်းချက်များအားလုံးကို အပြည့်အဝလိုက်နာဆောင်ရွက်စေရန်၊

(ဈ) စီမံကိန်းအဆိုပြုသူသည် ပတ်ဝန်းကျင်၊ လူမှုရေးနှင့်ကျန်းမာရေးဆိုင်ရာ ထိခိုက်နိုင်မှုများကို လျော့ချမည့်နည်းလမ်းများ၊ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်များ၊ ၎င်းနှင့်ဆက်စပ်သည့် အစီအစဉ်ခွဲများ၊ စောင့်ကြပ်ကြည့်ရှုမည့်နည်းလမ်းများ အပါအဝင်ဆောင်ရွက်ရမည့် ကိစ္စရပ်များအားလုံးကို အတည်ပြုထားသည့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာတွင် ဖော်ပြထားသည့်အတိုင်း လိုက်နာအကောင်အထည်ဖော်ဆောင်ရွက်ရန်၊

(ည) စီမံကိန်းအဆိုပြုသူသည် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်နှင့် အစီအစဉ်ခွဲများ၊ စောင့်ကြပ်ကြည့်ရှုမည့်အစီအစဉ်များအတွက် လုံလောက်သည့် ရန်ပုံငွေထားရှိသုံးစွဲရန်နှင့် ၎င်းအစီအစဉ်များကို အကောင်အထည်ဖော်ဆောင်ရွက်မည့်အဖွဲ့အစည်းများ ဖွဲ့စည်းဆောင်ရွက်ရန်၊

(ဋ) စီမံကိန်းအဆိုပြုသူသည် အတည်ပြုထားသည့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာကို အများပြည်သူများသိရှိနိုင်ရေး ထုတ်ဖော်ကြေညာရန်၊

(ဌ) ဒေသခံပြည်သူများ (stakeholders) နှင့် စဉ်ဆက်မပြတ်တွေ့ဆုံဆွေးနွေးပြီး ၎င်းတို့၏ အကြံပြုချက်နှင့် လိုလားချက်များအား အလေးထားပေါင်းစပ်ဆောင်ရွက်ရန်၊

(ဃ) စီမံကိန်းအဆိုပြုသူသည် အောက်ဖော်ပြပါ စံချိန်စံညွှန်းပါ ပြဋ္ဌာန်းချက်များ အတိုင်း လိုက်နာဆောင်ရွက်ရန်၊

- အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေး (ထုတ်လွှတ်မှု)လမ်းညွှန်ချက်များ World Health Organization (WHO)
- U. S Environmental Protection Agency (EPA)
- World Bank
- International Finance Corporation(IFC)
- IFC Performance Standards

(ဏ) စီမံကိန်းပိုင်ရှင်မှ ကနဦးစက်မှုဇုန်စီမံကိန်းအတွင်း အကောင်အထည်ဖော်ဆောင်ရွက်မည့်လုပ်ငန်းများနှင့်ပတ်သက်၍ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း(၂၀၁၅)၊ နောက်ဆက်တွဲ(က)ပါ ပြဋ္ဌာန်းသတ်မှတ်ချက်များ နှင့်အညီ EIA၊ IEE၊ EMP ရေးဆွဲဆောင်ရွက်စေရန်၊

(တ) ပတ်ဝန်းကျင်စောင့်ကြပ်ကြည့်ရှုသည့် အစီရင်ခံစာကို(၆)လတစ်ကြိမ် သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ တင်ပြရန်နှင့် အများပြည်သူ သိရှိနိုင်စေရေး ထုတ်ဖော်ကြေညာရန်၊

(ထ) အတည်ပြုပြီး အစီရင်ခံစာစာအုပ်ကို ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၊ တနင်္သာရီတိုင်းဒေသကြီးသို့ ပေးပို့ပါရန်။

၀၄/၁၁/၂၀၁၇

ပြည်ထောင်စုဝန်ကြီး(ကိုယ်စား)
(ဝင်းဇော်၊ဒုတိယအမြဲတမ်းအတွင်းဝန်)

မိတ္တူကို

ညွှန်ကြားရေးမှူးချုပ်
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The Republic of the Union of Myanmar

Ministry of Natural Resources and Environmental Conservation

The Union Minister's Office

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Letter No. (thitaw) 3 (2)/16 (D) (3620/2017)

Date: 9th November 2017

To

Dawei Special Economic Zone Management Committee

Subject: Comments on re-submitted EIA Report of Initial Industrial Estate Project to be implemented in initial stage of Dawei Special Economic Zone

Reference: Letter of Dawei Special Economic Zone Management Committee dated 1st June 2017, Letter No. DW-16/DSEZ/2017

In the matter of Revised Environmental and Social Impact Assessment-ESIA of the Initial Industrial Estate Project submitted in compliance with the recommendations made by the Vetting Team, to be implemented in Dawei Special Economic Zone, the Ministry finds that the said report is in compliance with the Environmental Impact Assessment Procedure and according to the statements and commitments in the Environmental Impact Assessment Report, and the Ministry would like to stress the following important facts to comply with the following pursuant to undertakings contained therein, Myandawei Industrial Estate Co., Ltd:

(a) Draft resettlement action plan (2017) contained in Income Restoration Programme-IRP for Projected Affected Households-PAHs is annexed as 9-3 which is to be followed in strict compliance by the project developer under supervision of Dawei Special Economic Zone Management Committee. In so doing, project developer, if it has signed Land Lease Agreement, will have to provide PAHs with Income Restoration Programme. As such, the project developer, according to the agreement for compensation for land and support of income loss, shall complete construction of public establishments currently accessible to PAHs, three primary schools, three high schools, six monasteries, four offices and five cemeteries in addition to resettlement action plan, and continue with construction activities in the area stated in the final report.

(b) The project developer, Myandawei Industrial Estate Co., Ltd. shall form Environmental and Safety Health Section in order to carry out Environmental Conservation and Safety Health Section in the initial industrial estate to be established in initial stage in Dawei Special Economic Zone by and to organise it in systematic manner as the role and responsibilities are prescribed.

(c) It is found that only the infrastructure is considered in the Environmental Management Plan -EMP as the type and number of the investments to be invested in the industrial zone area in the initial stage cannot be known in details, and since the environmental and social impacts may be affected due to unforeseeable dangers or type of investment, the Environmental Management Plan - EMP shall be revised as necessary at every stage and submitted the same to Dawei Special Economic Zone Management Committee and the Ministry.

(d) The project developer shall revise the final EIA report depending on the changing conditions and submit the same to the Management Committee and the Ministry in addition to fire hazard, safety from chemical elements, flood and earthquake etc. addressed in the emergency response plan.

(e) In developing the project, performance results of basic infrastructure facilities such as public health programme, road for the locals, electricity, water supply etc. and safety programme shall be included in the monitoring report and during project construction period, operation period and closing period, and such report shall be submitted to Dawei Special Economic Zone Management Committee and the Ministry.

(f) In the industrial zone of Dawei Special Economic Zone, the developer shall conduct public consultation and negotiate with the local community continuously for improvement of environmental and social conditions, and include the realisation, and outcomes in monitoring report and submit the same to Dawei Industrial Zone Management Committee and the Ministry.

(g) The project developer shall comply with the undertakings contained in the Environmental Impact Assessment Report. In addition, during pre-construction period, construction period, operation period and closing period, it shall carry out without fail monitoring and scrutinising environmental conservation and social impacts, and reporting to relevant departments. Besides, in carrying out activities relating to environment and community, the developer shall continuously conduct public consultation and negotiate for transparency and to include the results in the monitoring report and submit the same to Dawei Special Economic Zone Management Committee and the Ministry.

(h) The developer shall comply with existing Environmental Conservation Law, regulations and the Environmental Impact Assessment Procedure issued by the Ministry, directives/regulations and the relevant procedures to be issued by Dawei Special Economic Zone Management Committee.

(i) The developer shall fully realise and implement environmental management programme, all undertakings of the project, and terms and conditions. The proponent shall ensure all developer, contractors and sub-contractors shall fully comply with relevant law, regulations, procedures, Environmental Management Plan and all terms and conditions.

(j) The developer shall implement in compliance with what all commitments in the environmental impact assessment report to be carried out including all methods to reduce environmental, social and health impacts, environmental management programmes, sub-programmes related to them, and method for monitoring.

(k) The developer shall keep sufficient fund for monitoring programmes and sub-programs of environmental management and form the committees to implement them.

(l) The developer shall disclose the environmental impact assessment report.

(m) The developer shall continuously discuss with the stakeholders and incorporate their recommendations in the plan.

(n) The developer shall comply with the standards contained in the following provisions:

- National Environmental Quality (Emission) Guidance
- World Health Organization (WHO)

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- International Finance Corporation (IFC)
- IFC Performance Standards

(o) Regarding the activities to be implemented by developer in the initial industrial project, EIA, IEE, EMP shall be developed in accordance with the provisions contained in the Environmental Impact Assessment Procedure (2015) and annexure (A) and comply with them.

(p) The environmental monitoring report shall be published once every six months and submitted the same to the Ministry of Natural Resource and Environmental Conservation and publish for public awareness.

(q) The approved report shall be submitted to the Department of Environmental Conservation, Taninthary Region.

Sd/

On behalf of The Union Minister

(Win Zaw, Deputy Permanent Secretary)

CC
Director General
Department of Environmental Conservation

CERTIFIED TRUE & CORRECT TRANSLATION
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MYANDAWEI INDUSTRIAL ESTATE COMPANY LIMITED

MYANDAWEI INDUSTRIAL ESTATE COMPANY LIMITED

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Reference No. MIE 18/2017

29th May 2017

Director

Environmental Conservation Department of the Ministry of Natural Resources and Environmental Conservation ("ECD-MONREC")

Subject: Submission of the Revised Draft Final Environmental and Social Impact Assessment ("ESIA") Reports addressing comments from ECD

Attachments:

1. Revised Draft Final report and CD – Environmental and Social Impact Assessment of the Initial Industrial Estate Project
2. Revised Draft Final report and CD – Environmental and Social Impact Assessment of the Two-Lane Road Project
3. Revised Draft Final report and CD – Environmental and Social Impact Assessment of the Small Port Project
4. Revised Draft Final report and CD – Environmental and Social Impact Assessment of the Water Treatment Plant for the Small Water Reservoir Project

Your Excellency,

Myandawei Industrial Estate Company Limited ("MIE") is pleased to attach herewith the updated the reports for the proposed development of the Dawei Initial Industrial Estate Development Project. MIE and EIA Consultants have addressed comments received from ECD on the 02 February 2017 and the 08 February 2017 on the previous version of the reports.

Your Excellency's kind acknowledgement and approval on the revised draft final EIA reports as attached herein will be greatly appreciated.

Sincerely Yours,

MYANDAWEI INDUSTRIAL ESTATE COMPANY LIMITED

Somchet Thinaphong
Managing Director
Myandawei Industrial Estate Company Limited

CC: Dawei Special Economic Zone Management Committee ("DSEZ MC"), Nay Pyi Taw, Republic of the Union of Myanmar

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန
ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန
ရုံးအမှတ် (၅၃)၊နေပြည်တော်

စာအမှတ်၊ အီးအိုင်အေ-၂/၇ (၁၃၂/၂၀၁၇)
ရက်စွဲ ၊ ၂၀၁၇ ခုနှစ် ဇန်နဝါရီလ **၃၀**ရက်

သို့

ဥက္ကဋ္ဌ
ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ

အကြောင်းအရာ။ **Myandawei Industrial Estate Co., Ltd. မှ ထားဝယ်အထူးစီးပွားရေးဇုန် ကနဦးအဆင့်တွင် အကောင်အထည်ဖော် ဆောင်ရွက်မည့် ကနဦးစက်မှုဇုန် စီမံကိန်း (Initial Industrial Estate Project) နှင့်ပတ်သက်၍ ပြန်လည်တင်ပြ လာသော နယ်ပယ်အတိုင်းအတာ သတ်မှတ်ခြင်းအစီရင်ခံစာ (Scoping Report) အပေါ် အတည်ပြုပြန်ကြားခြင်း**

ရည်ညွှန်းချက်။
(၁) ထားဝယ်အထူးစီးပွားရေးဇုန် စီမံခန့်ခွဲမှုကော်မတီ၏ ၃၀-၁၁-၂၀၁၅ ရက်စွဲပါ စာအမှတ်၊ထဝ-၁/DSEZ/၂၀၁၅ (၂၂၃)
(၂) ဤဝန်ကြီးဌာန၏၁၄-၁၂-၂၀၁၅ရက်စွဲပါစာအမှတ်၊၃(၂)/ ၁၆ (ဃ) (၆)/ (၃၅၇၆/၂၀၁၅)
(၃) ထားဝယ်အထူးစီးပွားရေးဇုန် စီမံခန့်ခွဲမှုကော်မတီ၏ ၁-၂-၂၀၁၆ ရက်စွဲပါ စာအမှတ်၊ထဝ-၁/DSEZ-၄/၂၀၁၆ (၁၃၃)
(၄) သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန၊ ပြည်ထောင်စုဝန်ကြီးရုံး၏ ၂၇-၁-၂၀၁၇ ရက်စွဲပါစာအမှတ်၊ (သစ်တော) ၃/၁၆(ဃ) (၂၈၅/၂၀၁၇)

၁။ အကြောင်းအရာပါကိစ္စနှင့်ပတ်သက်၍ ထားဝယ်အထူးစီးပွားရေးဇုန်အတွင်း Myandawei Industrial Estate Co., Ltd. မှ အကောင်အထည်ဖော်ဆောင်ရွက်မည့် ကနဦးစက်မှုဇုန်နယ်မြေ စီမံကိန်း (Initial Industrial Estate) နှင့်ပတ်သက်သော Scoping အစီရင်ခံစာအား ပြန်လည်တင်ပြလာသည့် Scoping အစီရင်ခံစာအား ထားဝယ်အထူးစီးပွားရေးဇုန် စီမံခန့်ခွဲမှုကော်မတီမှ ရည်ညွှန်း (၁) ပါစာဖြင့် တင်ပြခဲ့ပြီး အဆိုပါတင်ပြမှုအပေါ် သယံဇာတနှင့် သဘာဝ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနမှ ရည်ညွှန်း (၂) ပါစာဖြင့် သဘောထားမှတ်ချက်ပြန်ကြားခဲ့ရာ ပြန်လည်ပြုစုရေးဆွဲထားသည့် Scoping အစီရင်ခံစာအား ထားဝယ်အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှု ကော်မတီမှ ရည်ညွှန်း (၃) ပါစာဖြင့် ပြန်လည်ပေးပို့လာပါသည်။

၂။ ပြန်လည်တင်ပြလာသည့် ကနဦးစက်မှုဇုန်နယ်မြေ စီမံကိန်း (Initial Industrial Estate) ၏ Scoping အစီရင်ခံစာသည် သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနမှ ပြန်ကြားခဲ့သည့် သဘောထားမှတ်ချက်နှင့်အညီ ပြင်ဆင်ဖြည့်စွက်ဖော်ပြထားသည်ကို စိစစ်တွေ့ရှိရသဖြင့်

အတည်ပြုပြန်ကြားခွင့်ပြုပါရန် ပြည်ထောင်စုဝန်ကြီးရုံးသို့တင်ပြခဲ့ရာ အတည်ပြုပြန်ကြားရန် ရည်ညွှန်း (၄) ပါစာဖြင့် ညွှန်ကြားလာပါသည်။

၃။ သို့ဖြစ်ပါ၍ ထားဝယ်အထူးစီးပွားရေးဇုန်အတွင်း အကောင်အထည်ဖော်ဆောင်ရွက်မည့် ကနဦး စက်မှုဇုန်နယ်မြေစီမံကိန်း (Initial Industrial Estate) နှင့်ပတ်သက်၍ ပြန်လည်တင်ပြလာသော Scoping အစီရင်ခံစာသည် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်းနှင့်ကိုက်ညီမှု ရှိသဖြင့် အတည်ပြုပါကြောင်းနှင့် အောက်ဖော်ပြပါအချက်များကို အလေးထားလိုက်နာ ဆောင်ရွက်ရန် လိုအပ်ပါကြောင်း ပြန်ကြားအပ်ပါသည်-

(က) မြန်မာဘာသာဖြင့် ပြန်ဆိုထားသော အကျဉ်းချုပ်အစီရင်ခံစာ ထည့်သွင်းဖော်ပြရန်၊

(ခ) စီမံကိန်းလုပ်ငန်းဆောင်ရွက်နေစဉ် တွေ့ကြုံလာသည့် ကိစ္စရပ်များအပေါ် မူတည်၍ သက်ဆိုင်ရာကဏ္ဍအလိုက် လိုအပ်သည့် ဥပဒေ၊ နည်းဥပဒေ၊ လုပ်ထုံးလုပ်နည်း၊ ညွှန်ကြားချက်များကိုထပ်မံဖြည့်စွက်ပြီး စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်သူမှ လိုက်နာမည်ဖြစ်ကြောင်း ကတိကဝတ်အား ထည့်သွင်းဖော်ပြရန်၊

(ဂ) Scoping အစီရင်ခံစာနှင့် အဆိုပြု TOR နှင့်အညီ အကောင်အထည်ဖော် ဆောင်ရွက်ရန်၊

(ဃ) EIA Procedure ပါသတ်မှတ်ချက်များအရ Scoping အစီရင်ခံစာနှင့် အဆိုပြု TOR နှင့်အညီ EIA အစီရင်ခံစာအား သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဝန်ကြီးဌာနသို့ တင်ပြရန်။

20.3.2017

(လှမောင်သိန်း)

ညွှန်ကြားရေးမှူးချုပ်

မိတ္တူကို

ပြည်ထောင်စုဝန်ကြီးရုံး၊ သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန

ရုံးလက်ခံ၊ မျှောစာတွဲ၊ အမှုတွဲချုပ်

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန
ပြည်ထောင်စုဝန်ကြီးရုံး

စာအမှတ် (သစ်တော) ၃/၁၆(ဃ)(၂၈၉ /၂၀၁၇)
ရက်စွဲ ၂၀၁၇ ခုနှစ်၊ ဇန်နဝါရီလ ၂၇ ရက်

အကြောင်းအရာ။ **ထားဝယ်အထူးစီးပွားရေးဇုန် ကနဦးအဆင့်တွင် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် ကနဦးစက်မှုဇုန်စီမံကိန်း (Initial Industrial Estate Project) နှင့်ပတ်သက်၍ ပြန်လည်ပြင်ဆင်တင်ပြလာသော Scoping Report နှင့် Terms of Reference များအပေါ် အတည်ပြုပြန်ကြားခွင့်ပြုရန် တင်ပြလာခြင်းကိစ္စ**

ရည်ညွှန်းချက်။ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၏ ၂၀-၁-၂၀၁၇ ရက်စွဲပါ စာအမှတ်၊ အီးအိုင်အေ-၂/၇(၀၇၁/၂၀၁၇)

၁။ ထားဝယ်အထူးစီးပွားရေးဇုန်အတွင်း Myandawei Industrial Estate Co., Ltd. မှ အကောင်အထည်ဖော်ဆောင်ရွက်မည့် ကနဦးစက်မှုဇုန်စီမံကိန်း(Initial Industrial Estate Project) နှင့်ပတ်သက်၍ ပြန်လည်ပြင်ဆင်တင်ပြလာသော Scoping Report နှင့် Terms of Reference (TOR)သည် ဤဝန်ကြီးဌာန၏ သဘောထားမှတ်ချက်နှင့်အညီ ပြင်ဆင်ဖော်ပြထားကြောင်း စိစစ်တွေ့ရှိရပါသဖြင့် အတည်ပြုနိုင်ကြောင်းနှင့် အတည်ပြုကြောင်း ပြန်ကြားရာတွင် လိုက်နာဆောင်ရွက်ရမည့်အချက်များ ထည့်သွင်းဖော်ပြ၍ သက်ဆိုင်ရာသို့ ဆက်လက်ပြန်ကြားနိုင်ရေးအတွက် ရည်ညွှန်းပါစာဖြင့် တင်ပြလာခြင်းအပေါ် ပြည်ထောင်စုဝန်ကြီးက **"ECD ပြန်ကြားရန်"** ဟု မိန့်မှတ်ချက်ပြုထားပါသည်။

၂။ သို့ဖြစ်ပါ၍ အထက်ပါပြည်ထောင်စုဝန်ကြီး၏ မိန့်မှတ်ချက်နှင့်အညီ သက်ဆိုင်ရာသို့ ပြန်ကြားနိုင်ရေးအတွက် လိုအပ်သလိုဆက်လက်ဆောင်ရွက်နိုင်ပါရန် အကြောင်းကြားအပ်ပါသည်။

၂၇/၁/၂၀၁၇

ပြည်ထောင်စုဝန်ကြီး(ကိုယ်စား)
(ဝင်းဇော်၊ ဒုတိယအမြဲတမ်းအတွင်းဝန်)

ညွှန်ကြားရေးမှူးချုပ်
<u>ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန</u>

The Republic of the Union of Myanmar
Ministry of Natural Resources and Environmental Conservation
Environmental Conservation Department
Office No (53), Nay Pyi Taw

Letter No – EIA- 2/7 (132/ 2017)

Date – January 30th, 2017

Chairman
DSEZ Management Committee

Subject: **Matter about the replying of confirmation for Scoping Report of re-submission in accordance with Initial Industrial Estate Project which plan to implement at DSEZ Initial Phase, by Myandawei Industrial Estate Co. Ltd**

Reference: **1. Letter No. Hta Wa – 1/ DSEZ/ 2015 (223), dated on 30-11-2015 by DSEZ Management Committee**

2. Letter No. 3(2)/ 16 (D) (6)/ (3576/2015), dated on 14-12-2015 by this Ministry

3. Letter No. Hta Wa – 1/ DSEZ- 4/ 2016 (033), dated on 1-2-2016 by DSEZ Management Committee

4. Letter No. (Forest) 3/ 16 (D) (285/ 2017), dated on 27-1-2017 by Union Minister Office, Ministry of Natural Resources and Environmental Conservation

1. As per aforesaid subject, there was resubmitting the Scoping Report of resubmission of Myandawei Industrial Estate Co. Ltd for Initial Industrial Estate Project, which plan to implement at DSEZ Initial Phase, together with reference letter (1) by DSEZ Management Committee, and Ministry of Natural Resources and Environmental Conservation replied the comment for that submission with reference letter (2). DSEZ Management Committee, therefore, resubmitted the Scoping Report, after complying, with reference letter (3), again.

2. In accordance with the proposed Project, resubmitted Scoping Report of Initial Industrial Estate Project was conformed to the comment of Ministry of Natural Resources and Environmental Conservation after analyzing the amendment, and continuously submitted to Union Minister Office for confirmation, and it was instructed to reply the confirmation with reference letter (4).

3. Therefore, we would like to inform as confirm the Scoping Report of resubmission according to the Initial Industrial Estate Project of DSEZ Initial Phase, because of in line with the EIA Procedure and inform to emphasize the following:

    a. To express the summarized report with Myanmar version

    b. To express the commitments of project implemented persons after inserting the laws, acts, rules and regulations, procedures and instruction, which was required each sector in accordance with the any matters during implementation

    c. To implement the Scoping Report in line with the Terms of Reference (TOR)

    d. To submit the EIA report, after preparing with proposed TOR and specifications of EIA Procedure, to Ministry of Natural Resources and Environmental Conservation

Signature

Hla Maung Thein
Director General

Cc to;

- Union Minister Office, Ministry of Natural Resources and Environmental Conservation
- Office record/ Delivered to/ Cases Master File

The Republic of the Union of Myanmar
Ministry of Natural Resources and Environmental Conservation
Union Minister Office

Letter No – (Forest) 3/ 16 (D) (289/ 2017)

Date – January 27th, 2017

Subject: **Matter about submitting to reply the confirmation for Scoping Report and Terms of Reference of resubmission for Initial Industrial Estate Project which plan to implement at DSEZ Initial Phase**

Reference: **1. Letter No. EIA- 2/7 (071/ 2017), dated on 20-1-2017 by Environmental Conservation Department**

1. There is able to reply as confirm for Scoping Report and Terms of Reference (TOR) of resubmission of Initial Industrial Estate Project, which plan to implement at DSEZ Initial Phase, by Myandawei Industrial Estate Co. Ltd according to the comment of Ministry, because of in line with EIA Procedures, and Union Minister noted as **"to reply ECD"** for the submission with reference letter to reply continuously after inserting the some points to comply, when reply the confirmation.

2. Therefore, we would like to inform implementing as per requirements to reply to relevant in accordance with the note of Union Minister.

Signature

Behalf of Union Minister
Win Zaw, Vice Permanent Secretary

Cc to;

- Director General, Environmental Conservation Department

Translation

Official Emblem

Form SorWorLor.4

License

To be the person entitled to make a report on studies and preventive measure

and remedy for the effects on the environmental quality.

License No.15/2558

By virtue of the provision in Section 19 of the National Environmental Quality Act, B.E. 2535 (1992), the National Environment Board has issued this license to United Analyst and Engineering Consultant Co.,Ltd. to signify that the same is entitled to make a report on studies and preventive measure and remedy for the effects to the environmental quality with a prescribed period of 3 years form 27 June 2015 to 26 June 2018 with terms and conditions as follows:

(1) No terms and conditions;...

(2) ....

(3) ....

(4) ....

No. 349529 29 AUG 2016
BKK100

SEEN AT THE MINISTRY OF FOREIGN AFFAIRS

(MISS NIPA PEETISRIPHANT)
General Service Officer
Experienced Level
Ministry of Foreign Affairs of Thailand

1896124

Given on 26 June 2015

-Signature-

(Mr. Phongbun Pongthong)

Secretary-General of Office of Human Resources and Environmental Policy and Planning

26 June 2015

UAE
UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

CERTIFIED TRUE COPY

Certified Correct Translation
ขอรับรองว่าเป็นคำแปลที่ถูกต้อง

(Mr.Prasidhi Sochiratna)
LL.B., Dip. in Int'l Legal Cooperation (Belgium)
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"The Ministry of Foreign Affairs assumes no responsibility for erroneous translation./ กระทรวงการต่างประเทศไม่รับผิดชอบต่อการแปลที่ผิดพลาด"

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

United Analyst and Engineering Consultant Co., Ltd.
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Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com Email : uae@uaeconsultant.com

Report Certification

18th December 2017

This is to certify that United Analyst and Engineering Consultant Company Limited was the company who prepared The Environmental and Social Impact Assessment Report of DSEZ Initial Industrial Estate Project that located in the Dawei Special Economic Zone, in Dawei District, the Republic of the Union of Myanmar by the Environmental Impact Assessment Experts and Environmental Scientists that are in the list:

The Environmental Impact Assessment Expert

Mrs. Suparatana Jotisakulratana

Ms. Nawarat Kieomat

The Environmental Scientist

Dr. Pornwipa Klangsin

Mr. Somchai Suravit

Ms. Nannapat Natchakunlasap

Mr. Weerawat Thongkeatcharoen

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

(Mrs. Suparatana Jotisakulratana)

Authorized Representative under the Firms Power of Attorney

United Analyst and Engineering Consultant Co., Ltd

MYANDAWEI INDUSTRIAL ESTATE COMPANY LIMITED

MIE MYANDAWEI INDUSTRIAL ESTATE COMPANY LIMITED

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စာအမှတ် MIE ၀၃/၂၀၁၈

ရက်စွဲ ၂၀၁၈ ခုနှစ် ၊ ဧပြီလ ၃၀ ရက်

သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန

ရုံးအမှတ်(၁၉)

နေပြည်တော်၊ ပြည်ထောင်စုသမ္မတ မြန်မာနိုင်ငံ

သို့

ဦးလှမောင်သိန်း

သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဌာန

ရည်ညွှန်း ။ ထားဝယ်အထူးစီးပွားရေးဇုန်၏ ကနဦးမြို့နယ်စီမံကိန်းနှင့် ပတ်သက်သော ပတ်ဝန်းကျင်နှင့်လူမှုရေးထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ (EMP နှင့် RAP ပါဝင်သော ESIA)

လေးစားရပါသောဦးအုန်းဝင်းခင်ဗျာ

Myandawei Industrial Estate Company Limited (MIE) မှ သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဌာန (ECD) သို့ စာအမှတ်-MIE ၁၈/၂၀၁၇ ဖြင့် ၂၉ရက် မေလ ၂၀၁၇ ခုနှစ် တွင် တင်ပြထားသည့် United Analyst and Engineering Consultant Co.Ltd နှင့် International Engineering Consultant မှ Myandawei Industrial Estate Company Limited (MIE) ၏ညွှန်ကြားမှုအောက်တွင် ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်း(၂၉ရက် ဒီဇင်ဘာလ ၂၀၁၅ခုနှစ်) နှင့်အညီရေးဆွဲထားသောပတ်ဝန်းကျင်နှင့်လူမှုရေးထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ(ESIA)ကိုရည်ညွှန်းပါသည်။

အဆိုပါကိစ္စနှင့်ပတ်သက်၍ မိမိတို့၏ ငွေကြေးတာဝန်ခံမှုများကို သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ ဥပဒေအရ အောက်ပါအတိုင်း တင်ပြအပ်ပါသည်။

(က) မိမိတို့သည် သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ ပတ်ဝန်းကျင်နှင့်လူမှုရေးထိခိုက်မှု ဆန်းစစ်ခြင်းအစီရင်ခံစာ (ESIA) သည် တိကျမှန်ကန်မှုရှိကြောင်းနှင့် ပြည့်စုံမှုရှိကြောင်း အတည်ပြုတင်ပြပါသည်။

(ခ) ပတ်ဝန်းကျင်နှင့်လူမှုရေးထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ (ESIA) သည် ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံ၏ တည်ဆဲဥပဒေ၊ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း ဆိုင်ရာလုပ်ထုံးလုပ်နည်းများ၊ သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဝန်ကြီးဌာနမှ စာအမှတ် EIA–၂/၇ (၁၃၂/၂၀၁၇)ဖြင့် ၃၀ရက် ဇန်နဝါရီလ ၂၀၁၇ခုနှစ်တွင် အတည်ပြုခဲ့သော သတ်မှတ်တာဝန်နှင့် လုပ်ပိုင်ခွင့် (Scoping Report / Terms of Reference) (၂၇ရက် ဇန်နဝါရီလ ၂၀၁၆ခုနှစ်) များနှင့်အညီ ရေးဆွဲထားကြောင်း သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ တာဝန်ယူလျှောက် ထားအပ်ပါသည်။

(ဂ) မိမိတို့က အဆိုပါဝန်ကြီးဌာနသို့ တာဝန်ခံသည်မှာ Dawei Power Company Limited မှ ထားဝယ်အထူးစီးပွားရေးဇုန်၏ကနဦးမြို့နယ်စီမံကိန်းနှင့် ပတ်သက်၍ (၁) ပတ်ဝန်းကျင်နှင့်လူမှုရေးထိခိုက်မှု ဆန်းစစ်ခြင်းအစီရင်ခံစာ (ESIA) တွင်ဖော်ပြထားသော ကတိကဝတ်များနှင့် တာဝန်များ နှင့်အညီလိုက်နာခြင်း၊ (၂) ပြင်ဆင်မှု၊ ထိခိုက်မှု ရှောင်ကြဉ်ရေးအပါအဝင် အထက်ပါ အပိုဒ်(၁)နှင့်(၂)နှင့်အညီ တာဝန်ခံလျက် ဆောက်လုပ်ရေးလုပ်ငန်းများကို ပြီးစီးအောင် တာဝန်ယူလုပ်ဆောင်သွားမည်ဖြစ်ကြောင်း ၄င်းကိစ္စအရပ်ရပ်ကိုလည်း မည်သည့်ကန်ထရိုက်တာ၊ တဆင့်ခံကန်ထရိုက်နှင့်မဆို တာဝန်ယူ အကောင်အထည်ဖော်သွားမည်ဖြစ်ကြောင်းအာမခံပါသည်။

(ဃ) မိမိတို့က အထက်ပါစီမံကိန်းနှင့်ပတ်သက်၍ ချိုးဖေါက်ခြင်း၊ ပျက်ကွက်ခြင်း၊ မလိုက်နာခြင်း အရပ်ရပ်ပြုမိပါက သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ ဥပဒေနှင့်အညီ လျော်ကြေးငွေ ၊ ဒဏ်ကြေးငွေ ပေးအပ်ရမည်ဖြစ်ကြောင်း ဤစာချုပ်နောက်ဆက်တွဲနှင့်အညီ လက်မှတ်ရေးထိုးပါသည်။ Myandawei Industrial Estate Company Limited သည် စီမံချက်နှင့်မညီညွတ်သော တည်ဆောက်မှုတို့အားလုံးအတွက် ပြန်လည်အစားထိုး ပြင်ဆင်ပေးရန် အကုန်အကျခံမည်ဖြစ်ကြောင်း ကတိပြုပါသည်။

(င) ပျက်ကွက်မှုအရပ်ရပ်အတွက် စီမံကိန်းကုမ္ပဏီမှ စာချုပ် ချိုးဖေါက်သည်ဟု သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနမှ သတ်မှတ်

မည်ဖြစ်ကြောင်း၊ မိမိတို့စီမံကိန်းကုမ္ပဏီမှ စာချုပ်ပါစည်းကမ်းချက်များအတိုင်း ကုစား ပြင်ဆင်ခြင်းမပြုပါက မြန်မာနိုင်ငံတော်အစိုးရအနေဖြင့် စာချုပ်အဆုံးသတ်နိုင်ပါ ကြောင်း သဘောတူပါသည်။

ဤအတည်ပြုစာကို သက်ဆိုင်ရာမိမိတို့၏ကုမ္ပဏီဆုံးဖြတ်ချက်နှင့်အညီ ပြုစုရေးသားပြီး ကိုယ်စားလှယ်လွှဲစာနှင့်အညီ အတည်ပြုစာထုတ်ပေးပါကြောင်း နောက်ဆက်တွဲနှင့်တကွ ပေးပို့အပ်ပါသည်။

မှ	Myandawei Industrial Estate Company Limited
အမည်	Dr. Somchet Thinaphong
ရာထူး	အမှုဆောင်ဒါရိုက်တာ

MYANDAWEI INDUSTRIAL ESTATE COMPANY LIMITED

MYANDAWEI INDUSTRIAL ESTATE COMPANY LIMITED

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Reference No. MIE 03/2018

30th April 2018

Ministry of Natural Resource and Environmental Conservation
Office No. (19)
Nay Pyi Taw, Myanmar

Attn: U Hla Maung Thein
Environmental Conservation Department

Re: Environmental and Social Impact Assessment Report in respect of the Dawei SEZ Initial Industrial Estate Project (the "ESIA including EMP and RAP")

Dear U Ohn Win,

We refer to the captioned ESIA, which was prepared and finalized by The International Engineering Consultant Company Limited in association with The United Analyst and Engineering Consultant Company Limited in accordance with the Environmental Impact Assessment Procedure (29th December, 2015) under the instructions of Myandawei Industrial Estate Company Limited (MIE) and formally submitted by Myandawei Industrial Estate Company Limited to Environmental Conservation Department (ECD) under MIE letter date 29th May 2017 (Letter no. MIE 18/2017).

Intending to be legally bound hereby and financially liable to Ministry of Natural Resource and Environmental Conservation/MONREC hereunder, we:

a. Endorse and confirm to Ministry of Natural Resource and Environmental Conservation/MONREC the accuracy and completeness of the ESIA,

b. Confirm and undertake to Ministry of Natural Resource and Environmental Conservation/ MONREC that the ESIA has been prepared in strict compliance with applicable Myanmar law, including EIA Procedures and with the Scoping Report /Terms of Reference dated 27th January 2016 as approved by Ministry of Natural Resource and Environmental Conservation/MONREC on 30th January 2017 as evidenced by the ECD letter No. EIA-2/7 (132/2017) and

c. Confirm and undertake to Ministry of Natural Resource and Environmental Conservation/MONREC that the project company established by Dawei Power Company Limited in respect of the Initial Phase Power Plant of Dawei SEZ project shall at all times comply fully with: (i) any and all commitments and obligations as set forth in the ESIA, and (ii) any and all plans and the various components thereof, including without limitation, impact avoidance, mitigation, and remediation measures, and with respect to both (i) and (ii), including but not limited to such commitments, obligations, plans and measures as relate to the development, construction, commissioning, operation and maintenance of the

project, and any circumstance in which work done or to be done, or services performed or to be performed, in connection with the project' s development, construction, commissioning, operation and maintenance is carried out or intended or required to be carried out by any contractor, subcontractor or other party.

d. We acknowledge and agree that any failure to so comply shall subject us to liability for breach of this undertaking and that, in addition to making financial compensation to Ministry of Natural Resource and Environmental Conservation/MONREC and payment of any applicable penalties under the law or under the project's concession agreement and its appendixes, Myandawei Industrial Estate Company Limited shall be responsible to Ministry of Natural Resource and Environmental Conservation/MONREC to carry out and bear all costs of the immediate and proper rectification of the event of non-compliance and any effects thereof.

e. We acknowledge and agree, further, that any failure to so comply may be treated by Ministry of Natural Resource and Environmental Conservation/MONREC as a breach by the project company under the concession agreement which, if not rectified in accordance with the terms and conditions of the concession agreement, may lead to termination or other due exercise by the GOVERNMENT OF MYANMAR of remedies available to it thereunder.

The issuance of this confirmation and undertaking has been duly authorized by all necessary corporate actions and a copy of the resolution of the Myandawei Industrial Estate Company Limited authorizing it and the power of attorney explicitly granting signing authorization to the individual who has signed below are attached as schedules hereto.

....

By: Myandawei Industrial Estate Company Limited
Name: Dr. Somchet Thinaphong
Title: Managing Director

ပဏာမစက်မှုနယ်မြေ စီမံကိန်းက လိုက်နာဆောင်ရွက်ရမည့် ဥပဒေဆိုင်ရာကတိကဝတ်များ

၁။ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ(၂၀၁၂)

၂။ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေ(၂၀၁၄)

၃။ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးနည်းလုပ်နည်း(၂၀၁၅)

၄။ အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေးထုတ်လွှတ်မှုလမ်းညွှန်ချက်(၂၀၁၅)

၅။ မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှု ဥပဒေ (၂၀၁၆)

၆။ တိုင်းရင်းသားလူမျိုးများ အကျိုးစီးပွားကာကွယ်စောင့်ရှောက်ရေး ဥပဒေ(၂၀၁၅)

၇။ ပြည်သူ့ကျန်းမာရေးဥပဒေ(၁၉၇၂)

၈။ ကူးစက်ရောဂါများကာကွယ်နှိမ်နှင်းရေးဥပဒေ(၁၉၉၅)

၉။ ဆေးလိပ်နှင့်ဆေးရွက်ကြီးထွက်ပစ္စည်းသောက်သုံးမှုထိန်းချုပ်ရေးဥပဒေ(၂၀၁၆)

၁၀။ ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများ အန္တရာယ်မှ တားဆီးကာကွယ်ရေးဥပဒေ (၂၀၁၃)

၁၁။ ပုဂ္ဂလိကစက်မှုလုပ်ငန်းဥပဒေ (၁၉၉၀)

၁၂။ မြန်မာနိုင်ငံမီးသတ်တပ်ဖွဲ့ဥပဒေ(၂၀၁၅)

၁၃။ မော်တော်ယာဉ်ဥပဒေ(၂၀၁၅)နှင့် မော်တော်ယာဉ်နည်းဥပဒေများ(၁၉၈၇)

၁၄။ မြန်မာ့အာမခံလုပ်ငန်းဥပဒေ(၁၉၉၃)

၁၅။ အလုပ်သမားအဖွဲ့အစည်းဥပဒေ(၂၀၁၁)

၁၆။ အလုပ်သမားရေးရာအငြင်းပွားမှုဖြေရှင်းရေးဥပဒေ(၂၀၁၂)

၁၇။ အလုပ်အကိုင်နှင့်ကျွမ်းကျင်မှုဖွံ့ဖြိုးတိုးတတ်ရေးဥပဒေ(၂၀၁၃)

၁၈။ ၂၀၁၃ခုနှစ်၊အနည်းဆုံးအခကြေးငွေ ဥပဒေ

၁၉။ ၂၀၁၆ခုနှစ်၊အခကြေးငွေပေးချေရေးဥပဒေ

၂၀။ အလုပ်သမားလျော်ကြေးအက်ဥပဒေ(၁၉၅၁)

၂၁။ ခွင့်နှင့်အလုပ်ပိတ်ရက်များအက်ဥပဒေ(၁၉၅၁)

၂၂။ လူမှုဖူလုံရေးဥပဒေ(၂၀၁၂)

၂၃။ ရေနံအက်ဥပဒေ(၁၉၃၄)

၂၄။ ရေနံနည်းဥပဒေများ(၁၉၃၇)

၂၅။ ရေအရင်းအမြစ်နှင့် မြစ်၊ ချောင်းများထိန်းသိမ်းရေး ဥပဒေ(၂၀၀၆)

၂၆။ ရေချိုငါးလုပ်ငန်း ဥပဒေ (၁၉၉၁)

၂၇။ မြန်မာ့ပင်လယ်ငါးလုပ်ငန်းဥပဒေ (၁၉၉၁)

၂၈။ ယဉ်ကျေးမှုအမွေအနှစ်ဒေသများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ (၁၉၉၈)

၂၉။ ရှေးဟောင်းဝတ္ထုပစ္စည်းများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ (၂၀၁၅)

၃၀။ ရှေးဟောင်းအဆောက်အအုံများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ (၂၀၁၅)

၃၁။ သစ်တောဥပဒေ (၁၉၉၂)

၃၂။ မြန်မာ့အထူးစီးပွားရေးဇုန်ဥပဒေ (၂၀၁၄)

၃၃။ မြန်မာနိုင်ငံအင်ဂျင်နီယာကောင်စီဥပဒေ (၂၀၁၃)

၃၄။ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်ဥပဒေ (၂၀၁၅)

၃၅။ ပို့ကုန်သွင်းကုန်ဥပဒေ (၂၀၁၂)

၁။ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ(၂၀၁၂)

စီမံကိန်းပိုင်ရှင်သည်-

(က) ပတ်ဝန်းကျင်ကိုညစ်ညမ်းစေခဲ့လျှင်ဝန်ကြီးဌာနက သတ်မှတ်သည့်လျော်ကြေးငွေကို ပေးလျော်ပါမည်။ (ပုဒ်မ၇၊ ပုဒ်မခွဲ(ဏ) အရ)

(ခ) ပတ်ဝန်းကျင်ကိုညစ်ညမ်းမှုဖြစ်ပေါ်စေသည့်ထုတ်လွှတ်ခြင်းကို သတ်မှတ်ထားသည့် ပတ်ဝန်းကျင်အရည်အသွေး စံချိန်စံညွှန်းများနှင့်အညီ ထုတ်လွှတ်ပါမည်။(ပုဒ်မ၁၄အရ)

(ဂ) ပတ်ဝန်းကျင်ညစ်ညမ်းမှုများကို စောင့်ကြပ်ကြည့်ရှုရန်၊ ထိန်းချုပ်ရန်၊ စီမံခန့်ခွဲရန်၊ လျှော့ချရန် သို့မဟုတ် ပပျောက်စေရန်လုပ်ငန်းခွင် အထောက်အကူပြုပစ္စည်း သို့မဟုတ် ထိန်းချုပ်ရေးပစ္စည်းကိရိယာကို တပ်ဆင်ခြင်း သို့မဟုတ် သုံးစွဲခြင်းပြုပါမည်။ ထိုသို့မဆောင်ရွက်နိုင်ပါက စွန့်ပစ်ပစ္စည်းများကို ပတ်ဝန်းကျင်ကိုမထိခိုက်စေသော နည်းလမ်းများနှင့်အညီ စွန့်ပစ်ပါမည်။(ပုဒ်မ၁၅အရ)

(ဃ) ဝန်ကြီးဌာနကထုတ်ပေးသည့် ကြိုတင်ခွင့်ပြုချက်ပါစည်းကမ်းချက်များနှင့်အညီ ဆောင်ရွက်ခြင်း ရှိ မရှိ လာရောက်စစ်ဆေးသည့် တာဝန်ရှိပုဂ္ဂိုလ် သို့မဟုတ် အဖွဲ့အစည်းအား စစ်ဆေးခွင့်ပြုပါမည်။ (ပုဒ်မ၂၄အရ)

(င) ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေအရထုတ်ပြန်သော နည်းဥပဒေများ၊ အမိန့်ကြော်ငြာစာ၊ အမိန့်၊ ညွှန်ကြားချက်နှင့် လုပ်ထုံးလုပ်နည်းပါ တားမြစ်ချက်များကို လိုက်နာပါမည်။(ပုဒ်မ၂၉အရ)

၂။ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေ(၂၀၁၄)

စီမံကိန်းပိုင်ရှင်သည်-

(က) နည်းဥပဒေ၆၉၊ နည်းဥပဒေခွဲ(က)အရ ပတ်ဝန်းကျင်ကိုညစ်ညမ်းစေသည့် ပစ္စည်းများကို အများပြည်သူအား တိုက်ရိုက်ဖြစ်စေ သွယ်ဝိုက်၍ဖြစ်စေ ထိခိုက်စေနိုင်မည့် နေရာတစ်ခုခုတွင် တစ်နည်းနည်းဖြင့် ထုတ်လွှတ်ခြင်း၊ ထုတ်လွှတ်စေခြင်း၊ စွန့်ပစ်ခြင်း၊ စွန့်ပစ်စေခြင်း၊ စုပုံခြင်း၊ စုပုံစေခြင်း မပြုပါ။

(ခ) နည်းဥပဒေ၆၉၊ နည်းဥပဒေခွဲ(က)အရ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ၊ နည်းဥပဒေများ တစ်ခုခုအရ အမိန့်ကြော်ငြာစာဖြင့် သတ်မှတ်ထားသော ဘေးအန္တရာယ်ရှိပစ္စည်းများကို အများပြည်သူအား တိုက်ရိုတ်ဖြစ်စေ သွယ်ဝိုက်၍ဖြစ်စေ ထိခိုက်စေနိုင်မည့်နေရာတစ်ခုခုတွင် တစ်နည်းနည်းဖြင့်ထုတ်လွှတ်ခြင်း၊ ထုတ်လွှတ်စေခြင်း၊ စွန့်ပစ်ခြင်း၊ စွန့်ပစ်စေခြင်း၊ စုပုံခြင်း၊ စုပုံစေခြင်း မပြုပါ။

(ဂ) နည်းဥပဒေ၆၉၊နည်းဥပဒေခွဲ(ခ)အရ ဂေဟာစနစ်နှင့်ယင်းစနစ်ကြောင့် ဖြစ်ပေါ်ပြောင်းလဲနေသော သဘာဝပတ်ဝန်းကျင်ကို ထိခိုက်ပျက်စီးစေနိုင်သည့် ပြုလုပ်မှုကို ဆောင်ရွက်ခြင်းမပြုပါ။

၃။ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးနည်းလုပ်နည်း (၂၀၁၅)

စီမံကိန်းပိုင်ရှင်သည်-

(က) မိမိကိုယ်တိုင်ကြောင့်ဖြစ်စေ၊ မိမိကိုယ်စား ဆောင်ရွက်သည့်ကန်ထရိုက်တာ၊ လက်ခွဲ ဆောင်ရွက်ပေးသူ ဆပ်ကန်ထရိုက်တာ၊ အရာရှိ၊ အလုပ်သမား၊ ကိုယ်စားလှယ် သို့မဟုတ် အတိုင်ပင်ခံ၏ပြုလုပ်မှု သို့မဟုတ် ပျက်ကွက်မှုကြောင့်ပေါ်ပေါက်သည့် ဆိုးကျိုးသက်ရောက်မှုကို တာဝန်ယူပါမည်။ (အပိုဒ်၁၀၂(က)အရ)

(ခ) စီမံကိန်းကြောင့်ထိခိုက်ခံစားရသူကို လက်ရှိ သို့မဟုတ် စီမံကိန်းမဆောင်ရွက်မီကာလထက် မနိမ့်ကျသော လူမှုစီးပွားရေး တည်ငြိမ်ခိုင်မာမှုရရှိသည်အထိ ဆောင်ရွက်ပေးရန်နှင့် သက်မွေးဝမ်းကျောင်းလုပ်ငန်းများ ပြန်လည်တည်ထောင်ရေးနှင့် ပြန်လည်နေရာချထားရေး အစီစဉ်များကို စီမံကိန်းကြောင့်ထိခိုက်ခံစားရသူများ၊ သက်ဆိုင်ရာအစိုးရဌာန၊ အဖွဲ့အစည်းများ၊ အခြားသက်ဆိုင်သူများနှင့် တိုင်ပင်ဆွေးနွေး၍ လိုအပ်သလိုပံ့ပိုးပေးပါမည်။ (အပိုဒ်၁၀၂(ခ)အရ)

(ဂ) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်၊ စီမံကိန်းကတိကဝတ်အားလုံးနှင့် စည်းကမ်းချက်များကို အပြည့်အဝ အကောင်အထည်ဖော်ပါမည်။ မိမိကိုယ်စားဆောင်ရွက်သည့် ကန်ထရိုက်တာ၊ လက်ခွဲဆောင်ရွက်ပေးသူ ဆပ်ကန်ထရိုက်တာများက စီမံကိန်းအတွက်လုပ်ငန်းများ ဆောင်ရွက်ရာတွင် သက်ဆိုင်ရာဥပဒေ၊ နည်းဥပဒေများ၊ ဤလုပ်ထုံးလုပ်နည်း၊ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်နှင့် စည်းကမ်းချက်များအားလုံးကို အပြည့်အဝ လိုက်နာဆောင်ရွက်စေပါမည်။ (အပိုဒ်၁၀၄အရ)

(ဃ) ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာ လိုက်နာဆောင်ရွက်မှု သက်သေခံလက်မှတ်၊ သက်ဆိုင်ရာဥပဒေများ၊ နည်းဥပဒေများ၊ ဤလုပ်ထုံးလုပ်နည်းနှင့် စံချိန်စံညွှန်းတို့တွင်ပါရှိသော လိုအပ်ချက်အားလုံးကို တာဝန်ယူသည့်အပြင် ထိရောက်စွာအကောင်အထည်ဖော် ဆောင်ရွက်ပါမည်။ (အပိုဒ်၁၀၅အရ)

(င) အကြိုတည်ဆောက်ခြင်း၊ တည်ဆောက်ခြင်း၊ လုပ်ငန်းလည်ပတ်ဆောင်ရွတ်ခြင်း၊ လုပ်ငန်းရပ်စဲခြင်း၊ လုပ်ငန်းပိတ်သိမ်းခြင်းနှင့် လုပ်ငန်းပိတ်သိမ်းပြီးကာလတို့တွင် ဆိုးကျိုးသက်ရောက်မှု အားလုံးအတွက် စီမံကိန်းနှင့်ဆက်စပ်ဆောင်ရွက်မှုများကို စဉ်ဆက်မပြတ် ဘက်စုံစောင့်ကြပ် စစ်ဆေးပါမည်။(အပိုဒ်၁၀၆အရ)

(စ) မိမိ၏တာဝန် သို့မဟုတ် ဆောင်ရွက်ချက်ပျက်ကွက်မှုကို အမြန်ဆုံး စာဖြင့်တင်ပြပါမည်။ ပျက်ကွက်မှုကြောင့် ပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှုဖြစ်နိုင်သည့်ကိစ္စ သို့မဟုတ် ဝန်ကြီး ဌာနက အမြန်သိရန်လိုအပ်သည့်ကိစ္စကို ၂၄နာရီအတွင်းလည်းကောင်း အခြားကိစ္စဖြစ်ပါက စတင်သိရှိချိန်မှ ၇ ရက် အတွင်းလည်းကောင်း ဝန်ကြီးဌာနသို့ တင်ပြပါမည်။ (အပိုဒ်၁၀၇အရ)

(ဆ) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီစဉ်၏ဇယားပါအတိုင်းစောင့်ကြပ်ကြည့်ရှုမှု အစီရင်ခံစာကို ၆လ တစ်ကြိမ် သို့မဟုတ် ဝန်ကြီးဌာနကသတ်မှတ်သည့်အတိုင်း ဝန်ကြီးဌာနသို့ အစီရင်ခံ တင်ပြပါမည်။ (အပိုဒ်၁၀၈အရ)

(ဇ) စောင့်ကြပ်ကြည့်ရှုမှု အစီရင်ခံစာတွင် အပိုဒ်၁၀၉ပါ သတ်မှတ်ချက်များ အနည်းဆုံး ထည့်သွင်းဖော်ပြပါမည်။ (အပိုဒ်၁၀၉အရ)

(ဈ) အပိုဒ် ၁၀၈ အရ တင်ပြသည့်နေ့ရက်မှ ၁၀ရက်အတွင်း အများပြည်သူသိရှိနိုင်ရန် စီမံကိန်း၏ဝက်ဘ်ဆိုဒ်၊ စာကြည့်တိုက်၊ ပြည်သူခန်းမ၊ အများပြည်သူစုဝေးရာနေရာနှင့် စီမံကိန်းရုံးဌာနတို့တွင် အများပြည်သူသိရှိစေရန် ယင်းအစီရင်ခံစာကိုတင်ပြပါမည်။ ယင်းအစီရင်ခံစာ၏ ဒီဂျီတယ်မိတ္တူ တောင်းခံချက်ကို လက်ခံရရှိသည့်နေ့မှစ ၁၀ရက်အတွင်း အီးမေလ်ဖြင့် ဖြစ်စေ၊ တောင်းခံသူနှင့် သဘောတူညီထားသည့် အခြားနည်းလမ်းဖြင့် ဖြစ်စေ တောင်းခံသူအား ပေးပါမည်။ (အပိုဒ်၁၁၀အရ)

(ည) စောင့်ကြပ်ကြည့်ရှုရန်နှင့် စစ်ဆေးရန်တာဝန်ရှိသူကို သာမန်အလုပ်ချိန်အတွင်း ဝင်ရောက်ခွင့် ပြုပါမည်။ (အပိုဒ်၁၁၃(က)အရ) စီမံကိန်း၏ရုံးများ၊ လုပ်ငန်းခွင်၊ စီမံကိန်းနှင့် သက်ဆိုင်သော လုပ်ငန်းများ ဆောင်ရွက်နေသည့်အခြားနေရာများသို့ လိုအပ်ပါက အချိန်မရွေး ဝင်ရောက်ခွင့်ပြုပါမည်။ (အပိုဒ်၁၁၃(ခ)အရ)

(ဋ) အရေးပေါ်အခြေအနေတွင်ဖြစ်စေ၊ ပတ်ဝန်းကျင်ဆိုင်ရာနှင့် လူမှုရေးဆိုင်ရာ လိုအပ်ချက်ကို ဆောင်ရွက်ပေးရန် ပျက်ကွက်လျှင်ဖြစ်စေ၊ ထိုသို့ပျက်ကွက်နိုင်သည်ဟု ယူဆလျှင်ဖြစ်စေ စစ်ဆေးရန်တာဝန်ရှိသူက ဝင်ရောက်စစ်ဆေးလိုသည့်အချိန်တွင် ချက်ချင်းခွင့်ပြုပါမည်။ (အပိုဒ်၁၁၅အရ)

(ဌ) ကိုယ်စားဆောင်ရွက်ပေးသူ ကန်ထရိုက်တာနှင့် လက်ခွဲဆောင်ရွက်သူ ဆပ်ကန်ထရိုက်တာတို့ကို တာဝန်ရှိသူက စစ်ဆေးခြင်းကိုခွင့်ပြုပါမည်။ (အပိုဒ်၁၁၇အရ)

၄။ မျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေးထုတ်လွှတ်မှု လမ်းညွှန်ချက်(၂၀၁၅)

စီမံကိန်းပိုင်ရှင်သည် လမ်းညွှန်ချက်ပါ စံချိန်စံညွှန်းများနှင့်အညီ ထုတ်လွှတ်ခြင်း၊ စွန့်ပစ်ခြင်းပြုပါမည်။

၅။ မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှု ဥပဒေ (၂၀၁၆)

စီမံကိန်းပိုင်ရှင်သည်-

(က) ငှားရမ်းခွင့် ရရှိထားသည့် အစိုးရစီမံခန့်ခွဲခွင့်ရှိသော မြေကို စာချုပ်စာတမ်းများ မှတ်ပုံတင်ခြင်း အက်ဥပဒေနှင့်အညီ စာချုပ်စာတမ်း မှတ်ပုံတင်ရုံးတွင် မှတ်ပုံတင်ပါမည်။ (ပုဒ်မ ၅၀အရ)

(ခ) အဆင့်ဆင့်သော စီမံခန့်ခွဲမှု၊ နည်းပညာ၊ လုပ်ငန်းကျွမ်းကျင်သူ နေရာတို့တွင် နိုင်ငံသားများကို စွမ်းဆောင်ရေမြှင့်တင်ပေးပြီး အစားထိုးခန့်ထားပါမည်။ (ပုဒ်မ ၅၁ (ခ)အရ)

(ဂ) ကျွမ်းကျင်မှုမလိုအပ်သည့် လုပ်ငန်းများတွင် မြန်မာနိုင်ငံသားများကိုသာ ခန့်ထားပါမည်။ (ပုဒ်မ ၅၁ (ဂ)အရ)

(ဃ) မြန်မာနိုင်ငံသားနှင့် နိုင်ငံခြားသားများကို အလုပ်ခန့်ထားမှုဆိုင်ရာ သဘောတူညီချက် စာချုပ်ဖြင့် တည်ဆဲဥပဒေနှင့်အညီ ခန့်ထားပါမည်။ (ပုဒ်မ ၅၁ (ဃ)အရ)

(င) တည်ဆဲဥပဒေများ နည်းဥပဒေများ၊ လုပ်ထုံးလုပ်နည်းများနှင့် နိုင်ငံတကာတွင် ကျင့်သုံးသည့် အကောင်းဆုံး စံချိန်စံညွှန်းများနှင့်အညီ သဘာဝပတ်ဝန်းကျင်နှင့် လူမှုပတ်ဝန်းကျင် ထိခိုက်ပျက်စီးမှု၊ ညစ်ညမ်းမှု မဖြစ်စေရန်နှင့် ယဉ်ကျေးမှု အမွေအနှစ်များကို ထိခိုက်ပျက်စီးမှု မဖြစ်ပေါ်စေရန် လိုက်နာဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၆၅ (ဆ)အရ)

(စ) အလုပ်ခန့်ထားမှုဆိုင်ရာ သဘောတူစာချုပ် ဖောက်ဖျက်ခြင်း၊ ရင်းနှီးမြှုပ်နှံမှု အပြီး ပိတ်သိမ်းခြင်း၊ လွှဲပြောင်းရောင်းချခြင်း၊ ရင်းနှီးမြှုပ်နှံမှု ရပ်ဆိုင်းခြင်း၊ လုပ်သားအင်အား လျှော့ချခြင်းတို့အတွက် အလုပ်သမားများကို တည်ဆဲဥပဒေ များနှင့်အညီ နစ်နာကြေးပေးပြီးမှသာ ရင်းနှီးမြှုပ်နှံမှုကို ရပ်ဆိုင်းပိတ်သိမ်း ပါမည်။ (ပုဒ်မ ၆၅ (ဈ)အရ)

(ဆ) ခိုင်လုံသောအကြောင်းပြချက်ဖြင့် ရင်းနှီးမြှုပ်နှံမှု ယာယီပိတ်သိမ်းပါက ပိတ်သိမ်းထားရသည့် ကာလအတွင်း အလုပ်သမားများကို တည်ဆဲဥပဒေ၊ နည်းဥပဒေများ၊ ညွှန်ကြားချက်များ၊ လုပ်ထုံးလုပ်နည်းများနှင့်အညီ လုပ်ခ၊ လစာ ပေးပါမည်။ (ပုဒ်မ ၆၅ (ည)အရ)

(ဇ) အလုပ်ကြောင့် ထိခိုက်ဒဏ်ရာ ထိခိုက်မှု၊ ကိုယ်အင်္ဂါအစိတ်အပိုင်း ချို့ယွင်းဆုံးရှုံးမှု၊ ရောဂါရရှိမှု၊ သေဆုံးမှုတို့ ဖြစ်ပွားသော အလုပ်သမားများအတွက် သက်ဆိုင်ရာအလုပ်သမား သို့မဟုတ် အမွေဆက်ခံခွင့်ရှိသူကို တည်ဆဲဥပဒေနှင့် အညီ ရထိုက်သည့် နစ်နာကြေးနှင့် လျော်ကြေးပေးပါမည်။ (ပုဒ်မ ၆၅ (ဋ)အရ)

(ဈ) လာရောက်အလုပ်လုပ်ကိုင်နေသည့် နိုင်ငံခြားသား ကျွမ်းကျင်ပညာရှင်များနှင့် ကြီးကြပ်သူများ၊ မိသားစုဝင်များသည် တည်ဆဲဥပဒေများ၊ နည်းဥပဒေများ၊ အမိန့်နှင့် ညွှန်ကြားချက်များ၊ ယဉ်ကျေးမှုနှင့် ဓလေ့ထုံးစံများကို လေ့လာလိုက်နာ ရန် ကြပ်မတ်ပါမည်။ (ပုဒ်မ ၆၅ (ဌ)အရ)

(ည) စီမံကိန်းလိုအပ်ချက်အရ ခွင့်ပြုထားခြင်း မဟုတ်သော ဆောင်ရွက်ခြင်းကြောင့် သဘာဝပတ်ဝန်းကျင် ထိခိုက်ပျက်စီးစေခြင်းနှင့် လူမှုစီးပွားအပေါ် ဆုံးရှုံးမှုများ ဖြစ်ပေါ်စေပါက အဆိုပါ ဆုံးရှုံးနစ်နာမှုအတွက် ထိရောက်သည့် လျော်ကြေးကို နစ်နာသူထံသို့ ပေးလျော်ပါမည်။ (ပုဒ်မ ၆၅ (ဏ)အရ)

(ဋ) ကော်မရှင်က စစ်ဆေးကြည့်ရှုရန် ကြိုတင်အကြောင်းကြားလာပါက မည်သည့် နေရာကိုမဆို ဝင်ရောက်စစ်ဆေးခွင့်ပြုပါမည်။ (ပုဒ်မ ၆၅ (တ)အရ)

(ဌ) ကော်မရှင်၏ ခွင့်ပြုမိန့် သို့မဟုတ် အတည်ပြုမိန့်ကို ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ငန်းစဉ်များ မဆောင်ရွက်မီ ဦးစွာရယူပါမည်။ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ငန်းစဉ်များ ဆောင်ရွက်မှု အခြေအနေကို ကော်မရှင်သို့ တင်ပြပါမည်။ (ပုဒ်မ ၆၅ (ထ)အရ)

(ဍ) နည်းဥပဒေ၌ ဖော်ပြသတ်မှတ်ထားသော အာမခံအမျိုးအစားများကို အာမခံ ထားရှိပါမည်။ (ပုဒ်မ ၇၃ အရ)

၆။ တိုင်းရင်းသားလူမျိုးများအကျိုးစီးပွားကာကွယ်စောင့်ရှောက်ရေး ဥပဒေ(၂၀၁၅)

စီမံကိန်းပိုင်ရှင်သည်-

(က) စီမံကိန်းကို အကောင်အထည်ဖော်မည့် ဒေသရှိ ဌာနေတိုင်းရင်းသား လူမျိုးများအား စီမံကိန်း၏ အကြောင်းအရာများကို ပြည့်စုံတိကျစွာ ကြိုတင်ချပြ အသိပေးပါမည်။ (ပုဒ်မ ၅ အရ)

(ခ) စီမံကိန်းကို အကောင်အထည်ဖော် ဆောင်ရွက်ရာတွင် စီမံကိန်းကို အကောင်အထည်ဖော်မည့် ဒေသရှိ ဌာနေတိုင်းရင်းသား လူမျိုးများနှင့် ညှိနှိုင်းဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၅ အရ)

၇။ ပြည်သူ့ကျန်းမာရေးဥပဒေ(၁၉၇၂)

စီမံကိန်းပိုင်ရှင်သည်-

(က) ပြည်သူ့ကျန်းမာရေးအတွက် ပုဒ်မ ၃ ပါ ကိစ္စများနှင့် စပ်လျဉ်း၍ မည်သည့် စည်းကမ်းသတ်မှတ်ချက်များ၊ ညွှန်ကြားချက်များကိုမဆို လိုက်နာဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၃ အရ)

(ခ) လိုအပ်ချက်အရ ဤဥပဒေအရ တာဝန်ရှိသူများက လာရောက်စစ်ဆေးခြင်းနှင့် စပ်လျဉ်း၍ မည်သည့်နေရာ၊ မည်သည့်အချိန်တွင် မည်သည့် စစ်ဆေးမှုကိုမဆို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၅ အရ)

၈။ ကူးစက်ရောဂါများကာကွယ်နှိမ်နှင်းရေးဥပဒေ(၁၉၉၅)

စီမံကိန်းပိုင်ရှင်သည်-

(က) အလုပ်သမားများကို ကူးစက်ရောဂါ မဖြစ်ပွားစေရေးအတွက် လုပ်ငန်းခွင်တွင် ကျန်းမာရေးနှင့် ညီညွတ်သော နေအိမ်ဆောက်လုပ်ပေးပါမည်။ ကျန်းမာရေးနှင့် ညီညွတ်သော သောက်ရေနှင့် သုံးရေရရှိအောင် ဆောင်ရွက်ပေးပါမည်။ အညစ်အကြေးများကို စနစ်တကျ စွန့်ပစ် စေရန် ဆောင်ရွက်ပေးပါမည်။ (ပုဒ်မ ၃ (က) (၉) အရ)

(ခ) ကျန်းမာရေးဝန်ကြီးဌာနနှင့် ကျန်းမာရေးဦးစီးဌာနတို့က ညွှန်ကြားသည်နှင့် အညီ လိုက်နာဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၄ အရ)

(ဂ) အောက်ပါကိစ္စရပ်များ ဖြစ်ပွားကြောင်း သိရှိလျှင် သိရှိခြင်း အနီးဆုံး ကျန်းမာရေး ဌာန သို့မဟုတ် ဆေးရုံသို့ ချက်ချင်း သတင်းပို့ပါမည် –

(၁) ကြက်နှင့် အပါအဝင် တရိစ္ဆာန်များ အစုအလိုက်၊ အပြုံလိုက် သေဆုံးခြင်း၊

(၂) ကြွက်ကျခြင်း၊

(၃) ကူးစက်မြန်ရောဂါဖြစ်သည်ဟု သံသယရှိခြင်း သို့မဟုတ် ယင်းရောဂါ ဖြစ်ပွားခြင်း

(၄) တိုင်ကြားရမည့် ကူးစက်ရောဂါဖြစ်ပွားခြင်း၊

(ဃ) ကျန်းမာရေးအရာရှိက လိုအပ်၍ လာရောက်စစ်ဆေးလျှင် မည်သည့်နေရာ၊ မည်သည့်အချိန်တွင်မဆို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၁၁ အရ)

၉။ ဆေးလိပ်နှင့်ဆေးရွက်ကြီးထွက်ပစ္စည်း သောက်သုံးမှုထိန်းချုပ်ရေး ဥပဒေ(၂၀၁၆)

စီမံကိန်းပိုင်ရှင်သည်-

(က) ဆေးလိပ်သောက်သုံးခွင့်မရှိသော နေရာများတွင် ထိုသို့ခွင့်မပြုကြောင်း ဖော်ညွှန်း သည့် စာတမ်းနှင့် အမှတ်အသားများကို သတ်မှတ်ချက်နှင့်အညီ ထားရှိပါမည်။ (ပုဒ်မ ၉ (က) အရ)

(ခ) ဓာတ်အားပေး စက်ရုံ ဧရိယာအတွင်း ဆေးလိပ်သောက်သုံးရန် နေရာကို စီစဉ်ပေးပြီး သတ်မှတ်ချက်နှင့်အညီ ယင်းသို့ခွင့်ပြုသည့် နေရာဖြစ်ကြောင်း ဖော်ညွှန်းသည့် စာတမ်းနှင့် အမှတ်အသား ထားရှိပါမည်။ (ပုဒ်မ ၉ (ခ) အရ)

(ဂ) ဆေးလိပ်သောက်ခွင့်မရှိသော နေရာ၌ မည်သူမျှ ဆေးလိပ်သောက်ခြင်းမပြုရန် ကြပ်မတ်ပါမည်။ (ပုဒ်မ ၉ (ဂ) အရ)

(ဃ) ကြီးကြပ်ရေးအဖွဲ့ လာရောက်စစ်ဆေးသည့်အခါ စစ်ဆေးခြင်းကို ခံယူပါမည်။ (ပုဒ်မ ၉ (ဃ) အရ)

၁၀။ ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများ အန္တရာယ်မှ တားဆီးကာကွယ်ရေး ဥပဒေ(၂၀၁၃)

စီမံကိန်းပိုင်ရှင်သည် -

(က) လုပ်ငန်းစတင်လုပ်ကိုင်ခြင်းမပြုမီ စက်ပစ္စည်းကိရိယာများ၏ လုံခြုံစိတ်ချရမှုနှင့် ခံနိုင်ရည်ရှိမှုတို့အတွက် သက်ဆိုင်ရာ ကြီးကြပ်ရေးအဖွဲ့နှင့် စစ်ဆေးရေးအဖွဲ့များ၏ စစ်ဆေးခြင်းကို ခံယူပါမည်။ (ပုဒ်မ ၁၅ (က) အရ)

(ခ) လုပ်ငန်းတွင် လုပ်ကိုင်ဆောင်ရွက်မည့်သူများကို ပြည်ပသင်တန်းများ သို့မဟုတ် အစိုးရ ဌာန၊ အစိုးရအဖွဲ့အစည်းများက ဖွင့်လှစ်သော ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများ အန္တရာယ်မှ တားဆီးကာကွယ်မှုသင်တန်းနှင့် ကျွမ်းကျင်မှုသင်တန်းများသို့ တက်ရောက်စေပါမည်။ (ပုဒ်မ ၁၅(ခ) အရ)

(ဂ) လိုင်စင်ပါစည်းကမ်းချက်များကို လိုက်နာပါမည်။ (ပုဒ်မ ၁၆(က) အရ)

(ဃ) ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများ ကိုင်တွယ်အသုံးပြုရာတွင် အန္တရာယ်ကင်းရှင်းစေရေးအတွက် ညွှန်ကြားချက်များကို မိမိကိုယ်တိုင်နှင့် လုပ်ငန်းတွင်လုပ်ကိုင် ဆောင်ရွက်သူများက လိုက်နာစေပါမည်။ (ပုဒ်မ ၁၆(ခ) အရ)

(င) ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများဆိုင်ရာ လုပ်ငန်းတွင် လိုအပ်သော လုံခြုံရေး ကိရိယာများ လုံလောက်စွာ ထားရှိပါမည်။ ထို့ပြင် လုပ်ငန်းတွင်လုပ်ကိုင်သူများအား ကိုယ်ခန္ဓာကာကွယ်ရေး ကိရိယာနှင့် ဝတ်စုံများကို အခမဲ့ထုတ်ပေးပါမည်။ (ပုဒ်မ ၁၆(ဂ) အရ)

(စ) ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများဆိုင်ရာ လုပ်ငန်းတွင် လုပ်ကိုင်သူများအား လုပ်ငန်းခွင်လုံခြုံရေး ကိရိယာ၊ ကိုယ်ခန္ဓာကာကွယ်ရေး ကိရိယာနှင့် ဝတ်စုံများကို စနစ်တကျသုံးစွဲတတ်စေရန် သင်တန်းပေးခြင်း၊ လေ့ကျင့်သင်ကြားပေးခြင်းနှင့် လိုအပ်သလို ညွှန်ကြားခြင်းများ ပြုပါမည်။ (ပုဒ်မ ၁၆(ဃ) အရ)

(ဆ) လူနှင့် တိရိစ္ဆာန်များ၏ ကျန်းမာရေးကိုလည်းကောင်း၊ ပတ်ဝန်းကျင်ကိုလည်းကောင်း၊ ဘေးအန္တရာယ်ထိခိုက်မှု ရှိ မရှိနှင့် စပ်လျဉ်း၍ သက်ဆိုင်ရာကြီးကြပ်ရေးအဖွဲ့နှင့် စစ်ဆေးရေးအဖွဲ့များ၏ စစ်ဆေးခြင်းကို ခံယူပါမည်။ (ပုဒ်မ ၁၆(င) အရ)

(ဇ) ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများဆိုင်ရာ လုပ်ငန်းတွင် လုပ်ကိုင်သူများအား ကျန်းမာရေးစစ်ဆေးပေးပြီး လုပ်ငန်းလုပ်ကိုင်ရန် ကျန်းမာရေးနှင့် ညီညွတ်ကြောင်း ထောက်ခံချက်ရရှိမှသာ လုပ်ကိုင်ခွင့်ပြုပါမည်။ ယင်းတို့၏ ကျန်းမာရေးစစ်ဆေးချက် မှတ်တမ်းများကို စနစ်တကျထိန်းသိမ်းထားပါမည်။ (ပုဒ်မ ၁၆(စ) အရ)

(ဈ) အန္တရာယ်ရှိသော ဓာတုပစ္စည်း သို့မဟုတ် ဆက်စပ်ပစ္စည်းများကို သိုလှောင်ခွင့်ရပါက ခွင့်ပြုသည့် အကြောင်းကြားစာ မိတ္တူကို သက်ဆိုင်ရာ မြို့နယ် အထွေထွေအုပ်ချုပ်ရေး ဦးစီးဌာနသို့ ပေးပို့ပါမည်။ (ပုဒ်မ ၁၆(ဆ) အရ)

(ည) မီးဘေးအန္တရာယ်ဖြစ်စေတတ်သည့် ပစ္စည်း သို့မဟုတ် ပေါက်ကွဲစေတတ်သည့် ပစ္စည်းများကို အသုံးပြု၍ မီးဘေးအန္တရာယ်စိုးရိမ်ရသော လုပ်ငန်းလုပ်ကိုင်လိုပါက သက်ဆိုင်ရာ မီးသတ်ဦးစီးဌာန၏ လမ်းညွှန်သဘောတူညီချက် ကြိုတင်ရယူပါမည်။ (ပုဒ်မ ၁၆(ဇ) အရ)

(ဋ) ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများကို သတ်မှတ်ထားသော စည်းကမ်းချက်များနှင့် အညီ ခွင့်ပြုထားသော ပမာဏကိုသာ ပြည်တွင်းတွင် သယ်ဆောင်ပါမည်။ (ပုဒ်မ ၁၆(ဈ) အရ)

(ဌ) ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများကို လိုင်စင်ပါနေရာဒေသ တစ်ခုခုမှ အခြားနေရာဒေသတစ်ခုခုသို့ ပြောင်းလဲပြီး သယ်ယူပို့ဆောင်လိုပါက ဗဟိုကြီးကြပ်ရေးအဖွဲ့ထံမှ ခွင့်ပြုချက်ရယူပါမည်။ (ပုဒ်မ ၁၆(ည) အရ)

(ဎ) လူနှင့် တိရိစ္ဆာန်တို့ကို ဖြစ်စေ၊ ပတ်ဝန်းကျင်ကိုဖြစ်စေ ထိခိုက်ဆုံးရှုံးမှု ဖြစ်ပေါ်ပါက လျော်ကြေးပေးနိုင်ရန် သတ်မှတ်ချက်များနှင့်အညီ အာမခံထားရှိပါမည်။ (ပုဒ်မ ၁၇ အရ)

(ဏ) ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းဆိုင်ရာ မှတ်ပုံတင်လက်မှတ်ပါ စည်းကမ်းချက်များ ကို လိုက်နာပါမည်။ ထို့အပြင် ဗဟိုကြီးကြပ်ရေးအဖွဲ့က အခါအားလျော်စွာ ထုတ်ပြန်သော အမိန့်နှင့် ညွှန်ကြားချက်များကိုလည်း လိုက်နာပါမည်။ (ပုဒ်မ ၂၂ အရ)

(ဏ) ကြိုတင်ကာကွယ်နိုင်ရေးအတွက် ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများ၏ ဂုဏ်သတ္တိ များအရ အန္တရာယ်အဆင့်ကို ခွဲခြားသတ်မှတ်ပါမည်။ (ပုဒ်မ ၂၇(က) အရ)

(တ) အန္တရာယ်ကင်းရှင်းမှုအဆင့် မှတ်တမ်းလွှာနှင့် အန္တရာယ်သတိပေး အမှတ်အသား တို့ကို ဖော်ပြပါမည်။ (ပုဒ်မ ၂၇(ခ) အရ)

(ထ) မတော်တဆဖြစ်ပွားမှု ကာကွယ်ရန်နှင့် လျော့ပါးစေရန် လုံခြုံရေးကိရိယာများ၊ ကိုယ်ခန္ဓာကာကွယ်ရေး ကိရိယာများ ထားရှိပါမည်။ ယင်းတို့ကို စနစ်တကျသုံးစွဲတတ် စေရန် သင်တန်းများ တက်ရောက်စေပါမည်။ (ပုဒ်မ ၂၇(ဂ) အရ)

(ဒ) ဓာတုပစ္စည်းနှင့် ဆက်စပ်ပစ္စည်းများကို သယ်ယူပို့ဆောင်ခြင်း၊ လက်ဝယ်ထားရှိခြင်း၊ သိုလှောင်ခြင်း၊ သုံးစွဲခြင်း၊ စွန့်ပစ်ခြင်းတို့ကို သတ်မှတ်ချက်များနှင့်အညီ လိုက်နာ ဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၂၇(ဃ) အရ)

၁၁။ ပုဂ္ဂလိကစက်မှုလုပ်ငန်းဥပဒေ (၁၉၉၀)

စီမံကိန်းပိုင်ရှင်သည် -

(က) မြင်းကောင်ရေ သုံးကောင်အားနှင့်အထက် ရှိသော အားတစ်မျိုးမျိုးကို အသုံးပြု၍ဖြစ်စေ၊ လုပ်ခစား အလုပ်သမား ၁၀ ဦးနှင့်အထက် ဖြစ်စေ၊ ပုဂ္ဂလိကစက်မှုလုပ်ငန်း လုပ်ကိုင်ရန်မှတ်ပုံတင်ပါမည်။ (ပုဒ်မ ၄ အရ)

(ခ) မှတ်ပုံတင်လက်မှတ်ပါ စည်းကမ်းချက်များကို လိုက်နာပါမည်။ (ပုဒ်မ ၁၃(ခ) အရ)

(ဂ) ပုဂ္ဂလိကစက်မှုလုပ်ငန်းနှင့် သက်ဆိုင်သည့် စာရင်းဇယားများကို ဦးစီးဌာနကသတ်မှတ် သည့်အတိုင်း စနစ်တကျပြည့်စုံစွာ ထားရှိပါမည်။ ထို့ပြင် သက်ဆိုင်ရာအစိုးရဌာန၊ အဖွဲ့အစည်း သို့မဟုတ် ကြီးကြပ်ရေးအဖွဲ့က တောင်းခံပါက ယင်းစာရင်းဇယားများကို တင်ပြပါမည်။ (ပုဒ်မ ၁၃(ဃ) အရ)

(ဃ) ဦးစီးဌာန သို့မဟုတ် ကြီးကြပ်ရေးအဖွဲ့က တာဝန်ပေးအပ်သော ပုဂ္ဂိုလ် သို့မဟုတ် စစ်ဆေးရေးအဖွဲ့၏ စစ်ဆေးခြင်းကို ခံယူပါမည်။ (ပုဒ်မ ၁၃(င) အရ)

(င) စက်မှုဝန်ကြီးဌာနနှင့် စက်မှုကြီးကြပ်ရေးနှင့် လုပ်ငန်းစစ်ဆေးမှု ဦးစီးဌာနတို့က ထုတ်ပြန် သည့် အမိန့်နှင့် ညွှန်ကြားချက်များ၊ တည်ဆဲဥပဒေများကို လိုက်နာပါမည်။ (ပုဒ်မ ၁၃(ဆ) နှင့် (ဇ) တို့အရ)

၁၂။ မြန်မာနိုင်ငံမီးသတ်တပ်ဖွဲ့ဥပဒေ(၂၀၁၅)

စီမံကိန်းပိုင်ရှင်သည်-

(က) သီးသန့်မီးသတ်တပ်ဖွဲ့ ဖွဲ့စည်းပါမည်။ (ပုဒ်မ ၂၅ (က) အရ)

(ခ) မီးဘေးလုံခြုံရေးဆိုင်ရာ ပစ္စည်းများကို ထားရှိပါမည်။ (ပုဒ်မ ၂၅ (ခ) အရ)

၁၃။ မော်တော်ယာဉ် ဥပဒေ(၂၀၁၅) နှင့် မော်တော်ယဉ်နည်းဥပဒေများ(၁၉၈၇)

စီမံကိန်းပိုင်ရှင်သည်-

လေထုညစ်ညမ်းစေခြင်း၊ အသံဆူညံစေခြင်းနှင့် အသက်အန္တရာယ် လုံခြုံစိတ်ချမှုတို့နှင့် သက်ဆိုင်သည့် ဤဥပဒေနှင့် နည်းဥပဒေများပါ ပြဋ္ဌာန်းချက်များကို လိုက်နာဆောင်ရွက် ပါမည်။

၁၄။ မြန်မာ့အာမခံလုပ်ငန်းဥပဒေ(၁၉၉၃)

စီမံကိန်းပိုင်ရှင်သည်-

(က) ကိုယ်ပိုင်ယာဉ်များ သုံးစွဲမည်ဆိုပါက လူထိခိုက်မှုဆိုင်ရာ အာမခံ ထားရှိပါမည်။ (ပုဒ်မ ၁၅ အရ)

(ခ) ပတ်ဝန်းကျင်ကို ထိခိုက်စေခြင်းနှင့် ပြည်သူလူထုကို နစ်နာစေခြင်းဖြစ်ပေါ်လျှင် ယင်းအထွေထွေ ဆုံးရှုံးနစ်နာမှုကို ပေးလျော်နိုင်ရန် ထားရှိရမည့် အာမခံကို ထားရှိပါမည်။ (ပုဒ်မ ၁၆ အရ)

၁၅။ အလုပ်သမားအဖွဲ့အစည်းဥပဒေ(၂၀၁၁)

စီမံကိန်းပိုင်ရှင်သည်-

(က) အလုပ်သမား ဥပဒေနှင့် မညီဘဲ အလုပ်ထုတ်ခံရသည့် အလုပ်သမားကို ပြန်လည် အလုပ်ခန့်ထားရန် တောင်းဆိုသည်ကို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၁၈အရ)

(ခ) အလုပ်ရှင်နှင့် အလုပ်သမားအကြား အငြင်းပွားမှုကို ညှိနှိုင်းဖျန်ဖြေရေးအဖွဲ့က ဖြေရှင်းရာတွင် ယင်းအဖွဲ့သို့ အလုပ်သမားကိုယ်စားလှယ် စေလွှတ်ခြင်းကို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၁၉ အရ)

(ဂ) အလုပ်သမားဥပဒေများပါ အလုပ်သမားအခွင့်အရေး သို့မဟုတ် အကျိုးစီးပွားနှင့် စပ်လျဉ်း၍ အစိုးရ၊ အလုပ်ရှင်နှင့် တောင်းဆိုသူ အလုပ်သမားတို့ ဆွေးနွေးရာတွင် အလုပ်သမား အဖွဲ့အစည်း၏ ကိုယ်စားလှယ်ကို ပါဝင်ဆွေးနွေးခွင့်ပြုပါမည်။ (ပုဒ်မ ၂၀ အရ)

(ဃ) အလုပ်သမား ဥပဒေများနှင့်အညီ အလုပ်သမားများ၏ စုပေါင်းအရေးဆိုမှုများကို ဖြေရှင်းရာတွင် အလုပ်သမားအဖွဲ့အစည်းကို ပါဝင်ဆောင်ရွက်ခွင့်ပြုပါမည်။ (ပုဒ်မ ၂၁ အရ)

(င) အလုပ်သမား အဖွဲ့အစည်းက သက်ဆိုင်ရာ အလုပ်သမား အဖွဲ့ချုပ်က ချမှတ်ထားသော လုပ်ထုံးလုပ်နည်းများ၊ စည်းမျဉ်းစည်းကမ်း၊ ညွှန်ကြားချက်များနှင့်အညီ အစည်းအဝေးများပြုလုပ်ခြင်း၊ သပိတ်မှောက်ခြင်းတို့ကို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၂၂ အရ)

၁၆။ အလုပ်သမားရေးရာအငြင်းပွားမှုဖြေရှင်းရေးဥပဒေ(၂၀၁၂)

စီမံကိန်းပိုင်ရှင်သည်-

(က) တောင်းဆို တိုင်ကြားချက်နှင့် စပ်လျဉ်း၍ သတ်မှတ်ကာလအတွင်း ဆွေးနွေး ညှိနှိုင်းဖြေရှင်းရာတွင် ပျက်ကွက်မည် မဟုတ်ပါ။ (ပုဒ်မ ၃၈ အရ)

(ခ) ခုံသမာဓိအဖွဲ့ သို့မဟုတ် ခုံအဖွဲ့က အငြင်းပွားမှု စစ်ဆေးနေစဉ် ကာလအတွင်း ထိုအငြင်းပွားမှု မစမီက ချမှတ်ထားသော အလုပ်သမားများနှင့် သက်ဆိုင်သည့် စည်းကမ်းများကို အလုပ်သမားများ၏ အကျိုးစီးပွားထိခိုက်စေရန် ရုတ်တရက် ပြောင်းလဲခြင်း မပြုပါ။ (ပုဒ်မ ၃၉ အရ)

(ဂ) အငြင်းပွားမှု တစ်ခုနှင့် စပ်လျဉ်း၍ ဤဥပဒေနှင့်အညီ ဆွေးနွေးညှိနှိုင်းခြင်း၊ ဖျန်ဖြေခြင်းနှင့် ခုံသမာဓိအဖွဲ့ဖြင့် ဆုံးဖြတ်ခြင်းတို့ကို မပြုဘဲ အလုပ်မထုတ်ပါ။ (ပုဒ်မ ၄၀ အရ)

(ဃ) ခုံသမာဓိ သို့မဟုတ် ခုံအဖွဲ့က ပုဒ်မ ၅၁ အရ ဆုံးဖြတ်သည့် လျော်ကြေးငွေကို ပေးဆောင်ပါမည်။ (ပုဒ်မ ၅၁ အရ)

၁၇။ အလုပ်အကိုင်နှင့် ကျွမ်းကျင်မှုဖွံ့ဖြိုးတိုးတတ်ရေး ဥပဒေ(၂၀၁၃)

စီမံကိန်းပိုင်ရှင်သည်-

(က) အလုပ်သမားခန့်ထားရာတွင် ဤဥပဒေ ပုဒ်မ ၅ ပါ ပြဋ္ဌာန်းချက်များနှင့်အညီ စာချုပ်ချုပ်ဆို၍ ခန့်ထားပါမည်။ (ပုဒ်မ၅အရ)

(ခ) ခန့်ထားရန် လျာထားသော အလုပ်သမားနှင့် လုပ်ငန်း၌ လုပ်ကိုင်လျက်ရှိသော အလုပ်သမားများ၏ အလုပ်အကိုင်ဆိုင်ရာ ကျွမ်းကျင်မှုအဆင့် မြင့်မားစေရန် လေ့ကျင့်ရေး အစီအစဉ်များကို လုပ်ငန်းလိုအပ်ချက်အရ ကျွမ်းကျင်မှု ဖွံ့ဖြိုးတိုးတက်ရေးအဖွဲ့၏ မူဝါဒနှင့်အညီ ဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၁၄ အရ)

(ဂ) မိမိ၏ လုပ်ငန်း၌ အလုပ်သမားကြီးကြပ်သူအဆင့်နှင့် ယင်းအဆင့်အောက်ရှိ အလုပ်သမားများကို ပေးချေရသည့် စုစုပေါင်းလုပ်ခ၊ လစာ၏ ၀.၅ ရာခိုင်နှုန်း အောက် မနည်းသောငွေကို ရန်ပုံငွေသို့ ထည့်ဝင်ခြင်းအဖြစ် လစဉ်ပေးသွင်းပါမည်။ ယင်းထည့်ဝင်ကြေးအတွက် အလုပ်သမားများ၏ လုပ်ခ၊ လစာမှ ဖြတ်တောက်ခြင်းမပြုပါ။ (ပုဒ်မ၃၀အရ)

၁၈။ ၂၀၁၃ခုနှစ်၊ အနည်းဆုံးအခကြေးငွေဥပဒေ

စီမံကိန်းပိုင်ရှင်သည်-

(က) ပုဒ်မ ၁၂ ပါ သတ်မှတ်ချက်များနှင့်အညီ အခကြေးငွေ ပေးချေပါမည်။ (ပုဒ်မ၁၂အရ)

(ခ) သတ်မှတ်ထားသော အနည်းဆုံးအခကြေးငွေ နှုန်းထားများကို အလုပ်သမား များကို အသိပေးမည့်အပြင် လုပ်ငန်းခွင်တွင် မြင်နိုင်စေရန် ကြော်ငြာထားပါမည်။ (ပုဒ်မ၁၃ (က)အရ)

(ဂ) ပုဒ်မ ၁၃ ပါ ပြုစုရမည့် စာရင်းဇယားနှင့် စာတမ်းအမှတ်အသားများကို ပြုစုခြင်း၊ သက်ဆိုင်ရာ ဦးစီးဌာနသို့ သတ်မှတ်ချက်များနှင့်အညီ အစီရင်ခံခြင်း၊ ယင်းတို့ကို တောင်းခံသည့်အခါ တင်ပြခြင်းတို့ ပြုပါမည်။ (ပုဒ်မ ၁၃ (ခ)၊ (ဂ)၊ (ဃ) တို့အရ)

(ဃ) ပုဒ်မ ၁၃ (င)နှင့် ပုဒ်မ ၁၈ အရ စစ်ဆေးရေးအရာရှိများက လာရောက် စစ်ဆေးခြင်းကို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၁၃ (င)နှင့် ၁၈ အရ)

(င) အလုပ်သမား ဖျားနာ၍ အလုပ်မလုပ်နိုင်သည့်အခါ ဆေးကုသရန် သတ်မှတ်ချက်များနှင့်အညီ နားခွင့်ပေးပါမည်။ (ပုဒ်မ ၁၃ (စ) အရ)

(စ) အလုပ်သမားများ၏ မိသားစုဝင် သို့မဟုတ် မိဘနာရေးဖြစ်သည့်အခါ အနည်းဆုံး အခကြေးငွေမှာ ဖြတ်တောက်ခြင်းမပြုဘဲ သတ်မှတ်ချက်များနှင့် အလုပ်နားခွင့် ပြုပါမည်။ (ပုဒ်မ ၁၃ (ဆ) အရ)

၁၉။ ၂၀၁၆ခုနှစ်၊ အခကြေးငွေပေးချေရေးဥပဒေ

စီမံကိန်းပိုင်ရှင်သည်-

(က) အခကြေးငွေ ပေးချေခြင်းနှင့် စပ်လျဉ်း၍ ပုဒ်မ ၃ နှင့် ပုဒ်မ ၄ ပါပြဋ္ဌာန်းချက် များနှင့်အညီ ပေးချေပါမည်။ (ပုဒ်မ၃ နှင့် ၄အရ)

(ခ) သဘာဝဘေးအန္တရာယ်အပါအဝင် မမျှော်လင့်သော ထူးခြားသည့်အခြေအနေ ပေါ်ပေါက်ပါက အခကြေးငွေ ပြောင်းလဲပေးချေလိုကြောင်းကို သက်ဆိုင်ရာ အလုပ်သမားများ၏ သဘောတူညီချက်ဖြင့် တင်ပြပါမည်။ (ပုဒ်မ၅အရ)

(ဂ) အလုပ်သမားထံမှ နုတ်ယူရန် လိုအပ်သည့်ငွေကြေးနှင့် စပ်လျဉ်း၍ အခန်း (၃)ပါ ပြဋ္ဌာန်းချက်နှင့်အညီ လိုက်နာဆောင်ရွက်ပါမည်။ (အခန်း ၃ အရ)

(ဃ) အချိန်ပို လုပ်ကိုင်ရသည့် အလုပ်သမားကို ဥပဒေက သတ်မှတ်သည့် နှုန်းထားအတိုင်း အချိန်ပိုလုပ်ခပေးပါမည်။ (ပုဒ်မ၁၄ အရ)

၂၀။ အလုပ်သမားလျော်ကြေး အက်ဥပဒေ(၁၉၅၁)

စီမံကိန်းပိုင်ရှင်သည် ရရှိသည့် ထိခိုက်နစ်နာမှု အမျိုးအစားအလိုက် ကိစ္စရပ်တစ်ခုချင်း အပေါ်တွင် ဤဥပဒေပါ ပြဋ္ဌာန်းချက်များနှင့်အညီ လျော်ကြေးငွေကို ပေးလျော်ပါမည်။

၂၁။ ခွင့်နှင့် အလုပ်ပိတ်ရက်များ အက်ဥပဒေ(၁၉၅၁)

စီမံကိန်းပိုင်ရှင်သည် ဤဥပဒေပါ ပြဋ္ဌာန်းချက်များနှင့်အညီ ခွင့်နှင့် အလုပ်ပိတ်ရက် များကို ခွင့်ပြုပါမည်။

၂၂။ လူမှုဖူလုံရေးဥပဒေ(၂၀၁၂)

စီမံကိန်းပိုင်ရှင်သည်-

(က) သက်ဆိုင်ရာ လူမှုဖူလုံရေးရုံးတွင် မှတ်ပုံတင်ထားရှိပါမည်။ (ပုဒ်မ၁၁ (က)အရ)

(ခ) ပုဒ်မ ၁၅၊ ပုဒ်မခွဲ (က)ပါကျန်းမာရေးနှင့် လူမှုရေး စောင့်ရှောက်မှု ရန်ပုံငွေ၊ အလုပ်လုပ်ကိုင်နိုင်စွမ်းမရှိမှု အကျိုးခံစားခွင့်၊ သက်ပြည့်အငြိမ်းစား အကျိုးခံစားခွင့်နှင့် ကျန်ရစ်သူ အကျိုးခံစားခွင့် ရန်ပုံငွေ၊ အလုပ်လက်မဲ့ အကျိုးခံစားခွင့် ရန်ပုံငွေနှင့် သတ်မှတ်ထားသော မထည့်မနေရ ထည့်ဝင်ရမည့် ရန်ပုံငွေများကို မှတ်ပုံတင်ထည့်ဝင်ပါမည်။ (ပုဒ်မ၁၅ (ခ) အရ)

(ဂ) အလုပ်သမားက ပေးသွင်းရမည့် ထည့်ဝင်ကြေးကို ယင်း၏ လုပ်ခထဲမှ နုတ်ယူပြီး မိမိက ပေးသွင်းရမည့် ထည့်ဝင်ကြေး ငွေနှင့်အတူ သက်ဆိုင်ရာ လူမှုဖူလုံရေး ရန်ပုံငွေသို့ ပေးသွင်းပါမည်။ ထိုသို့ပေးသွင်းရသည့် ကုန်ကျစားရိတ်ကို မိမိက ကျခံပါမည်။ (ပုဒ်မ၁၈ (ခ) အရ)

(ဃ) အလုပ်တွင် ထိခိုက်မှု အကျိုးခံစားခွင့် ရန်ပုံငွေသို့ သတ်မှတ်ထားသော ထည့်ဝင်ကြေးပေးပြီး အာမခံထားရှိပါမည်။ (ယင်းရန်ပုံငွေသည် အလုပ်သမား လျော်ကြေး အက်ဥပဒေပါ ပြဋ္ဌာန်းချက်များနှင့် သက်ဆိုင်ခြင်းမရှိကြောင်း သိရှိပါသည်။) (ပုဒ်မ၄၈ (ခ)နှင့် ၄၉ (က) တို့အရ)

(င) ပုဒ်မ ၁၇ တွင် ဖော်ပြထားသည့် မှတ်တမ်းနှင့် စာရင်းများကို မှန်ကန်စွာပြုစုပြီး သက်ဆိုင်ရာ လူမှုဖူလုံရေးရုံးသို့ သတ်မှတ်ချက်များနှင့်အညီ တင်ပြပါမည်။ (ပုဒ်မ၇၅အရ)

၂၃။ ရေနံအက်ဥပဒေ(၁၉၃၄)

စီမံကိန်းပိုင်ရှင်သည် စီမံကိန်းအတွက် လိုအပ်သည့် လောင်စာဆီများကို တင်သွင်းခြင်း၊ သယ်ယူပို့ဆောင်ခြင်းနှင့်သိုလှောင်ခြင်းတို့အတွက် ပုဒ်မ ၃ အရ လိုအပ်သည့် လိုင်စင်ကို ရယူပါမည်။ ထို့ပြင် ယင်းလိုင်စင်ပါ စည်းကမ်းချက်များကိုလည်း လိုက်နာပါမည်။

၂၄။ ရေနံနည်းဥပဒေများ(၁၉၃၇)

စီမံကိန်းပိုင်ရှင်သည် စီမံကိန်းအတွက် လိုအပ်သည့် လောင်စာဆီများကို တင်သွင်းခြင်း၊ သယ်ယူပို့ဆောင်ခြင်းနှင့်သိုလှောင်ခြင်းတို့အတွက် နည်းဥပဒေများ အခန်း (၃) နှင့် (၄) ပါ သတ်မှတ်ပြဋ္ဌာန်းချက်များနှင့်အညီ လိုက်နာဆောင်ရွက်ပါမည်။ (အခန်း (၃)နှင့် (၄)အရ)

၂၅။ ရေအရင်းအမြစ်နှင့် မြစ်၊ ချောင်းများထိန်းသိမ်းရေး ဥပဒေ(၂၀၀၆)

စီမံကိန်းပိုင်ရှင်သည်-

(က) ရေအရင်းအမြစ်နှင့်မြစ်၊ ချောင်းများထိခိုက်ပျက်စီးစေရန် ရည်ရွယ်၍ တစ်စုံတစ်ရာပြုလုပ်ခြင်း မပြုပ။ (ပုဒ်မ၈ (က) အရ)

(ခ) ကမ်းပါးမှ သဘာဝပတ်ဝန်းကျင် ထိခိုက်ပျက်စီးခြင်းဖြစ်စေမည့် စက်သုံးဆီ၊ ဓာတုပစ္စည်း၊ အဆိပ်သင့်ပစ္စည်းနှင့် အခြားပစ္စည်းများ စွန့်ပစ်ခြင်း၊ ပေါက်ကွဲစေတက်သောပစ္စည်း များ စွန့်ပစ်ခြင်းမပြုပါ။ (ပုဒ်မ ၁၁(က)အရ)

(ဂ) ကမ်းပါးမှ ရေလမ်းပျက်စီးခြင်း သို့မဟုတ် ရေကြောင်းပြောင်းလဲခြင်း ဖြစ်ပေါ်စေမည့် အရာဝတ္ထုတစ်ခုခုကို စွန့်ပြစ်ခြင်းမပြုပါ။ (ပုဒ်မ ၁၉ အရ)

(ဃ) ဦးစီးဌာနက မြစ်၊ ချောင်းအတွင်း ရေထုညစ်ညမ်းမှု မဖြစ်ပေါ်စေရေးနှင့် ရေလမ်းကြောင်းမပြောင်းလဲစေရေးအတွက် သတ်မှတ်ထားသော စည်းကမ်းချက်များကို ဖောက်ဖျက်ခြင်းမပြုပါ။ (ပုဒ်မ ၂၄ (က)အရ)

၂၆။ ရေချိုငါးလုပ်ငန်း ဥပဒေ (၁၉၉၁)

စီမံကိန်းပိုင်ရှင်သည်ရေချိုငါးလုပ်ငန်း ရေပြင်အတွင်း ရေထုညစ်ညမ်းစေခြင်းနှင့် ငါးနှင့် အခြားရေနေသတ္တဝါများကို နှောက်ယှက်ခြင်း မပြုပါ။ (ပုဒ်မ ၄၀ အရ)

၂၇။ မြန်မာ့ပင်လယ်ငါး လုပ်ငန်းဥပဒေ (၁၉၉၀)

စီမံကိန်းပိုင်ရှင်သည် ငါး၊ အခြားရေနေသတ္တဝါတို့ကို အနှောင့်အယှက်ဖြစ်စေရန် သို့မဟုတ် ရေထုကို ညစ်ငြမ်းစေရန် သက်ရှိရေသတ္တဝါကို ဖြစ်စေ၊ အရာဝတ္ထုပစ္စည်းတစ်ခုခုကို ဖြစ်စေ၊ မြန်မာ့ ပင်လယ်ငါးလုပ်ငန်း ရေပြင်တွင် စွန့်ပစ်ခြင်းမပြုပါ။ (ပုဒ်မ ၃၉ အရ)

၂၈။ ယဉ်ကျေးမှုအမွေအနှစ်ဒေသများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ (၁၉၉၈)

စီမံကိန်းဧရိယာသည် ရှေးဟောင်းအမွေအနှစ် ဒေသအတွင်း ကျရောက်ပါက စီမံကိန်းပိုင်ရှင်သည် ပုဒ်မ ၁၃ နှင့် ၁၅ တို့ပါ ပြဋ္ဌာန်းချက်များနှင့်အညီ လိုက်နာဆောင်ရွက် ပါမည်။

၂၉။ ရှေးဟောင်း ဝတ္ထုပစ္စည်းများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ (၂၀၁၅)

စီမံကိန်းပိုင်ရှင်သည် မိမိ၏ စီမံကိန်း ဧရိယာအတွင်း ရှေးဟောင်းဝတ္ထုပစ္စည်းကို တွေ့ရှိပါက အနီးဆုံးရပ်ကွက် သို့မဟုတ် ကျေးရွာအုပ်စု အုပ်ချုပ်ရေးမှူးထံ အကြောင်းကြားပါမည်။ (ပုဒ်မ၁၂ အရ)

၃၀။ ရှေးဟောင်းအဆောက်အအုံများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ (၂၀၁၅)

စီမံကိန်းပိုင်ရှင်သည်-

(က) စီမံကိန်း နယ်နမိတ်အတွင်း မြေအောက် သို့မဟုတ် မြေပေါ်တွင် ရှေးဟောင်း အဆောက်အအုံကို တွေ့ရှိပါက အနီးဆုံးရပ်ကွက် သို့မဟုတ် ကျေးရွာအုပ်စု အုပ်ချုပ်ရေးမှူးထံ အကြောင်းကြားပါမည်။ (ပုဒ်မ၁၂အရ)

(ခ) စီမံကိန်း ဧရိယာသည် ရှေးဟောင်းအဆောက်အအုံ ဧရိယာအဖြစ် သတ်မှတ်သည့် ဧရိယာအတွင်း ကျရောက်ပါက ရှေးဟောင်းသုတေသန ဦးစီးဌာန၏ ကြိုတင်ခွင့် ပြုချက်ကို ရယူပါမည်။ (ပုဒ်မ ၁၅ အရ)

(ဂ) ရှေးဟောင်းအဆောက်အအုံ နယ်နမိတ်အတွင်း အစိုင်အခဲများ စွန့်ပစ်ခြင်းနှင့် ဓာတုပစ္စည်းများ စွန့်ပစ်မည်ဆိုပါက ရှေးဟောင်းသုတေသန ဦးစီးဌာန၏ ကြိုတင်ခွင့် ပြုချက်ကို ရယူပါမည်။ (ပုဒ်မ ၂၀ (စ) အရ)

၃၁။ သစ်တောဥပဒေ (၁၉၉၂)

စီမံကိန်းပိုင်ရှင်သည် သစ်တောနယ်မြေ သို့မဟုတ် သစ်တောဖုံးလွှမ်းသော နယ်မြေတွင် စီမံကိန်းကို ဆောင်ရွက်ရမည်ဖြစ်ပါက သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဝန်ကြီးဌာန၏ ခွင့်ပြုချက်ရယူပြီးမှ ဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၁၂ (က) အရ)

၃၂။ မြန်မာ့အထူးစီးပွားရေးဇုန်ဥပဒေ (၂၀၁၄)

စီမံကိန်းပိုင်ရှင်သည် -

(က) စီမံခန့်ခွဲမှုကော်မတီက အမိန့်ကြော်ငြာစာ၊ အမိန့်၊ ညွှန်ကြားချက်နှင့် လုပ်ထုံးလုပ်နည်း များဖြင့် သတ်မှတ်ပေးသည့် လိုက်နာရမည့် သတ်မှတ်ချက်များကို လိုက်နာဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၁၁(စ) အရ)

(ခ) သဘာဝပတ်ဝန်းကျင် ထိန်းသိမ်းကာကွယ်ရေးအတွက် စီမံခန့်ခွဲမှုကော်မတီ၏ တည်ဆဲ ဥပဒေများနှင့်အညီ ကြီးကြပ်ကွပ်ကဲခြင်းကို လိုက်နာဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၁၁(တ) အရ)

(ဂ) မြန်မာနိုင်ငံ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဥပဒေပါစံချိန်စံညွှန်းများနှင့် နိုင်ငံတကာ စံချိန် စံညွှန်းများကို လိုက်နာပါမည်။ ထို့ပြင် လူမှုရေးနှင့် ကျန်းမာရေးဆိုင်ရာ ထိခိုက်မှုများ မရှိစေရန် တည်ဆဲဥပဒေများနှင့်အညီ လိုက်နာဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၃၅ အရ)

(ဃ) အဆင့်မြင့်နည်းပညာနှင့် ကျွမ်းကျင်မှုဆိုင်ရာ မလိုအပ်သော လုပ်ငန်းများတွင် နိုင်ငံသား များကိုသာ ခန့်ထားပါမည်။ (ပုဒ်မ ၇၄ အရ)

(င) အဆင့်မြင့်နည်းပညာနှင့် ကျွမ်းကျင်မှုဆိုင်ရာ လိုအပ်သော လုပ်ငန်းများတွင် နိုင်ငံသား ကျွမ်းကျင်သူ အလုပ်သမားများ၊ အတတ်ပညာရှင်များနှင့် ဝန်ထမ်းများကို -

(၁) လုပ်ငန်းစတင်သည့်နှစ်မှ ပထမ ၂ နှစ်အတွင်း၌ အနည်းဆုံး ၂၅ ရာခိုင်နှုန်း၊

(၂) လုပ်ငန်းစတင်သည့်နှစ်မှ ဒုတိယ ၂ နှစ်အတွင်း၌ အနည်းဆုံး ၅၀ ရာခိုင်နှုန်း၊

(၃) လုပ်ငန်းစတင်သည့်နှစ်မှ တတိယ ၂ နှစ်အတွင်း၌ အနည်းဆုံး ၇၅ ရာခိုင်နှုန်း၊

ခန့်ထားပါမည်။ (ပုဒ်မ ၇၅ အရ)

(စ) မိမိနှင့် အလုပ်သမား၊ အတတ်ပညာရှင် သို့မဟုတ် ဝန်ထမ်းတို့အကြား အငြင်းပွားမှု ပေါ်ပေါက်ပါက စီမံခန့်ခွဲမှုကော်မတီ၏ စေ့စပ်ညှိနှိုင်းခြင်းနှင့် ဖြန်ဖြေခြင်းကို ခံယူပါမည်။ (ပုဒ်မ ၇၆(က) အရ)

(ဆ) မိမိခန့်ထားမည့် နိုင်ငံခြားသားဝန်ထမ်းများအတွက် ထားဝယ်အထူးစီးပွားရေးဇုန်အတွင်း ဖွင့်လှစ်ထားသည့် အလုပ်သမားကိုယ်စားလှယ်ရုံးက ထုတ်ပေးသည့် အလုပ်လုပ်ခွင့် ပါမစ်ကို ရယူပါမည်။ (ပုဒ်မ ၇၇ အရ)

(ဇ) နိုင်ငံခြားသားဝန်ထမ်းကို သတ်မှတ်ထားသည့် အရေအတွက်ထက် ပိုမို ခန့်ထားလိုပါက စီမံခန့်ခွဲမှုကော်မတီ၏ ခွင့်ပြုချက်ရရှိမှသာ ခန့်ထားပါမည်။ (ပုဒ်မ ၇၈ အရ)

(ဈ) အသုံးပြုခွင့်ရရှိထားသည့် စီမံကိန်းမြေပေါ်တွင် လူနေအိမ်ခြေများ၊ အဆောက်အအုံများ၊ လယ်ယာဥယျာဉ်ခြံမြေများ၊ သီးပင်စားပင်များ၊ စိုက်ခင်းများ၊ ပြောင်းရွှေ့ရှင်းလင်းပေးရန် လိုအပ်ပါက ထိုသို့ပြောင်းရွှေ့နေရာချထားခြင်းနှင့် လျော်ကြေးပေးခြင်းတို့အတွက် ကုန်ကျစရိတ်များကို ချုပ်ဆိုထားသည့် သဘောတူညီချက်နှင့်အညီ ကျခံပါမည်။ (ပုဒ်မ ၈၀(က) အရ)

(ည) ပြောင်းရွှေ့ရသူများအတွက် မူလအဆင့်အတန်းထက် မနိမ့်ကျစေရန်၊ ယင်းတို့၏အခြေခံ လိုအပ်ချက်များ ပြည့်စုံစေရန်နှင့် အဆိုပါလုပ်ငန်းများ အဆင်ပြေချောမွေ့စေရန် စီမံခန့်ခွဲမှု ကော်မတီနှင့် ညှိနှိုင်းဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၈၀(ခ) အရ)

(ဋ) အသုံးပြုခွင့်ရရှိသော စီမံကိန်းမြေကို သတ်မှတ်ထားစည်းကမ်းချက်များနှင့်အညီ အသုံးပြု ပါမည်။ (ပုဒ်မ ၈၀(ဂ) အရ)

(ဃ) အသုံးပြုခွင့်ရရှိသော စီမံကိန်းမြေ၏ သဘာဝမြေမျက်နှာသွင်ပြင် သို့မဟုတ် မြေ အနိမ့် အမြင့် အနေအထားကို စီမံခန့်ခွဲမှုကော်မတီ၏ ခွင့်ပြုချက်မရှိဘဲ သိသာထင်ရှားစွာ ပြုပြင် ပြောင်းလဲခြင်းမပြုပါ။ (ပုဒ်မ ၈၀(ဃ) အရ)

(င) အသုံးပြုခွင့်ရရှိသော စီမံကိန်းမြေ၏ မြေပေါ်သို့မဟုတ် မြေအောက်၌ မိမိအားခွင့်ပြုသည့် လုပ်ငန်းနှင့် မသက်ဆိုင်သည့် သဘာဝသယံဇာတ တွင်းထွက်ပစ္စည်းကိုဖြစ်စေ၊ ရှေးဟောင်းဝတ္ထုပစ္စည်းကို ဖြစ်စေ၊ ရတနာသိုက်ကိုဖြစ်စေ တွေ့ရှိလျှင် စီမံခန့်ခွဲမှုကော်မတီ သို့ ချက်ချင်းအကြောင်းကြားပါမည်။ ထို့ပြင် စီမံခန့်ခွဲမှုကော်မတီက အစားထိုးစီစဉ်ပေးသည့် နေရာသို့ ပြောင်းရွှေ့ဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၈၅ အရ)

၃၃။ မြန်မာနိုင်ငံအင်ဂျင်နီယာကောင်စီဥပဒေ (၂၀၁၃)

စီမံကိန်းပိုင်ရှင်သည် -

(က) အင်ဂျင်နီယာဆိုင်ရာလုပ်ငန်းနှင့် နည်းပညာဆိုင်ရာ လုပ်ငန်းများကို ကောင်စီကထုတ်ပေး သော မှတ်ပုံတင်လက်မှတ် ရရှိထားသည့် အင်ဂျင်နီယာများကိုသာ ခန့်အပ်ဆောင်ရွက်စေ ပါမည်။ (ပုဒ်မ ၃၇ အရ)

(ခ) အင်ဂျင်နီယာဝန်ထမ်းများက မှတ်ပုံတင်လက်မှတ်ပါ စည်းကမ်းချက်များကို လည်းကောင်း၊ မြန်မာနိုင်ငံအင်ဂျင်နီယာ ကောင်စီဥပဒေပါ ပြဋ္ဌာန်းချက်များကို လည်းကောင်း၊ ယင်းဥပဒေအရ ထုတ်ပြန်သည့် နည်းဥပဒေများ၊ အမိန့်နှင့် ညွှန်ကြားချက် တို့ပါ တားမြစ်ချက်များကို လည်းကောင်း လိုက်နာစေရပါမည်။ (ပုဒ်မ ၃၄ အရ)

၃၄။ မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်ဥပဒေ (၂၀၁၅)

စီမံကိန်းပိုင်ရှင်သည် ဆိပ်ကမ်းနယ်နိမိတ်အတွင်း ကမ်းပါးနယ်နှင့် ကုန်းမြေမှ ဘေးအန္တရာယ် ဖြစ်စေတတ် သော ပစ္စည်းများ၊ အဆိပ်သင့်ပစ္စည်းများ၊ အမှိုက်သရိုက်များ၊ အညစ်အကြေးများနှင့် စွန့်ပစ်ပစ္စည်းများကို ရေထုအတွင်း ပြစ်ချခြင်းမပြုရန် ဆိပ်ကမ်းအာဏာပိုင်၏ စီမံချက်နှင့်အညီ လိုက်နာဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၂၃(က) အရ)

၃၅။ ပို့ကုန်သွင်းကုန်ဥပဒေ (၂၀၁၂)

စီမံကိန်းပိုင်ရှင်သည် ပြည်ပမှပစ္စည်းများ တင်သွင်းပါက၊ မိမိ၏ထုတ်ကုန်များ ပြည်ပသို့ တင်ပို့ပါက ခွင့်ပြုချက်ပါ စည်းကမ်းချက်များအတိုင်း လိုက်နာပါမည်။ (ပုဒ်မ ၇ အရ)

လက်မှတ်...

Dr. Somchet Thinaphong

မန်းနေးဂျင်းဒါရိုက်တာ

မြန်ထားဂယ် စက်မှုဇုံ ကုမ္ပဏီလစ်မစ်တက်

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
1.	The Environmental Conservation Law (2012)	To construct a healthy and clean environment and to conserve natural and cultural heritage for the benefit of present and future generations and to maintain the sustainable development through effective management of natural resources and to enable to promote international, regional and bilateral cooperation in the matters of environmental conservation.	• The project proponent has to pay the compensation for damages if the project will causes injuries to environment under the sub-section (o) of section 7 of said law. • The project proponent has to purify, emit, dispose and keep the polluted materials in line with the stipulated standards, under section 14 of said law • The project proponent has to install or use the apparatus which can control or help to reduce, manage, control or monitor the impacts on the environment, under section 15 of said law. • The project proponent has to allow relevant governmental organization or department to inspect whether performing is conformity with the terms and condition included in prior permission, stipulated by the ministry, or not, under section 24 of said law. • The project proponent has to comply with the terms and conditions included in prior permission, under section25 of said law. • The project proponent has to abide by the stipulations included in the rules, regulation, by-law, order, notification and procedure issued by said law, under section 29.
2.	The Environmental Conservation Rules (2014)		• The project proponent has to avoid emit, discharge or dispose the materials which can pollute to environment, or hazardous waste or hazardous material prescribed by notification in the place where directly or indirectly injure to public under sub- rule (a) of rule 68. • The project proponent has to avoid performing to damage to ecosystem and the environment generated by said ecosystem under sub-rule (b) of rule 68.
3.	Environment Impact Assessment Procedure (2015)		• The project proponent has to be liable for all adverse impacts caused by doing or omitting of project owner or contractor, sub-contractor, officer, employee, representative or consultant who is appointed or hired to perform on behalf of project owner, under sub-paragraph (a) of paragraph 102. • The project proponent has to support, after consultation with effected persons by project, relevant government organization, government department and other related persons, to resettlement and rehabilitation for livelihood until the effected persons by the project receiving the stable socio-economy which is not lower than the status in pre-project, under sub-paragraph (b) of paragraph 102. • The project proponent has to fully implement all commitments of project and conditions included in EMP. Moreover the project proponent has to be liable for contractor and sub-contractor who perform on behalf of him/her have to fully abide by the relevant laws, rules, this procedure, EMP and all conditions, under paragraph 103.
			• The project proponent has to be liable and fully & effectively implement all requirements included in ECC, relevant laws and rules, this procedure and standards under rule 104.

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
			• The project proponent has to inform the completed information, after specifying the adverse impacts caused by the project, from time to time, under paragraph 105. • The project proponent has to continuously monitor all adverse impacts in the pre-construction phrase, construction phrase, operation phrase, suspension phrase, closure phrase and post-closure phrase, moreover has to implement the EMP with abiding the all conditions included in ECC, relevant laws & rules and this procedure, under paragraph 106. • The project proponent has to submit, as soon as possible, the failures of his or her responsibility, other implementation, ECC or EMP. If dangerous impact caused by this failure or failure should be known by the Ministry the project proponent has to submit within 24 hours and other than this situation has to submit within 7 days from knowing it, under paragraph 107. • The project proponent has to submit the monitoring report dually or prescribed time by Ministry in line with the schedule of EMP, under paragraph 108. • The project proponent has to prepare the monitoring report in accord with the rule 109. • The project proponent has to show this monitoring report in public place such as library, hall and website and office of project for the purpose to know this report by public within 10 days from the date which the report is submitted to the Ministry. Moreover has to give the copy of this report, by email or other way which way agreed with the asked person, to any asked person or organization, under paragraph 110. • The project proponent has to allow inspector to enter and inspect in working time and if it is needed by Ministry has to allow inspector to enter and inspect in the office and work-place of project and other work-place related to this project in any time, under paragraph 113. • The project proponent has to allow inspector to immediately enter and inspect in any time if it is emergency or failure to implement the requirements related to social or environment or caused to it, under paragraph 115. • The project proponent has to allow inspector to inspect the contractor and sub-contractor who implement on behalf of project, under paragraph 117.
4.	Emission Quality Standards Guideline (2015)		• The project proponent has to emit, discharge or dispose in line with the standards stipulated in said guideline.
5.	The Myanmar Investment Law (2016)	To ensure the appointing of employees, fulfilling the rights of employees, avoiding any injury to environment, social and cultural heritage, insure the	• The project proponent has to lease the land or building owned by government or private with lease agreement and register it by the registration of deeps law under sub- section (a) and (d) of section 50 of said law.

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
		prescribed insurance in line with the above law.	• The project proponent has to appoint the nationalities in the various levels of administrative, technical and expert work by the arrangement to develop their expertise, in line with the sub-sectio (b) of section51of said law. • The project proponent has to appoint the nationalities only in normal work without expertise, in line with the sub-section (c) of section 51of said law. • The project proponent has to appoint either foreigner or nationality with the appointment agreement in accord with the law, in line with the sub-section (d) of section51of said law. • The project proponent has to comply with the international best practices, existing laws, rules and procedures to not damage, pollute, and injure to environment, cultural heritage and social, in line with the sub-section (g) of section 65 of said law. • The project proponent has to close the project after paying the compensation to the employees in accord with the existing laws if violates the appointment agreement or terminate, transfer or suspend the investment or reduce the number of employees , in line with the sub-section (i) of section 65 of said law. • The project proponent has to pay the wages or salary to the employees in accord with the laws, rules, order and procedures in the suspension period, in line with the sub-section (j) of section 65 of said law. • The project proponent has to pay the compensation or injured fees to the respected employees or their inheritors if injury in or loss of part of body or death caused by work, in line with the sub-section (k) of section 65of said law. • The project proponent has to stipulate the foreign employees to respect the culture and custom and abide by the existing laws, rules, orders, directives, in line with the sub-section (l) of section65of said law.. • The project proponent has to abide by labour laws, in line with the sub-section (m) of section65of said law. • The project proponent has to pay the compensation to the injured person for damages if damages of environment or socio-economy is occurred by misuse of project, in line with the sub-section (o) of section65of said law. • The project proponent has to allow to inspect in anywhere of project if Myanmar Investment Commission inform to inspect the project, in line with the sub-section (p) of section 65 of said law.. • The project proponent has to obtain the permission of MIC before EIA process and report back this process to MIC, in line with the sub-section (q) of section 65of said law.

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
			• The project proponent has to insure the prescribed insurance by rules, under section 73 of said law.
6.	Protection the Rights of National Races Law (2015)	To ensure to disclose to residents ethnic nationalities about the project fully, moreover to ensure to cooperate with them.	• The project proponent has to disclose to the residents national races all about the project fully, under section 5 of said law. • The project proponent has to cooperate with the residents national races.
7.	The Public Health Law (1972)	To ensure the public health include not only employees but also resident people and cooperation with the authorized person or organization of health department.	The project owner will cooperate with the authorized person or organization in line with the section 3 and 5 of said law. • The project proponent has to abide by any instruction or stipulation for public health, under section 3 of said law. • The project proponent has to allow any inspection, anytime, anywhere if it is needed, under section 5 of said law.
8.	Prevention and Control of Communicable Diseases Law (1995)	To ensure the healthy work environment and prevention the communicable diseases by the cooperation with the relevant health department.	• The project proponent has to build the housing in line with the health standards, distribute the healthful drinking water & using water and arrange to systematically discharge the garbage & sewage, under clause (9) of sub-section (a) of section 3 of said law. • The project proponent has to abide by any instruction or stipulation by Department of health and Ministry of Health, under section 4 of said law. • The project proponent has to inform promptly to the nearest health department or hospital if the following are occurred: (section 9) (a) Mass death of animals included in birds or chicken; (b) Mass death of mouse; (c) Suspense of occurring of communicable disease or occurring of communicable disease; (d) Occurring of communicable disease which must be informed. • The project proponent has to allow any inspection, anytime, anywhere if it is need to inspect by health officer, under section 11 of said law.
9.	The Control of Smoking and Consumption of Tobacco Product Law (2006)	To ensure the creation of smoking area and non-smoking area in the power plant area for health and control of smoking.	• The project proponent has to keep the caption and mark referring that is non- smoking area in the project area, under sub-section (a) of section 9 of said law. • The project proponent has to arrange the specific place for smoking in the project area and keep the caption and mark in accordance with the stipulations, under sub-section (b) of section 9 of said law.

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
			• The project proponent has to supervise and carry out the measures so that no one shall smoke at the non-smoking area, under sub-section (c) of section 9 of said law. • The project proponent has to allow the inspection of supervisory body in the power plant area, under sub-section (d) of section 9 of said law.
10.	The Myanmar Fire Force Law (2015)	To ensure to prevent the fire, to provide the precautionary material and apparatuses, if the fire caused in the project area to be defeated because the project is business in which electricity and any inflammable materials such as petroleum are used. So, the project owner has to institute the specific fire service in line with the above law.	• The project proponent has to institute the specific fire services, under sub-section (a) of section 25 of said law. • The project owner has to provide materials and apparatuses for fire precaution and prevention, under Sub-section (b) of section 25 of said law.
11.	The Motor Vehicles law (2015) and Rules (1987)	When the construction period and if it is needed in operation and production period for the all vehicles.	• The project proponent has to promise to abide by the nearly all provisions of said law and rules, especially the provisions related to air pollution, noise pollution and life safety.
12.	The Myanmar Insurance Law	The project can cause the damages to the environment and injuries to public so to ensure the needed insurances are insured at Myanmar Insurance.	• If the project proponent uses the owned vehicles the project owner has to insure the insurance for injured person, under section 15 of said law. • The project proponent has to insure the insurance to compensate for general damages because the project may cause the damages to the environment and injury to public, under section 16 of said law.
13.	Labour Organization Law (2011)	To ensure protection the rights of the employees, having the good relationships between the employees and employer and enabling to form and carry out the labour organizations systematically and independently.	• The project owner has to allow the labour organization to negotiate and settle with the employer if the workers are unable to obtain and enjoy the rights of the workers contained in the labour laws and to summit demands to the employer and claim in accord with the relevant law if the agreement cannot be reached, under section 17 of said law. • The project proponent has to allow the demand for the re-appointment of worker who is dismissed by the employer without the conformity with the labour laws, under section 18. • The project proponent has to send the representatives to the Conciliation Body in settling a dispute between the employer and the worker, under section 19 of said law.

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
			• The project proponent has to allow the labour organization to participate and discuss in discussing with the government, the employer and the complaining employees in respect of employee's rights or interest contained in the labour laws, under section 20 of said law. • The project proponent has to allow the labour organization to participate in solving the collective bargains of the employees in accord with the labour laws, under section 21 of said law. • The project proponent has to allow the labour organization to carry out the holding the meetings, going on strike and other collective activities in line with the procedure, regulation ,by-law and directive of relevant Chief Labour Organization, under section 22 of said law.
14.	The Settlement of Labour Dispute Law,2012	To ensure negotiation and discussion between employees and project proponent, abiding the decision of Tribunal.	• The project proponent has to not absent to negotiation within the stipulated time for complaint, under section 38 of said law. • The project proponent has to not change the existing stipulations for employees within conducting period before Tribunal, under section 39 of said law. • The project proponent has to not close the work without negotiation, discussion on dispute in accord with this law, decision by Tribunal, under section 40 of said law. • The project proponent has to pay the compensation decided by Tribunal if violates any act or any omission to damage the interest of labour by reducing of product without efficient cause, under section 51 of said Law.
15.	Employment and Skill Development Law (2013)	To ensure the job security and to develop the employee's skill with the fund of project owner.	• The project proponent has to appoint employees with the contract in line with the provision of section 5 of said law. • The project proponent has to carry out the training programs with the policy of Skill Development Body to develop the employment skill of employees who is appointed or will be appointed, under section 14 of said law. • The project proponent has to monthly pay to the fund, which is fund for development of skill of employees, not less below 0.5 percentage of the total payment to the level of worker supervisor and the workers below such level, under sub-section (a) of section 30 of said law. • The project proponent has to deduct from the payment of employees for above mentioned fund, under sub-section (b) of section 30 of said law.
16.	The Minimum Wages Law (2013)	To ensure the project owner pay the wages not less than prescribed wages and notify obviously this wages in work place, moreover to be inspected.	• The project proponent has to pay the wages in line with section 12 of said law. • The project proponent has to notify the prescribed wages obviously in work place, under sub-section (a) of section 13 of said law. • The project proponent has to correctly record the lists, schedules, documents and wages and report these to the relevant department and give if these are asked while inspecting, in accord with the stipulations, under sub-section (b)(c)(d) of section13 of said law.

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
			• The project proponent has to allow to be inspected by the inspector, under sub-section (d) and (e) of section 13 and section 18 of said law. • The project proponent has to allow holiday for medical treatment if the employee' health is not fit to work, under sub-section (f) of section 13 of said law. • The project proponent has to allow holidays without deducting from the wages if one of parents or one of family dies, under sub-section (g) of section 13 of said law.
17.	Payment of Wages Law (2016)	To ensure the way of payment and avoiding delay payment to the employees.	• The project proponent has to pay the wages in accord with the section 3 and 4 of said law, under section 3 & 4 of said law. • The project proponent has to submit with the agreements of employees & reasonable ground to department if it is difficult to pay because of force majeure included in natural disaster, under section 5 of said law. • The project proponent has to abide by the provisions of section 7 to 13 in chapter (3) in respect of deduction from wages. • The project proponent has to pay the overtime fees, prescribed by law, to the employees who work over working hours, under section 14 of said law.
18.	Workmen's Compensation Act (1923)	To ensure the compensations to injured employee while implementing in line with the above law. To pay the prescribed compensations in various kinds of injury.	• The project proponent has to pay the compensation in line with the provisions of said law base on kind of injury and case by case.
19.	The Leaves and Holiday Act (1951)	The employees can take the leaves and get the holidays legally and to ensure the right to get the holidays and leaves.	• The project proponent has to allow the leaves and holidays in line with the law.
20.	Social Security Law	The project proponent has to create the social security for the employees because the project is the business under the Myanmar Citizen Investment Law. To ensure the social security for employees of the project, the project owner has to register to the social security	• The project proponent has to register to the respected social security office, under sub-section (a) of section 11 of said law • The project proponent has to pay the social security fund for at least four types of social security included in sub-section (a) of section 15, under section 15 of said law. • The project proponent has to pay the fund which has to be paid myself and together with the fund which has to be paid from their salary by the employees .Moreover the project owner will pay the cost for paying the above mentioned fund only myself under sub-section (b) of section 18 of said law.

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
		offices and to pay the prescribed fund.	• The project proponent has to pay the fund for accidence, under sub-section (b) of section 48 of said law. (but this fund is not related to workmen compensation) • The project proponent has to make correctly and submit the list and record provided in section 75 to respected social security office, under section 75 of said law.
21.	Petroleum Act (1934)	The project will carry the oil in any phase and may import it. So, to ensure to take the license for importation and storage and abide by the stipulations in the license.	• The project proponent has to obtain the license for importation, transportation and storage of the fuel under section 3 of said law and abide by the stipulations in the license.
22.	The Petroleum Rules (1937)	To ensure the project owner has to abide by the stipulations for transportation of oil.	• The project proponent will abide by the provision of chapter (3) of the Petroleum Rules for transportation and the provisions of chapter (4) of said rules for storage.
23.	The Underground Water Act (1930)	To ensure to obtain the license before sinking the groundwater if it is needed to sink the ground water.	• The project proponent has to obtain the licence granted by the water officer for sinking the underground water before sinking water, under section 3 of said law •
24.	Conservation of Water Resources and Rivers Law (2006)	The project proponent will avoid the disposal of stipulated materials into river-creek.	• The project proponent has to avoid any performing to damage to the river, creek and water resource, under sub-section (a) of section 8 of said law. • The project proponent has to avoid the violation of conditions stipulated by the directorate for prevention of water pollution, under sub-section (b) of section 24 of said law.
25.	Freshwater Fisheries Law (1991)	According to the sub-section (e) of section 2 of said law, the freshwater area includes any river, creek, pond and water area so the project will be near by the river or creek which is freshwater area the safety of freshwater and aquatics.	• The project proponent has to avoid any water pollution and disturbing to fish &other aquatic lives in any fresh-water such as river or creek, under section 40 of said law.
26.	Myanmar Marine Fishery Law (1990)	According to the sub-section (f) of section 2 of said law, the Myanmar marine fishery water area includes the water area along the sea cost of Myanmar	• The project proponent has to avoid any water pollution and disturbing to fish &other aquatic lives in any Myanmar marine-water under section 39 of said law.

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
		from the high tide mark toward the open sea and on the seaside of the straight line drawn from one extreme end of one bank to the extreme end of the other bank of the river and creek mouths so the project will be nearby Myanmar marine water area, river or creek which is freshwater area.	
27.	The Protection and Preservation of Cultural Heritage Regions Law (1998)	To ensure the protection of cultural heritages and the cultural heritage area from the damage by the natural disaster or man-made.	• The project proponent has to apply to get the prior permission of Directorate of Ancient-Research to build the road, bridge or dam in the cultural heritage area, under section 13 of said law. • The project proponent promises not to build the building which is not in line with the stipulations prescribed by the Ministry of Culture in the cultural heritage area.
28.	The Protection and Preservation of Antique Objective Law (2015)	To ensure the protection of ancient monument and information about it if it was in the project area.	• The project proponent has to inform to the village-tract or ward administrator if any antique objective is found in project area under section 12 of said law.
29.	The Protection and Preservation of Ancient Monument Law (2015)	To ensure the protection of ancient monument and information about it if it is in the project area.	• The project proponent has to report to the village-tract or ward administrators if the project proponent will find any ancient monument under the ground or on the ground or under the water under section 12 of said law. • The project proponent has to obtain the prior permission of Department of Ancient Research Museum if the project area is in the prescribed area of Ancient monument under section 15 of said law. • The project proponent has to obtain the prior permission, by written, of Department of Ancient Research and National Museum if the project proponent dispose the chemical and solid waste in the Ancient Monument area under sub-section of section 20 of said law.
30.	The Forest Law (1992)	To sustain forest resources and ensure perpetual supply of benefits from forest for next generation and to protect soil, water, wildlife, biodiversity and environment	• Under sub-section (a) of section 12, the project proponent has to obtain the approval of Ministry if the project area is included in the forest land or the land administrated by the government which covers the forest under section 1 of said law.

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
31.	The Special Economic Zone Law (2014)	The project locates in Dawei special economic zone. According to section 89 of said law the project has to abide by said law so to ensure the responsibilities of project proponent.	• The project proponent has to abide by the any stipulation included in the notification, order, directive and procedure issued by special economic zone administrative committee, under sub-section (f) of section 11 of said law. • The project proponent has to comply with the stipulations of SEZ administrative committee, under sub-section (p) of section 11 of said law. • The project proponent has to abide by the standards included in the environmental conservation law and international standards, moreover has to abide by the existing laws to not injure to social and health, under section 35 of said law. • The project proponent has to appoint the nationalities only for normal work without expertise, under section 27 of said law. • The project proponent has to appoint the nationalities in the high- technical work and expert work at least 25 % in first two years later the date which is commencement of project, and at least 50% in second two years later, and at least 75% in third two years later, under section 75 of said law. • The project proponent has to abide by the negotiation by the administrative committee if the dispute, between employees and me, is occurred, under sub-section (a) of section 76 of said law. • The project proponent has to obtain the work permit for foreign employees issued by representative office of labour department before starting to work, under section 77 of said law. • The project proponent has to obtain the approval of administrative committee before appointment if it is needed to appoint the foreign employees in administrative and technical work over the limited numbers, under section 78 of said law. • The project proponent has to pay the cost for compensation and resettlement for project land if housing, buildings, farm, garden, fruit trees or other plantation is in the project area, in accord with the agreement, under sub-section (a) of section 80. • The project proponent has to coordinate with the administrative committee to facilitate in resettlement process for to not low the original living standards and fulfill their basic needs, under sub-section (b) of section 80 of said law. • The project proponent has to use the project land in accord with the stipulations under sub-section (c) of section 80 of said law. • The project proponent do not change the physical features of land without the approval of administrative committee, under sub-section (d) of section 80 of said law. • The project proponent has to inform to the administrative committee if any antique objective or any natural resource or treasure trove is found on or under the land in project area, moreover has to move to the replaced land for project if the original land cannot be allowed to continue the project, under sub-section (e) of section 80 of said law.

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
32.	The Engineering Council Law (2013)	To ensure the safety in technical and engineering work in the project.	• The project proponent has to appoint the employees, who obtained the registration certificate issued by the Myanmar Engineering Council, in the technical and engineering work, under section 37 of said law. • The project proponent has to ensure the employees who are engineers abide to the provisions of Myanmar Engineering Council law, prohibitions included in the rules, order and directive issued under said law, conditions included in the registration certificate issued by the Myanmar engineering council, under section 34 of said law.
33.	Prevention of Hazardous from Chemical and Related Substances Law, 2013	To ensure to use the hazardous chemical and related substances safely and safety for the employees. Moreover to be safe in carrying the hazardous chemical and related substances and storage place of it. If it is needed to train how to use the safety dresses which provided to the employees with free of charges. To ensure that compensate for injury to person or damage to environment. The project has to be inspected for safety use of hazardous chemical and related substances before starting the project.	• The project owner will be inspected for the safety and resistance of the machinery and equipment by the respective Supervisory Board and Board of Inspection before starting the business, under sub-section(a) of section 15 of said law • The project owner will assign the employees, who will serve with the hazardous chemical and substances, to attend the trainings on prevention of hazardous chemical and substances in local or abroad, under sub-section(b) of section 15 of said law • The project owner will abide by the conditions included in the licensee, under sub-section(a) of section 16 • The project owner will abide by and assign to the employees who serve in this work to abide by the instructions for safety in using the hazardous chemical and related substances, under sub-section(b)of section 16 • The project owner will arrange the enough safety equipment in the work-place and provide the safety dresses to the employees who serve in this work with free of charge, under sub-section(c)of section 16 • The project owner will train, in work-place my arrangement ,the know-how to use the occupational safety equipment, personal protection equipment and safety dresses systemically in the work-place, under sub-Section(d) of section 16 • The project owner will allow the receptive Supervisory Board and Board of Inspection to inspect whether the hazard may be injured to health of human or animal or damaged to environment, under sub-section(e) of section 16 • The project owner will assign the healthy employees who have obtained the recommendation that is fit for this work after taken medical check- up and keep systematically the medical records of employees, under sub-section (f) of section 16. • The project owner will inform the copy of storage permission for hazardous chemical and related substances to the relevant township administrative office, under sub-section (g) of section 16.

Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
			• The project owner will obtain the approval with instructions of relevant fire force before starting the work if the project will use the fire hazard substances or explosive substances, under sub-section (h) of section 16. • The project owner will transport only the limited amount of the chemical and related substance in accord with the prescribed stipulations in local transportation under sub-section (i) of section 16. • The project owner will insure, in accord with the stipulations, to pay the compensation if the project cause injury to person or animals or damage to environment, under section 17. • The project owner will abide by the conditions included in the registration certificate. Moreover will abide by the orders and directives issued by the Central Supervisory Board from time to time, under section 22. • The project owner will classify the level of hazard to protect it in advance according to the properties of chemical and related substances, under sub-section (a) of section 27. • The project owner will provide the safety equipment, personal protection equipment to protect and reduce the accident and assign to attend the training to use the equipment systematically, under sub-section(c) of section 27. • The project owner will transport, possess, store, use and discharge the chemical and related substances in accordance with the stipulations, under sub-section (d) of section 27. • The project owner will abide by the conditions included in rules, order, notification, directive and procedure which issued under this law, according to section 30.
34.	Myanmar Port Authority Law (2015)	To abide by the conditions included in permit if it is needed to import the material for project and export products from the project.	• The project proponent has to abide by the conditions included in permit, under section 7 of said law.

Signed...
Dr. Somchet Thinaphong

Managing Director
Myandawei Industrial Estate Company Limited

ကနဦးစက်မှုလုပ်ငန်းစီမံကိန်းအတွက် စီမံကိန်း၏ အဓိက ကတိကဝတ်များ

စဉ်	ခေါင်းစဉ်	ကတိကဝတ်များ
အခန်း (၃) ဥပဒေ၊ နည်းဥပဒေနှင့် မူဘောင်များ		
၁	စီမံကိန်းတခုလုံး အတွက် စီမံခန့်ခွဲမှု	မြန်မာနိုင်ငံ၏ဖွဲ့စည်းပုံအခြေခံဥပဒေ အမှတ် ၁/၂၀၀၈ ပုဒ်မ ၄၅ နှင့် ပုဒ်မ ၃၉၀ တွင် ပြဋ္ဌာန်းထားသည့်အတိုင်း သဘာဝပတ်ဝန်းကျင်၊ လူသားအရင်းအမြစ်ဖွံ့ဖြိုးတိုးတက်မှုနှင့် အများပြည်သူပိုင်ပစ္စည်းများ မပျက်စီးစေရန် ကာကွယ်ရန်နှင့် ထိမ်းသိမ်းစောင့်ရှောက်ရန် ကတိပြုသည်။
		၂၀၁၆ ခုနှစ် ရင်းနှီးမြှုပ်နှံမှုဥပဒေ ပုဒ်မ ၃၅ အရ စီမံကိန်းအတွက် ရင်းနှီးငွေရှာဖွေရန်လိုအပ်ပြီး ဒေသအတွက် မဟာဗျူဟာ ကျသောကြောင့် ရင်းနှီးမြှုပ်နှံမှုအတွက် ခွင့်ပြုချက်ရယူရန် ကတိပြုသည်။
၂	EIA လေ့လာမှု	ပတ်ဝန်းကျင်ထိမ်းသိမ်းရေးဥပဒေ (၂၀၁၂) အမှတ် ၉/၂၀၁၂ ပုဒ်မ ၄၂ (ခ) နှင့် ရင်းနှီးမြှုပ်နှံမှုဥပဒေ ပုဒ်မ ၇၂ အရ လိုအပ်ချက် အတိုင်း EIA လေ့လာမှု ပြုလုပ်သည်။
		EIA လေ့လာမှုအား ပတ်ဝန်းကျင်ဆိုင်ရာအကျိုးသက်ရောက်မှုအကဲဖြတ်မှုအတွက် လမ်းညွှန်ချက်များ (၂၀၁၄)၊ လုပ်ထုံးလုပ်နည်း (၂၀၁၅) တို့နှင့် ကိုက်ညီစွာ လုပ်ဆောင်မည်ဟု ကတိပြုသည်။
		စီမံကိန်းဖော်ဆောင်သည့်အချိန် EIA, IEE နှင့် EMP အချိန်အတွင်း လုပ်ငန်းလုပ်ဆောင်မှုအားလုံးအတွက် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း (၂၀၁၅) နောက်ဆက်တွဲ (က) နှင့် ကိုက်ညီစေရန် ကတိပြုသည်။
		ပတ်ဝန်းကျင်ဆိုင်ရာအကျိုးသက်ရောက်မှုအကဲဖြတ်ချက်အစီခံစာတွင် လုပ်ဆောင်ရမည့်အချက်များ၊ ပတ်ဝန်းကျင် လူမှုအသိုင်းအဝန်းနှင့် ကျန်းမာရေး အကျိုးသက်ရောက်မှုလျှော့ချရန်နည်းလမ်းမျိုးစုံ၊ ပတ်ဝန်းကျင်စီမံခန့်ခွဲရေးပရိုဂရမ်၊ သက်ဆိုင်ရာလုပ်ငန်းခွဲများ၊ ထိမ်းချုပ်ကွပ်ကဲမှုနည်းလမ်းများနှင့် အားလုံး ကိုက်ညီစွာ ဆောင်ရွက်ရန် ကတိပြုသည်။
၃	ထုတ်လွှတ်မှုအတွက် လိုက်နာမှုများ	လေထုညစ်ညမ်းမှု နည်းနိုင်သမျှနည်းစေရန်၊ တားဆီးရန် သို့မဟုတ် လျှော့ချရန်နှင့် အထူးစီးပွားရေးဇုန်ဥပဒေ ပုဒ်မ ၃၅ တွင် ဖော်ပြထားသည့်အတိုင်း ပြဋ္ဌာန်းထားသော မြန်မာနိုင်ငံ ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေးစံချိန်စံညွှန်းများ သို့မဟုတ် နိုင်ငံတကာစံချိန်စံညွှန်းများနှင့် ကိုက်ညီစေရန် လုပ်ထုံးလုပ်နည်း၊ အလေ့အထ၊ နည်းလမ်းများ ဖော်ဆောင်ပြီး လေထုညစ်ညမ်းမှု ကာကွယ်ရန် ကတိပြုသည်။
		အောက်ပါ ပြဋ္ဌာန်းချက်များတွင် ပါဝင်သည့် စံချိန်စံညွှန်းများနှင့် ကိုက်ညီရန် ကတိပြုသည်။ နိုင်ငံတော်ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ဖန်လုံအိမ်ဓာတ်ငွေ့ထုတ်လွှတ်မှု) လမ်းညွှန်၊ ကမ္ဘာ့ကျန်းမာရေးအဖွဲ့ (WHO)၊ အမေရိကန်နိုင်ငံပတ်ဝန်းကျင် ထိမ်းသိမ်းရေးအေဂျင်စီ (EPA)၊ ကမ္ဘာ့ဘဏ်နှင့် နိုင်ငံတကာဘဏ္ဍာရေးအဖွဲ့ (IFC)
၄	ပတ်ဝန်းကျင်နှင့် လူမှုရေး ဆိုင်ရာ လိုက်နာမှု	ဇယား ၃.၁-၃** ပါ သက်ဆိုင်ရာဥပဒေနှင့် စည်းကမ်းများနှင့် ကိုက်ညီစွာ လုပ်ကိုင်ဆောင်ရွက်ရန် ကတိပြုသည်။
		စီမံကိန်းမှ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ အကျိုးသက်ရောက်မှုအကဲဖြတ်အစီခံစာတွင် ဖော်ပြထားသည့်အတိုင်း ကိုက်ညီမှုရှိစေရန် ကတိပြုသည်။ ထို့အပြင် ဆောက်လုပ်မှုအကြိုကာလ၊ ဆောက်လုပ်မှု၊ လုပ်ငန်းလည်ပတ်မှုနှင့် ပြီးဆုံးချိန်ကာလအတွင်း ပတ်ဝန်းကျင် ထိမ်းသိမ်းစောင့်ရှောက်ရေးနှင့် လူမှုရေးအကျိုးသက်ရောက်မှုများ၊ သက်ဆိုင်ရာ [illegible]

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စဉ်	ခေါင်းစဉ်	ကတိကဝတ်များ
		အစီရင်ခံစာပေးပို့ခြင်း မပျက်မကွက် ထိမ်းချုပ်ကွပ်ကဲ ဆောင်ရွက်ရန် ကတိပြုသည်။ ထို့အပြင် ပတ်ဝန်းကျင်၊ လူမှုအသိုင်းအဝိုင်း ပတ်သက်သောလှုပ်ရှားမှုများ ဆောင်ရွက်ရန်၊ ဖောက်ထွင်းမြင်သာစွာဖြင့် အများပြည်သူအကြေံပေးခြင်း ညှိနှိုင်းတိုင်ပင်ခြင်း ပြုလုပ်ရန်၊ ထိမ်းချုပ်ကွပ်ကဲမှုအစီရင်ခံစာ တွင် ဖော်ပြရန်နှင့် DSEZ နှင့် MONREC သို့တင်ပြရန် ကတိပြုသည်။
၅	မြေယာပိုင်ဆိုင်မှု	စီမံကိန်းခွင့်ပြုချက်ပြုချက် ရယူရန် သက်ဆိုင်ရာ ဥပဒေများနှင့်အညီ မြေနစ်ရှည်ငှားရမ်းပိုင်ခွင့် ရရှိရန် ၂၀၁၆ ခုနှစ် ရင်းနှီးမြှုပ်နှံမှု ဥပဒေ ပုဒ်မ ၅၁ (က) နှင့် (ခ) တွင် ပြဌာန်းထားသည့်အတိုင် ခွင့်ပြုချက်ရရှိပြီးနောက် ပထမဦးဆုံးမြေငှားရမ်းချိန်ကာလ ၅၀ နှစ်ထိ ငှားရမ်းရန် ကတိပြုသည်။
၆	ပြောင်းရွှေ့ခြင်း ပြန်လည်နေရာချခြင်း	ပြောင်းရွှေ့စရိတ်နှင့် လျော်ကြေးတို့အား ပြောင်းရွှေ့ရန်လိုအပ်သည့် ပစ္စည်းဥစ္စာ သဘောတူညီချက်များအတိုင်း ပေးဆောင်ရန်၊ လူပုဂ္ဂိုလ်များအား မူလလူနေမှုအဆင့်အတန်းထက် နိမ့်ကျမှုမရှိဘဲ ပြောင်းရွှေ့ရန်၊ ၂၀၁၁ ခုနှစ် အထူးစီးပွားရေးဇုန်ဥပဒေ ပုဒ်မ ၈၀ တွင် ပြဌာန်းထားသည့် အခြေခံလိုအပ်များ ဖြည့်ဆည်းပေးရန် ကတိပြုသည်။
အခန်း (၄) စီမံကိန်းဖော်ပြချက်နှင့် အခြားနည်းလမ်းများ		
၇	မြေရှင်းလင်းခြင်းနှင့် အကြိုဆောက်လုပ်ရေး	၁၉၉၂ ခုနှစ် သစ်တောဥပဒေ ပုဒ်မ ၁၂ နှင့် ပုဒ်မ ၂၃ ဆက်နွယ်မှုရှိသော သစ်တော သို့မဟုတ် သစ်တောအမျိုးအစားအားလုံး ထိမ်းသိမ်းစောင့်ရှောက်ရန် အလိုရှိသည့် လုပ်ငန်းဆောင်ရွက်ချက်များမစတင်မီ သက်ဆိုင်ရာအဖွဲ့အစည်းထံမှ ခွင့်ပြုချက် ရရှိရန် ကတိပြုသည်။
		၁၉၉၄ ခုနှစ် တောရိုင်းတိရစ္ဆာန်နှင့် သဘာဝဧရိယာထိမ်းသိမ်းမှု ကာကွယ်ရေးတွင် ပြဌာန်းထားသော တောရိုင်းတိရစ္ဆာန်/ရှားပါးတိရစ္ဆာန် သို့မဟုတ် သဘာဝပတ်ဝန်းကျင်နှင့် ဂေဟာစနစ်ထိခိုက်မှုရှိသော အလိုရှိသည့် လုပ်ငန်းဆောင်ရွက်ချက်များမစတင်မီ သက်ဆိုင်ရာအဖွဲ့အစည်းထံမှ ခွင့်ပြုချက် ရယူရန် ကတိပြုသည်။
		၂၀၁၅ ခုနှစ် ရှေးဟောင်းအဆောက်အဦးများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ ပုဒ်မ ၁၅ အရ ရှေးဟောင်းအဆောက်အဦး အစိတ်အပိုင်း တခုခုအား ပြောင်းရွှေ့ခြင်း ပြင်ဆင်ခြင်း တူးဖော်ခြင်း သို့မဟုတ် တိုးချဲ့ခြင်း မပြုလုပ်မီ သက်ဆိုင်ရာအေဂျင်စီထံမှ ခွင့်ပြုချက် ရယူရန် ကတိပြုသည်။
		၂၀၁၅ ခုနှစ် မီးသတ်ဥပဒေ ပုဒ်မ ၁၇ တွင်ပြဌာန်းထားသည့်အတိုင်း မြို့နယ်အဆောက်အဦ ဆောက်လုပ်ခြင်းမပြုမီ မီးဘေးကြိုတင်ကာကွယ်ရေးနှင့် တားဆီးရေး (နှင့်/သို့မဟုတ် အရေးပေါ်အစီအစဉ်) ခွင့်ပြုချက် ရယူရန် ကတိပြုသည်။
၈	ဆောက်လုပ်ရေး လုပ်ငန်းအားလုံး	စီမံကိန်းဧရိယာတွင်၂၀၁၅ ခုနှစ် ရှေးဟောင်းအဆောက်အဦးများ ကာကွယ်ထိန်းသိမ်းရေးဥပဒေ နှင့် ၂၀၁၅ ခုနှစ် ရှေးဟောင်းဝတ္ထုပစ္စည်းများ ကာကွယ်ထိန်းသိမ်းရေးဥပဒေ အရ သတ်မှတ်ထားသော ရှေးဟောင်းအမွေအနှစ် သို့မဟုတ် ရှေးဟောင်းအဆောက်အဦး တခုခု တွေ့ရှိပါက သက်ဆိုင်ရာအေဂျင်စီထံ အကြောင်းကြားရန် ကတိပြုသည်။
		အထူးစီးပွားရေးဇုန်ဥပဒေ ပုဒ်မ ၈၀ (c) အရ ငှားယူသည့် သို့မဟုတ် အသုံးပြုသည့် စီမံကိန်းမြေပေါ် သို့မဟုတ် မြေအောက်တွင် သဘာဝသယံဇာတများ သို့မဟုတ် ရှေးဟောင်းအမွေအနှစ်များ သို့မဟုတ် သယံဇာတများ သို့မဟုတ် သတ္တုတွင်း တွေ့ရှိပါက သက်ဆိုင်ရာ အေဂျင်စီသို့ ချက်ချင်း သတင်းပို့ရန် ကတိပြုပြီး သက်ဆိုင်ရာအေဂျင်စီမှ ဆက်လက်လုပ်ဆောင်ရန် ခွင့်ပြုပါက ဆက်လက်လုပ်ကိုင်နိုင်သည်။ ခွင့်မပြုပါက [illegible]

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စဉ်	ခေါင်းစဉ်	ကတိကဝတ်များ
		အစားထိုးစီစဉ်ပေးသည့်နေရာသို့ ရွှေ့ပြောင်းမည်။
		၂၀၁၆ ခုနှစ် ရင်းနှီးမြှုပ်နှံမှုဥပဒေ ပုဒ်မ ၆၆ နှင့် အထူးစီးပွားရေးဇုန်ဥပဒေ ပုဒ်မ ၈၀ (ဃ) အရ ခွင့်ပြုချက်မရရှိဘဲ မြေ၏ ပင်လယ်ပြင်အမြင့် သို့မဟုတ် မြေမျက်နှာသွင်ပြင်အား သိသာထင်ရှားစွာပြောင်းလဲခြင်း မပြုလုပ်ရန် ကတိပြုသည်။
၉ 9	ရေတူးမြောင်းနှင့် ရေကန် တည်ဆောက်ခြင်း	၂၀၀၆ ခုနှစ် မြစ်-ချောင်း နှင့် ရေအရင်းအမြစ် ထိမ်းသိမ်းရေးဥပဒေ ပုဒ်မ ၈၊ ပုဒ်မ ၁၂ နှင့် ပုဒ်မ ၁၅ တို့တွင် ပြဋ္ဌာန်းထားသည့် အတိုင်း သက်ဆိုင်ရာအေဂျင်စီ၏ခွင့်ပြုချက်မရဘဲ မြစ်ချောင်းနယ်နမိတ်၊ ကမ်းပါးနယ်နမိတ်နှင့် ကမ်းနားနယ်နမိတ်တို့အား ပုဒ်မ ၁၂ တွင် ပြဋ္ဌာန်းထားသည့်အရာ တခုခုပြုလုပ်ခြင်း သို့မဟုတ် လိုင်းပြောင်းလဲခြင်း သို့မဟုတ် တားဆီးခြင်း မပြုရန်၊ ပုဒ်မ ၁၅ တွင် ပြဋ္ဌာန်းထားသည့်အဆောက်အဦ ဆောက်လုပ်ခြင်းမပြုရန် ကတိပြုသည်။
အခန်း (၆) သက်ရောက်မှုနှင့် ဘေးအန္တရာယ်အကဲဖြတ်ခြင်းနှင့် လျော့ပါးစေရေးနည်းလမ်းများ		
၁၀	ကနဦးစက်မှုဇုန်နေရာ၏ လုပ်ငန်းလည်ပတ်မှု	၂၀၀၆ ခုနှစ် မြစ်-ချောင်း နှင့် ရေအရင်းအမြစ် ထိမ်းသိမ်းရေးဥပဒေ ပုဒ်မ ၁၁ (က) နှင့် ပုဒ်မ ၁၉ တွင်ပြဋ္ဌာန်းထားသည့်အတိုင်း မြစ်-ချောင်းအတွင်းသို့ ရေလမ်းကြောင်းနှင့် ပတ်ဝန်းကျင်ထိခိုက်မှု ဖြစ်ပွားနိုင်သော အင်ဂျင်ဂိုင်၊ ဓာတုဗေဒပစ္စည်း၊ အရာဝတ္ထု သို့မဟုတ် ပစ္စည်းများ စွန့်ပစ်ခြင်းမပြုရန် ကတိပြုသည်။
		၁၉၉၀ ခုနှစ် မြန်မာ့ပင်လယ် ငါးလုပ်ငန်းဥပဒေ ပုဒ်မ ၃၉ တွင် ပြဋ္ဌာန်းထားသည့်အတိုင်း အဏ္ဏဝါရေလမ်းကြောင်းသို့ သက်ရှိရေနေ သတ္တဝါများ သို့မဟုတ် အခြားပစ္စည်းများ စွန့်ပစ်ခြင်းမပြုရန် ကတိပြုသည်။
		၁၉၉၁ ခုနှစ် ရေချိုငါးလုပ်ငန်းဥပဒေ ပုဒ်မ ၄၀ တွင် ပြဋ္ဌာန်းထားသည့် ရေချိုငါးလုပ်ငန်းတွင် သက်ရှိရေသတ္တဝါများ ညစ်ညမ်းမှု နှောင့်ယှက်မှု မဖြစ်ပွားစေရန် သို့မဟုတ် ပုဒ်မ ၄၁ တွင် ပြဋ္ဌာန်းထားသည့်အတိုင်း ရေအရည်အသွေး သို့မဟုတ် ရေပမာဏ ပြောင်းလဲခြင်း မပြုရန် ကတိပြုသည်။
		၂၀၁၁ ခုနှစ် အလုပ်သမားအဖွဲ့အစည်းဥပဒေ ပုဒ်မ ၄၁ (က) နှင့် (ဃ)၊ ပုဒ်မ ၄၃၊ ပုဒ်မ ၄၄ (က) မှ (ဃ) နှင့် ပုဒ်မ ၅၁ နှင့် ကိုက်ညီစွာ ဝန်ဆောင်မှုများ လည်ပတ်လုပ်ကိုင် ပံ့ပိုးရန် စီမံကိန်းမှ ကတိပြုသည်။ ထို့အပြင် အလုပ်သမားအစည်းအရုံး ဖွဲ့စည်းမှုနှင့် လှုပ်ရှားမှုများ သတိမူရန် ကတိပြုသည်။
		စီမံကိန်းနှင့် အလုပ်သမားအစည်းအရုံး သို့မဟုတ် ဝန်ထမ်း သို့မဟုတ် အလုပ်သမားများအကြား အငြင်းပွားမှုများအား ၂၀၁၂ ခုနှစ် အလုပ်သမားရေးရာအငြင်းပွားမှုဖြေရှင်းရေးဥပဒေနှင့် ၂၀၁၁ ခုနှစ် အထူးစီးပွားရေးဇုန် ပုဒ်မ ၇၆ (က) နှင့် (ခ) နှင့်အညီ ဖြေရှင်းပေးရန် ကတိပြုသည်။
၁၁	အလုပ်အကိုင်ရရှိမှု	အထူးစီးပွားရေးဇုန်ဥပဒေ ပုဒ်မ ၇၅ တွင် ပြဋ္ဌာန်းထားသည့်အတိုင်း နိုင်ငံသားကျွမ်းကျင်အလုပ်သမား၊ ပညာရှင်များနှင့် ဝန်ထမ်းများအား လုပ်ငန်းစတင်လည်ပတ်သည့် ပထမ ၂ နှစ်တွင် အနဲဆုံး ၂၅ ရာခိုင်နှုန်း ခန့်အပ်ရန်၊ ဒုတိယ ၂ နှစ်တွင် ၅၀ ရာခိုင်နှုန်း ခန့်အပ်ရန်၊ တတိယ ၂ နှစ်တွင် ၇၅% ခန့်အပ်ရန် ကတိပြုသည်။
		စီမံကိန်းမှ အလုပ်သမားများ နှင့်/သို့မဟုတ် ဝန်ထမ်းများအား သတ်မှတ်ထားသောဥပဒေများ - ၂၀၁၃ ခုနှစ် အနည်းဆုံးအခကြေးငွေ ဥပဒေ၊ ၂၀၁၆ ခုနှစ် အခကြေးငွေပေးချေရေး အက်ဥပဒေ၊ ၂၀၁၃ ခုနှစ် အလုပ်အကိုင်နှင့် ကျွမ်းကျင်မှုဖွံ့ဖြိုးတိုးတက်ရေးဥပဒေ၊ ၂၀၀၆ ခုနှစ် ခွင့်ရက်နှင့် အလုပ်ပိတ်ရက်အက်ဥပဒေ ကို ပြင်ဆင်သည့်ဥပဒေတို့နှင့်အညီ တန်းတူညီမျှ၍ တရားမျှတစွာ

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ကနဦးစက်မှုလုပ်ငန်းစီမံကိန်းအတွက် စီမံကိန်း၏ အဓိက ကတိကဝတ်များ

စဉ်	ခေါင်းစဉ်	ကတိကဝတ်များ
		အလုပ်ခန့်အပ်ရန်၊ လုပ်အားခပေးရန်၊ ခွင့်ရက်နှင့် အများပြည်သူရုံးပိတ်ရက်များ ခွင့်ပြုရန် ကတိပြုသည်။
		၂၀၁၂ခုနှစ် လူမှုဖူလုံရေးဥပဒေ နှင့်အညီ စီမံကိန်းမှ ဝန်ထမ်းများ နှင့်/သို့မဟုတ် အလုပ်သမားများအတွက် လိုအပ်ချက်များနှင့် ညီညွတ်စေရန်၊ အကျိုးခံစားခွင့်ပေးရန် ကတိပြုသည်။
၁၂	သင်တန်းပို့ချမှု	၂၀၁၃ ခုနှစ် အလုပ်အကိုင်နှင့် ကျွမ်းကျင်မှုဖွံ့ဖြိုးတိုးတက်ရေးဥပဒေ ပုဒ်မ ၁၆ မှ ပုဒ်မ ၂၃ အထိ ကိုက်ညီစွာ သင်တန်းပို့ချရေးအစီအစဉ်နှင့် စက်မှုလုပ်ငန်းအတွက် သင်တန်းဌာန တည်ထောင်ရန်၊ နေရာရွှေ့ပြောင်းခြင်းနှင့် ပြန်လည်နေရာချထားရေးအစီအစဉ်အတွက် စီမံကိန်းအကျိုးသက်ရောက်သူများ (PAPs) ပါဝင်ရန် ကတိပြုသည်။
၁၃	လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် အန္တရာယ်ကင်းဂေးမှု	အလုပ်သမားများအတွက် ၂၀၀၇ ခုနှစ် IFC EHS အထွေထွေလမ်းညွှန်ချက်များနှင့် ကိုက်ညီမှုရှိရန် ကတိပြုသည်။ ပတ်ဝန်းကျင်ဆိုင်ရာ အန္တရာယ်ကင်းဂေးရေးနှင့် ကျန်းမာရေးအခန်းကဏ္ဍတွင် ဖော်ပြထားသည့်အတိုင်း။ မြန်ထားဝယ် DSEZ ကနဦးစက်မှုဇုန်ဌာန၏ ပတ်ဝန်းကျင်ထိမ်းသိမ်းစောင့်ရှောက်ရေးနှင့် အန္တရာယ်ကင်းဂေးရေး ကျန်းမာရေးအခန်းကဏ္ဍအား တည်ထောင်ပြီး တာဝန်နှင့်ဝတ္တရား သတ်မှတ်ချက်များအတိုင်း စနစ်တကျ ဖွဲ့စည်းရမည်။
၁၄	စက်ရုံများတည်ထောင်ခြင်း	စီမံကိန်းသည် အလုပ်ရုံများအက်ဥပဒေ ၁၉၅၁ခုနှစ် ပါကဏ္ဍများနီးပါး လိုက်နာဆောင်ရွက်ရမည်။
၁၅	ဆေးရုံ (သို့) ကျန်းမာရေးဌာန တည်ထောင်ခြင်း	မြို့နယ်ရှိ နေထိုင်သူလူဦးရေသည် သက်ဆိုင်ရာဥပဒေပြဌာန်းချက် ပြည့်မှီပါက ဆေးရုံ သို့မဟုတ် ကျန်းမာရေးဌာန တည်ထောင်ရန် ကတိပြုသည်။
၁၆	ကူးစက်ရောဂါ ကာကွယ်တားဆီးရေး နှင့်ထိမ်းချုပ်ရေး	၁၉၉၅ ခုနှစ် ကူးစက်ရောဂါ ကာကွယ်တားဆီးရေး နှင့်ထိမ်းချုပ်ရေးဥပဒေ ပုဒ်မ ၈ တွင် ပြဌာန်းထားသည့်အတိုင်း ကူးစက်ရောဂါ ပြန့်ပွားမှုကာကွယ်ရေးနှင့် ထိရောက်သောထိမ်းချုပ်ရေးတွင် ကျန်းမာရေး တာဝန်ရှိအရာရှိများ၏ လမ်းညွှန်ချက်လိုက်နာရန်နှင့် ပူးပေါင်းဆောင်ရွက်ရန် ကတိပြုသည်။
၁၇	ဆေးလိပ်သောက်ရန် နေရာ/ဆေးလိပ် မသောက်ရနေရာ	၂၀၀၆ ခုနှစ် ဆေးလိပ်နှင့် ဆေးရွက်ကြီးထွက်ပစ္စည်းသောက်သုံးမှုထိန်းချုပ်ရေးဥပဒေ ပုဒ်မ ၆ နှင့် သယ်ဆောင်မှုအတိုင်းအတာနှင့် စစ်ဆေးမှုလက်ခံခြင်း ပုဒ်မ ၉ (ဂ) နှင့် (ဃ) တို့တွင်ပြဌာန်းထားသည့်အတိုင်း ဆေးလိပ်သောက်ရန်နေရာနှင့် ဆေးလိပ်မသောက်ရ နေရာ စီစဉ်ဆောင်ရွက်ရန် ကတိပြုသည်။
၁၈	ယာဉ်အသုံးပြုမှု	ရည်ရွယ်ချက်အားလုံးနှင့် ပေးဆပ်ရန်တာဝန်များ၏ ပိုင်ဆိုင်မှု ရယူရာတွင် ၂၀၁၅ ခုနှစ် မော်တော်ယာဉ်ဥပဒေနှင့် ညီညွတ်စေရန် ကတိပြုသည်။ စီမံကိန်းမှ မော်တော်ယာဉ်မောင်းများအား ဥပဒေပြဌာန်းချက်အတိုင်းရှိစေရန် ပညာပေး လှုပ်ရှားမှုဆောင်ရွက်မည်။
၁၉	ရေအရင်းအမြစ် ထိမ်းသိမ်းစောင့်ရှောက်ခြင်း	ရေအရင်းအမြစ်အား အမြော်အမြင်ရှိစွာ စီမံခန့်ခွဲရန်နှင့် ရေကြောင်းအကျိုးသက်ရောက်မှု အောက်ပါအတိုင်း ထိမ်းချုပ်ရန် ကတိပြုသည်။ ရေပြန်လည်အသုံးပြုခြင်း ပြန်လည်သန့်စင်အသုံးပြုခြင်း၊ ရေထိမ်းသိမ်းစောင့်ရှောက်ရေးအစီအစဉ်၊ ညစ်ညမ်းရေနှင့် ရေဆိုး နည်းနိုင်းသမျှနည်းအောင်ပြုလုပ်ခြင်း။
၁၉	မိလ္လာနှင့် ရေဆိုးစွန့်ပစ်မှု	ပြည်တွင်းအလေအလွင့်အား ရေရှည်တည်တံ့သောအပြုအမူများ ဥပမာ စွန့်ပစ်မှုပမာဏနှင့် စွန့်ပစ်မှုအတွက်နေရာ လျှော့နည်းစေရန် လျှော့ချခြင်း၊ ပြန်လည်အသုံးပြုခြင်း၊

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စဉ်	ခေါင်းစဉ်	ကတိကဝတ်များ
	စီမံခန့်ခွဲရေး	ပြန်လည်သန့်စင်ခြင်း (3Rs) စီမံခန့်ခွဲရန် ကတိပြုသည်။ စွန့်ပစ်ပစ္စည်းများအား ၁၉၇၂ ခုနှစ် ပြည်သူ့ကျန်းမာရေးဥပဒေနှင့် ၁၉၉၃ ခုနှစ် အမျိုးသားကျန်းမာရေးမူဝါဒနှင့်အညီ စီမံခန့်ခွဲရန် ကတိပြုသည်။
၂၀	ဓာတ်ဆီ သိုလှောင်မှုနှင့် သယ်ယူပို့ဆောင်မှု	ရေနံလောင်စာဆီများအား ၁၉၃၄ ခုနှစ် ရေနံအက်ဥပဒေနှင့် ၁၉၃၇ ခုနှစ် ရေနံစည်းမျဉ်းစည်းကမ်းနှင့်အညီ သယ်ဆောင် သိမ်းဆည်းရန် ကတိပြုသည်။
၂၁	အရေးပေါ်တုန့်ပြန်မှု အစီအစဉ်	ဓာတုဗေဒပစ္စည်းညစ်ညမ်းမှု/ဖြစ်ပွားမှုနှင့် အခန်း ၄.၃ တွင် ဖော်ပြထားသောဖြစ်ရပ်များဖြစ်သည့် ဖြစ်နိုင်သောဘေးအန္တရာယ်အားလုံး ဥပမာ ရေကြီးခြင်း၊ အပူပိုင်းမုန်တိုင်း/ဆိုင်ကလုန်းမုန်တိုင်း၊ မီးလောင်ခြင်း၊ ဓာတုဗေဒပစ္စည်းညစ်ညမ်းမှုများနှင့် ပတ်သက်၍ အရေးပေါ်တုန့်ပြန်မှုအစီအစဉ် အကောင်အထည်ဖော်ရန် ကတိပြုသည်။
		အရေးပေါ်တုန့်ပြန်မှုအစီအစီတွင် ဖော်ပြထားသည့်အတိုင်း မီးအန္တရာယ်အခြေအနေပြောင်းလဲမှု၊ ဓာတုဗေဒပစ္စည်း၊ မြေလျှောင်နှင့် သဘာဝဘေးအန္တရာယ် စသည်တို့မှ ဘေးကင်းလုံခြုံမှုအပေါ်မူတည်၍ နောက်ဆုံး EIA အစီရင်ခံစာအား ပြင်ဆင်ရန်၊ DSEZMC နှင့် MONREC ထံသို့ ပေးပို့ရန် ကတိပြုသည်။
၂၂	ဖန်လုံအိမ်ဓာတ်ငွေ့ ထုတ်လွှတ်မှု	လက်ရှိ မြန်မာနိုင်ငံဖန်လုံအိမ်ဓာတ်ငွေ့မူဝါဒနှင့်အညီ စီမံကိန်း လုပ်ရှားမှုများနှင့် တည်ထောင်မှုကြောင့် ဖန်လုံအိမ်ဓာတ်ငွေ့လျှော့ချရေး လုပ်ဆောင်ရန် ကတိပြုသည်။
၂၃	CSR အစီအစဉ်	နှစ်စဉ်အမြတ်ရရှိမှုအပေါ်မူတည်၍ လူမှုအသိုင်းအဝိုင်းတာဝန်ယူမှု (CSR) သီးသန့်ထားပြီး ဆောင်ရွက်ရန် ကတိပြုသည်။ စီမံကိန်းမှ မြို့နယ်အနီးပိုက်ရှိ ကျေးရွာများတွင်နေထိုင်သည့် လူငယ်များအတွက် ပညာရေးဆိုင်ရာ ပညာသင်ထောက်ပံ့ကြေး လှူဒါန်းပြီး အနီးတပိုက်ရှိကျေးရွာများအား အရေးပေါ် ဥပမာ မီးလောင်ခြင်း သို့မဟုတ် သဘာဝဘေးအန္တရာယ်ကျရောက်ခြင်းတွင် ထောက်ပံ့မည်။
		စီမံကိန်းပံ့ပိုးသူသည် CSR လှုပ်ရှားမှုများ နှစ်စဉ် ပုံမှန် လုပ်ဆောင်သွားရန် ကတိပြုသည်။ CSR ကုန်ကျစရိတ်သည် ပုံမှန်အားဖြင့် ကော်ပိုရေးရှင်း၏ ဘဏ္ဍာရေးအဆင်သင့်ဖြစ်မှုအပေါ်မူတည်သည်။
၂၄	အာမခံ	၁၉၉၃ ခုနှစ် မြန်မာ့အာမခံဥပဒေ ပုဒ်မ ၁၆ နှင့်အညီ စီမံကိန်းသည် အသက်နှင့် ပြည်သူပိုင်ပစ္စည်း ပျက်စီးဆုံးရှုံးခြင်း သို့မဟုတ် ပတ်ဝန်းကျင်ညစ်ညမ်းမှု ဖြစ်ပွားခြင်းရှိပါက မြန်မာ့အာမခံနှင့် မထားမနေရ အထွေထွေတာဝန်ယူမှုအာမခံထားရှိရန် ကတိပြုသည်။
၂၅	လျော်ကြေးပေးခြင်း	ပတ်ဝန်းကျင်ထိမ်းသိမ်းရေးဥပဒေ ပုဒ်မ ၇(ဏ) နှင့် ၂၀၁၆ ခုနှစ် ရင်းနှီးမြှုပ်နှံမှုဥပဒေ ပုဒ်မ ၆၆ အရ စီမံကိန်းကြောင့် သဘာဝပတ်ဝန်းကျင်ထိခိုက်ပျက်စီးပြီး လူမှုရေးစီးပွားရေး ပျက်စီးဆုံးရှုံးမှုဖြစ်ပွားပါက ဖြစ်ပွားသည့်ပျက်စီးဆုံးရှုံးမှုအတွက် ထိရောက်သောနစ်နာကြေးပေးဆောင်ရန် ကတိပြုသည်။
အခန်း (၈) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်		
၂၆	ISO 14001	ရေရှည်တည်တံ့သောပတ်ဝန်းကျင်ထိမ်းသိမ်းစောင့်ရှောက်ရန် ပတ်ဝန်းကျင်ကာကွယ်ထိမ်းသိမ်းရေး ကောင်းမွန်စွာ လိုက်နာနိုင်ရန်အတွက် ISO 14001 လိုက်နာကျင့်သုံးရန် ကတိပြုသည်။
၂၇	ပတ်ဝန်းကျင်စီမံခန့်	ဆောက်လုပ်ရေးအချိန်ကာလ၊ လုပ်ငန်းလုပ်ပတ်မှုအချိန်ကာလနှင့် ပိတ်သိမ်းချိန်ကာလအတွင်းတွင်

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စဉ်	ခေါင်းစဉ်	ကတိကဝတ်များ
	ခွဲမှုနှင့် စောင့်ကြည့်လေ့လာမှု အစီအစဉ်	နောက်ဆုံး EMPs နှင့် EMoPs အားလုံး လုပ်ကိုင်ဆောင်ရွက်ရန် ကတိပြုသည်။
	ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြည့်လေ့လာမှု အစီရင်ခံစာ	အခြေခံအဆောက်အအုံ စဉ်းစားဆောင်ရွက်ချက်ရလာဒ်များ ဥပမာ ပြည်သူ့ကျန်းမာရေးအစီအစဉ်၊ ဒေသခံများအတွက် လမ်းများ၊ လျှပ်စစ်မီး၊ ရေ စသည်တို့နှင့် တည်ဆောက်မှု၊ လုပ်ငန်းလည်ပတ်မှု၊ လုပ်ငန်းပိတ်သိမ်းမှု စီမံကိန်းဖော်ဆောင်မှုကာလအတွင်း အန္တရာယ်ကင်းဂေးရေးအစီအစဉ်များ ထိမ်းချုပ်ကွပ်ကဲရေးအစီရင်ခံစာတွင် ထည့်သွင်းဖော်ပြပြီး DSEZMC နှင့် MONREC သို့ အစီရင်ခံစာ ပေးပို့ရန် ကတိပြုသည်။
		ပတ်ဂန်းကျင်စီမံခန့်ခွဲရေးအစီအစဉ်နှင့် အသေးစိတ်အစီအစဉ်များ စောင့်ကြည့်စစ်ဆေးရန်နှင့် ၎င်းတို့အား အကောင်အထည်ဖော်နိုင်ရေး ကော်မီတီဖွဲ့စည်းရန်အတွက် ရံပုံငွေ ထားရှိရန် ကတိပြုသည်။
		စောင့်ကြည့်စစ်ဆေးရေးအစီရင်ခံစာအား ပြည်သူလူထုသတိမှုနိုင်ရေးအတွက် ပုံနှိပ်ထုတ်ဂေရန်နှင့် ၆ လတကြိမ် MONREC သို့ ပေးပို့ရန် ကတိပြုသည်။
၂၈	ကန်ထရိုက်တာများ / ဆပ်ကန်ထရိုက်တာများ	စီမံကိန်းဖော်ဆောင်သူ၊ ကန်ထရိုက်တာနှင့် ဆပ်ကန်ကရိုက်တာအားလုံးမှ သက်ဆိုင်ရာဥပဒေများ၊ စည်းကမ်းများ၊ လုပ်ထုံးလုပ်နည်းများ၊ EMP နှင့် စည်းကမ်းသတ်မှတ်ချက်အားလုံးအား အပြည့်အဂလိုက်နာနိုင်ရန် EMP, ဆောင်ရွက်ရမည့်အရာနှင့် စည်းကမ်းသတ်မှတ်ချက် အားလုံး အပြည့်အဂ အကောင်အထည်ဖော်ရန် ကတိပြုသည်။
အခန်း (၉) အများပြည်သူတွေ့ဆုံခြင်းနှင့် ထုတ်ဖော်ပြောကြားခြင်း		
၂၉	အများပြည်သူတွေ့ဆုံဆွေးနွေးခြင်း	ပတ်ဂန်းကျင်နှင့်လူမှုရေးအခြေအနေများ၊ သဘောပေါက်နားလည်မှုနှင့် ရလာဒ်များ အဆက်မပြတ်တိုးတက်ကောင်းမွန်စေရန်အတွက် ဒေသခံပြည်သူများနှင့် အများပြည်သူဆိုင်ရာ အကြံပေးခြင်း ဆွေးနွေးတိုင်ပင်ခြင်း ပြုလုပ်ရန်နှင့် DSEZMC နှင့် MONREC သို့ ပေးပို့ရန် ကတိပြုသည်။
		ရှယ်ယာဂင်များနှင့် အဆက်မပြတ် ဆွေးနွေးတိုင်ပင်ပြီး အစီအစဉ်တွင် ၎င်းတို့၏ထောက်ခံချက်များ ပူးပေါင်းပါဂင်ရန် ကတိပြုသည်။
၃၀	အချက်အလက်ဖြန့်ဝေခြင်း	ပတ်ဂန်းကျင်အကျိုးသက်ရောက်မှုအကဲဖြတ်အစီရင်ခံစာ ထုတ်ဂေရန် ကတိပြုသည်။
အခန်း (၁၀) ဆန္ဒမပါသောနေရာပြောင်းရွှေ့မှု		
၃၁	ပြန်လည်နေရာချထားရေးနှင့် ဂင်ငွေပြန်လည်ထူထောင်ရေး	DSEZMC ၏ကြီးကြပ်မှုအောက်တွင် ပြန်လည်နေရာချထားရေးလုပ်ငန်းစီမံချက်နှင့် ပြန်လည်နေရာချထားရေးလုပ်ထုံးလုပ်နည်းကို တင်းကျပ်စွာလိုက်နာရန် ကတိပြုသည်။ မြေဌားစာချုပ် လက်မှတ်ရေးထိုးပြီးပါက MIE, ဂင်ငွေဖန်တီးမှုရေး အစီအစဉ်နှင့် လူမှုအသိုင်းအဝိုင်းပစ္စည်းအဆောက်အဦများ ဥပမာ စာသင်ကျောင်းများ၊ ဘုန်းတော်ကြီးကျောင်းများ၊ သုသာန်တို့အား အများပြည်သူအခြေချနိုင်ရန်အတွက် အပြီးတည်ဆောက်ပြီး PAHs တင်ပြရမည်။
		PAHs အဖွဲ့ဂင်တစ် (၁) ဦး ခန့်အပ်ရန် ကတိပြုပြီး သူ/သူမ၏ စွမ်းဆောင်မှုနှင့် ကျွမ်းကျင်မှုအလိုက် စီမံကိန်းတွင် ပါဂင်လုပ်ကိုင်ရန် အမှန်တကယ်စိတ်ဂင်စားသူများအား ကျွင်ကျင်မှုသင်တန်း ပို့ချသွားမည်။

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ကနဦးစက်မှုလုပ်ငန်းစီမံကိန်းအတွက် စီမံကိန်း၏ အဓိက ကတိကဝတ်များ

စဉ်	ခေါင်းစဉ်	ကတိကဝတ်များ
		သွယ်ဝိုက်၍အကျိုးသက်ရောက်မှုခံရသော လူပုဂ္ဂိုလ်များ/အိမ်ထောင်စုများ ဥပမာ ပြောင်းရွှေ့ရန်မလိုအပ်သော်လည်း စိုက်ပျိုးရေး အတွက် လယ်ယာမြေသွားရောက်သူနှင့် အသုံးပြုသူများ သို့မဟုတ်/နှင့် အသက်မွေးဝမ်းကြောင်းလုပ်ကိုင်သူများ သို့မဟုတ်/နှင့် သဘာဝအရင်းအမြစ်များအား စီမံကိန်းကြောင့် အကျိုးသက်ရောက်မှုခံရပါက ၎င်းတို့၏အလုပ်ခန့်ထားမှုအခွင့်အလမ်းများနှင့် ဝင်ငွေရရှိမှုအခွင့်အလမ်းတို့အား ဤအခန်းရှိ ဇယား ၁၈.၅.၁ သို့မဟုတ် ပြန်လည်နေရာချထားရေးလုပ်ငန်းစီမံချက် (၂၀၁၇) အခန်း ၉ ရှိ ဇယား ၉.၄.၁ အရ အကူအညီပေးသွားရန် ကတိပြုသည်။
၃၂	နစ်နာမှုအတွက် ဖြေရှင်းချက်များ	တိုင်ကြားမှုလက်ခံရေးအဖွဲ့အစည်း တည်ထောင်ဖွဲ့စည်းရန်နှင့် အကြံပြုချက် သို့မဟုတ် ဤအခန်းနှင့် ပြန်လည်နေရာချထားရေး လုပ်ငန်းစီမံချက် (၂၀၁၇) အခန်း ၁၃ တွင် ဖော်ပြထားသည့် ဒေသခံများ/PAPs ၏စိုးရိမ်ပူပန်မှုများ တိုင်ကြားမှု လက်ခံရန်နှင့် တုန့်ပြန်ရန်အတွက် တိုင်ကြားရေးလုပ်ထုံးလုပ်နည်းများ အကောင်အထည်ဖော်ရန် ကတိပြုသည်။

လက်မှတ်..

Dr. Somchet Thinaphong

စီမံခန့်ခွဲမှုဒါရိုက်တာ

မြန်ထားဝယ် စက်မှုဇုံ ကုမ္ပဏီလစ်မိတက်

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Project Key Commitments For Initial Industrial Project

No.	Issues	Commitments
CHAPTER 3 OVERVIEW OF LAWS AND REGULATION AND INSTITUTIONAL FRAMEWORK		
1.	Overall Project Management	The Project commits to conserve and protect natural environment, development of human resource and preservation of public property, as stated in *The Constitution of the Union of Myanmar No.1/2008 Section 45 and Section 390.*
		The Project commits to get permission for investment, as the Project is capital intensive and strategic to the region according to *The Investment Law 2016, Section 35.*
2.	EIA Study	EIA study is conducted, as mandated by *The Environmental Conservation Law (2012), in No.9/2012 Section 42 (b) and The Investment Law Section 72.*
		The Project commits itself that the EIA study is undergone in concordant with *The Guidelines (2014) and Procedure (2015) for Environmental Impact Assessment.*
		The Project commits to comply with *The Environmental Impact Assessment Procedure (2015)* and annexure (A) for all implemented activities during the project development including in EIA, IEE and EMP.
		The Project commits to implement in compliance with what all matters contained in the environmental impact assessment report to be carried out including all method to reduce environmental, social and health impacts, environmental management programs, sub-programs related to them, method for monitoring.
3.	Emission Compliance	The Project commits to prevent pollution, through the implementation of processes, practices and techniques that will minimize, avoid or reduce the pollution and comply with the enacted Myanmar Environmental Quality Standards or the International Standards, as prescribed in *The Special Economic Zone Law, Section 35.*
		The Project commits to comply with the standards contained in the following provisions: National Environmental Quality (Emission) Guidance, World Health Organization (WHO), U.S Environmental Protection Agency (EPA), World Bank and International Finance Corporation (IFC).
4.	Environmental and Social compliance	The Project commits to implement and comply with the relevant laws and regulations in Table 3.1-3**
		The Project commits to comply with the undertakings contained in the Environmental and Social Impact Assessment Report. In addition, the Project commit to carry out without fail monitoring and scrutinizing environmental conservation and social impacts during pre-construction, construction, operation and closing period and reporting to relevant departments. Besides, The Project commits to carryout activities relate to environment and community and conduct public consultation and negotiation for transparency and include in the Monitoring Reports and then submit to DSEZ and MONREC.
5	Land Acquisition	The Project commits in receivable authorization and has right to obtain a long-term lease of land in according with the relevant laws and may lease land up to an initial period of 50 years after approval of the permit, as enacted in *The Investment Law 2016, Section 51 (a) and (b).*
6.	Relocation and Resettlement	The Project commits to bear the expenses of relocating and paying compensation in accordance with the agreements of the assets those are required to relocate and shall relocate the persons so as not to lower their original standard of living, to fulfill the fundamental needs as promulgated in *The Special Economic Zone Law 2011, Section 80.*

Project Key Commitments For Initial Industrial Project

No.	Issues	Commitments
CHAPTER 4 PROJECT DESCRIPTION AND ALTERNATIVES		
7.	Land clearing and Pre-Construction	The Project commits to get permission from the relevant agency before establishing any desirous activities to/in reserve forest or all type of forests that in affiliate of *The Forest Law 1992*, *Section 12 and Section 23.*
		The Project commits to get permission from the relevant agency before establishing any desirous activities to wild life/endanger species or threatening their natural habit and ecosystem as promulgated in *The Protection of Wildlife and Conservation of Natural Area 1994.*
		The Project commits to get permission from the relevant agency before relocating, modifying or excavating or extending any parts of ancient monuments in according with *The Protection and Preservation of Ancient Monuments Law 2015, Section 15*
		The Project commits to obtain approval of Fire precaution and prevention (and/or Emergency Plan) prior construction of the township buildings as enacted in *The Fire Brigade Law 2015 Section 17.*
8.	Overall Construction	The Project commits to inform the relevant agency that if any antique objects or ancient monuments as defined in *The Protection and Preservation of Ancient Monuments Law 2015 and The Protection and Preservation of Antique Objects 2015* are found within the Project area.
		The Project commits to report immediately to the relevant agency, if natural mineral resources or antiques or treasure or mine are found above or under the land which the Project is entitled to lease or use, according to *The Special Economic Zone Law Section 80 (e)* and may continue the work on such land if the relevant agency allow. If not, the Project shall move the substituted arranged area.
		The Project commits to not make any significant alteration of topography or elevation of the land prior receiving the approval, according to *The Investment Law 2016, Section 66* and *The Special Economic Zone Law Section 80 (d).*
9.	Polder dike and Retention Ponds construction	The Project commits itself to not carry out any acts or channel shifting or disturbance as prescribed in *Section 12* and construction of such the structures as defined in *Section 15*, in the river-creek boundary, bank boundary and waterfront boundary without permission of the relevant agency, as prescribed in *The Conservation of Rivers, Creeks and Water Resources Law 2006, Section 8, Section 12 and Section 15.*
10	Operation of The Initial Industrial Estate	The Project commits to not dispose of engine oil, chemicals, materials or substances which may cause water way/course and environmental damages into the river-creek, as prescribed in *The Conservation of Rivers, Creeks and Water Resources Law 2006, Section 11 (a) and Section 19.*
		The Project commits to not dispose living aquatic creatures or any materials in marine water courses as prescribed *in Section 39 of The Myanmar Marine Fishery Law 1990.*
		The Project commits to not cause pollution or harassment of aquatic organisms in a freshwater courses as prescribed *in Section 40* or alter water quality and volume as prescribed *in Section 41* in *The Freshwater Fishery Law 1991.*
		The Project commits to operate and provide services in accordance with *The Labor Organization Law 2011, Section 41 (a) and (d), Section 43, Section 44 (a) to (d) and Section 51.* Also, The Project commits itself to aware of the formation of labor organization and its activities.

Project Key Commitments For Initial Industrial Project

No.	Issues	Commitments
		The Project commits to settle any disputes between the project and labor organization or employee or workers in accordance with *The Settlement of Labor Dispute Law 2012* and *The Special Economic Zone Law 2011, Section 76 (a) and (b).*
11.	Employment	The Project commits to employ citizen skilled workers, technicians and staff at least 25 percent in the first two years from the commencing year of operation and at least 50 percent in the second two years and at least 75 percent in the third two years, as prescribed in *The Special Economic Zone Law, Section 75.*
		The Project commits to employ, pay wages, and grant leaves and holidays in fairness and equity manners to the workers and/or employee in accordance with the stipulated laws: *The Minimum Wages Laws 2013, The Payment of Wages Act 2016, The Employment and Skill Development Law 2013*, *The Law Amending the Leave and Holidays Act 2006.*
		The Project commits to comply requirements and establish benefits for the employee and/or workers by the Project in accordance with *The Social Security Law 2012.*
12	Training Program	The Project commit to establish training program and the center for training for industries and may include the Project Affected Persons (PAPs) from the relocation and resettlement program in accordance with *The Employment and Skill Development Law 2013 Section 16 to Section 23.*
13	Occupational Health and Safety	The Project commits to comply the IFC EHS General guideline 2007 for workers. [and as stated in the Environmental Safety and Health section. The Environmental Conservation and Safety Health Section of Department of Myandawei's DSEZ Initial Industrial Estate must be established and systematically organize in manner as the role and responsibilities are prescribed.
14	Establishment of Factories	The Project commits to comply with almost *Sections* in *The Factories Act 1951*
15	Foundation of Hospital or Health Center	The Project commits to establish hospital or health center when appropriate number of residents in the Township have reached requirement that promulgated in the relevant law.
16	Prevention and Control of Communicable Diseases	The Project commits to follow the guidance and co-operate with health officers in prevention of the outbreak and effective control of the communicable disease as prescribed *in Section 8* of *The Prevention and Control of Communicable Diseases Law 1995.* The Project will report immediately to the nearest health department or hospitals if the defined epidemics *in Section 9* occur.
17	Smoke/Non-Smoking Areas	The Project commits to arrange the smoking and non-smoking area as prescribed *in Section 6 and Section 7 of The Control of Smoking and Consumption of Tobacco Product Law 2006* including carry measures and accepting the inspection in *Section 9 (c) and (d).*
18	Uses of Vehicles	The Project commits to comply *The Motor Vehicle Law 2015* in obtaining ownership of all purposes and liabilities. The Project shall educate and campaign the vehicles' drivers in such manners as prescribed by the Law.
18	Conservation of Water Resources	The Project commits to manage water resources wisely and control the impacts to water courses as following: Reuse and Recycling of water, Water conservation program, minimization of contaminated water and wastewater effluent.

Project Key Commitments For Initial Industrial Project

No.	Issues	Commitments
19	Sanitation and waste management	The Project commits to manage domestic waste in sustainable manners i.e. reduce, reuse and recycling (3Rs) in order to diminish quantity of waste and the spaces for disposal. The Project commits itself to manage the waste in accordance with *The Public Health Law 1972 and The National Health Policy 1993.*
20	Storage and Transport of Petroleum	The Project commits to store and transport of Petroleum fuels in accordance with *The Petroleum Act 1934 and the Petroleum Rules 1937.*
21	Emergency Responses Plans	The Project commits to implement the emergency response plans with regard to chemical pollution/incidents and all potential hazards such as flood, tropical storm/cyclone, fire, chemical pollution, incidents as stated Section 4.3
		The Project commits to revise the Final EIA report, depending on changing of conditions in fire hazard, safety from chemical elements, earthquake and natural disaster etc. addressed in the Emergency Response Plans and then submit to DSEZMC and MONREC.
22	Green House Gases Emission	The Project commits to promote reduction of the Green House Gases by the Project activities and the establishment in accordance with the current Myanmar Green House Gases Policy
23	CSR Program	The Project commits to reserve and conduct Cooperate Social Responsibility (CSR) program base on the yearly profit. The project will donated for education such as scholarships donation for young people who live in villages nearby the Township and to support the nearby villages in Emergency such as Fire or Natural disasters.
		The Project Proponent commits to conduct the CSR activities regularly every year. The CSR spending normally depends on corporate financial readiness. In addition, the Project Proponent commits to invest in CSR, gradually increasing each year until it reaches budget of 3 million THB per year.
24	Insurance	The Project commits to effect compulsory general liability insurance with the Myanmar Insurance, if the Project may cause damage to the life and property of public or cause pollution to the environment, in accordance with *The Myanmar Insurance Law 1993, Section 16.*
25	Compensation	The Project commits to pay effective compensation for loss incurred, if the Project causes damage to the natural environment and causes socioeconomic losses, according to *The Environmental Conservation Law, Section 7(o)* and *The Investment Law 2016, Section 66.*
CHAPTER 8 ENVIRONMENTAL MANAGEMENT PLAN		
26	ISO 14001	The Project commits to develop ISO 14001 for better compliance with environmental protection and conservation for sustainable environment.
27	Environmental Management and Monitoring Plans	The Project commits to develop and implement all the updated EMPs and EMoPs during construction phase, operation phase and decommissioning phase.
	Environmental Monitoring Report	The Project commits to report the results of realizing infrastructure such as public health programme, road for the locals, electricity, water supply etc. and safety programme during the project development period covering construction, operation and decommissioning in the Monitoring Report and then submit to DSEZMC and MONREC.

Project Key Commitments For Initial Industrial Project

No.	Issues	Commitments
		The Project commits to keep fund for monitoring programmes and sub-programs of environmental management and form the committees to implement them.
		The Project commits to submit the Monitoring Reports every 6 months to MONREC for publishing for public awareness.
28	Contractors/Sub-Contractors	The Project commits to fully implement the EMP, all undertakings, terms and condition and ensure that all developer, contract and sub-contractors fully comply with relevant laws, regulations, procedures, EMP and all terms and conditions.
CHAPTER 9 PUBLIC CONSULTATION AND DISCLOSURE		
29	Public Consultation	The Project commits to conduct public consultation and negotiate with the local community continuously for improvement of environmental and social conditions, realization and outcomes in the Monitoring Reports and then submit to the DSEZMC and the MONREC.
		The Project commits to continuously discuss with the stakeholders and incorporate their recommendations in the plan.
30	Information Dissemination	The Project commits to publish the environmental impact assessment report.
CHAPTER 10 INVOLUNTARY RESETTLEMENT		
31	Resettlement and Income Restoration	The Project commits to follow the Resettlement Action Plan and resettlement procedure in strict compliance under supervision of DSEZMC. If the Land Lease Agreement have been signed, the PAHs must be provided by the MIE, the Income Restoration Program including community's properties such schools, monasteries and cemeteries must be complete construction for public establishment.
		The Project commits to employ one (1) member of PAHs, subject to his/her capability and competency, will be employed and skill training can be provided to those who are really interesting to work with the Project.
		For the indirect affected persons/households; for example, those who do not have to relocate but whose access and use of the farmland for cultivation or/and who work for livelihood or/and natural resources are affected by the Project, the Project commits to assist them for their employment opportunities and their income will be restored in accordance with Table 10.5 1 of this Section or Table 9.4.1 in Chapter 9 of the Resettlement Action Plan (2017).
32	Grievance Redress	The Project commits to establish grievance organization and implement the grievance procedures in order to receive and responses to grievances in relating feedback or concerns of the locals / PAPs as described in this Section and Chapter 13 of the Resettlement Action Plan (2017).

Signed...

Dr. Somchet Thinaphong

Managing Director

Myandawei Industrial Estate Company Limited

Certify The Environmental and Social Mitigation Measures

Environmental and Social Impact Assessment for

Initial Industrial Estate Project

UNITED ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED

Certified Report by

Suparatana V.
....

(Suparatana Jotisakulratana)

Chief Executive Officer

United Analyst And Engineering Consultant

Date 30 April 2018

Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
1. Physical resources		
1.1 Air quality	1. Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. 2. Clearing and grubbing to be done, just before the start of next activity on that site. In case of time gap, water should be sprinkled regularly till the start of next activity. 3. In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried out at regular intervals to prevent dust generation. 4. Embankment slopes to be covered with turf /stone pitching immediately after completion 5. Exhaust gas from construction vehicles are acceptable. However, all equipment and vehicles will need to be maintained in good mechanical conditions 6. Water shall be sprayed covering the access road and on every construction in order to control dust suppression the least 2 times/day (morning and afternoon) during dry season 7. Haulage truck must be covered or the aggregates sprayed with water before loading the haulage truck 8. Covered construction materials such as sand, gravel, cement by canvas 9. Foliage planting and cover cropping are very good mitigation for dust controlling that must be planted completely in the early period of construction phase especially buffer zone area of the initial industrial estate which adjacent to communities 10. Open burning of solid waste or any material is not permitted	Myandawei Industrial Estate Company Limited
1.2 Noise and vibration	1. The Contractor and Sub-contractor shall endeavor to keep noise generating activities to a minimum. 2. The Contractor and Sub-contractor shall restrict all operations that result in undue noise disturbance to local communities and/or dwellings (e.g. blasting, crushing, etc.) to daylight hours on weekdays or as otherwise agreed with the ER. 3. The Contractor and Sub-contractor shall warn any local communities and/or residents that could be disturbed by noise generating activities such as blasting well in advance and shall keep such activities to a minimum. 4. The Contractor and Sub-contractor shall be responsible for compliance with the relevant legislation with respect to noise. 5. Construction works within the distance of 500 m from villages and resettlement areas will be carried out between 06:00 to 18:00	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

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Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	6. Avoid impact pile-driving where possible in vibration-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver causes lower vibration levels where the geological conditions permit their use 7. Construction workers exposed to noise levels of 80 dBA or more shall be provided with adequate hearing protection. 8. Regularly maintain engines, equipment machines and vehicles in good condition 9. Consider alternatives of construction method to reduce noise 10. Construction and haulage activities to be limited to daytime 11. Contractor must use equipment and machines that generate low noise levels 12. Install temporary noise barriers, if necessary	
1.3 Erosion and Sedimentation control	1. Embankment slopes to be covered, soon after completion 2. Next layer/activity to be planned, soon after completion of, clearing and grubbing, laying of embankment layer, sub grade layer, sub-base layer, scarification etc. 3. Top soil from borrow area, Debris disposal sites; borrow area, construction site to be protected/covered for soil erosion. 4. Debris due to excavation of foundation, dismantling of existing cross drainage structure will be removed from the water course immediately. 5. Diversions for bridges will be removed from the water course before the onset of monsoon. Any runnels or erosion channels developed during the construction or maintenance period shall be backfilled and compacted and the areas restored to a proper condition. 6. In areas where construction activities have been completed and where no further disturbance would take place, rehabilitation and re-vegetation should commence as soon as possible. 7. An assessment of the potential for contamination of natural waterways. Basic principles include the size of the disturbed area, site drainage, and waterways receiving storm water from the disturbed area 8. Sedimentation controls shall be implemented in the form of silt trap fences and sedimentation basins where be suit, and all runoff from the disturbed area shall be directed to the sediment controls	Myandawei Industrial Estate Company Limited

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Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	9. Measures to be taken to collect, store and treat storm water prior to discharge from the site considering options for water re-use onsite 10. Management of material storage area – Stockpile and spoil disposal area shall not be located on drainage line 11. Control of erosion and sedimentation shall be constructed progressively prior to commencement of each stage of earthworks until the permanent protection is established	
1.4 Ground water and surface water	1. Construction work close to water bodies should be avoided. 2. Labor camps are to be located away from water bodies. 3. Car washing/workshops near water bodies are to be avoided 4. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course and ground are banned 5. Saving water sanitary wares such as faucet, flush toilet must be applied 6. " Water is worth it " need to be reminded all workers/sectors forward water saving 7. In case insufficient ground water quantity supply, the project must use other water source for tap water production to avoid water supply conflict	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor
2. Biological resources		
2.1 Terrestrial biology	1. Only clear the area needed for construction of infrastructure and utility system. 2. Avoid disturbance of beach forest as much as possible. 3. Wherever possible, identify the endangered species and transfer them to safe locations prior to clearing the vegetation. 4. Hunting of wildlife is prohibited 5. Disturbance of forest areas outside the project area is prohibited.	Myandawei Industrial Estate Company Limited

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Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
3. Human use values		
3.1 Water supply	1. Directly drain raw wastewater and/or used chemicals/oils/lubricants to ground are banned 2. Treated wastewater must be discharged to surface water course or recycled 3. Saving water sanitary wares such as faucet, flush toilet must be applied 4. " Water is worth it " need to be reminded all workers/sectors forward water saving 5. Pipeline of water supply must be regularly checked and immediately repaired for preventing of water leakage	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor
3.2 Wastewater treatment	1. Provide sufficient number of toilet and bathing facilities for labors, the contractors/subcontractors must not be allowed to establish worker camps outside PROJECT OWNER labor camp 2. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course are banned 3. Discharged treated wastewater to surface water must meet effluent standard of IEAT and/or related local regulations of Myanmar 4. Seepage unit/pit is not recommended for water pollution prevention 5. Consider alternatives for treated wastewater recycling such as watering trees 6. Provide sedimentation pond for sediments quantity reduction before run off water flow into surface water	Myandawei Industrial Estate Company Limited /Contractor and Sub-contractor
3.3 Waste management	1. Sorting waste must be regularly operated at construction site and labor camp 2. Solid waste must not be thrown away to surface water course or directly dumped on ground 3. Reuse and recycle waste buyers in Myanmar must be contacted in early stage of construction period and provide lists to factories. "*Solid waste is worth* " must be promoted for labor awareness 4. landfill units need to design and operate as US EPA guidelines 5. Hazardous waste disposal in or off the construction site is strictly prohibited 6. Project owner must have a strict control system for construction waste disposal	Myandawei Industrial Estate Company Limited /Contractor and Sub-contractor

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Signed..
Managing Director
Myandawei Industrial Estate Co., Ltd.

Signed..
Registered Environmental Impact Assessment Expert
The United Analyst and Engineering Consultant Co., Ltd.

Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
3.4 Transportation	1. All access roads in the construction area shall be signposted with the following information in Myanmese and English: - Speed limit; - Construction activities and machinery; - Roadside borrow pits and material stockpiles; - Any applicable load limit, particularly for temporary bridges; and - Road features that may affect driving conditions such as curves, hidden accesses etc. 2. A speed limit of 40 km/hr shall be applied in village areas and construction camps. Drivers shall be trained and notified of such limit; 3. Consider building speed humps before and after each village, where appropriate; 4. Route for heavy vehicles used for transportation of construction materials shall be designated. Route with least number of villages and residential area is most preferable; 5. Survey of the access roads to identify blind spots need to be regularly conducted. Improvement to the blind spots such as removal of obstructing objects when necessary; 6. Access road used for the construction activities shall be maintained in good conditions. 7. Roads should be kept free of construction debris. Debris, created as a result of construction, should be cleared timeously 8. Material shall be appropriately secured to ensure safe passage between destinations during transportation 9. Loads shall have appropriate cover to prevent them spilling from the vehicle during transit - The Contractor and Sub-contractor shall be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials. - Existing access routes should not be blocked or impeded by construction. If this is unavoidable, adequate prior planning should be implemented to ensure that safety and access to routes is maintained. 10. Construction vehicle may not be left overnight on or near to any environmentally sensitive area, or in a position where water runoff, in the event of rain, will cause a negative impact on the sensitive area	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

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Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
3.5 Historical and cultural resources	1. Sites with historical and cultural values shall be identified, recorded and located in the map. This information shall be agreed upon by the local authorities and villagers. 2. If construction activities have to be carried out within 50 m from these sites, the leaders of the communities that the sites belong to need to be notified at least 1 week prior to commencement of the activities. 3. Establish a plan and communication channel in case an unidentified site is encountered during the construction work to avoid damage to the site. 4. Removal and relocation method and destination shall be a mutual agreement between PROJECT OWNER, local authorities, and the leader of the communities that the site belongs to.	Myandawei Industrial Estate Company Limited
4. Quality of life values		
4.1 Economic and social conditions	1. Facilitate in compensation and relocation process for all households in the project areas, prior to the commencement of any construction activities. 2. Consider hiring local workers with relevant skills to create incomes for local communities near the constructions areas. 3. Regularly, provide information related to progress of the Project activities during the construction phase.	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
4.2 Occupational Health and Safety	1. Establish the *occupational and safety management plan*. Program for the construction should be established to assess and manage ESH impacts and risks. Project or activity-specific plans or procedures should be prepared and the basic site rules of work should be included. ESH section shall be established and organized in systematic maner with defined roles and responsibilities. 2. Perform occupational accidents and disease recording and reporting, and investigate all incidents to understand the cause of accident and to identify measures necessary to prevent a recurrence. 3. Provide Contractor and Sub-contractor management plan to ensure that the Contractor and Sub-contractor will have safety performances and procedures to protect their employee. Supervise and monitor Contractor and Sub-contractor performance periodically. 4. Train and provide information to employees. Occupational health training program should be provided as needed, for example, hazard awareness, specific hazards and safe work practices, to ensure that workers are capable of work safely. 5. Provide appropriate personal protective devices to employee and ensuring that personal protective devices will be worn during working at all time. 6. Restrict local community to access the site or area using fencing, signage and risks communication. 7. Appropriately mark area signage and labeling of equipment, determine hazardous area, for example electrical rooms, compressor etc., as well as installations, materials and emergency exits, and label in accordance with international standards, and easily to understood by workers, visitors and general public. 8. Supervise and monitor performance of Contractor and Sub-contractors and sub-Contractor and Sub-contractors on housekeeping in the campsite. 9. Include training programs for workers with these following topics: health awareness, hygiene and sanitary, waste management, communicable and transmission diseases, cultural awareness, regulations and compliance, and drug abuse. 10. Register foreign or migrated workers should be seriously performed to ensure that these workers have medical and health certificates to guarantee their personal health conditions. 11. Conduct surveillance and active screening and treatment of workers. Immunization program may be required. 12. Establish emergency response plan and procedures which also should be in place for any remote sites including revised as change of environmental condition and submit to DSEZMC and MONREC.	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

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Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	13. Provide appropriate emergency services and personnel to expedite emergency response when needed, maintain equipment facilities, fire-fighting equipment in good working order, accessible and adequate for the dimension and the basis use. 14. Provide health services and first-aid unit at all time, with comprehensive and appropriate equipment, establish the qualified the first-aid unit to properly handle with serious or trauma cases, and sufficient to meet the requirements, treat and/or patients to appropriate medical facilities in time. 15. Provide sufficient infrastructure amenities and public health services in the campsite, for example accommodations, water and drinking water availability, solid wastes disposal and sewage treatment. 16. In close collaboration with the community health authorities, implement an integrated control strategy for environmental and occupational diseases, such as integrated vector control programs, eliminating of breeding habitats in the campsite, and eradicating disease reservoirs. 17. Collaborate with community health authorities to enhance the worker families to access public health services, and promote immunization. 18. Distribute appropriate education materials for example health awareness, sexual transmission disease and communicable disease. 19. Consider the level of local fire fighting capacity to identify firefighting equipment that should be available when needed, and provide all necessary equipment with regular maintenance program. 20. Communicate potential accidents and/or hazards to local authorities, communities and relevant parties. 21. Conduct emergency response practices, including liaison with local response organizations and local responders. . 22. Provide the first aid unit at the campsite for their workers, assess whether the local health service capacity sufficient for worker's family and supporting industries, and in close collaborating with local authorities, consider supporting/additional health service facility.	
4.3 Community health and sanitation	1. Camp rules shall be established and informed to all residences. The rules should contain the following components: a. Policy on alcohol and substance abuse; b. Safety measures and emergency response particularly in case of fire;	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	c. Waste management requirements; d. Other measures to prevent dissemination of vectors and transmissible disease including STDs and HIV/AIDs; 2. General areas of the camp shall be kept clean and tidy. Waste shall be collected regularly to avoid accumulation of waste in the camp; 3. Conduct emergency response practices, including liaison with local response organizations and local responders 4. Revise or/and establish Emergency Response Plans that in concurrent with relevant policy, law and regulation. 5. Toilets shall be provided at a ratio of 1 toilet per 15 workers. All toilets shall be equipped with septic and treatment tanks of adequate size. The toilets need to be at least 100 m from any natural waterways. The pit shall be at least 1 km from any groundwater wells and is higher than groundwater table; 6. Proper drainage has to be provided. Improve areas with stagnant water as much as possible; and 7. Pest control measures shall be planned and implemented. All bedrooms need to be equipped with mosquito protection.	
5. Social and information		
5.1 Public participation and dissemination	1. Establish *Public Relation and Public Participation Plan* to incorporate in requests and recommendation of the continuous engagement of stakeholders following: a. Inform about project activities to community b. Support nearby community as appropriate to build good relationship with community c. Communicate to build community understanding about - Construction activities and progress - Potential environmental impacts and mitigation measures d. Conduct by MIE consistent with the applicable standard for public meeting/consultation e. Take account the results of the public consultation in improving and revised EMPs 2. Disclose about project information, ESIA, Environmental Monitoring report and public relation activities through channels such as website, e-mails, meeting/visiting and local exhibition board or local media.	Myandawei Industrial Estate Company Limited

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Signed.......................................
Managing Director
Myandawei Industrial Estate Co., Ltd.

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Registered Environmental Impact Assessment Expert
The United Analyst and Engineering Consultant Co., Ltd.

Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
5.2 Grievances redress	1. Establish *Grievance Redress Procedure* to address any complaints/grieves to resolve/settle disputes that brought forward by community pertaining to project activities.	Myandawei Industrial Estate Co.Ltd
6. Overall managment		
6.1 Revise and report	1. Revised Environmental Management Plan as necessary at every stage and submitted to DSEZMC and MONREC or since the type and number of invested industrial can be known in details. 2. Revised ESIA report and Emergency Response Plan depending on the changing in condition such fire hazard, safety from chemicals, flooding and earthquake and submitted to DSEZMC and MONREC 3. Reporting on performance of basic infrastructure e.g. local roads, electricitity, water supply, safety and results of continuous public consultation in the monitoring reports that will carry out every 6 months and submitted to DSEZMC and MONREC	Myandawei Industrial Estate Company Limited

Environmental Mitigation and Managment Plan for Operation Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
1. Physical resources		
1.1 Air quality	1. Dust generation due to vehicle wheel will be reduced due to increased/widened paved surface. 2. Avenue plantation to be maintained, casualties to be replaced. 3. Avenue plantation includes species having dust absorption characteristic. 4. Community properties and realignment locations has been proposed for peripheral plantation and landscaping. 5. Maintenance of roads to be ensured. 6. With the reduction in journey time, idle engine running time air pollution will reduce. 7. Avenues plantation is proposed throughout the corridor, casualties to be replaced. 8. Avenue plantation includes species having air purifying characteristic. 9. Enforce Pollution Under Control (PUC) Programs. The public will be informed about the regulations on air pollution of vehicles. 10. Air pollution monitoring program has been devised for checking pollution level and suggesting remedial measures. 11. VOCs recovery system shall be equipped for the industries that or use solvents or have potential to release high amount of VOCs. 12. For combustion process, the Project would equip Dry Low NOx Burner in order to minimize Nitrogen Oxide This burner is automatic control system. 13. Periodically maintain and provide readiness, and Preventive Maintenance Program for equipment should be implemented. 14. Provision of installation and operation of Continuous Emission Monitoring System (CEMS) when hazardous and non-hazardous waste incinerators or concerned industries agree to set up a plant in the initial industrial estate project. 15. Continual collect data from the industries and update the numerical model when data from the CEMS is available or at the 3rd year of the operation, whichever comes first. Then runs updated model every year afterwards based on the actual measured data. 16. Regularly check and maintenance various equipment, machines, and vehicles in good condition to minimize the exhaust emission 17. Plant trees around the project site boundaries and empty land to increase green area 18. Consider cleaner technology for alternative of production process 19. Promote awareness that fuel combustion caused global warming, energy saving is a rule 20. Provision of air pollution loading control system such as emitted pollutant loading and its control of each factory is necessary for industrial estate operator 21. Control emission loads of main air pollutants as mentioned ; - Emission rate of PM_{10} for stack sources shall be no greater than 0.0025 kg/ha/day. - Emission rate of NO_2 for stack sources shall be no greater than 0.003125 kg/ha/day. - Emission rate of SO_2 for stack sources shall be no greater than 0.0075 kg/ha/day.	Myandawei Industrial Estate Company Limited

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Environmental Mitigation and Managment Plan for Operation Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	22. Provide Continuous Emission Monitoring System (CEMS) for power plant and waste incinerators 23. Control emitted air quality from stacks of power plant and waste incinerators are giving standard 24. Measure emitted air quality from stacks regularly by ISO/IEC 17025 qualified laboratory (twice a year, dry and wet season) 25. Plan for emission of GHGs from the Project shall be established and/or revised in concurrently with the relevant policy and regulations.	
1.2 Noise and vibration	1. Maintenance of noise barriers need to be conducted. 2. Discouraging local people from establishing sensitive receptor near the road. 3. The public to be informed about the regulations on noise pollution. 4. Monitoring of noise pollution to be done regularly as per frequency and suggesting remedial measures. 5. Equipment and machine that generate high level of noise shall be installed in an enclosed building so that, when operated, noise level at the fence line of the industries do not exceed 70 dB(A).	Myandawei Industrial Estate Company Limited
1.3 Ground water and surface water	1. All industry facility in the industrial estate shall pretreat the wastewater to meet the acceptance criteria of the central wastewater treatment system. 2. A detention pond with a sufficient capacity to retain 2 day expected flow rate has to be constructed at each industry facility and at each Central Wastewater Treatment System as a buffer storage in case the treated wastewater fails to meet the effluent criteria. 3. Inside each industry facility, wastewater stream that requires chemical pretreatment shall be collected separately from other wastewater streams to minimize and use of chemical and increase efficiency of chemical pretreatment process. 4. Wastewater stream has to be separated from storm drain. Dilution of wastewater is not acceptable. 5. An inspection manhole has to be installed at the point where the pretreated wastewater is discharged to the collection system of the industrial estate. 6. Warning and penalty system needs to be established for industry facility that fails to meet the acceptance criteria repeatedly. 7. Storm water retention system needs to be constructed to prevent surge of storm water discharge to the natural environment in case of large storm and to act as a buffer storage in case of spills into storm drainage system. 8. Thermal wastewater needs to be treated so that temperature at the edge of the mixing zone, or 100 m from the discharge point, is change from natural conditions by less than 3 Degree Celsius. 9. Recycling of wastewater should be promoted. Treated effluent should be used in the industrial estate wherever possible, such as for watering the green areas. 10. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course and ground are banned 11. Discharged treated wastewater to surface water must meet effluent standard of IEAT and/or related local regulations of Myanmar (except BOD that must be lower than 10 mg/l when zone C and/or D developed) 12. Water balance of each factory is need to be show PROJECT OWNER for update water consumption	Myandawei Industrial Estate Company Limited

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Environmental Mitigation and Managment Plan for Operation Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	13. Provide emergency holding pond, retreated system and emergency plan for over effluent standard treated wastewater storage 14. Regularly maintain equipment and machines of wastewater treatment plant in good condition 15. Provide stand by aerators and diesel engine generator at the wastewater treatment plant for emergency case 16. laboratory analysis of influent and effluent of Central Wastewater Treatment System should be regularly conducted 17. Raw wastewater must be discharged to wastewater collection system for treating to meet effluent standard 18. Ground water application of factories to be water supply in factories is prohibited	
2. Biological resources		
2.1 Terrestrial ecology	1. Wherever possible, conserve the existing trees, particularly in the green areas, 2. Encourage the manufacturers to conserve the existing trees in the design of their facilities. 3. Select local species if plantation in the project area is needed. 4. Coordinate with local authorities and engage local communities for reforestation projects surrounding the project area. Discourage and educate the workers in the industrial estate against wildlife consumption to reduce demand and indirect impacts to the wildlife in reserved forests elsewhere outside the project area.	Myandawei Industrial Estate Company Limited
3. Human use values		
3.1 Water supply from central water treatment plant (WTP)	1. Directly drain raw wastewater and/or used chemicals/oils/lubricants to ground or surface water course are banned 2. Ground water application of factories to be water supply in factories is prohibited 3. Saving water sanitary wares such as faucet, flush toilet must be applied 4. "Water is worth it " need to be reminded all workers/sectors forward water saving industries 5. Pipeline of water supply must be regularly checked and immediately repaired for preventing of water leakage 6. Cleaner technology for production processes especially water saving machines/equipment must be first alternative for investors 7. Reusing and recycling of treated wastewater must be promoted and awarded 8. Application of raw water source must be accepted by local communities to avoid water supply conflict and project ban 9. Laboratory analysis of product water or tap water should be conducted regularly 10. Surveillance of Trihalomethane (THM) compounds in product water or tap water is recommended 11. Transportation of chlorine gas and other chemicals must be under UN recommendation on the transport of dangerous goods and ASEAN Framework Agreement on Facilitation of Goods in Transit Chemicals storage safety OSHA requirements should be conducted	Myandawei Industrial Estate Company Limited

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Environmental Mitigation and Managment Plan for Operation Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
3.2 Wastewater treatment	1. The discharged of untreated wastewater into the receiving water is strictly prohibited at all time 2. Emergency plan for operation of wastewater treatment should be established to prevent untreated wastewater or over standard effluent discharged into the receiving water 3. Regularly check and maintain wastewater treatment plant to control the treated wastewater quality, at least as required effluent from Dawei Industrial Estate's Wastewater Treatment System especially BOD must be less than mentioned values for minimizing the impact to surface water and sediment qualities. 4. Installation of online monitoring system for flow measurement of both influent and effluent and BOD concentration of the effluent 5. Regularly maintain equipment and machines of wastewater treatment plant in good condition 6. Provide stand by aerators and diesel engine generator at the wastewater treatment plant for emergency case 7. Discharged treated wastewater to surface water must meet effluent standard of IEAT (except BOD that must be lower than 10 mg/l when zone C and/or D developed) 8. Consider alternatives for treated wastewater reusing and recycling such as watering trees, raw water for some production process 9. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course and ground are banned laboratory analysis of influent and effluent of central wastewater treatment plant should be regularly conducted	Myandawei Industrial Estate Company Limited
3.3 Waste management	<u>Before Completion of Waste Management Facility</u> 1. Classify hazardous and non-hazardous waste according to the definitions in the Waste Management Plan prepared during the construction phase. 2. The Dawei SEZ Initial Industrial Estate Project will provide sanitary landfill for disposal of non-hazardous waste generated from the Industrial Estate area. 3. Design and construction of the landfill shall be in accordance with Solid Waste Disposal Facility Criteria – Technical Manual published by U.S. EPA (1993) or other applicable standards. 4. Detailed hydrogeological condition of the proposed landfill area has to be studied in the design of landfill. 5. Groundwater monitoring wells will be installed. As a minimum, 1 well is to be installed up gradient of the landfill and at least 1 well is to be installed down gradient of the land fill. Depth of screens and well construction depends on the results from the hydrogeological condition study. 6. Hazardous waste will be temporarily stored until the hazardous waste stabilization and disposal system at the waste management system is functional. Minimum requirements of the temporary hazardous waste storage areas include: – Impervious floor without cracks or spaces that may allow spills to perforate into the ground; – Surrounded by secondary containment bunds. The secondary containment bunds shall be at least 0.5 m high with a volume large enough to contain the spill of the largest container expected in the storage area;	Myandawei Industrial Estate Company Limited

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Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	- Designate storage area for liquids or materials that are not allowed to be mixed, such as acids and alkalis; - Equipped with spill response kits; - Consider providing the area with roofing and temporary walls with a provision that the temporary hazardous waste storage area will have to be in use for at least 3 years until the permanent hazardous waste management facilities of the industrial estate are functional. 7. Type and quantity of hazardous waste in the storage area shall be recorded and kept current. 8. The landfill shall be closed daily to prevent vectors and odors. 9. Workers need to be trained of Waste Management Plan. 10. When the permanent waste management facility is operational, evaluate options of permanent closure of the landfill site or moving the waste material in the landfill to the permanent facility. 11. Concept of 3 Rs (Reduce, Reuse, Recycle) must be promoted and awarded 12. Open burning is not permitted 13. Landfill site must be constructed above the record flooding level 14. Controlling vector populations that having capability of transmitting disease to humans 15. Control public access to prevent illegal dumping 16. Build and maintain a control system designed to prevent surface water run-off and storm waters from running on the active part of the landfill After Completion of Waste Management Facility 1. The components of the waste management facility: i.e. sanitary landfill, secured landfill, and incinerator, shall be designed and constructed according to the internationally accepted standards. 2. Detailed hydrogeological condition of the proposed landfill area has to be studied in the design of landfill. 3. Groundwater monitoring wells will be installed. Location and number of groundwater monitoring wells depends on the results of the study and the layout of the facility. Depth of screens and well construction depends on the results from the hydrogeological condition study. 4. All hazardous and non-hazardous waste generated by the industries in the estate shall be transferred to the facility for disposal. 5. Waste manifest system has to be created and implemented. 6. The facility shall create its Standard Operating Procedure (SOP) covering steps from receiving waste, laboratory analysis, stabilization, temporary storage, incineration, and disposal. Audit by third party is necessary. 7. Workers need to be trained of Waste Management Plan. 8. Record of type of waste including its quantity and origins shall be kept in the data base of PROJECT OWNER. This knowledge can be used in promoting material and waste flow management between industries within the industrial estate. 9. Dioxin is need to be measured, when incinerator is operated 10. Methane gas produced from landfill site and other treatment unit must be flared	

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Environmental Mitigation and Managment Plan for Operation Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	11. Cover disposed solid waste with at least 6 inches of earthen material at the end of each operating day to control vectors, fires, odors, blowing litters and scavenging. An alternative cover material or temporary cover sheet is allowed, if local climate conditions make such a requirement impractical. 12. Open burning of waste is not permitted 13. Controlling vector populations that having capability of transmitting disease to humans 14. Control public access to prevent illegal dumping Build and maintain a control system designed to prevent surface water run-off and storm waters from running on the active part of the landfill	
3.4 Land use	<u>Special Plan and Buffer Zone</u> 1. A special specific area plan is needed to control the land use adjacent to the project. The plan must be legitimate and authorized by the state. 2. The buffer zone all around the Industrial Estate boundaries should be set up to control and prevent any uses other than agriculture and forest <u>Setting up a management committee overseeing the project land use.</u> 1. A team or committee should be set up to monitor and manage activities and structures built in and around the project 2. The team should have legitimate authority to control the areas adjacent or nearby, though outside the estate boundaries. <u>Transportation and Infrastructure Outside the Industrial Estate Area</u> The infrastructure of the Industrial Estate will be enable setting up structures and services, such as, local roads, electricity, water supply, and drainage, should be also well planned and controlled. <u>Enforcement</u> The proposed set-up land use management committee/team should have duty to regularly monitor land use activities outside and inside the project as the development progresses.	Myandawei Industrial Estate Company Limited /MC's Authorized Agency
4. Quality of life values		

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Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
4.1 Economic and social conditions	1. Facilitate and support community development initiatives. 2. Provide special training programs for local communities to have skills required to work in Initial Industrial Zones. 3. Consider hiring local workers to create incomes and/or special benefits to local communities near the Initial Industrial Zones. Establish the Unit under the Initial Industrial Zone, to handle public consultation, information disclosure, and grievance redress mechanisms, both formally and informally.	Myandawei Industrial Estate Company Limited
4.2 Occupational health and safety	<u>Accidents and Injuries</u> 1. Provide the environmental health and safety management system and programs for the whole industrial estate. ESH section shall be established and organized in systematic maner with defined roles and responsibilities. 2. Request for each individual industry to provide proper and capable to manage occupational health and safety issues to protect health and safety of workers and public. 3. Establish occupational health and safety management plans and programs to assess and manage EHS impacts and risks which are based on comprehensive job safety analyses. 4. Include the following issues in the occupational health and safety management system: - Accident investigation, recording and reporting - Surveillance of the working environment and worker health - Training and hazard communication - Monitoring and auditing procedures to evaluate the effectiveness of prevention and control measures. 5. Perform occupational accidents and disease recording and reporting, investigate all incidents to understand the cause of accident and to identify measures necessary to prevent a recurrence. 6. Provide provisions for Contractor and Sub-contractor to ensure that the Contractor and Sub-contractor will have safety procedures to protect their employees, and periodically monitor Contractor and Sub-contractor performance. 7. Restrict access into site or area including fencing, signage and communication of risks to local community, appropriately provide area signage and labeling of equipment in accordance with international standards and easily to understand by workers, visitors and general public. 8. Promote traffic safety programs to all personnel, for examples: - Specifying limits for trip duration - Improving driving skill - Use of speed control devices	Myandawei Industrial Estate Company Limited

UAE
UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

Environmental Mitigation and Managment Plan for Operation Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	<u>Occupational, Sexual Transmission and Communicable Diseases:</u> 1. Conduct surveillance and active screening and treatment of workers. Immunization program may be required. 2. Register foreign or migrated workers to ensure that these workers have medical and health certificates to guarantee their personal health conditions. 3. Provide training programs for workers in these following topics: health awareness, and promote health protection strategies including encouraging condom use. 4. Perform periodic worker health checks in accordance with the potential risks. <u>Fire, Explosion, Chemical Leaks and Major Hazards:</u> 1. Conduct major hazard assessment of each specified industry prior establishment in order to identify buffer zone/strips or other physical separation methods to protect public from any potential hazards. 2. Provide comprehensive emergency preparedness and response plan and procedures covering fire, explosion, chemical Leaks and major hazards control. 3. Provide appropriate emergency services and personnel to execute emergency response when needed, and maintain equipment facilities, fire-fighting equipment in good working order, accessible and adequate for the dimension and the basis use. 4. Establish fire safety system using appropriate prescriptive standards regarding with type and number of industries, and revise fire risk management periodically to ensure its capability to cope with all the potential hazards. 5. Perform mutual aid agreements among the industries in the industrial estate as well as local authorities to provide a clear basis for response to share personnel and specialized equipment. 6. Conduct annual training and updating emergency preparedness and response plan to account for changes in equipment, personnel and facilities. 7. Revised or/and establish Emergency Response Plans in concordance with recent policy, law and regulation for change of environmental condition and submit to DSEZMC and MONREC. <u>Adequacy and Readiness of Healthcare Services</u> Establish the hospital and periodically evaluate in terms of adequacy, capacity and readiness in accordance with the change in numbers and types of industry and potential risks.	
4.3 Community health	<u>Sanitation</u> 1. Provide sufficient infrastructure amenities and public health services for the industrial estate and township, for example accommodations, water and drinking water availability, solid wastes disposal and sewage treatment in order to reduce pressure on local authorities in servicing public.	Myandawei Industrial Estate Company Limited

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

Signed...
Managing Director
Myandawei Industrial Estate Co., Ltd.

Signed...
Registered Environmental Impact Assessment Expert
The United Analyst and Engineering Consultant Co., Ltd.

Environmental Mitigation and Managment Plan for Operation Phase

<table>
<tr><th>Potential Environmental Impacts</th><th>Proposed Mitigation Measures</th><th>Institutional Responsibilities</th></tr>
<tr><td></td><td>2. Technically support or collaborate with local authorities to enhance potentiality of communities in solid waste disposal by means of 3 R (Reduce, Reuse and Recycle).
3. Distribute appropriate education materials for example health awareness, hygiene and sanitation.

<u>Environmental/Communicable/Non-Communicable Diseases:</u>

1. Establish the buffer strip/zone to separate the township and industries to protect dwellers from pollutions emitted.
2. Implement engineering preventive measures to install physical separation between industry and community, for example fence or tree plantation as buffer zone along the estate boundaries, and use of air modeling results and/or potential pollutions of each industry as the criteria for the distance between industries and affected community.
3. With close collaboration with community health authorities, implement an integrated control strategy for environmental and occupational diseases, for example promoting immunization, eradicating disease reservoir and promoting healthy workplace.
4. Provide worker health information to local government agencies.
Set up a grievance procedure to manage complaints, if any.</td><td></td></tr>
<tr><td></td><td><u>Accidents/Fire/Chemical Leaks</u>

1. Invite representative of local emergency and securities services to participate in annual site inspections to ensure familiarity with the potential hazards present.
2. Inform and communicate potential accidents and hazards of the project that may impact to community to local communities and relevant parties.
3. Prepare and train workers and nearby communities to respond to accidents, including providing technical and financial resources in order to control and response such events effectively and safely, and provide periodic emergency response practice with communities.

<u>Adequacy and Readiness of Healthcare Services</u>

1. Promote collaboration with local authorities to enhance access of community to public health services, consider whether the capacity of the local health services sufficient for the worker family and support industries, and, if not sufficient, in close collaborating with local authorities support technical and financial resources to develop health service facility.
Collaborate with local health authorities to provide relevant information and technical as well as financial resources to set up the public health and occupation health surveillance system.</td><td>Myandawei Industrial Estate Company Limited</td></tr>
</table>

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

Environmental Mitigation and Managment Plan for Operation Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
5.Social and information		
5.1 Employment and training program	Comply with IFC EHS General guideline/Laws and regulations in terms of the employee management and established plan for training programme and implement.	Myandawei Industrial Estate Co.Ltd.
5.2 Public participation and dissemination	1. Establish *Public Relation and Public Participation Plan* to incorporate in requests and recommendation of the continuous engagement of stakeholders following: a. Inform about project activities to community b. Support nearby community as appropriate to build good relationship with community c. Communicate to build community understanding about - Potential environmental impacts and mitigation measures - CSR activity d. Conduct by MIE consistent with the applicable standard for public meeting/consultation e. Take account the results of the public consultation in improving and revised EMPs 2. Disclose about project information and public relation activities through channels such as website,e-mails, meeting/visiting and local exhibition board or local media.	Myandawei Industrial Estate Company Limited
5.3 Grievances redress	1. Establish *Grievance Redress Procedure* to address any complaints/grieves to resolve/settle disputes that brought forward by community pertaining to project activities.	Myandawei Industrial Estate Co.Ltd.
6. Overall managment		
6.1 Revise and report	1. Revised Environmental Management Plan as necessary at every stage and submitted to DSEZMC and MONREC or since the type and number of invested industrial can be known in details. 2. Revised ESIA report and Emergency Response Plan depending on the changing in condition such fire hazard, safety from chemicals, flooding and earthquake and submitted to DSEZMC and MONREC 3. Reporting on performance of basic infrastructure e.g. local roads, electricitity, water supply, safety and results of continuous public consultation in the monitoring reports that will carry out every 6 months and submitted to DSEZMC and MONREC	Myandawei Industrial Estate Company Limited

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

Signed...

Managing Director

Myandawei Industrial Estate Co., Ltd.

Signed...

Registered Environmental Impact Assessment Expert

The United Analyst and Engineering Consultant Co., Ltd.

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LIST OF ABBREVIATION

ADB	Asian Development Bank
AEC	Asian Economic Community
BAT	Best Available Technology
CA	Concession Agreement
CB	Central Body
CC	Construction Contractor
CEMP	Construction phase Environmental Management Plan
CERMP	Construction phase Environmental Risk Management Plan
CO	Construction Phase
CSR	Corporation Social Responsibility
CWB	Central Working Body
DSEZ	Dawei Special Economic Zone
DSEZMC	Dawei Special Economic Zone Management Committee
EC	Emergency Response Commander
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
ECL	Environmental Conservation Law
ECR	Environmental Conservation Rules
ED	Emergency Response Director
EHIA	Environmental and Health Impact Assessment
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMoP	Environmental Monitoring Plan
EMP	Environmental Management Plan
EMS	Environmental Management System
EPC	Engineering Procurement and Construction
ERA	Environmental Risk Assessment
ERC	Emergency Response Center
ERP	Environmental Response Plan
ESIA	Environmental and Social Impact Assessment
FCS	Flood Controlling System
FFS	Fire Fighting System
FHWA	Federal Highway Administration
GIIP	Good International Industry Practice
IE	Initial Industrial Estate
IEC	International Engineering Consultant
IEE	Initial Environmental Examination

IFC	International Financial Cooperation
ITD	Italian Thai Development Company Limited
MAPDRR	Myanmar Action Plan on Disaster Risk Reduction
MIE	Myandawei Industrial Estate Company Limited
MOECAF	Ministry of Environmental Conservation And Forestry
MONREC	Ministry of Natural Resource and Environmental Conservation
MOU	Memorandum Of Understanding
NCEA	National Commission for Environmental Affairs
NECC	National Environmental Conservation Committee
NEQG	National Environmental Quality (Emissions) Guidelines
NESDB	National Economic and Social Development Board
OEMP	Operation phase Environmental Management Plan
OERMP	Operation phase Environmental Risk Management Plan
OHSA	Occupational Health and Safety Administration
OP	Operation Phase
PAHs	Project Affected Households
PAPs	Project Affected People
PCCD	Pollution Control and Cleaning Department
PIC	Person In Charge
PPAH	Pollution Prevention and Abatement Handbook
PPP	Public Private Participation
PRMP	Project Risk Management Plan
PS	Performance Standard
PTW	Permit To Work
RAP	Resettlement Action Plan
REM	Resource and Environment Myanmar Limited
SEATEC	SEATEC Engineering Consultant
SEZ	Special Economic Zone
SIA	Social Impact Assessment
SWB	Support Working Body
TEAM	TEAM Group Consultant
THB	Thai Baht
TOR	Term Of Reference
UAE	United Analyst and Engineering Consultant
US EPA	US Environmental Protection Agency
US$	The United States of America Dollar
USACE	US Army Corps of Engineers
WHO	World Health Organization

LIST OF TECHNICAL ABBREVIATION

BOD	Biological Oxygen Demand
CC	Construction Contractor
CCTV	Closed-Circuit Television
CD	Chart Datum
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
DO	Dissolve Oxygen
FCB	Fecal Coliform Bacteria
FOG	Fat Oil and Grease
GDS	Generator Docking Station
GHG	Green House Gases
GPS	Global Positioning System
HIV/AIDs	Human Immunodeficiency Virus/Acquired Immune Deficiency syndrome
HRT	Hydraulic Retention Time
ISO	International Organization for Standardization
IT	Information Technology
IUCN	Red Data List of Threatened Species
IVI	Important Value Index
L_{Aeq}	Equivalent Continuous Noise Level
L_{Amax}	Maximum value of A-weighted sound pressure Level
LNG	Liquefied Natural Gas
MHC	Methane Hydrocarbon
MR	Main Road
NMHC	Non Methane Hydrocarbon
PCE	Passenger Car Equivalent
PCU	Passenger Car Unit
PM	Particular Matter
SR	Secondary Road
TCB	Total Coliform Bacteria
TR	Tertiary Road
TSP	Total Suspended Particulate
TSS	Total Suspended Solid
VOC	Volatile Organic Compounds
VPN	Virtual Private Network

WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant
Tc	Retention Time
FCP	Fire Alarm Control Panel
ANN	Graphic Annunciator
F	Fire Alarm Manual Station
B	Fire Alarm Bell
FHC	Fire Hose Cabinet
FDC	Fire Department Connection
OTU	Onsite Treatment Unit
WGS	World Geodetic System
FSD	Foundation for Sustainable Development

LIST OF UNITS

dB(A)	A-weight decibels (Noise level unit)
DWT	Deadweight Tonnage
Gbps	Gigabits Per Second
kV	Kilo Volts
KYATs	Myanmar Currency Unit
MVA	Mega Volts Amperes
MW	Mega Watt
NTU	Nephilometric Turbidity Unit
PCU	Passenger Car Unit
TEU	Twenty-Foot Equivalent Unit
UTM	Universal Transvers Mercator (Geographic Location)
CFU	Colony Forming Unit
KNU	Karen National Union
VA	Volt-Ampere

အခန်း (၁)

အစီရင်ခံစာ အကျဉ်းချုပ်

၁.၁ စီမံကိန်းအကြောင်းအရာ

၁.၁.၁ လေ့လာရသည့် ရည်ရွယ်ချက်

ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများ အကဲဖြတ်ခြင်း (ESIA)၏ ရည်ရွယ်ချက်မှာ မန်းထားဝယ်စက်မှုဇုန် ကုမ္ပဏီမှ ဆောင်ရွက်သော ထားဝယ်အထူးစီးပွားရေးဇုန်အတွင်းရှိ ကနဦး စက်မှုဇုန်ဖွံ့ဖြိုးမှု (နောက်ပိုင်းတွင် စီမံကိန်းဟု အသုံးပြုသွားပါမည်။) ကြောင့် ဖြစ်ပေါ်လာသော ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများကို အကဲဖြတ်ရန် ဖြစ်ပြီး စီမံကိန်းကြောင့် ဖြစ်ပေါ်လာသော ဆိုးကျိုးသက်ရောက်မှုများကို လျော့ချရန် လျော့နည်းစေရန် လျော့ပါးစေရေးနည်းလမ်းများ ပါဝင်သည့် ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှုအစီအစဉ်ကိုလည်း ထည့်သွင်းစဉ်းစားသွားပါမည်။

ထားဝယ်အထူးစီးပွားရေးဇုန်အတွင်းရှိ ၂၇ စတုရန်းကီလိုမီတာခန့်ကို (ပုံ ၁.၁-၁) စီးပွားရေးဇုန်အဖြစ် တည်ထောင်မည်ဖြစ်ပြီး ၎င်းစီးပွားရေးဇုန်တွင် ထောက်ပံ့ပို့ဆောင်ရေး၊ ရေနံဓါတုစက်ရုံများနှင့် ထားဝယ်အထူးစီးပွားရေးဇုန် (DSEZ)အတွင်း သင်တန်းများကို ထောက်ပံ့ပေးသွားပါမည်။ စီမံကိန်းသည် အဆောက်အဦးဝန်ဆောင်မှု၊ အသုံးပြုမှုများနှင့် အခြားဝန်ဆောင်မှုများကို DSEZ အတွင်းလိုအပ်ချက်များနှင့်အညီ စီစဉ်ထားပါသည်။ ၎င်းတို့သည် အောက်ပါ ကဏ္ဍများ၏ ဆောက်လုပ်ရေး လုပ်ငန်းလည်ပတ်ရေးများကို အောင်မြင်စေပါလိမ့်မည်။

- လမ်းပန်းဆက်သွယ်ရေး
- ရေကြီးရေလျှံမှု ကာကွယ်ခြင်းနှင့် ရေနုတ်မြောင်းစနစ်
- စွမ်းအင်နှင့် ဆက်သွယ်ရေး
- ရေသန့်စင်မှုနှင့် ထောက်ပံ့မှုစနစ်
- ဗဟိုရေဆိုးသန့်စင်စနစ်
- အစိုင်အခဲစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုစနစ်
- မီးကာကွယ်ရေးနှင့် အရေးပေါ်တုန့်ပြန်မှုစနစ်
- သတင်းပေးဆက်သွယ်ရေးစနစ်
- လုံခြုံရေးစနစ်
- ပို့ဆောင်ဆက်သွယ်ရေးဗဟိုနှင့်
- အပန်းဖြေအနားယူခြင်း။

သယံဇာတနှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဝန်ကြီးဌာန (MONREC) မှ ထုတ်ပြန်ထားသော ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၃)နှင့် ပတ်ဝန်းကျင်သက်ရောက်မှု အကဲဖြတ်ခြင်း နည်းဥပဒေ (နံပါတ် ၆၁၆/၂၀၁၅) အရ စက်မှုဇုန်ဆောက်လုပ်ခြင်းနှင့် ဖွံ့ဖြိုးတိုးတက်ရေး စီမံကိန်းများအတွက် EIA ဆောင်ရွက်ရန် လိုအပ်ပါသည်။ စီမံကိန်းသည် လူမှုရေးဆိုင်ရာ ကိစ္စများတွင် ဆက်သွယ်နေပါက လူမှုရေးဆိုင်ရာ အကဲဖြတ်ခြင်းကို EIA လေ့လာမှုတွင် ထည့်သွင်းရမည်ဖြစ်ပြီး ပတ်ဝန်းကျင်နှင့် လူမှုရေးသက်ရောက်မှု အကဲဖြတ်ခြင်း (ESIA) အဖြစ် ဖော်ပြပါမည်။ ဥပဒေနှင့်အညီ လိုက်နာဆောင်ရွက် အကောင်အထည်ဖော်ရန် MIE သည် United Analyst and Engineering Consultant Co., Ltd. (UAE) ကို စီမံကိန်းအတွက် ESIA လုပ်ငန်းများ ဆောင်ရွက်ရန် တာဝန်ပေးအပ်ထားပါသည်။ ဤအစီရင်ခံစာတွင် UAE ကို EIA လေ့လာရေးအဖွဲ့ဟု ကိုယ်စားပြု ဖော်ပြသွားပါမည်။

Source: ITD (2015)

ပုံ ၁.၁-၁ ထားဝယ် SEZ ရှိ စီမံကိန်းတည်နေရာ

၁.၁.၂ စပ်ဆက်နေသော စီမံကိန်းများ

DSEZ စီမံကိန်းသည် ၂၀၁၀ ကတည်းက ဖွံ့ဖြိုးမှု ဆောင်ရွက်ခဲ့ပြီး ရေနက်ဆိပ်ကမ်းနှင့် စက်မှုဇုန်အတွက် သဘောတူညီမှု မူဘောင်များကို စတင်ဆောင်ရွက်ခဲ့ပါသည်။ ၂၀၁၅ ခုနှစ်နောက်ပိုင်းတွင် DSEZ သည် မကြာသေးမီက ဆောင်ရွက်ချက်များနှင့် နိုင်ငံခြားရင်းနှီးမြှုပ်နှံမှုများအတွက် ပိုဆွဲဆောင်နိုင်လာခဲ့ပါသည်။ မကြာသေးမီက ဆောင်ရွက်ထားသော စီမံကိန်းများကို အောက်ပါ ဆောင်ရွက်ချက်များနှင့်အတူ ဆောင်ရွက်ခဲ့ပါသည်။

- ထိုင်းနိုင်ငံသို့ လမ်းဖောက်ခြင်း
- ဆိပ်ကမ်းနှင့် LNG Terminal
- ကနဦးစွမ်းအင်စက်ရုံ
- ရေလှောင်ကန်နှင့် တာတမံ
- ကနဦးမြို့
- ဆက်သွယ်ရေးလိုင်းများ

နှစ်လမ်းသွားလမ်းမကြီးသည် DSEZ နှင့် ထိုင်းနိုင်ငံနှင့် အခြားအရှေ့တောင်အာရှ နေရာများသို့ ဆက်သွယ်ထားသော အဓိကလမ်းဖြစ်ပါသည်။ လမ်းမကြီးသည် အက်ဒမန်ပင်လယ်ကမ်းရိုးတန်းမှ ယိုးဒယားပင်လယ်ကွေ့ကိုဖြတ်၍ တောင်တရုတ်ပင်လယ်နှင့် ဆက်သွယ်ထားပါသည်။ စီမံကိန်းသည် ထားဝယ်ဆိပ်ကမ်းမှစ၍ ၁၃၈ ကီလိုမီတာအရှည်ရှိပြီး ကနဦးစက်မှုဇုန်နှင့် ထိုင်းနိုင်ငံ၊ ကန်ချနာပူရီ၊ ဗန်ဖူနန်ရွှန်နယ်ကိုဖြတ်သွားပါသည်။ အပိုင်းအများစုမှာ မြန်မာနိုင်ငံအတွင်းဖြစ်ပြီး ထိုင်းနိုင်ငံတွင် အပိုင်း (၃) ခု၊ ၅ကီလိုမီတာခန့်သာ ရှိပါသည်။ လမ်းအသုံးပြုခ ကောက်ခံမှု၊ အခွန်အခများကိုလဲ ဆောင်ရွက်သွားပါမည်။

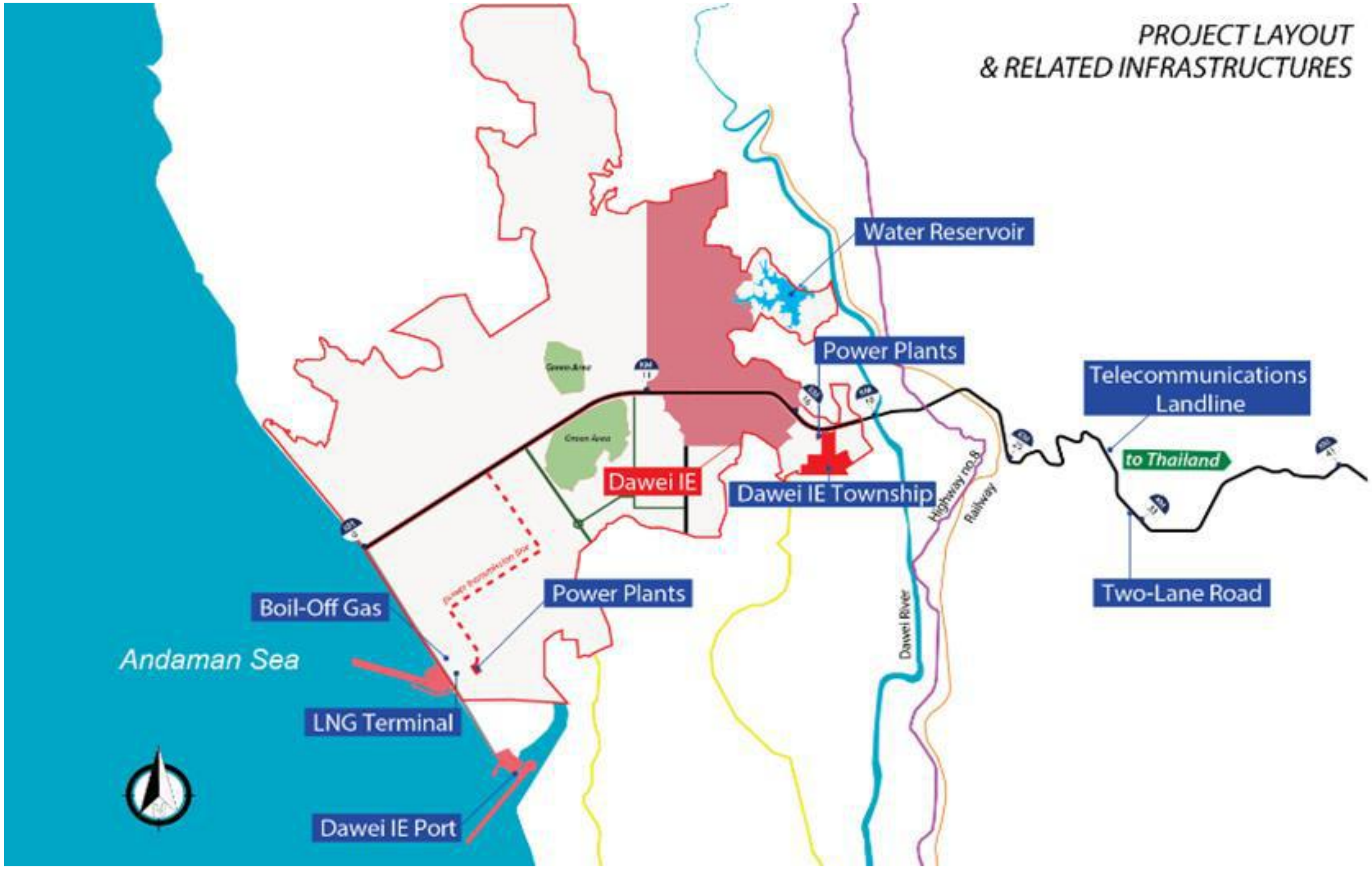
ထားဝယ်ဆိပ်ကမ်းတွင် သင်္ဘောဆိုက်ကပ်ရာနေရာ (၃) နေရာရှိပါသည်။ ၁၀၀မီတာရှည်သော ဘောတံတားသည် တစ်နှစ်လျှင် ၃၃၀၀၀၀ တန်ရှိ ရေယဉ်များ ဘက်စုံအသုံးပြုရန်ဖြစ်ပြီး (ခန့်မှန်း 400 TEU or 13,000 DWT) မကြာသေးမီက ဆောက်လုပ်ပြီးစီးထားပါသည်။ ၄င်းစီးပွားရေးသုံး သင်္ဘောဆိုက်ကပ်ရာနေရာကို ခန့်မှန်း နှစ်စဉ် တန် ၁၄ သန်းရှိ Panamax ရေယဉ် (60000 DWT)အတွက် တိုးမြှင့်ဆောင်ရွက်ရန် စီစဉ်ထားပါသည်။ သင်္ဘောဆိပ်ကမ်းသည် ယခုဆောက်လုပ်ဆဲဖြစ်ပြီး ၂၀၂၀တွင် စတင်အသုံးပြုနိုင်ရန် စီစဉ်ထားပါသည်။ ၂၅၀ မီတာရှည်သော သင်္ဘောဆိပ်ကမ်းသည် တစ်နှစ်လျှင် ပျမ်းမျှ တန် ၂ သန်းနှင့် ကုန်စည်များအတွက် ဖြစ်ပါသည်။ ၇၀၀ မီတာရှည်သော သင်္ဘောဆိပ်ကမ်းသည် ခန့်မှန်း တစ်နှစ်လျှင် တန် ၁၂ သန်းဟု ခန့်မှန်းထားပါသည်။

ထားဝယ်ဆိပ်ကမ်းအနီးရှိ LNG terminal သည် ဒေသအတွက် စျေးသက်သာပြီး သန့်ရှင်းသော စွမ်းအင်များကို ထောက်ပံ့ပေးပါမည်။ ယနေ့ LNG terminals များသည် တစ်နှစ်လျှင် တန် ၆သန်းရှိပြီး ဂတ်စ်စွမ်းအင်သုံး စက်ရုံများသို့ အဓိက ထောက်ပံ့ပါမည်။ 450 MW ပါဝါစက်ရုံသည် ထားဝယ်စက်မှုဇုန်အတွက် အဓိက လျှပ်စစ်ထောက်ပံ့ရာနေရာဖြစ်ပါသည်။ (ဥပမာ- ကနဦးမြို့နှင့် စွမ်းအင်အများဆုံးသုံးသော ရေနံဓါတုစက်ရုံများ)။ စွမ်းအင်စက်ရုံများတွင် ကွင်းပြင်များ၊ အရေးပေါ် ဒီဇယ်စက်များ၊ ဒီဇယ်သိုလှောင်ကန်များနှင့် ၁၁၅ KV ဆက်သွယ်ရေးလိုင်းများ ပါဝင်ပါသည်။

ပယင်းဖြူရေလှောင်တမံနှင့် တလိုင်းဂတမံသည် စက်မှုဇုန်တည်ဆောက်ခြင်းနှင့် ကနဦးစက်မှုတွင် အသုံးပြုရန်အတွက် ရေအဓိကထောက်ပံ့ပေးရာ နေရာများ ဖြစ်ပါသည်။ ရေလှောင်တမံသည် ရေ ၇.၁၄ စတုရန်းကီလိုမီတာနှင့် အများဆုံး သန်း ၈.၅၄ ကုဗမီတာ ထိန်းထားနိုင်ပါသည်။ ဗဟိုရေသန့်စင်စက်ရုံသည် ရေလှောင်တမံအနီးတည်ရှိပြီး တစ်ရက်လျှင် ရေ ၃၆၀၀၀ ကုဗမီတာ အသုံးပြုပါသည်။

တယ်လီဖုန်း (IP ဖုန်း)၊ CCTV၊ ထိရောက်သော တစ်ဦးချင်းသုံး ကွန်ယက် (VPN)များအပါအဝင် 10 Gbps အမြန်နှုန်းရှိ အင်တာနက်လိုင်းများ၊ မိုဘိုင်းဝန်ဆောင်မှုများကို လက်ရှိနိုင်ငံတွင်း အော်ပရေတာများအားဖြင့် ဆောင်ရွက်ပေးသွားပါမည်။

ကနဦးမြို့သည် DSEZ အတွင်း လူနေထိုင်ရာနှင့် စီးပွားရေးဆိုင်ရာ နေရာဖြစ်ပါသည်။ မြို့သည် DSEZ အဓိကလမ်းမကြီး၏ ၁၇ ကီလိုမီတာတွင် တည်ရှိပြီး နေထိုင်စရာနှင့် အဆင်ပြေသော အသုံးပြုမှု၊ ဝန်ဆောင်မှုများကို ထောက်ပံ့ပေးထားပါသည်။



Source: ITD (2012)

ပုံ ၁.၁-၂ ထားဝယ် SEZ ရှိ ဆက်စပ်နေသော စီမံကိန်းများ

ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ ထည့်သွင်းစဉ်းစားမှုများ

ပတ်ဝန်းကျင်ဆိုင်ရာ ဥပဒေများသည် စီမံကိန်းလည်ပတ်ခြင်းနှင့် စီမံခန့်ခွဲမှုတွင် အလွန်အရေးကြီးပါသည်။ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအတွက် နည်းဥပဒေများသည် နိုင်ငံမူဝါဒ၊ ဥပဒေနှင့် နည်းဥပဒေများ ထည့်သွင်းစဉ်းစားမှုကို အခြေခံထားပါသည်။ စာရင်းတွင် ဖော်ပြထားသော ဥပဒေအများစုသည် မကြာသေးမီးနှင့် လက်ရှိ အကောင်အထည်ဖော်နေဆဲဖြစ်ပြီး အချို့အက်ဥပဒေများသည် ဗြိတိသျှအိန္ဒိယလက်အောက်ခံကတည်းက ပြဌာန်းထားသည်များ ဖြစ်ပါသည်။ ဤအခန်းတွင် ထည့်သွင်းစဉ်းစားမှုများကို စီမံကိန်းဖွံ့ဖြိုးမှု၊ အကြိုဆောက်လုပ်မှု၊ ဆောက်လုပ်မှု၊ လုပ်ငန်းလည်ပတ်မှု၊ ဖျက်သိမ်းမှုအဆင့်အမျိုးမျိုးအတွက် သုံးသပ်ပြီး အကောင်အထည်ဖော် ထည့်သွင်းထားပါသည်။

၁.၂.၂ မြန်မာဥပဒေမူဘောင်

၁.၂.၂.၁ နိုင်ငံအဆင့် ဖွဲ့စည်းအုပ်ချုပ်ပုံ

မေ ၂၀၁၇ ပြဌာန်းချက်အရ မြန်မာနိုင်ငံ သမ္မတရုံးအောက်တွင် ဝန်ကြီးဌာန ၂၁ခုရှိပါသည်။ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ ထည့်သွင်းစဉ်းစားခြင်းများအတွက် တာဝန်ယူ ဦးဆောင်နေသော ဝန်ကြီးဌာနများမှာ သယံဇာတနှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဝန်ကြီးဌာန (MONREC) ရှိ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာန (ECD) ဖြစ်ပါသည်။

၁.၂.၂.၂ ပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေးဆိုင်ရာ ဥပဒေများ

ပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေးဆိုင်ရာ အခြေခံ ဥပဒေများကို ဇယား ၁.၂-၁ တွင် ဖော်ပြထားပါသည်။ မြန်မာနိုင်ငံမှ သဘောတူလက်မှတ်ရေးထိုးထားသော အပြည်ပြည်ဆိုင်ရာ သဘောတူညီမှုနှင့် ဆောင်ရွက်မှုများကိုလည်း ဇယား ၁.၂-၅ တွင် ဖော်ပြထားပါသည်။

ဇယား ၁.၂-၁ စီမံကိန်းတွင် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ ဥပဒေများ ထည့်သွင်းစဉ်းစားမှု

စဉ်	မေ ၂၀၁၇ ရှိ ဥပဒေများနှင့် စည်းမျဉ်းစည်းကမ်းများ
ပတ်ဝန်းကျင်ဆိုင်ရာမူဘောင်	
၁	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာမူဝါဒ(၁၉၉၄)
၂	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ(၂၀၁၂)
၃	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေ(၂၀၁၄)
EIA / ပတ်ဝန်းကျင်ဆိုင်ရာ စံချိန်စံညွှန်းများ	
၄	ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်း(၂၀၁၅)
၅	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေး(ထုတ်လွှတ်မှု)လမ်းညွှန်ချက်များ(၂၀၁၅)
ပတ်ဝန်းကျင်ဆိုင်ရာ အရင်းအမြစ်နှင့် အသုံးချမှု	

၆	မြေယာပိုင်ဆိုင်မှုအက်ဥပဒေ(၁၈၉၄)
၇	တာတမံအက်ဥပဒေ(၁၉၀၉)
၈	လယ်ယာမြေဥပဒေ(၂၀၁၂)
၉	လယ်ယာမြေနည်းဥပဒေ(၂၀၁၂)
၁၀	မြေလွတ်၊မြေလပ်နှင့်မြေရိုင်းများစီမံခန့်ခွဲရေးဥပဒေ(၂၀၁၂)
၁၁	မြေလွတ်၊မြေလပ်နှင့်မြေရိုင်းများစီမံခန့်ခွဲရေးနည်းဥပဒေများ(၂၀၁၂)
၁၂	သစ်တောဥပဒေ(၁၉၉၂)
၁၃	တောရိုင်းတိရစ္ဆာန်နှင့်အပင်များကာကွယ်ခြင်းနှင့်သဘာဝဧရိယာများထိန်းသိမ်းရေးဥပဒေ(၁၉၉၄)
၁၄	ရေအရင်းမြစ်များနှင့်မြစ်များထိန်းသိမ်းရေးဥပဒေ(၂၀၀၆)
၁၅	ရေအရင်းမြစ်များနှင့်မြစ်များထိန်းသိမ်းရေးနည်းဥပဒေများ(၂၀၁၃)
၁၆	ပင်လယ်ရေပိုင်နက်နှင့်ရေကြောင်းသွားလာရေးဇုန်ဥပဒေ(၁၉၇၇)

ဇယား ၁.၂-၂ စီမံကိန်းတွင် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ ဥပဒေများ ထည့်သွင်းစဉ်းစားမှု

စဉ်	မေ ၂၀၁၇ ရှိ ဥပဒေများနှင့် စည်းမျဉ်းစည်းကမ်းများ
စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု	
၁၇	မြေအောက်ရေအက်ဥပဒေ(၁၉၃၀)
၁၈	ရေစွမ်းအားအက်ဥပဒေ(၁၉၂၇)
၁၉	ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးအက်ဥပဒေ(၁၉၂၂)
၂၀	ရန်ကုန်မြို့တော်ဖွံ့ဖြိုးရေး(၁၉၂၂)
၂၁	ဖွံ့ဖြိုးရေးကော်မတီ (၁၉၉၃)
၂၂	မြန်မာ့သတ္တုတွင်းဥပဒေ(၂၀၁၄)
လူမှုရေးနှင့် ယဉ်ကျေးမှု	
၂၃	ယဉ်ကျေးမှုအမွေအနှစ်ဒေသကာကွယ်ထိန်းသိမ်းရေးဥပဒေ(၁၉၉၄)
၂၄	ရှေးဟောင်းအဆောက်အအုံများကာကွယ်ထိန်းသိမ်းရေးဥပဒေ(၂၀၁၅)
၂၅	ရှေးဟောင်းဝတ္ထုပစ္စည်းများကာကွယ်ထိန်းသိမ်းရေးဥပဒေ(၂၀၁၅)
၂၆	အမျိုးသားလူမျိုးကာကွယ်ရေးဥပဒေ(၂၀၁၅)
ပြည်သူ့ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံမှု	
၂၇	ပြည့်သူ့ကျန်းမာရေးဥပဒေ(၁၉၇၂)
၂၈	အမျိုးသားကျန်းမာရေးမူဝါဒ(၁၉၉၃)

၂၉	ကူးစက်ရောဂါထိန်းချုပ်ခြင်းနှင့်တားဆီးကာကွယ်ရေးဥပဒေ(၁၉၉၅)
၃၀	ဆေးရွက်ကြီးထုတ်ကုန်သောက်သုံးခြင်းဆိုင်ရာထိန်းချုပ်ရေးဥပဒေ(၂၀၀၆)
၃၁	မော်တော်ယာဉ်ဥပဒေ(၂၀၁၅)
၃၂	မြန်မာနိုင်ငံမီးသတ်တပ်ဖွဲ့ဥပဒေ(၂၀၁၅)
အလုပ်အကိုင်နှင့် လုပ်ငန်းခွင်	
၃၃	အလုပ်ရုံများအက်ဥပဒေ(၁၉၅၁)
၃၄	အလုပ်သမားလျော်ကြေးအက်ဥပဒေ(၁၉၂၃)
၃၅	အခကြေးငွေပေးချေရေးအက်ဥပဒေ(၁၉၃၆)
၃၆	အလုပ်အကိုင်နှင့်ကျွမ်းကျင်မှုဖွံ့ဖြိုးတိုးတက်ရေးဥပဒေ(၂၀၁၃)
၃၇	အနည်းဆုံးအခကြေးငွေဥပဒေ/နည်းဥပဒေများ(၂၀၁၃)
၃၈	ခွင့်ရက်နှင့်အလုပ်ပိတ်ရက်အက်ဥပဒေ (1951, partially revised in 2014)
၃၉	အလုပ်သမားအဖွဲ့အစည်းဥပဒေ(၂၀၁၁)
၄၀	အလုပ်သမားအဖွဲ့အစည်းနည်းဥပဒေ(၂၀၁၂)
၄၁	အလုပ်သမားရေးရာအငြင်းပွားမှုဖြေရှင်းရေးဥပဒေ(၂၀၁၂)
၄၂	လူမှုဖူလုံရေးဥပဒေ(၂၀၁၂)
၄၃	ဆိုင်များနှင့်အလုပ်ဌာနများအက်ဥဒေ(၁၉၅၁)
စက်မှုဇုန်ဥပဒေ	
၄၄	ပေါက်ကွဲစေတတ်သည့်အရာများအက်ဥပဒေ(၁၈၈၄)
၄၅	ပေါက်ကွဲစေတတ်သောပစ္စည်းများအက်ဥပဒေ(၁၉၀၈)
၄၆	ပင်လယ်ရေကြောင်းငါးဖမ်းလုပ်ငန်းများဥပဒေ(၁၉၉၀)
၄၇	ရေချိုငါးဖမ်းလုပ်ငန်းများဥပဒေ(၁၉၉၁)
၄၈	ဓာတုပစ္စည်းနှင့်ဆက်စပ်ပစ္စည်းများအန္တရာယ်မှတားဆီးကာကွယ်ရေးဥပဒေ(၂၀၁၃)
၄၉	ရေနံအက်ဥပဒေ (၁၉၃၄)

ဇယား ၁.၂-၃ စီမံကိန်းတွင် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ ဥပဒေများ ထည့်သွင်းစဉ်းစားမှု

No.	မေ ၂၀၁၇ ရှိ ဥပဒေများနှင့် စည်းမျဉ်းစည်းကမ်းများ
၅၀	ရေနံနည်းဥပဒေများ(၁၉၃၇)
၅၁	မြေသြဇာဥပဒေ(၂၀၀၂)
၅၂	မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုဥပဒေ(၂၀၁၆)
၅၃	နိုင်ငံခြားရင်းနှီးမြှုပ်နှံမှုဥပဒေ(၂၀၁၂)
၅၄	မြန်မာနိုင်ငံသားများ၏ရင်းနှီးမြှုပ်နှံမှုဥပဒေ(၂၀၁၃)
၅၅	မြန်မာ့အာမခံလုပ်ငန်းဥပဒေ(၁၉၉၃)
၅၆	ပုဂ္ဂလိကစက်မှုလုပ်ငန်းဥပဒေ(၁၉၉၀)
၅၇	အခြေခံထောက်ပံ့ဝန်ဆောင်မှုဥပဒေ(၂၀၁၅)
၅၈	စံချိန်စံညွှန်းသတ်မှတ်ခြင်းဆိုင်ရာဥပဒေ(၂၀၁၄)
၅၉	လျှပ်စစ်ဥပဒေ(၂၀၁၄)
၆၀	ဘွိုင်လာဥပဒေ(၂၀၁၅)
အထူးစီးပွားရေးဇုန်ဥပဒေ	
၆၁	မြန်မာ့အထူးစီးပွားရေးဇုန်ဥပဒေ(၂၀၁၄)
၆၂	မြန်မာ့အထူးစီးပွားရေးဇုန်နည်းဥပဒေ(၂၀၁၅)
၆၃	ထားဝယ်အထူးစီးပွားရေးဇုန်ဥပဒေ(၂၀၁၂)

ဇယား ၁.၂-၄ စီမံကိန်းတွင် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ ဥပဒေများ ထည့်သွင်းစဉ်းစားမှု

စဉ်	မေ ၂၀၁၇ အမိန့်ကြော်ငြာစာများ
၁	အမိန့်ကြော်ငြာစာ အမှတ်.၁/၂၀၁၃ နှင့် အမှတ်.၅၀/၂၀၁၄၊ မြန်မာ့ရင်းနှီးမြှုပ်နှံမှုကော်မရှင်အားဖြင့် ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုအကဲဖြတ်ခြင်းလိုအပ်သော စီးပွားရေးဆောင်ရွက်ချက်များ
၂	အမိန့်ကြော်ငြာစာ အမှတ် ၈၁/ ၂၀၁၄ ထားဝယ်အထူးစီးပွားရေးဇုန်တွင် ရင်းနှီးမြှုပ်နှံမှုအတွက် အမျိုးသားစီမံကိန်းနှင့် စီးပွားရေးဖွံ့ဖြိုးတိုးတက်မှု ဝန်ကြီးဌာန၏ ခွင့်ပြုချက်
၃	အိုဇုန်းလွှာပျက်စီးစေသော စီးပွားရေးလုပ်ငန်းများ - အမိန့်ကြော်ငြာစာ အမှတ် ၃၇/ ၂၀၁၄
စဉ်	**မေ ၂၀၁၇ လုပ်ဆောင်ချက်များ**
၁	The Myanmar National Building Code, Part 1, 2 and 5 (2012)

Source: ECD suggestion on draft final report on 2nd February 2017 and EIA Study Team

ဇယား ၁.၂-၅ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ ထည့်သွင်းစဉ်းစားမှုများနှင့် သက်ဆိုင်သော အဓိကအပြည်ပြည်ဆိုင်ရာ သဘောတူညီချက်များ

စဉ်	အပြည်ပြည်ဆိုင်ရာ သဘောတူဆောင်ရွက်ချက်များ	လက်မှတ်ရေးထိုးသည့်နှစ်
၁	Basel Convention, 1989	2015
၂	Ramsar Convention, 1971	2005
၃	Stockholm Convention on Persistent Organic Pollutants, 2001	2004
၄	Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1979	1997
၅	United Nations Framework Convention on Climate Change, 1992	1994
၆	Convention on Biological Diversity, 1992	1994
၇	Montreal Protocol on Substances that Deplete the Ozone Layer, 1989	1993
၈	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, 1990	1993

Source: EIA Study Team

၁.၂.၃ လမ်းညွှန်ချက်နှင့် စံချိန်စံနှုန်းများ

မြန်မာနိုင်ငံ ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်ကို ၂၀၁၅တွင် ပြဌာန်းခဲ့ပါသည်။ ၄င်းထုတ်လွှတ်မှု (စွန့်ထုတ်မှု) လမ်းညွှန်ချက်သည် လေနှင့်ရေ အရည်အသွေး၊ ဆူညံသံနှင့်တုန်ခါမှုသည် ယခုလေ့လာမှုတွင် အဓိကထားရမည့် စံချိန်စံညွှန်းများဖြစ်ပါသည်။ အချို့တိုင်းတာမှုများ (ဥပမာ- NO_2၊ CO_2 သို့မဟုတ် ပတ်ဝန်းကျင်ရေအရည်အသွေးများသည် မြန်မာ NEQG တွင်မပါဝင်ပဲ ဂျပန်၊ အင်ဒိုနီးရှား၊ ထိုင်းနှင့် ဗီယက်နမ်ရှိ စံနှုန်းများနှင့် ဆောင်ရွက်ရပါသည်။ IFC EHS လမ်းညွှန်ချက်တွင် ရေအရည်အသွေး၊ အဆောက်အဦးနှင့် ဝန်ဆောင်မှု၊ သက်ရှိနှင့် မီးအန္တရယ်၊ ယဉ်အန္တရယ် ကင်းရှင်းရေးများ ပါဝင်သော လူမှုရေးနှင့်ကျန်းမာရေး စံနှုန်းများပါဝင်ပါသည်။

၁.၂.၄ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ မူဝါဒများ

စီမံကိန်း၏ တည်ဆောက်ဆဲကာလ နှင့် လည်ပတ်ဆဲကာလ အတွင်း ၄င်း၏ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စီမံခန့်ခွဲမှုကိုညွှန်ကြားရန် ဖွဲ့စည်းထားသော ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ မူဝါဒကို စီမံကိန်းအဆိုပြုသူက ဖော်ဆောင်ပါမည်။ စီမံကိန်းအဆိုပြုသူက ISO 14001 ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှုစနစ်အရ စီမံကိန်း၏ ပတ်ဝန်းကျင်ဆိုင်ရာ ရှုထောင့်များကို စီမံဆောင်ရွက်ပါမည်။ တဆက်တည်းမှာပင် စီမံကိန်းအဆိုပြုသူသည် စီမံကိန်းအတွက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုစနစ် (EMS) ကို လုပ်ဆောင်ပြီး EMS ကို ISO14001 လိုအပ်ချက်များနှင့်အညီ ဆောင်ရွက်ပါမည်။ EHS စီမံခန့်ခွဲမှုကို စတင်ဆောက်လုပ်သည့်နေ့မှစ၍ စတင်ဆောင်ရွက်ပါမည်။

၁.၂.၅ နယ်နိမိတ်သတ်မှတ်ခြင်းအစီရင်ခံစာနှင့် အစီရင်ခံစာမူကြမ်းအပေါ် MONREC၏ သုံးသပ်ချက်

အစီရင်ခံစာမူကြမ်းကို MONREC က ၂၀၁၇ ဇူလိုင်လ (၁၇) ရက်တွင် သုံးသပ်ချက်ပေးခဲ့ပါသည်။ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန (ECD) သည် ကဏ္ဍအသီးသီး (ဥပမာ- ပြန်လည်နေရာချထားရေး၊ လျော်ကြေး၊ သဘာဝဘေးအန္တရယ်များသို့ အရေးပေါ်တုန့်ပြန်မှု အစီအစဉ်၊ ပတ်ဝန်းကျင်ဆိုင်ရာ၊ ကျန်းမာရေးနှင့် လုံခြုံရေး အစီအစဉ်၊ ဥပဒေလိုက်နာမှု၊ သင်တန်းနှင့် CSR အစီအစဉ်များ)တွင် ပြန်လည်သုံးသပ်ရန် အကြံပြုခဲ့ပါသည်။ အကြံပြုချက်များကို အခန်း ၂.၆ တွင် အကျဉ်းချုပ် ဖော်ပြထားပါသည်။

စီမံကိန်းအကြောင်းတင်ပြမှု

၁.၃.၁ စီမံကိန်းဖော်ပြချက်

စီမံကိန်းမြေကွက်အချို့ကို အလယ်အလတ်နှင့် အသေးစား စက်ရုံများအတွက် ငှားရမ်းပါမည်။ စီမံကိန်းကို အဆင့်(က)၊ (ခ)၊ (ဂ)၊ (ဃ) အဆင့်ဆင့် ဖွံ့ဖြိုးတိုးတက်ရေးနှင့် အသုံးပြုမှုစနစ်များကို ဆောင်ရွက်သွားပါမည်။ တစ်ဆင့်လုံးတွင် အခြားအပိုင်းများပါလာစေရန်နှင့် ကနဦးအပိုင်းအတွက် အပိုင်း (က)ကိုပထမဦးစွာ တည်ထောင်ပါမည်။ ပုံ ၁.၃-၂ တွင်ဖော်ပြထားသည့်အတိုင်း အဆင့် (က)နှင့် (ခ) အတွက် အဓိက စက်ရုံများသည် အော်တိုအစိတ်အပိုင်းများ၊ လျှပ်စစ်ပစ္စည်း၊ အိမ်သုံးပစ္စည်း၊ အထည်ချုပ်နှင့် ချည်မျှဉ်၊ အစားအစာနှင့် ယမကာ၊ စည်သွပ်ဘူးနှင့် အေးခဲပင်လယ်စာ၊ စိုက်ပျိုးရေးနှင့် ရာဘာပစ္စည်းများ၊ ဆေးဝါးပစ္စည်းများနှင့် ဆောက်လုပ်ရေးသုံးပစည်းများဖြစ်ပြီး အဆင့် (ဂ)နှင့် (ဃ)အတွက် ဖန်ပစ္စည်းများ၊ ပလပ်စတစ်၊ စက်ပစ္စည်းနှင့် တစ်စုတစည်းထဲ ထုတ်လုပ်မှုများ ဖြစ်ပါသည်။

ဇယား ၁.၃-၁ ထားဝယ်အထူးစီးပွားရေးဇုန်ရှိ ဇုန်တစ်ခုစီ၏ ဧရိယာ

အဆင့်နှင့် ဇုန်	ဧရိယာ(စတုရန်းကီလိုမီတာ)
A	၇.၀၀
B	၇.၀၀
C	၇.၀၀
D	၆.၀၀

Source: ITD (2012)

၁.၃.၁.၁ စီမံကိန်းတည်နေရာ

စီမံကိန်းသည် မြန်မာနိုင်ငံတောင်ဘက် တနင်္သာရီတိုင်း၊ ထားဝယ်နယ်တွင် တည်ရှိပါသည် (ပုံ ၁.၃-၁၊ ဘယ်ဘက်)။ စီမံကိန်းသည် ထားဝယ်အထူးစီးပွားရေးဇုန်တွင် တည်ရှိပြီး ၄င်းသည် အနောက်ဘက်တွင် အက်ဒမန် ပင်လယ်နှင့် ဝန်းရံထားပြီး အရှေ့ဘက်တွင် ထားဝယ်မြစ်ရှိပါသည်။ စီမံကိန်းသည် ထားဝယ်လေဆိပ်မြောက်ဘက်နှင့် ထားဝယ်မြို့လယ် ၃၀ ကီလိုမီတာခန့် ရှိပါသည်။

အနောက်ဘက်တွင် ထားဝယ်မြို့နှင့် ထိုင်းနိုင်ငံ၊ ကန်ချနာပူရီနယ်ကို ဆက်သွယ်ထားသော နှစ်လမ်းသွားကွန်ကရစ်လမ်းဖြင့် စီမံကိန်းကို ရောက်ရှိနိုင်ပါသည်။ အရှေ့ဘက်တွင် ထားဝယ်မြို့၏ လေးလမ်းသွားကွန်ကရစ်လမ်းနှင့် ရေဆိပ်မှ စီမံကိန်းသို့ ရောက်ရှိနိုင်ပါသည်။ မြောက်ဘက်ရှိ ရန်ကုန်မြို့မှ အမှတ် (၈) လမ်းမကြီးနှင့် ရန်ကုန်-မန္တလေး လမ်းမကြီးမှ စီမံကိန်းနေရာသို့ရောက်ရှိနိုင်ပြီး အမှတ်(၈) လမ်းမကြီးပေါ်ရှိ တောင်ဘက်မှ ထားဝယ်လေဆိပ်မှလည်း ရောက်ရှိနိုင်ပါသည်။

၁.၃.၁.၂ စီမံကိန်းအချိန်ဇယား

စီမံကိန်းအချိန်ဇယားသည် EIA ကာလ ၁-၂ နှစ်နှင့် စတင်ပါသည်။ စီမံကိန်းတစ်ခုလုံးအတွက် နှစ် ၅၀ သဘောတူညီချက်ဖြင့် ဆောင်ရွက်ပါသည်။ အပိုင်း (က) ဆောက်လုပ်ရေးကို ၂၀၁၆ ဝန်းကျင် (သို့) EIA အတည်ပြုချက်အတွင်း ဆောင်ရွက်ပါမည်။ အပိုင်း (ခ)ကို ၂၀၁၈တွင် စတင်ရန် စီစဉ်ထားပါသည်။ အပိုင်း(ဂ)ကို ၂၀၂၀ တွင် စတင်ရန် စီစဉ်ထားပြီး အပိုင်း (ဃ) ကို ၂၀၂၂ တွင် စတင်ဆောင်ရွက်ရန် စီစဉ်ထားပါသည်။ အပိုင်း (က)၏ လုပ်ငန်းလည်ပတ်ခြင်းကို ၂၀၂၀ တွင် စတင်လောက်ပါသည်။ ပြန်လည်ဖျက်သိမ်းခြင်းကို သဘောတူညီချက်မပြည့်မီ နှစ်အနည်းငယ်တွင် ဆောင်ရွက်သွားပါမည်။ စီမံကိန်းကို စီမံကိန်းအဆိုပြုသူ၊ မန်းထားဝယ်ကုမ္ပဏီဖြင့် ဖွဲ့စည်းထားပါသည်။ စီမံခန့်ခွဲမှုကို ပုံ ၁.၃-၃ တွင် ဖော်ပြထားပါသည်။

၁.၃.၁.၃ ဆောက်လုပ်ရေးကာလ

ထားဝယ်ကနဦးစက်မှုဇုန်ကို အပိုင်းများဖြင့် ဆောက်လုပ်သွားပါမည်။ ၂၀၁၆တွင် အပိုင်း(က)ကို စတင်လုပ်ဆောင်မည်ဖြစ်ပြီး အပိုင်း (ခ)၊ (ဂ)၊ (ဃ)ကို ၂၀၁၈၊ ၂၀၂၀နှင့် ၂၀၂၂ တွင် ဆောင်ရွက်ပါမည်။ အပိုင်းတစ်ခုစီကို ရေအသုံးပြုမှု၊ စွန့်ပစ်ရေသန့်စင်မှု၊ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုနှင့် စွမ်းအင်လည်ပတ်မှုတို့ကို ထောက်ပံ့ရန် လုံလောက်သော အဆောက်အဦး အသုံးပြုမှုစနစ်များဖြင့် လုပ်ဆောင်ပါမည်။ အဆောက်အဦးနှင့် အသုံးပြုမှုစနစ်များ၏ နောက်ထပ်အသေးစိတ် အချက်အလက်များကို အခန်း (၄) အပိုင်း ၄.၂ တွင် ဖော်ပြထားပါသည်။ စီမံကိန်းကို ၂၀၂၃ တွင် အပြီးဆောင်ရွက်ရန် စီစဉ်ထားပြီး မြေကွက်များ ငှားရန်းခြင်းနှင့် လုပ်ငန်းလည်ပတ်ခြင်းအတွက် အဆင်သင့်ဖြစ်ပါလိမ့်မည်။ ဆောက်လုပ်ရေးသည် အောက်ပါ လုပ်ဆောင်မှုများနှင့် ပတ်သက်နေပါမည်။

(က) မြေကတုတ်ရိုက်ခြင်းနှင့် အပင်များရှင်းလင်းခြင်း

မြေသားအများအပြားကို ရွှေ့ပြောင်းပါမည်။ အပန်းဖြေဧရိယာအတွက် စီစဉ်ထားသော ဧရိယာမှ လွဲ၍ စီမံကိန်း ဧရိယာတွင် ရှိနေသော အပင်အားလုံးကို ရှင်းလင်းပစ်ပါမည်။ ကျောက်ကျင်းသည် စီမံကိန်းအနောက်မြောက်ဘက် ၁၀ကီလိုမီတာခန့်တွင် တည်ရှိပြီး ၎င်းက ဆောက်လုပ်ရေးအတွက် မြေသား သန်း ၂၀ ကုဗမီတာကို ထောက်ပံ့ပေးပါမည်။ လမ်းဆောက်လုပ်ရေးအတွက် တွင်းငယ်အသေးများသည် အဓိကလမ်းမကြီးအနီး စီမံကိန်းဧရိယာတွင် တည်ရှိပါသည်။ အထွေထွေ ဆောက်လုပ်ရေးအတွက် အထိုင်ကျင်းများသည် DSEZ အတွင်း စီမံကိန်းဧရိယာအပြင်ဘက်တွင် ရှိပြီး ကမ်းနားလမ်းနှင့် ITD စခန်းချထားရာနေရာအနီးတွင် တည်ရှိပါသည်။

(ခ) ဆောက်လုပ်ရေးတဲ၊ အလုပ်ရုံနှင့် အလုပ်ဝင်း

ဆောက်လုပ်ရေးကာလအတွင်း အလုပ်သမားငါးရာခန့်ဆံ့သော အလုပ်တဲကို ဆောက်လုပ်ရန် စီစဉ်ထားပါသည်။ အလုပ်သမားများကို Italian-Thai Development Plc အားဖြင့် ခန့်အပ်ပြီး အဓိက ဆောက်လုပ်ရေး လက်အောက်ခံကန်ထရိုက်တာဖြစ်ပါမည်။ နေထိုင်ရာနေရာကို ဆောက်လုပ်ရေးလုပ်ငန်းများ၊ ကွန်ကရစ်ရောနှောစက်၊ စက်ပစ္စည်းအလုပ်ရုံ၊ သိုလှောင်ရုံ နှင့် ရုံးခန်းနေရာများအတွက် အသုံးပြုပါမည်။ အလုပ်သမားနေထိုင်ရာ နေရာများကို ထိုင်းနိုင်ငံ အင်ဂျင်နီယာအသင်း၏ စံနှုန်းများနှင့်အညီ ဆောက်လုပ်သွားမည်ဖြစ်ပြီး မိလ္လာစနစ်ကို H.M.

ဘုရင့်လက်အောက်ခံ ထိုင်းနိုင်ငံအင်ဂျင်နီယာအသင်း အားဖြင့် ထုတ်ပြန်ထားသော ယာယီဆောက်လုပ်ရေးတဲများအတွက် စံနှုန်း(Wor Sor Tor. 1010-34 Standard ၊ ပုံစံများနှင့်အညီ ဆောင်ရွက်သွားပါမည်။ အလုပ်သမားတဲများဆောက်လုပ်ခြင်းသည် အလုပ်သမားအရေအတွက်နှင့် လုံလောက်အောင်ဆောင်ရွက်မည်ဖြစ်ပြီး အဆောက်အဦးနှင့် လျှပ်စစ်ဆိုင်ရာ စည်းမျဉ်းစည်းကမ်းများကိုလည်း လိုက်နာဆောင်ရွက်သွားပါမည်။

(ဂ) ဆောက်လုပ်ရေးသုံး ပစ္စည်းနှင့် ကိရိယာများ သယ်ယူပို့ဆောင်ရေး

ဆောက်လုပ်ရေးပစ္စည်းများ၊ စက်နှင့် ကိရိယာများကို ထိုင်းနိုင်ငံမှ ရေယဉ်များဖြင့် တင်ပို့ရန် စီစဉ်ထားပါသည်။ ရေကြောင်း ယဉ်များသည် ပစ္စည်းများနှင့် စက်များကို DSEZ ဆိပ်ကမ်းငယ်သို့ ပို့ဆောင်ပေးပါမည်။ ထားဝယ်ဆိပ်ကမ်းသည် ဇေ ၁၀၀ ရှိပြီး အလျား ၁၀၀နှင့် ၁၅၀ အလျားရှိသော သင်္ဘောဆိုက်ကပ်ရာ နစ်နေရာ ရှိပါသည်။ DSEZ ရှိ လက်ရှိအဓိကလမ်းသည် စီမံကိန်းဧရိယာနှင့် ဆိပ်ကမ်းငယ်ကို ဆက်သွယ်ထားပါသည်။ ပစ္စည်း၊ စက်နှင့် ကိရိယာများသယ်ယူတင်ပို့ရန် ကုန်တင်ကားကြီးများ၊ ပစ္စည်းဆွဲယဉ်များ သွားလာရအဆင်ပြေစေရယ် လမ်းကို အဆင့်မြင့်တင် ချဲ့ထွင်ထားပါသည်။

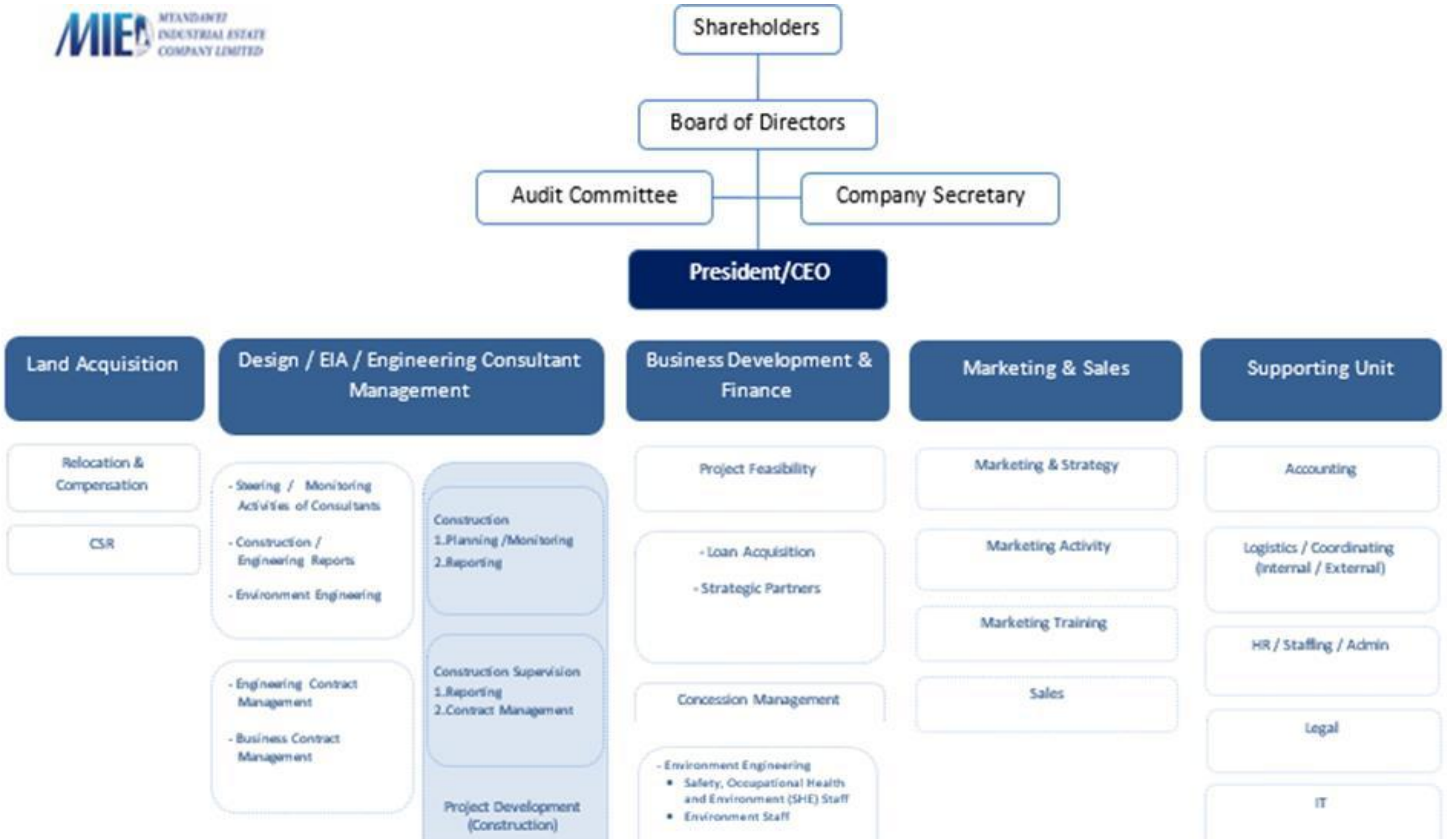
(ဃ) အသုံးပြုမှုနှင့် ဝန်ဆောင်မှုစနစ်များ ဆောက်လုပ်ခြင်း

အသုံးပြုမှုနှင့် ဝန်ဆောင်မှုစနစ်များ ဆောက်လုပ်ခြင်းတွင် လိုအပ်သောမြေသားလုပ်ငန်း၊ ကွန်ကရစ်၊ ဖျက်သိမ်းခြင်းနှင့် အဆောက်အဦးနှင့် သုံးဆောင်မှုစနစ်များအတွက် လိုအပ်သော စက်ကိရိယာ၊ ပစ္စည်းများ ထိန်းသိမ်းစောင့်ရှောက်ခြင်းတို့ ပါဝင်ပါသည်။ အဆောက်အဦးနှင့် အသုံးပြုမှု စနစ်များ၏ အခြား အသေးစိတ်များကို အခန်း ၄၊ အပိုင်း ၄.၂ တွင် ဖော်ပြထားပါသည်။

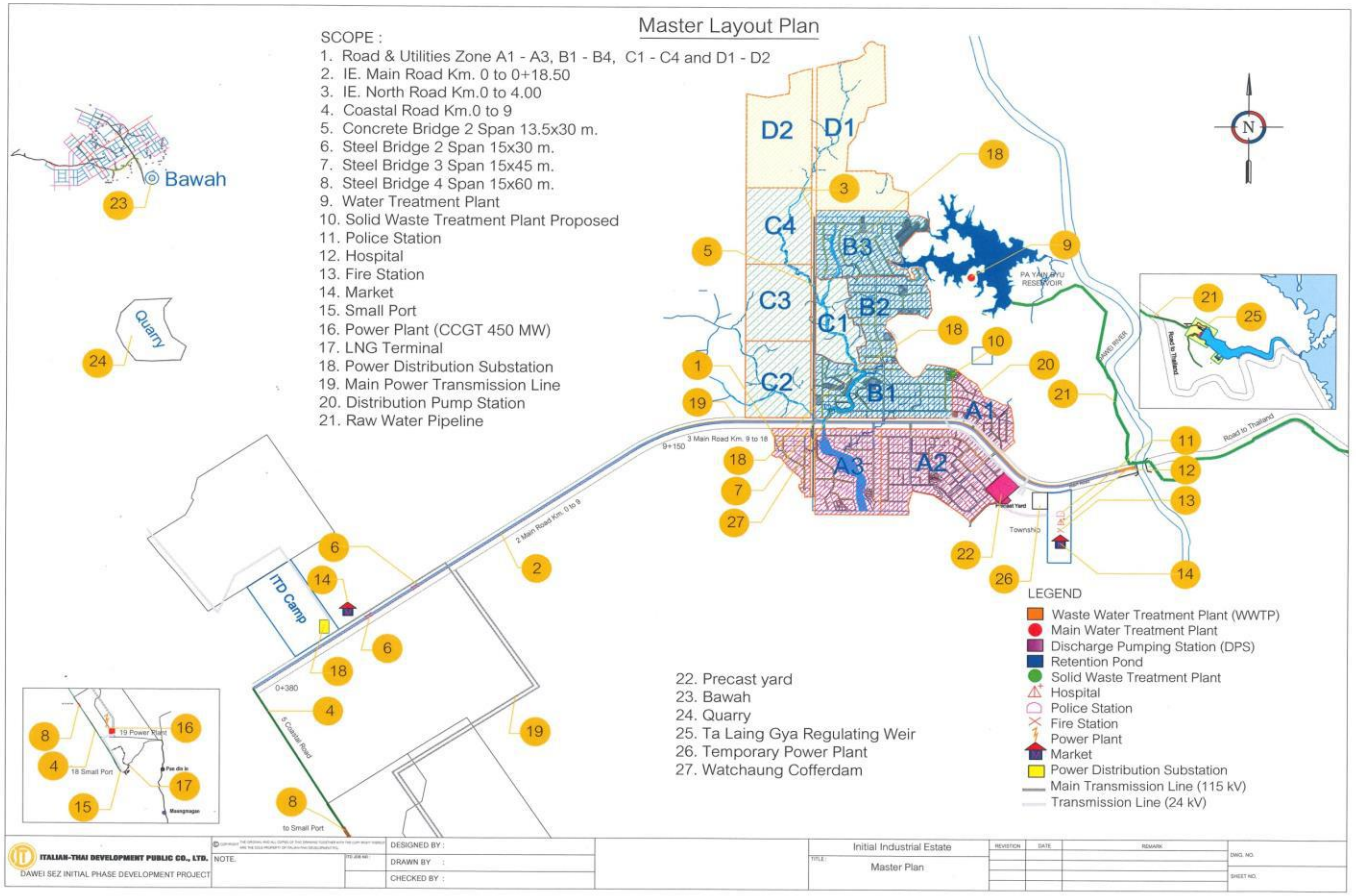
၁.၃.၁.၄ လုပ်ငန်းလည်ပတ်မှုအဆင့်

ဖွံ့စည်းထားသော ကနဦး ထားဝယ် စက်မှုဇုန်စီမံကိန်းသည် အဆင့် (က)၊ (ခ)၊ (ဂ)၊ (ဃ) ဟူ၍ အပိုင်း လေးပိုင်းဖြင့် ဖွံ့စည်းထားပါသည်။ ဇုန် (က၁)၊ (က၂)၊ (က၃) တို့သည် အပိုင်း(က)အတွင်း လည်ပတ်ပါမည်။ အလားတူ ဇုန် (ခ)၊ (ဂ)၊ (ဃ) တို့ကိုလည်း စက်မှုဇုန်လုပ်ဆောင်မှု မြင့်မားလာစေရန် လည်ပတ်ဆောင်ရွက်ပါမည်။ ဇုန်တစ်ခုစီတွင် စက်ရုံ (သို့) ထုတ်လုပ်မှုများ ရှိပါသည်။ ဇုန် (က)နှင့် (ခ) တို့သည် တူညီပြီး ကားအပိုပစ္စည်းများ၊ လျှပ်စစ်ပစ္စည်း၊ အိမ်အသုံးအဆောင်၊ အထည်ချုပ်၊ အစားအစာနှင့် ယမကာ၊ အေးခဲပင်လယ်စာ၊ စိုက်ပျိုးရေးနှင့် ရာဘာထုတ်လုပ်မှု၊ ဆေးဝါးပစ္စည်း၊ ဆောက်လုပ်ရေးပစ္စည်းများ ထုတ်လုပ်မည်ဖြစ်ပြီး ဇုန် (ဂ)နှင့် (ဃ) တို့သည် ဖန်ထည်ပစ္စည်း၊ ပလပ်စတစ်၊ ကာအပိုပစ္စည်း၊ အငှားစက်ရုံများ ဆောင်ရွက်ပါမည်။ ၄င်းတို့ကို ဇယား ၁.၃-၂ နှင့် ပုံ ၁.၃-၂ တွင် ဖော်ပြထားပါသည်။

Source: MIE (2015)



ပုံ ၁.၃-၂ မန်းထားဝယ် ကုမ္ပဏီ၏ စီမံကိန်းစီမံခန့်ခွဲမှုနှင့် ဖွဲ့စည်းပုံဇယား



Source: ITD (2012)

ပုံ ၁.၃-၁ ထားဝယ် SEZ ကနဦးစက်မှုဇုန်ရှိ နေရာချထားပုံ

ဇယား ၁.၃-၂ ထားဝယ် ကနဦး စက်မှုဇုန်၏ လုပ်ငန်းလည်ပတ်မှုအဆင့်နှင့် ဖွံ့ဖြိုးမှု

အဆင့်	စက်ရုံလည်ပတ်မည့်နှစ်	အပိုင်း	ဧရိယာ (Km^2)	ရည်မှန်းထားသော စက်ရုံများ
က	၂၀၁၆-၂၀၁၇	က၁ က၂ က၃	၁.၀၁ ၃.၁၆ ၂.၈၃	ကားအပိုပစ္စည်းများ၊ လျှပ်စစ်ပစ္စည်း၊ အိမ်အသုံးအဆောင်၊ အထည်ချုပ်၊ အစားအစာနှင့် ယမကာ၊ အအေးခဲပင်လယ်စာ၊ စိုက်ပျိုးရေးနှင့် ရာဘာထုတ်လုပ်မှု၊ ဆေးဝါးပစ္စည်း၊ ဆောက်လုပ်ရေးပစ္စည်းများ၊ အငှားစက်ရုံများ။
ခ	၂၀၁၈-၂၀၁၉	ခ၁ ခ၂ ခ၃	2.78 1.55 2.68	
ဂ	၂၀၂၀-၂၀၂၁	ဂ၁ ဂ၂ ဂ၃ ဂ၄	၁.၇၀ ၁.၈၅ ၁.၇၆ ၁.၆၉	ဖန်ထည်ပစ္စည်း၊ ပလပ်စတစ်၊ ကာအပိုပစ္စည်း၊ အငှားစက်ရုံများ။
ဃ	၂၀၂၂-၂၀၂၃	ဃ၁ ဃ၂	၃.၈၃ ၂.၁၇	

စီမံကိန်းသည် ထားဝယ်အထူးစီးပွားရေးဇုန် (DSEZ)တင်ပို့စက်ရုံဖြစ်ရန် ရည်ရွယ်ထားပြီး AEC နယ်၏ တင်ပို့မှုနှင့် ထောက်ပံ့ပို့ဆောင်ရေးတို့အတွက် အချက်အချာဖြစ်ပြီး ဒေသခံအတွက် အလုပ်အကိုင်များ မျှော်မှန်းထားပါသည်။

(က) လျှပ်စစ်နှင့် စွမ်းအင်

လျှပ်စစ်အသုံးပြုမှုသည် ထုတ်လုပ်မှုနှင့် စီမံကိန်းလုပ်ဆောင်မှုများ၊ လမ်းမီးတိုင်၊ စွန့်ပစ်ရေသန့်စင်မှုစက်ရုံ၊ ဗဟိုရေဆိုးသန့်စင်စနစ်၊ အစိုင်အခဲစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုစနစ်နှင့် အဆင့်တစ်ခုစီတွင် စက်ရုံများ၏ လည်ပတ်ခြင်းမှ အဓိကအသုံးပြုပါသည်။ ဆောင်ရွက်မှုအဆင့်တစ်ခုစီအတွက် ခန့်မှန်းလျှပ်စစ်အသုံးပြုမှုမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်။

- အဆင့် (က) တွင် ၁၀၂.၉ MW
- အဆင့် (ခ) တွင် ၁၀၃.၈ MW
- အဆင့် (ဂ) တွင် ၁၀၃.၉ MW
- အဆင့် (ဃ) တွင် ၉၂.၈ MW
- အဆင့်အားလုံးအတွက် စုစုပေါင်း ၄၀၃.၄ MW

စွမ်းအင်ကို ထားဝယ်စွမ်းအင်ကုမ္ပဏီမှ လည်ပတ်သော ထားဝယ် အထူးစီးပွားရေးဇုန်၏ ကနဦး စွမ်းအင်စက်ရုံက ဖြန့်ဖြူးပေးပါမည်။ ခန့်မှန်း ၄၅၀ MW လျှပ်စစ်ဓါတ်အားကို စက်မှုဇုန်နှင့် ထားဝယ် SEZ အတွင်း အခြားနေရာများသို့ ဖြန့်ဖြူးရန် ဗဟို GT/CCGT စွမ်းအင်စက်ရုံမှ ထုတ်လုပ်ပါမည်။ လျှပ်စစ်ကို စီမံကိန်းနေရာသို့ 115/24 KV လိုင်းဖြင့် လမ်းတလျှောက်တပ်ဆင်ပြီး လျှပ်စစ်ရုံခွဲများဖြင့် ဖြန့်ဖြူးပါမည်။

(ခ) ရေနှင့် ရေသန့်စင်မှု စနစ်

ရေသန့်စင်မှုစနစ်ကို မဖြစ်မနေဆောင်ရွက်ရမည်ဖြစ်ပြီး အဆင့် (က) တွင် တစ်ရက်လျှင် ရေအသုံးပြုမှု ၃၆၀၀၀ ကုဗမီတာ ထောက်ပံ့ပေးမည်ဖြစ်ပြီး အဆင့်တစ်ခုလုံးတွင် တစ်ရက်လျှင် ရေ ၁၃၀၀၀၀ ကုဗမီတာ ထောက်ပံ့ပေးသွားပါမည်။ ရေသန့်စင်မှုစနစ်၏ ဆောက်လုပ်ရေးနှင့် လည်ပတ်မှုကို အဆင့်အလိုက်ဆောင်ရွက်သွားမည်ဖြစ်ပြီး အဆင့်တစ်ခုလုံးအတွက် စုစုပေါင်း ယူနစ် ၈ခု ဆောင်ရွက်သွားပါမည်။ ပယင်းဖြူရေလှောင်တမံသည် အကြမ်းသုံးရေ ထောက်ပံ့ပေးသော အဓိကအရင်းအမြစ် ဖြစ်ပါသည်။ ရေလှောင်တမံမှ အကြမ်းသုံးရေကို ရေစုပ်တင်နေရာမှ စက်ရုံသို့ စုပ်တင်ပါမည်။ အသေးစိတ်ကို အခန်း ၄.၂ တွင် ဖော်ပြထားပါသည်။ သန့်စင်ထားသောရေသည် သုံးရန် အသင့်ဖြစ်ပြီး လှောင်ကန်များတွင် ထားရှိပါမည်။ တစ်ရက်လျှင် ခန့်မှန်း ရွံ့ညွှံရေ ၈၀၀ ကီလိုဂရမ်ခန့် ထုတ်မည်ဖြစ်သော်လည်း ၎င်းရွံ့ညွှံရေများကို Dewatering ဆောင်ရွက်ပြီး အစိုင်အခဲစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုစနစ်သို့ ပို့ဆောင်ပါမည်။ ရောဂါကာကွယ်ရန် တကိုယ်ရေသန့်ရှင်းရေးအတွက် ဓါတုပစ္စည်းများ လိုအပ်ပါသည်။ ရေကို ဇုန် (က-၁) ရှိ GDS pumping station အားဖြင့် ဖြန့်ဝေပါမည်။ ရေကို GDS pumping station မှ လမ်းအောက်ဖက် မြေမြှုပ်ပိုက်လိုင်းများဖြင့် ဖြန့်ဝေမည်ဖြစ်ပြီး ဇုန်တစ်ခုစီတွင် ရေပိုက်လိုင်းများဖြင့် ဖြန့်ဝေသွားပါမည်။

(ဂ) ဗဟိုစွန့်ပစ်ရေသန့်စင်စက်ရုံ

ဗဟိုရေဆိုးသန့်စင်စက်ရုံကို အဆင့်များဖြင့် ဆောင်ရွက်ပါမည်။ စက်ရုံတွင် အဆင့်လေးဆင့်ရှိပါသည်။ အပိုင်း (က) အစပိုင်းအတွက် စွန့်ပစ်ရေသန့်စင်စက် (၂) ခုရှိပါမည်။ အပိုင်း (က၂)တွင်ရှိသော စက်ရုံ (၁)သည် အပိုင်း (က၁)နှင့် (က၂)မှ စွန့်ပစ်ရေများကို လက်ခံပါမည်။ အပိုင်း (က၃)တွင်ရှိသော စက်ရုံ (၂) သည် အပိုင်း (က၃)မှ စွန့်ပစ်ရေများကို လက်ခံပါမည်။ အဆင့် (က) မှ စွန့်ပစ်ရေစုစုပေါင်းသည် တစ်ရက်လျှင် ၂၁၅၉၇ ကုဗမီတာ ရှိပါသည်။

စွန့်ပစ်ရေများကို စွန့်ပစ်ရေသန့်စင်မှု နိုင်ငံစံချိန်စံညွှန်းများနှင့်အညီ ဆောင်ရွက်ပါမည်။ ဓါတုသန့်စင်မှု မပြုမီ စွန့်ပစ်ရေများကို အနည်စစ်ထားပါမည်။ ရေလှောင်ကန်နှင့် အချောသတ်ကန်ထဲတွင် လေသွင်းခြင်းမပြုမီ ရေစီးနှုန်းကို ထိန်းထားပါမည်။ စွန့်ပစ်ရေများကို ၎င်း၏ ရေအရည်အသွေးအတွက် အနည်ထိုင်စေခြင်း စစ်ဆေးခြင်းပြုလုပ်ပြီး အခန်း (၃) တွင်ဖော်ပြခဲ့သည့်အတိုင်း နိုင်ငံပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လုပ်ခြင်း) လမ်းညွှန်ချက်များနှင့် ဆောင်ရွက်ပါမည်။ လမ်းညွှန်ချက်များနှင့် ကိုက်ညီပြီးသော စွန့်ပစ်ရေများကို လူထုအသုံးပြုနေသော ရေပိုက်လိုင်းများထဲသို့ မလွှတ်မီ ၂၄ နာရီကြာအောင် ထိန်းထားရပါမည်။

စွန့်ထုတ်ရေများကို ဗဟိုစွန့်ပစ်ရေသန့်စင်စက်ရုံ၏ အဆင့်များအတိုင်း ဆောင်ရွက်ပါမည်။ အပိုင်း (က)၏ အဆင့် (က)တွင် စွန့်ထုတ်မှုကို ခွန်ချန်မြစ်တွင်းသို့ စွန့်ပစ်ပြီး အဆင့် (ခ)၊ (ဂ)၊ (ဃ)တွင်

စွန့်ထုတ်မှုကို ထားးဝယ်မြစ်အတွင်း ဆောင်ရွက်သွားပါမည်။ စွန့်ထုတ်ရေများသည် ပိုက်လိုင်း၏ မြေအနိမ့်အမြင့်ကိုလိုက်ပြီး စီးဆင်းပါမည်။ အရေးပေါ်အခြေအနေတွင် အပိုင်း(က)တွင် ဇဟိုစွန့်ပစ်ရေသန့်စင်စက်ရုံသည် စွန့်ပစ်ရေများကို ၂၄ နာရီကြာ ထိန်းထားနိုင်ပါသည်။

(ဃ) ဓါတုပစ္စည်း အသုံးပြုမှု

စီမံကိန်းတွင် ဓါတုပစ္စည်းများကို ရေသန့်စင်စက်ရုံ၊ ဇဟိုစွန့်ပစ်ရေသန့်စင်စက်ရုံနှင့် အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုစနစ်တွင် အဓိက အသုံးပြုပါသည်။ ကျောက်ချဉ်၊ ထုံးကျောက်နှင့် ပိုလီမာများသည် ရေသန့်စင်စက်ရုံတွင် အဓိကသုံးသော ဓါတုပစ္စည်းများ ဖြစ်ပါသည်။ အချို့ဓါတုပစ္စည်းများကို ဇဟိုစွန့်ပစ်ရေ သန့်စင်စက်ရုံတွင် သန့်စင်ကန်နှင့် အညစ်အကြေး စီမံခန့်ခွဲမှုတွင် ယိုစိမ့်ခြင်းစီမံခန့်ခွဲမှုစနစ်တို့တွင် အသုံးပြုပါမည်။ ရွံ့ညွှံအခဲများကို ဖော်ပြပါ ဓါတ်ပြုမှုများဖြင့် ဆောင်ရွက်ပြီး စွန့်ပစ်ရေ စီမံခန့်ခွဲမှုစနစ်အရ စွန့်ပစ်ပါမည်။ အခြားဓါတုအသုံးပြုမှုများမှာ အဆင့်တစ်ခုစီ ထုတ်လုပ်မှုအပေါ် မူတည်ပြီး ၄င်းထုတ်လုပ်မှုများကို ၄င်းတို့၏ ကိုယ်ပိုင် EIA အတည်ပြုချက်အတွင်း ဆောင်ရွက်ရပါမည်။.

(င) လမ်းပန်းဆက်သွယ်ရေး

လမ်းမ နံပါတ် (၈)သည် ထားဝယ် SEZ နှင့် မြန်မာနိုင်ငံကျန်နေရာများကို ဆက်သွယ်ပေးထားသော အဓိက လမ်းမကြီးဖြစ်ပါသည်။ ဘန်ဖူနန်ရွှန်၊ ကန်ချနာပူရီကို ဆက်သွယ်ထားသော ထားဝယ် SEZ အဓိကလမ်းမကြီးသည် စီမံကိန်းနေရာ၊ ထိုင်းနိုင်ငံနှင့် အရှေ့တောင်အာရှ နိုင်ငံများ၏ အဓိကလမ်းများကို ဆက်သွယ်ပါမည်။ ထားဝယ် SEZ အဓိကလမ်းမကြီးသည် စီမံကိန်းနှင့် အက်ဒမန်ပင်လယ်ကမ်းရိုးတန်းပေါ်ရှိ ပင်လယ်ဆိပ်ကမ်းများနှင့် ဆက်သွယ်ထားပါသည်။ ထားဝယ် SEZ လမ်းသည် လေးလမ်းသွားဖြစ်ပါသည်။ တောင်မြောက်လမ်းမကြီးသည် စီမံကိန်း၏ အပိုင်းတစ်ခုစီကို ဆက်သွယ်ပါမည်။ လမ်းများသည် နှစ်လမ်းသွားနှင့် လေးလမ်းသွားများဖြစ်ပါသည်။ လမ်းအားလုံးတွင် လမ်းမီးတိုင်များကို အာရုဏ်တက်ချိန်အထိ အလင်းပေးပါမည်။ ဆောက်လုပ်ရေးအဆင့်နောက်ပိုင်းတွင် ၄င်းလမ်းများကို ထားဝယ် SEZ သို့ဆက်သွယ်သော အဓိကလမ်းမများအဖြစ် အသုံးပြုပါမည်။ လမ်းများကို ၄င်းအဆင့်များအထိ အသုံးပြုပါမည်။

(စ) ရေလွှမ်းမိုးမှု ကာကွယ်ခြင်း

ပုံမှန်အခြေအနေတွင် စီမံကိန်းနေရာတွင် မိုးရွာခြင်းသည် ရေစီးလမ်းများအတိုင်း စီးဆင်းပြီး ရေလွှမ်းမိုးမှု ထိန်းချုပ်စနစ်များတွင် လှောင်ထားပါသည်။ မိုးရေများကို ခွန်ချန်မြစ်အတွင်း မစွန့်ထုတ်မီ ရေထိန်းကန်တွင် ထိန်းထားပါသည်။ မုန်တိုင်း (သို့) မိုးသည်းထန်စွာရွာသွန်းမှု အရေးပေါ်ဖြစ်ရပ်များတွင် ရေထိန်းကန်များသည် မြစ်ထဲသို့မစွန့်ထုတ်မီ မိုးရေများကို ၆ နာရီကြာ ထိန်းထားနိုင်ပါသည်။ ထုတ်လုပ်မှုနေရာများ မိုးရွာသွန်းခြင်းများတွင် မိုးရေများကို ရေနုတ်မြောင်းများမှတဆင့် စုပြီး လူထုအသုံးပြုရေများသို့ မစွန့်ထုတ်မီ အခန်း (၃) ထုတ်လုပ်မှုကဏ္ဍတွင် စွန့်ပစ်ရေများအတွက် နိုင်ငံပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေး (ထုတ်လုပ်မှု) နှင့်အညီ သန့်စင်ခြင်း (သို့) ဇဟိုစွန့်ပစ်ရေသန့်စင်စက်ရုံသို့ ပို့ဆောင်ခြင်းများ ဆောင်ရွက်ပါမည်။

(ဆ) အစိုင်အခဲအညစ်အကြေး စီမံခန့်ခွဲမှုစနစ်

ထုတ်လုပ်မှုနေရာများနှင့် မြို့တွင်းမှ အစိုင်အခဲအညစ်အကြေးများကို အမိုက်သိမ်းယဉ်များဖြင့် နေ့စဉ် သိမ်းယူပါမည်။ အချို့စွန့်ပစ်ပစ္စည်းများသည် အန္တရာယ်ရှိပစ္စည်းနှင့် အန္တရာယ်မရှိပစ္စည်းများအဖြစ် ခွဲခြားပေးရန် လိုပါသည်။ သီးခြားခွဲထုတ်စက်ရုံသည် အစိုင်အခဲအညစ်အကြေးများကို ၎င်းတို့၏ အခြေအနေအတိုင်း အမှန်တကယ် ခွဲထုတ်ပေးပါမည်။ အန္တရာယ်မရှိသည့် စွန့်ပစ်ပစ္စည်းများကို အန္တရာယ်မရှိစွန့်ပစ်နေရာသို့ စွန့်ပစ်ပြီး အန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများကို အန္တရာယ်ရှိစွန့်ပစ်နေရာသို့ မစွန့်ပစ်မီ သန့်စင်မှုများ ပြုလုပ်ရန် လိုအပ်ပါသည်။ ဤအဆင့်တွင် ကူးစက်တတ်သော စွန့်ပစ်ပစ္စည်းများကို အရင်သိုလှောင်ထားပြီး ထားဝယ်ဆေးရုံအားဖြင့် (သို့) ရန်ကုန်အမှိုက်စွန့်ပစ်ရာနေရာသို့ ပို့ဆောင်ပါမည်။ အစိုင်အခဲစွန့်ပစ်ပစ္စည်းများကို မီးရှို့စက်တွင် အများဆုံး ဆုံ့နိုင်မှုအထိစွန့်ပစ်ပါမည်။ စွန့်ပစ်ပစ္စည်းစိမ့်ထွက်မှုများကို ဇဟိုစွန့်ပစ်ရေသန့်စင်စက်ရုံသို့ မပို့ဆောင်ခင် သတ်မှတ်ထားသော စံနှုန်းရောက်သည်အထိ သန့်စင်ပြီးမှ ပို့ဆောင်ပါမည်။ အမှိုက်ပုံမှထွက်လာသော ဓါတ်ငွေ့များကို စုဆောင်းပြီး passive gases နှင့် active gas စုဆောင်းမှုစနစ်များအသုံးပြုပြီး စုဆောင်းပါမည်။ မီးရှို့စက်အသုံးပြုနေစဉ်အတွင်း လေထုထဲထုတ်လွှတ်မှုကို အမျိုးသား ပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်အရ ဆောင်ရွက်ပါမည်။ ရှို့စက်မှ အကျွင်းအကျန်များ ဥပမာ-အောက်ခြေပြာများကို အန္တရာယ်မရှိ စွန့်ပစ်နေရာတွင် စွန့်ပစ်ပြီး အပေါ်ယံပြာများကို အန္တရာယ်ရှိ စွန့်ပစ်နေရာသို့ မစွန့်ပစ်မီ သန့်စင်ပေးရပါမည်။

(ဇ) မီးငြိမ်းသတ်ခြင်းနှင့် အရေးပေါ် တုန့်ပြန်မှုစနစ်

မီးသတ်ဌာနကို မြို့တွင်း မျှဝေအသုံးပြုပြီး ကနဦးမြို့ရှိ ဝန်ဆောင်မှုစင်တာတွင်တည်ရှိပါသည်။ ပထမတွင် မီးသတ်ကားတစ်ကားနှင့် ရေစုပ်စက်တစ်ခုသာရှိပါမည်။ မီးသတ်ကား၊ ရေစုပ်စက်၊ မီးငြိမ်းသတ်ပစ္စည်းများအရေအတွက်ကို ကနဦးမြို့အဆင့်နှင့် မြို့ရှိ လူဦးရေကိုလိုက်၍ တိုးမြင့်ရန် အစီအစဉ် ရှိပါသည်။ စီမံကိန်း၏ လက်ရှိ ပစ္စည်းအရေအတွက်သည် စက်ရုံ သို့မဟုတ် ကနဦးစက်မှုဇုန် ဧရိယာအတွင်း အရေးပေါ်မီးလောင်မှုများအတွက် လုံလောက်မှု ရှိပါသည်။ သို့သော်လည်း မီးပြင်းထန်လာပါက စီမံကိန်းသည် ရေးဖြူမီးသတ်စခန်းကဲ့သို့ အနီးဆုံးမြို့မှ ဒေသဆိုင်ရာ ဌာနများမှ အကူအညီရယူရပါလိမ့်မည်။

၁.၃.၂ အရေးပေါ်တုန့်ပြန်မှု အစီအစဉ်

လူထုကျန်းမာရေးနှင့် လုံခြုံရေးအတွက် IFC EHS လမ်းညွှန်ချက်များအရ စီမံကိန်း အဆိုပြုသူသည် မီးအန္တရာယ် (လူကြောင့်ဖြစ်သော မီးလောင်မှုနှင့် အခင်းမီးလောင်မှုများ နှစ်ခုလုံးအတွက်)၊ သဘာဝဘေးအန္တရာယ်များ၊ ငလျှင်၊ ဆူနာမီ၊ ရေကြီးမှုနှင့် မြေပြိုမှုများအတွက် အရေးပေါ် တုန့်ပြန်မှု အစီအစဉ်များကို ပြင်ဆင်ထားရပါမည်။ မြန်မာနိုင်ငံ ဘေးအန္တရာယ် လျော့ချရေး ဆောင်ရွက်ချက်များ (MAPDRR)၏ အစိတ်အပိုင်းတစ်ခုအဖြစ် ESIA အတွက် စီမံကိန်း၏ အရေးပေါ် တုန့်ပြန်ရေး အစီအစဉ်များ လိုအပ်ပါသည်။ သက်ဆိုင်ရာ ဥပဒေ စည်းမျဉ်းစည်းကမ်းများအရ စီမံကိန်း အဆိုပြုသူများ အပါအဝင် စက်ရုံတစ်ခုစီသည် အရေးပေါ် အခြေအနေများအတွက် အရေးပေါ်ပစ္စည်း အသုံးပြုမှုများ၊ ဆောင်ရွက်မှုများကို သက်ဆိုင်ရာများနှင့် ပူးပေါင်းပြီး အရေးပေါ် တုန့်ပြန်ရေးအဖွဲ့ကို ဖွဲ့စည်းထားရပါမည်။

အရေးပေါ်အခြေအနေအတွင်း သက်ရောက်ခံ လူထုအတွက် ငွေကြေးထောက်ပံ့မှုများစီစဉ်ထားပါသည်။ အသေးစိတ်ကို စီမံကိန်း၏ CSR တွင် ဖော်ပြထားပါသည်။

၁.၃.၂.၁ အရေးအပေါ်အဆင့်

ထားဝယ်ကနဦးစက်မှုဇုန်၏ အထွေထွေအရေးပေါ် တုန့်ပြန်မှုအစီအစဉ်ကို အောက်ပါ အဆင့် (၃)ခု - အဆင့် (၁)၊ အဆင့် (၂)၊ အဆင့် (၃)ဟူ၍ ပိုင်းခြားထားပါသည်။

- **အဆင့် ၁** သည် အရေးပေါ် အသေးစားဖြစ်ပြီး စက်ရုံဧရိယာတွင် တွေ့ရပါသည်။ ဖြစ်ပွားမှုကို စက်ရုံရှိ အဖွဲ့ (သို့) စက်ရုံမှကိုယ်တိုင်ထိန်းချုပ်နိုင်ပါသည်။ သက်ရောက်မှုများကို ထိန်းချုပ်ရန်၊ လျော့နည်းစေရန် စက်ရုံက အကောင်းဆုံး ဆောင်ရွက်ရပါသည်။ ဖြစ်ပွားမှုကို ကနဦးစက်မှုဇုန် အရေးပေါ် တုန့်ပြန်မှုစင်တာ/ အဖွဲ့သို့ အကြောင်းကြားရပါမည်။

- **အဆင့် ၂** သည် အရေးပေါ် အလယ်အလတ်အဆင့်ဖြစ်ပြီး စက်မှုဇုန်ဝင်းအတွင်း အခြားစက်ရုံများသို့ ကူးနိုင်သော အခြေအနေရှိပါသည်။ သို့သော်လည်း အရေးပေါ်အခြေအနေကို စက်မှုဇုန်ကိုယ်တိုင် (သို့) အနီးအနားရှိ မြို့များမှ အကူအညီအားဖြင့် ထိန်းချုပ်နိုင်ပါသည်။ ကနဦးစက်မှုဇုန်ဝင်းသည် သက်ရောက်မှုများကို ထိန်းချုပ်ရန်၊ လျော့နည်းစေရန် စက်ရုံက အကောင်းဆုံး ဆောင်ရွက်ရမည်ဖြစ်ပြီး ကနဦးစက်မှုဇုန်ဝင်း၏ အာဏာပိုင် (သို့) PIC သို့ တင်ပြရပါမည်။

- **အဆင့် ၃** သည် အရေးပေါ်အကြီးစားအခြေအနေဖြစ်ပြီး အနီးအနား လူထုနှင့် ပတ်ဝန်းကျင်ကို ကူးနိုင်သော အခြေအနေရှိပါသည်။ သက်ရောက်မှုကို ထိန်းချုပ်ရန် လျော့နည်းစေရန် ပြင်ပနေရာ သုံးခုမှ အကူအညီနှင့် အနီးအနားရှိ အဖွဲ့အစည်းများ၏ ပူးပေါင်းဆောင်ရွက်မှု လိုအပ်ပါသည်။ ဖြစ်စဉ်ကို မြန်မာစက်မှုဇုန်အာဏာပိုင်အဖွဲ့သို့မဟုတ် တာဝန်ရှိ မြန်မာနိုင်ငံ ဌာနများသို့ပ တင်ပြရပါမည်။

၁.၃.၂.၂ မီးနှင့် ပေါက်ကွဲမှုများအတွက် အစီအစဉ်

မီးငြိမ်းသတ်ခြင်း၊ ပေါက်ကွဲများတွင် အဆင့်သုံးဆင့်ပါဝင်ပါသည် (ကာကွယ်ခြင်း၊ တိမ်းရှောင်ခြင်းနှင့် ပြန်လည်ကုစားခြင်းအစီအစဉ်)။ စက်ရုံများတည်ထောင်ခြင်းနှင့် စီမံကိန်းအဆိုပြုသူသည် မြန်မာနိုင်ငံဥပဒေအရ သတ်မှတ်ထားသော ဆောင်ရွက်ချက်များကို လိုက်နာရပါမည်။ စက်ရုံတစ်ခုစီသည် ဥပဒေတွင် ဖော်ပြထားသည့်အတိုင်း နှစ်စဉ် မီးဘေးအန္တရာယ်

ကြိုတင်လေ့ကျင့်မှုများ၊ မီးကာကွယ်ခြင်းစနစ်များကို ဆောင်ရွက်ရပါမည်။ အရေးပေါ်အခြေအနေတွင် မီးနှင့် ပေါက်ကွဲမှုဖြစ်စဉ်များကို အရေးပေါ်မီးသတ်အဆင့်အရ ဆောင်ရွက်ရပါမည်။

၁.၃.၂. ၃ မုန်တိုင်းနှင့် ရေကြီးခြင်းများအတွက် အစီအစဉ်

မုန်တိုင်းနှင့် ရေကြီးခြင်းများအတွက် အစီအစဉ်တွင် အခြေအနေသုံးရပ်ပါဝင်ပါသည်။ (ကာကွယ်ခြင်း၊ သတိပေးခြင်းနှင့် တိမ်းရှောင်ခြင်း၊ ပြန်လည်ကုစားရေးအစီအစဉ်)။ ရေနုတ်မြောင်းနှင့် ရေကြီးမှု ကာကွယ်ရေးစနစ်ကို မိုးရာသီမတိုင်မီ ပြင်ဆင်ထားရပါမည်။ ထို့ပြင် ရေကြီးခြင်း (သို့) မိုးရာသီအတောအတွင်း အရေးပေါ် သတင်းပေးခြင်းများကိုလည်း လိုက်နာရန် လိုပါသည်။

၁.၃.၂.၄ ဓါတုပစ္စည်း ယိုဖိတ်မှုအတွက် အစီအစဉ်

ဓါတုပစ္စည်း ယိုဖိတ်မှုအတွက် အစီအစဉ်တွင် အဆင့်သုံးဆင့် ပါဝင်ပါသည်။ (ကာကွယ်ခြင်း၊ သတိပေးခြင်းနှင့် တိမ်းရှောင်ခြင်း၊ ပြန်လည်ကုစားရေး အစီအစဉ်)။ တိမ်းရှောင်းရေး အစီအစဉ်တွင် loading rack ၌ယိုဖိတ်မှုနှင့် လျံကျမှုနှင့် loading rack အတွင်း ယိုဖိတ်မှုနှင့် လျံကျမှုဟူ၍ နှစ်မျိုးရှိပါသည်။ ဓါတုပစ္စည်းများ ကိုင်တွယ်ခြင်း၊ သိုလှောင်ခြင်းကို EHS မူဝါဒနှင့် လမ်းညွှန်ချက်များ အပါအဝင် သက်ဆိုင်ရာ ဥပဒေနှင့် စည်းမျဉ်းစည်းကမ်းများကို လိုက်နာဆောင်ရွက်ရပါမည်။ စက်ရုံ (သို့) စီမံကိန်း အဆိုပြုသူသည် ၎င်းတို့၏ ဧရိယာအတွင်း ဆီများ ယိုဖိတ်မှု လျံကျမှုများကို အကောင်းဆုံး ထိန်းချုပ်ဆောင်ရွက်သွားရပါမည်။

၁.၃.၃ လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးကင်းလုံခြုံရေး

စီမံကိန်းသည် ISO14001, ISO9001 and OHSA 18001စံချိန်စံညွှန်းနှင့်အညီ စီမံကိန်းကို အကောင်အထည်ဖော်ဆောင်ရွက်ရန် ဘေးကင်းလုံခြုံသည့် ကျန်းမာရေးပတ်ဝန်းကျင် အဓိကအစီအစဉ်ကို ဖော်ဆောင်ခဲ့ပါသည်။ လုံခြုံရေးအစီအစဉ်တွင် ကျန်းမာရေးမူဝါဒနှင့် နည်းလမ်းများ (နှစ်စဉ်ကျန်းမာရေးစစ်ဆေးမှု၊ မူးရစ်ဆေးဝါးစစ်ဆေးမှု၊ ဆေးလိပ်သောကန်ရန် သတ်မှတ်နေရာ၊ အဆင့်အတန်းရှိသော အလုပ်ခွင်နှင့် အစားအစာ) များအပါအဝင် အလုပ်စနစ်၊ တစ်ဦးချင်းကာကွယ်ရေးပစ္စည်းများ (PPE)၊ မြေသယ်ယူမှုစနစ်၊ ဆောက်လုပ်ရေးအတွင်း လုံခြုံမှု၊ ကာကွယ်ရေးများပါဝင်ပါသည်။ ၁၀နှစ်အတွင်း SHE master plan အသေးစိတ်ကို အခန်း ၄.၄.၃ တွင် ဖော်ပြထားပါသည်။

၁.၃.၄ စီမံကိန်း၏ အခြားရွေးချယ်စရာနည်းလမ်းများ ဖော်ပြချက်

၁.၃.၄.၁ စီမံကိန်းနေရာ ရွေးချယ်ခြင်း

တနင်္သာရီကမ်းရိုးတန်းတောင်ဘက် နေရာသုံးခုကို ထားဝယ်စီမံကိန်းအတွက် ကနဦး ရွေးချယ်ထားပါသည်။ နိုင်းယဉ်ရွေးချယ်မှုရလဒ်ကို အောက်ပါဇယား ၁.၃-၂ တွင် ဖော်ပြထားပါသည်။

ဇယား ၁.၃-၂ စီမံကိန်းအတွက် မြေနေရာ နှိုင်းယှဉ်ရွေးချယ်မှု

မြေပုံ	နေရာ	တည်နေရာ	ထားဝယ်မှ	အင်ဂျင်နီယာရှုထောင့်
	နေရာ (၁)	မောင်းမကန်ပင်လယ်အော်	တောင်ဘက် ၂၈ ကီလိုမီတာ	သဘာဝသဲသောင်ခြေဖြစ်ပြီး နောက်ကျောဘက်တွင် ကြီးမားကျယ်ပြန့်သော ကမ်းရိုးတန်းလွင်ပြင်ရှိသည်။ နေရာတွင် စက်မှုဇုန်တည်ထောင်ပါက ဆိပ်ကမ်းဆောင်ရွက်မှုနှင့် အခြားနေရာများသို့ ဆက်သွယ်နိုင်သည်။ သို့သော် မုတ်သုံရာသီကို ခုခံရန် သဘာဝအကာအကွယ်များ မရှိပါ။ ထို့ကြောင့် လေကာတန်းများ လိုအပ်ပါသည်။
	နေရာ (၂)	ဆန်းလန်းပင်လယ်အော်	အနောက်တောင်ဘက် ၂၀ ကီလိုမီတာ	အနောက်ဘက်မုတ်သုံကို ကျွန်းက အကာအကွယ်ပေးထားသည်။ ရေသည်တိမ်သောကြောင့် သဲတူးခြင်းများ ဆောင်ရွက်ရန် လိုအပ်သည်။ ဧရိယာသည် နေရာ (၁)နှင့် နှိုင်းယှဉ်ပါက ကမ်းရိုးတန်းလွင်ပြင်ကျဉ်းပြီး ကမ်းခြေတိုသောကြောင့် ဆိပ်ကမ်းနှင့် စက်မှုဇုန် အတွက် ဧရိယာ သေးပါသည်။
	နေရာ (၃)	ညောပြင်ပင်လယ်အော်	တောင်ဘက် ၄၈ ကီလိုမီတာ	အက်ဒမန်ပင်လယ်နှင့် လုံးဝထိစပ်နေပြီး ဆိပ်ကမ်းနေရာကို လှိုင်းရိုက်ခတ်မှု ကာကွယ်ထားရန် လိုအပ်ပါသည်။ ပင်လယ်အော် အချို့နေရာများတွင် မြေယာချဲ့ထွင်မှုများ လိုအပ်ပြီး ရေအနက်သည် တိမ်ပါသည်။

Source: ITD (2012)

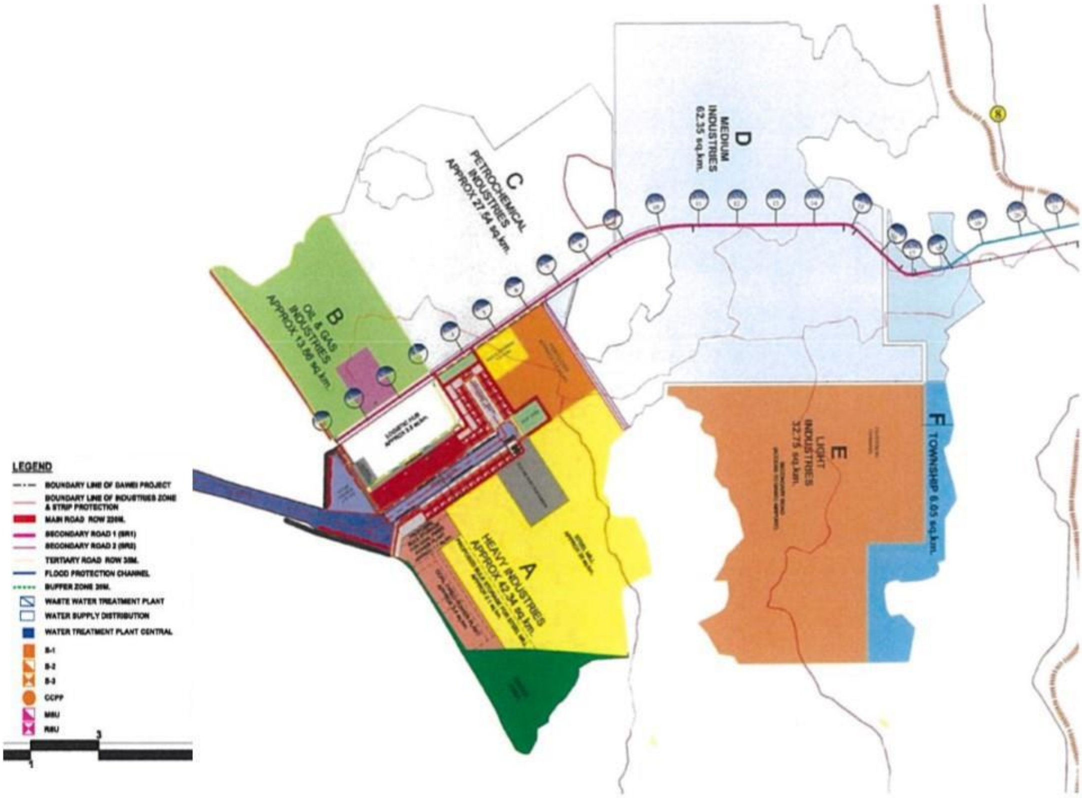
ITD (2010) ၏ အကဲဖြတ် စံနှုန်းများအရ (ဇယား ၄.၅.၁ကိုကြည့်ပါ) ဆိပ်ကမ်းတည်နေရာသည် အကာအကွယ်ကောင်းပြီး လုံလောက်သောရေအနက်နှင့် ရေယဉ်အကြီးစားများအတွက် သင့်တော်သော အရွယ်အစား ရှိရပါမည်။ နေရာတွင် ကုန်းတွင်း အရံထားသည့် ဧရိယာရှိသင့်ပြီး ရာသီအလိုက်ရေကြီး ရေလျှံမှုများလည်း ကင်းလွတ်ရပါမည်။ နေရာသည် အဓိကလမ်းမကြီးနှင့် သွားလာရလွယ်ကူပြီး အကွာအဝေးနီးသင့်ပါသည်။ ဆိပ်ကမ်းနေရာသည် စက်မှုဇုန်နေရာနှင့် နီးနိုင်သမျှ နီးရပါမည်။ နေရာသည် နောင်တွင် ချဲ့ထွင်နိုင်ရန်အတွက် လုံလောက်သော ကုန်းတွင်းကမ်းလွန် အကွာအဝေး ကျယ်ရမည်ဖြစ်ပြီး နေရာရှိ မြေထုသည်မြေယာချဲ့ထွင်မှုအတွက် သင့်တော်သော အခြေအနေရှိရပါမည်။ ထို့ကြောင့် နေရာ (၁) သည် စက်မှုဇုန်နှင့် ဆိပ်ကမ်းနေရာဆောက်လုပ်ခြင်းအတွက် အသင့်တော်ဆုံးဖြစ်ပါသည်။

၁.၃.၄.၂ စီမံကိန်းပုံစံ

စီမံကိန်းပုံစံ (၃)မျိုးမှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်။

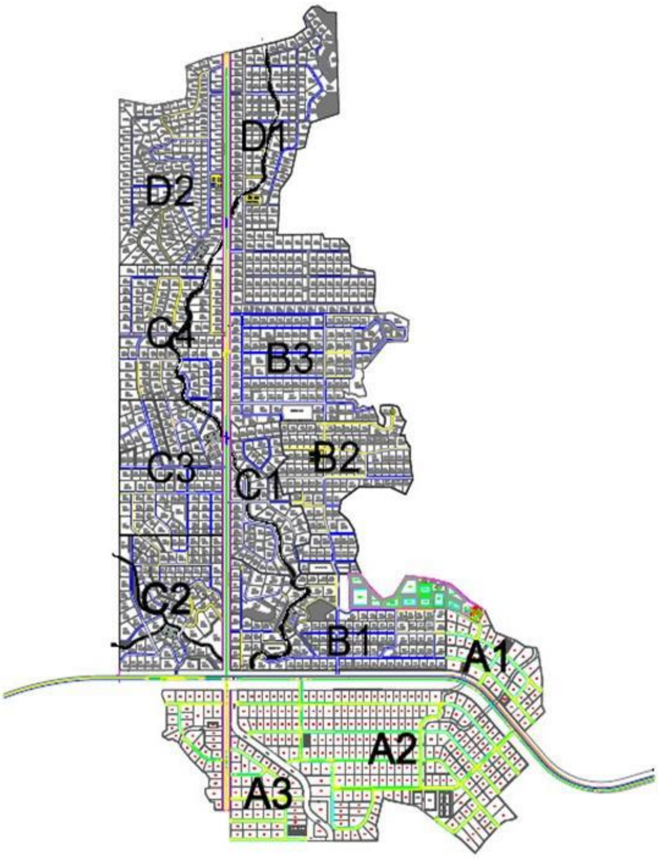
- ရွေးချယ်မှု ၁- ဇုန် D အလယ်အလတ်စက်မှုဇုန် (Pale blue)
- ရွေးချယ်မှု ၂- ဇုန် E အသေးစားစက်မှုဇုန် (Pink)
- ရွေးချယ်မှု ၃- လက်ရှိ master plan

လူမှုရေးဆိုင်ရာ သက်ရောက်မှုရှုထောင့်မှကြည့်လျှင် ဇုန် D၊ ဇုန် E နှင့် လက်ရှိ master plan နှိုင်းယှဉ်မှုအရ ဇုန် E သည် လက်ရှိဇုန်နှင့် ဇုန် D ထက် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများ မြင့်မားနိုင်ပါသည်။ ၄င်းမှာ ဖွံ့ဖြိုးတိုးတက်ရေးဧရိယာ ဇုန် E တွင် ရွာများပြောင်းရွှေ့နေထိုင်မှု မြင့်မားသောကြောင့် ဖြစ်ပါသည်။ (ဇယား ၄.၅-၃ ကိုကြည့်ပါ။) ထို့ကြောင့် ရွေးချယ်မှု (၃)၊ လက်ရှိစီမံကိန်းဆောင်ရွက်မှု အစီအစဉ်ကို အကောင်းဆုံးအဖြစ် ရွေးချယ်ထားပါသည်။ ပုံ၁.၃-၄ သည် ထားဝယ် SEZ ကနဦးစက်မှုဇုန်၏ နောက်ဆုံး အဓိကအစီအစဉ်ကို ဖော်ပြထားပါသည်။



Source: SEATEC (2012)

ပုံ ၁.၃-၃ ရွေးချယ်မှု ၁ နှင့် ၂ ရှိ စီမံကိန်းပုံစံ လျာထားမှု



Source: IEC (2015)

ပုံ ၁.၃-၄ ထားဝယ် SEZ ၏ နောက်ဆုံး အဓိကအစီအစဉ်

၁.၄ ပတ်ဝန်းကျင်ဖော်ပြချက်

၁.၄.၁ နေရာချထားမှုနှင့် လေ့လာမှုကန့်သတ်ချက်

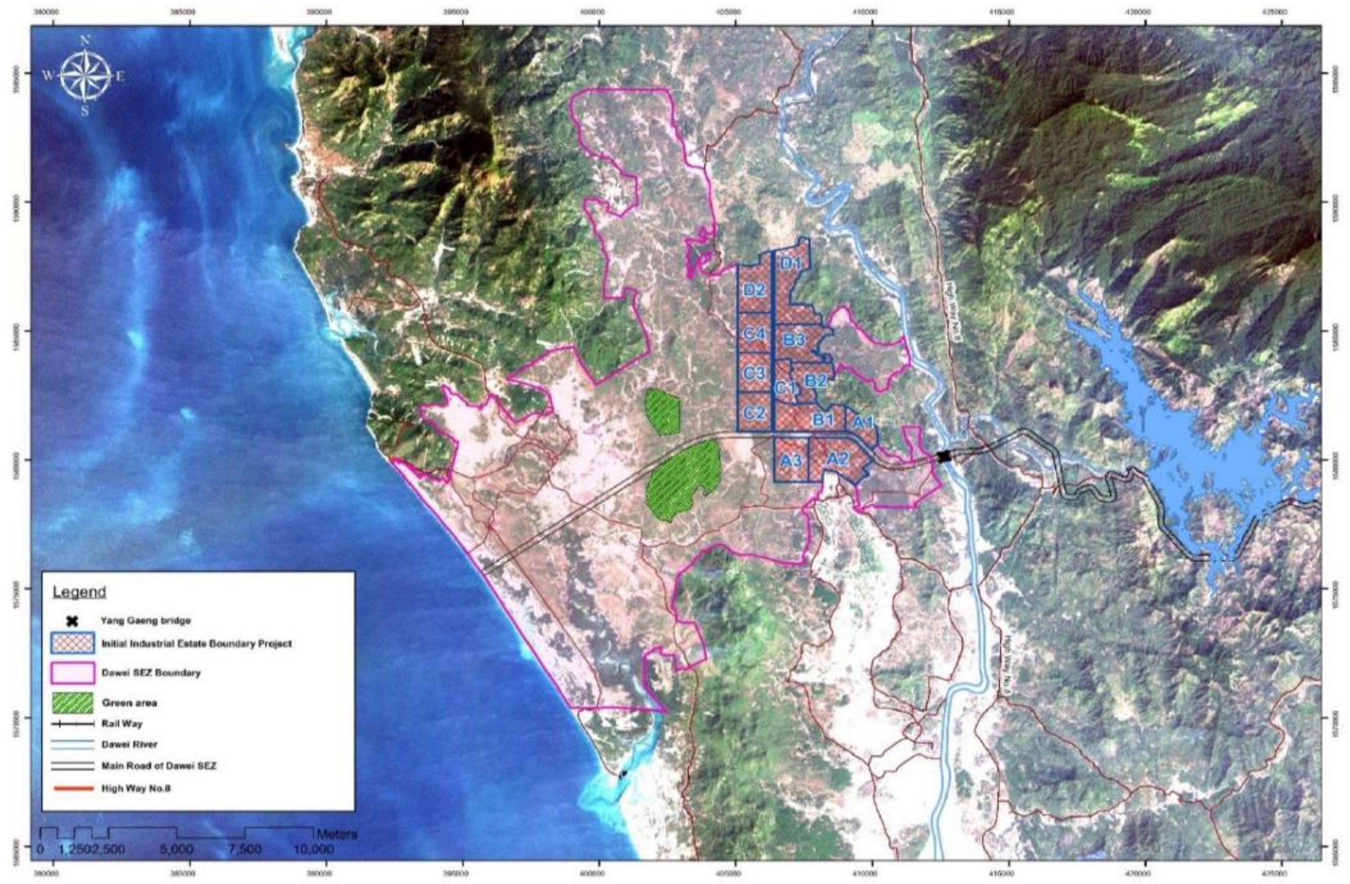
၁.၄.၁.၁ ဘူမိဗေဒဆိုင်ရာ လေ့လာမှု

ဘူမိဗေဒဆိုင်ရာ လေ့လာမှုကို အခြေခံအချက်အလက်များကောက်ယူရရှိထားသော စီမံကိန်းပတ်ဝန်းကျင် ဧရိယာများတွင် ဆောင်ရွက်ပါသည်။ ESIA လေ့လာမှုတွင် ဘူမိဗေဒဆိုင်ရာ လေ့လာမှုကို စီမံကိန်းနေရာ ဗဟိုမှ ၅ ကီလိုမီတာအတွင်း ဆောင်ရွက်ရပါမည်။ ၎င်းလေ့လာမှုသည် စီမံကိန်းနေရာဗဟိုမှ စက်ဝိုင်းပုံ ၇၈.၅၇ စတုရန်းကီလိုမီတာအတွင်း ဆောင်ရွက်ရပါမည်။ ပုံ ၁.၄-၁ တွင် မြေပုံနှင့် ဖော်ပြထားပါသည်။

၁.၄.၁.၂ အကြောင်းအရာနှင့် စပ်ဆက်လေ့လာမှု

ESIA လေ့လာမှုတွင်ပါဝင်သော စပ်ဆက်လေ့လာမှုတွင် အုပ်စု (၄) ခုပါဝင်ပါသည်။

- ရုပ်ပိုင်းဆိုင်ရာအပိုင်း
- ဇီဝဗေဒဆိုင်ရာအပိုင်း
- လူမှုစီးပွားရေးအပိုင်း
- ယဉ်ကျေးမှုအပိုင်း



Source: SEATEC (2012)

ပုံ ၁.၄-၁ ပထဝီဆိုင်ရာ လေ့လာမှု

၁.၄.၂ ရုပ်ပိုင်းဆိုင်ရာကဏ္ဍ

၁.၄.၂.၁ မြေမျက်နှာသွင်ပြင်

စီမံကိန်းဧရိယာသည် မြေပြန့်ဖြစ်ပါသည်။ ခွန်ချောင်းမြစ်သည် မြောက်မှတောင်သို့ စီးဆင်းနေသော ဧရိယာအတွင်း တစ်ခုတည်းသော မြစ်ဖြစ်ပါသည်။ စီမံကိန်း ဧရိယာအနီးဝန်းကျင်ရှိ မြစ်သုံးမြစ်မှာ နတ်ဘီလူးမြစ်၊ ထားဝယ်မြစ်နှင့် ပန်းဒင်အင်းချောင်းမြစ်တို့ ဖြစ်ပါသည်။

၁.၄.၂.၂ ဘူမိဗေဒ

စီမံကိန်းဧရိယာသည် ပြည်ထောင်စု သမ္မတမြန်မာနိုင်ငံ၏ ဘူမိဗေဒ မြေပုံအရ Q-2 Holocene နုန်းမြေပေါ်တွင် တည်ရှိပါသည်။ Holocene မြေလွှာများကို ကျောက်စရစ်ခဲကြီးများမှစ၍ သဲ၊ နုန်းမြေ၊ နှင့် ကျောက်စရစ်ခဲ အသေး၊ အလယ်အလတ်နှင့် ဝါကျင်ကျင် ရွှံ့စေးများအဖြစ် ခွဲခြား သတ်မှတ်ထားပါသည်။

၁.၄.၂.၃ ငလျှင်တိုင်းတာခြင်း

စီမံကိန်းဧရိယာသည် ငလျှင်အတော်အတန် အန္တရယ်ရှိသော ဇုန်အတွင်းတည်ရှိသော်လည်း ထိခိုက်မှုအနည်းငယ်သာ ရှိပါသည်။ ဤဇုန်တွင် မြေတုန်နှုန်း ၀.၀၇၅ ဂရမ်နှုန်း ရှိပြီး အများစုမှ ၆.၀ အောက်သာ တွေ့ရပါသည်။ ယခင်က ၆.၀မှ ၉.၀ အတွင်း ပြင်းထန်သော ငလျှင်များ အတော်ကြာ ဖြစ်ပွားခဲ့ဖူးပါသည်။

၁.၄.၂.၄ ဆူနာမီ

စီမံကိန်းဧရိယာသည် အတော်အတန် ဆူနာမီအန္တရယ်ရှိသော နေရာတွင် တည်ရှိပါသည်။ ဧရိယာသည် ကမ်းလွန်ကျွန်းများနှင့် အပင်များဖုံးလွှမ်းထားသောကြောင့် ဆူနာမီကြောင့် ပျက်ဆီးဆုံးရှုံးမှုများ မရှိခဲ့ဖူးပါ။

၁.၄.၂. ၅ ရေ

အနောက်ဘက်တွင် အက်ဒမန်မြစ်ဝှမ်းနှင့် အရှေ့ဘက်တွင် ထားဝယ်မြစ်ဝှမ်းတို့ရှိပြီး ထားဝယ်မြစ်နှင့် ခွန်ချောင်းမြစ်တို့သည် ထားဝယ်မြစ်ဝှမ်းတွင် ပါဝင်ပါသည်။ ခွန်ချောင်းမြစ်သည် ထားဝယ်မြစ်အတွင်းစီးဆင်းပြီး အနောက်ဘက် အက်ဒမန်ပင်လယ်ထဲသို့ စီးဝင်ပါသည်။

၁.၄.၂.၆ လေအရည်အသွေး

- လေအရည်အသွေး တိုင်းတာရန်အတွက် စီမံကိန်းဧရိယာအနီးတွင် နမူနာကောက်ယူသည့်နေရာ လေးခုရှိပါသည်။
- ၂၄ နာရီအတွက်TSP နှင့် PM_{10} တို့၏ ပါဝင်မှုသည် အထူးသဖြင့် နွေပိုင်းတွင် မြင့်မားနေတတ်ပါသည်။

- SO_2၊ NO_2 နှင့် CO ပါဝင်မှုများကို World Bank၊ U.S.EPA နှင့် WHO စံချိန်စံညွှန်းများနှင့်အညီ ဆောင်ရွက်ပါသည်။
- THC၊ MHCနှင့် NMHC တို့အတွက် စံချိန်စံညွှန်းများ မရှိသေးသော်လည်း အခြေခံအချက်အလက်များအဖြစ် ကောက်ယူပါမည်။

၁.၄.၂.၇ ဆူညံသံနှင့် တုန်ခါမှု

L_{Aeq} နှင့် L_{Amax} တို့ကို U.S.EPA နှင့် ထိုင်းစံနှုန်းအရ ခြောက်သွေ့ရာသီနှင့် မိုးရာသီ နှစ်ရာသီလုံး ၂၄ နာရီ တိုင်းတာပါသည်။ မည်သည့်အဆောက်အဦးမျှ မထိခိုက်သော အမြင့်ဆုံး တုန်ခါမှုနှုန်းမှာ ၂.၀ mm/s ထက် မများရပါ။

၁.၄.၂ .၈ မြေအောက်ရေအရည်အသွေး

မတ် ၂၀၁၅ တွင် စီမံကိန်းဧရိယာအနီး နမူနာကောက်ယူရာ နေရာနှစ်ခုမှ မြေအောက်ရေနမူနာကို နှစ်ကြိမ် ကောက်ယူခဲ့ပါသည်။ ရလဒ်များအားလုံးသည် စံချိန်စံညွှန်းနှင့် ကိုက်ညီမှုရှိပြီး ခဲပါဝင်မှုသည် စံချိန်စံညွှန်းထက် ကျော်လွန်နေပါသည်။ ကျေးရွာများရှိ ရေတိမ်တွင်းများမှ ရေများအားလုံးသည် ပတ်သိုဂျင်ပါဝင်မှုကြောင့် သောက်သုံးရန် မသင့်သည်ကို တွေ့ရှိရပါသည်။

၁.၄.၂ .၉ မြေပေါ်ရေအရည်အသွေး

ဖေဖော်ဝါရီ ၂၀၁၅ တွင် ရေနမူနာငါးခုကို ကောက်ယူခဲ့ပါသည်။ နမူနာနှစ်ခုကို ထားဝယ်မြစ်မှ ကောက်ယူပြီး အခြား သုံးခုကို စီမံကိန်းဧရိယာရှိ မြစ်နှင့် ချောင်းမှ ကောက်ယူခဲ့ပါသည်။ SW1 ကို စီမံကိန်းမြောက်ဘက်ရှိ အီကနီမြစ်မှ ယူခဲ့ပြီး SW2 ကို စီမံကိန်းတောင်ဘက်ရှိ Yalai ချောင်းကွေ့မှ ယူခဲ့ပါသည်။

တိုင်းတာမည့် Parameters များကို ထိုင်းနိုင်ငံ ရေစံချိန်စံညွှန်းနှင့် ဆောင်ရွက်ပါသည် (အခန်း ၅ တွင် အသေးစိတ် ဖော်ပြထားပါသည်)။ SW1 တွင် Do 5.8 mg/l၊ အစိုင်အခဲနည်းပြီး မာကျူရီ 0.0002mg/l ရှိပါသည်။ သို့သော် အဝါရောင် SW2သည် DO 4.2 mg/l နှင့် BOD၊ COD နည်းသည်ကို တွေ့ရပါသည်။ ထားဝယ်မြစ်မှ နမူနာများသည် DO ပါဝင်မှု များပြားပြီး (6mg/l နီးပါး) အနည်များသည်ကို တွေ့ရပါသည်။ ၎င်းတို့၏ TSS သည် 1417 မှ 1836 mg/l ထိ ရှိပါသည်။ Coliform bacteria နှင့် E. Coli များကို ထားဝယ်မြစ်မှ နမူနာများအားလုံးထဲတွင် မတွေ့ရပါ။

၁.၄.၂. ၁၀ အနည်အရည်အသွေး

မာကျူရီမှလွဲ၍ အနည်နမူနာအားလုံးကို အဆိုပြု အနည်အရေအသွေး စံနှုန်းများနှင့် ဆောင်ရွက်ပါသည်။ SW1 နှင့် SW2 54.9 နှင့် 44% သဲများဖြင့် ဖွဲ့စည်းထားပြီး Heavy metals အချို့ကိုလည်း တွေ့ရပါသည်။ SW3 နမူနာကောက်ယူရာနေရာသည် ရွှံ့စေး (58.39%) နှင့် မာကျူရီနှင့် သံ (0.719 နှင့်26,078 mg/kg) ဖြင့် ဖွဲ့စည်းထားပါသည်။ SW4 နှင့် SW5 ကို ရွှံ့စေး (47 နှင့် 63.7 %) ရှိသော

ထားဝယ်မြစ်မှ ကောက်ယူထားပါသည်။ အနည်နမူနာများတွင် တွေ့ရသော Heavy metals များမှာ arsenic, zinc၊ ကြေးနီ၊ သံ၊ ခဲ၊ နီကယ်နှင့် ခရိုမီယမ် တို့ဖြစ်ပါသည်။

၁.၄.၃ ဇီဝဗေဒ အစိတ်အပိုင်းများ

၁.၄.၃. ၁ ရေနေဂေဟဗေဒနှင့် ငါးလုပ်ငန်းများ

- ရေညှိစိမ်းနှင့် diatom တို့သည် phytoplankton ၏ လွှမ်းမိုးသော taxa များဖြစ်ကြပါသည်။ Wilhm နှင့် Dorris (1968) လမ်းညွှန်ချက်အရ စီမံကိန်းဧရိယာအနီးရှိ ရေအရေအသွေးအတွက် အကြံပြုထားသော မျိုးစုံမျိုးကွဲ အညွှန်း (H') သည် ရေနေသတ္တဝါများအတွက် သင့်တော်လက်ခံနိုင်သော အခြေအနေတွင် ရှိပါသည်။
- *Nauplius* Copepod နှင့် *Arcella* protozoan များကို ပေါပေါများများ တွေ့ရပါသည်။
- အဆစ်ပါသော တီကောင်များ၊ အထူးသဖြင့် ရေနှင့် နီးစပ်သော အကောင်များသည် တိုင်းတာသည့်နေရာအားလုံးတွင် လွှမ်းမိုးနေသော မြေအောက်သတ္တဝါများ ဖြစ်ပါသည်။
- ရေချိုပုဇွန်များသည် တိုင်းတာသည့် နေရာအားလုံးတွင် လွှမ်းမိုးနေသော ရေနေသတ္တဝါများဖြစ်ပါသည်။
- *Actinoscirpus grossus (ရေနေအပင်ကြီးမျိုး)* သည် ရေထုတွင် လွှမ်းမိုးနေသော မျိုးစိတ်ဖြစ်ပြီး *Acanthus ebracteatus (ပင်လယ် holly ပင်)နှင့် Nypa fructicans* (ဓနိ) တို့သည် ထားဝယ်မြစ် တိုးတာသည့်နေရာများတွင် လွှမ်းမိုးနေသော အပင်များဖြစ်ပါသည်။
- Cyprinid fishes (Cyprinidae: Barb and Minnow) နှင့် Gobiidae (Goby)တို့သည် လွှမ်းမိုးနေသော မျိုးစိတ်များဖြစ်ပါသည်။ ငါးစုစုပေါင်းမှာ တစ်ဟက်တာ ၁၄၀၀မှ ၄၄၀၀ ကောင်အထိရှိပြီး ငါးပေါများမှုမှာ တစ်ဟက်တာလျှင် ၆.၇၉၅မှ ၈.၅၁၀ ကီလိုဂရမ်အထိ ရှိပါသည်။
- ငါးလုပ်ငန်းများ- Pushnet boats၊ gillnet၊ fish trap၊ dip net၊ fish net နှင့် ငါးမျှားချိတ်များသည် ဒေသခံငါးဖမ်းသမားများ အသုံးပြုသော ငါးဖမ်းကိရိယာများ ဖြစ်ပါသည်။

၁.၄.၃ .၂ သစ်တောများ

စီမံကိန်းဧရိယာအတွင်း သစ်တောများကို ဒီရေတော၊ ကြီးပိုင်းတောနှင့် သဘာဝတောဟူ၍ သုံးမျိုး ခွဲခြားထားပါသည်။ IUCN Red list အရ *Ceriops decandra* မျိုးစိတ်ကို ဒီရေတောတွင် တွေ့ရပါသည်။ ကြီးပိုင်းတောအတွင်းတွင် IUCN Red list အတွင်းရှိ မျိုးစိတ်များ မပါဝင်ပါ။ IUCN Red list တွင် ပါဝင်သော မျိုးသုန်းပျောက်ကွယ်ရန် အန္တရာယ်ရှိသော မျိုးစိတ်တစ်ခုနှင့် အရေးပေါ် မျိုးသုန်းပျောက်ကွယ်ရန် အန္တရာယ်ရှိသော မျိုးစိတ်နှစ်ခုကို သဘာဝတောတွင် တွေ့ရပါသည်။ ပထမတစ်ခုမှာ *Diospyros crumentata* ဖြစ်ပြီး နောက်နှစ်ခုမှာ *Dipterocarpus kerrii* နှင့် *Dipterocarpus turbinatus* တို့ ဖြစ်ပါသည်။ Hopea odorata မျိုးစိတ်ကိုလည်း တောထဲတွင် တွေ့ရပါသည်။

၁.၄.၃ .၃ တောရိုင်းတိရစ္ဆာန်

ကျောရိုးရှိ သတ္တဝါလေးမျိုးကို တွေ့ရှိရပါသည်။ (တွားသွားသတ္တဝါ၊ ကုန်းနေရေနေသတ္တဝါ၊ ငှက်မျိုးစိတ်များနှင့် နို့တိုက်သတ္တဝါများ ဖြစ်ပါသည်။ စပါးကြီးမြွေ (*Python molurus bivittatus*) သည် IUCN Red list တွင်ပါဝင်သော အန္တရယ်ရှိ မျိုးစိတ်တစ်ခု ဖြစ်ပါသည်။ is an endangered species reptile listed in the IUCN Red-list. အရှေ့အာဆီယမ် porcupine (*Hystrix brachyuran*) နှင့် အမြီးရှည်ဆိတ် (*Naemorhedus caudatus*) တို့သည် IUCN Red list ရှိ ထိခိုက်ခံစားလွယ်သော နို့တိုက်သတ္တဝါမျိုးစိတ် ဖြစ်ပါသည်။

၁.၄.၄ လူမှုစီးပွားအခြေအနေများ

- ရွာ၁၈ ရွာတွင် အိမ်ခြေ ၅၈၃၄ အိမ်ထောင်စု ရှိပါသည်။ စုစုပေါင်းလူဦးရေမှာ ၃၅၄၄၃ (ကျား- ၁၆၆၂၈ နှင့် မ- ၁၈၈၀၅) ရှိပါသည်။ အများဆုံးလူဦးရေ ၇၇၀၀ ဦးမှာ ပဂေါ်ဇွန်းရွာတွင်ရှိပြီး လူဦးရေအနည်းဆုံး (၃၂၈ဦး) မှာ ညောင်ပင်ဆိပ်ရွာတွင် ဖြစ်ပါသည်။
- ၂၀၁၃ တွင် REM ၏ ရွာတွင်း ကွင်းဆင်းလေ့လာမှုအရ သက်ရောက်ခံ ၁၈ ရွာတွင် တိုင်းရင်းသား လူမျိုးစုများ နေထိုင်ခြင်း မရှိပါ။
- လေ့လာမှုအရ မြန်မာနိုင်ငံပညာရေးစနစ်ကို မူကြို၊ မူလတန်း၊ အလယ်တန်းနှင့် အထက်တန်းဟူ၍ လေးဆင့် ခွဲထားပါသည်။ တစ်ရွာစီတွင် ကျောင်းတစ်ကျောင်းစီရှိပြီး ကျခတ်တပင်ရွာတွင် နှစ်ကျောင်းရှိပါသည်။
- မြေအသုံးချ လေ့လာမှုကို ရေဖြူနှင့် လောင်းလုံတွင် ဆောင်ရွက်ပါသည်။ ရေဖြူကွင်းဆင်းလေ့လာမှုအရ ဧရိယာ၏ သုံးပုံနှစ်ပုံသည် သစ်တောအဖြစ် ထိန်းသိမ်းထားခြင်း မရှိသေးပါ။ ၁၂% ခန့်ကို စိုက်ပျိုးမြေအဖြစ် ပြောင်းလဲပြီး ဖြစ်ပါသည်။ လောင်းလုံ ကွင်းဆင်းလေ့လာမှုအရ စုစုပေါင်းဧရိယာ၏ သုံးပုံတစ်ပုံကို စိုက်ပျိုးမြေအဖြစ် အသုံးပြုပြီး ကျန်သုံးပုံနှစ်ပုံကို သဘာဝအတွက် ချန်ထားပါသည်။
- လဲရှောင်နှင့် ပန်းဒင်ရွာရှိ ကျေးလက်ဆေးခန်းများကို အတွေ့အကြုံရှိ အပြာဝတ်သူနာပြုများက ကူညီလုပ်ဆောင်ပေးပါသည်။(LHV Lady Health Assistance)
- လူဦးရေ ၇၀.၈% သည် ဆေးရွက်ကြီးဆေးလိပ်သောက်နေဆဲဖြစ်ပြီး ၁၂%သည် အရက်သောက်ကြပါသည်။
- နေထိုင်သူများအတွက် အဓိကအစားအစာကို ကိုယ်ပိုင်စိုက်ခင်းမှ (၈၄.၇၂%)၊ ဈေးမှ (၉.၉၄%) နှင့် သဘာဝအရင်းအမြစ်များ(ငါးဖမ်းခြင်း၊ သစ်တောနှင့် မြစ်)မှ (၅.၅၆%) ရရှိပါသည်။
- လေ့လာသောနေရာ၏ ရေရရှိမှုမှာ ရေတွင်းတီမ်မှ ဖြစ်ပါသည်။ ဒေသခံများအသုံးပြုရန် အခြားရေအရင်းအမြစ်များမှာ အဝီစိတွင်းနှင့် မိုးရေစုဆောင်ခြင်းတို့ ဖြစ်ပါသည်။ ဘဝက်ရွာကဲ့သို့ လေ့လာသောဧရိယာရှိ အိမ်ထောင်စုအများစုသည် ရေတိမ်တွင်းများနှင့် ချောင်းများမှ ရေသန့်များ ရရှိပါသည်။

- စီမံကိန်းဧရိယာပတ်ဝန်းကျင်ရှိ သောက်သုံးရေအခြေအနေမှာ ကောင်းပါသည်။ ဒေသခံ ၅၀% ကျော်သည် ရေစစ်သုံးကြပြီး ၂၆.၅% သည် ရေကျိုချက် အသုံးပြုကြပါသည်။
- လေ့လာသော နေရာတွင် လျှပ်စစ်မီးမရရှိပါ။ အိမ်ထောင်စုတစ်ခုတွင်သာ မီးစက်အသေးမှ လျှပ်စစ်ရရှိပါသည်။ ဆောက်လုပ်ဆဲကာလအတွင်း စီမံကိန်းဧရိယာတွင် မီးစက်ကြီးကို အသုံးပြုပါသည်။
- ထားဝယ်ဧရိယာတွင် အစိုင်အခဲ စွန့်ပစ်ပစ္စည်းနှင့် အနည်များကို စီမံခန့်ခွဲမှု ညံ့ဖျင်းနေဆဲ ဖြစ်ပါသည်။ ဒေသခံ အဖွဲ့အစည်းများမှ ကျန်းမာရေးနှင့် ပတ်သက်သော ကွင်းဆင်းလေ့လာရေးမှ ရလဒ်များကို ကန့်သတ်ထားပါသည်။ ဥပမာ- လူနေထိုင်ရာနေရာအိမ်ထောင်စုများမှ စွန့်ပစ်ရေများကို မြေပေါ်သို့ တိုက်ရိုက် စွန့်ပစ်ပါသည် (၈၂.၂%)။ ရေနုတ်မြောင်းများထဲသို့ စွန့်ပစ်မှုသည် ၅.၉%၊ ဥယျာဉ်ခြံထဲသို့ စွန့်ပစ်မှုသည် ၅.၁% ရှိပြီး မြစ်ထဲသို့ စွန့်ပစ်မှုသည် ၄% ရှိပါသည်။
- လူနေအိမ်အများစုမှ အစိုင်အခဲအညစ်အကြေးများကို မီးရှို့ဖျက်ဆီးပါသည် (၉၃.၈%)။ အိမ်အပြင်ဘက် စုပုံထားမှု ၂.၇%၊ မြေမြှုပ်ခြင်း ၂.၂%နှင့် ပြည်သူပိုင်နေရာတွင် စွန့်ပစ်မှု ၀.၈% တို့ ဖြစ်ပါသည်။
- စီမံကိန်းနေရာ နှင့် ဒေသခံရွာများလမ်းအခြေအနေနှင့် သည် အုတ်ပြားခင်းထားခြင်း မရှိသေးပါ။ လမ်းအကျယ်သည် ၄ မီတာခန့် ရှိပါသည်။
- အဝေးပြေးလမ်းနံပါတ် (၈)သည် နှစ်လမ်းသွားဖြစ်ပြီး စီမံကိန်းနေရာနှင့် မြန်မာနိုင်ငံ အခြားအပိုင်းများကို ဆက်သွယ်ထားပါသည်။ ထိုလမ်းသည် ထားဝယ်လေဆိပ်နှင့်လည်း ဆက်သွယ်ထားပါသည်။ အပြည်ပြည်ဆိုင်ရာ လေကြောင်းကို အပြည်ပြည်ဆိုင်ရာ မြန်မာ့လေကြောင်းဖြင့် ဆောင်ရွက်ပါသည်။ ပြည်တွင်းလေကြောင်းများကို Air Mandalay၊ Air Kanbawza၊ Asian Winds၊ Air Bagan နှင့် Yangon Airways တို့ဖြင့် ဆောင်ရွက်လျက်ရှိပါသည်။ ရန်ကုန်မှ ထားဝယ်လေကြောင်းသည် တစ်နာရီခန့် ကြာမြင့်ပါသည်။ ထားဝယ်-ရေးမီးရထားလမ်းသည် ရေဖြူမြို့မှ ဖြတ်သွားပါသည်။ မီးရထားလမ်းသည် တောင်မြောက်ဖြစ်ပြီး ထားဝယ်- ရေး အဝေးပြေးလမ်းနှင့် အပြိုင် တည်ရှိပါသည်။ ကုန်စည်များကို ထားဝယ်ဆိပ်ကမ်းကို အသုံးပြု၍ သင်္ဘောများဖြင့် ပို့ဆောင်ပါသည်။
- မြေအသုံးချမှုလေ့လာရေးကို အီတလီ- ထိုင်း ဖွံ့ဖြိုးရေးအားဖြင့် အကောင်အထည်ဖော် ဆောင်ရွက်ပါသည်။ လေ့လာမှုအရ စီမံကိန်းဧရိယာအတွင်း အဓိက မြေအသုံးချမှု သုံးမျိုး ရှိပါသည်။
  - စိုက်ပျိုးမြေသည် မြေပြန့်ဖြစ်ပြီး သီးနှံနှင့် စပါးများ စိုက်ပျိုးကြပါသည်။ စိုက်ပျိုးရေးကို တောင်ကုန်းများတောင်တန်းများတွင် စိုက်ပျိုးကြပါသည်။ အဓိကစိုက်ခင်းများမှာ ဆီအုန်း၊ သီဟိုဠ်၊ ရာဘာ၊ အုန်းနှင့် ကွမ်းတို့ဖြစ်ပါသည်။
  - ကျေးလက် လူနေဧရိယာ- စီမံကိန်းဧရိယာအတွင်း ကျေးရွာ ၁၆ ရွာ ရှိပါသည်။

၁.၄.၅ ယဉ်ကျေးမှုအမွေအနှစ်

REM မှ ၂၀၁၃ တွင်ကောက်ယူထားသော ကျေးရွာအချက်အလက်များအရ စီမံကိန်းပတ်ဝန်းကျင်တွင် ယဉ်ကျေးမှုဆိုင်ရာ အလေးထားရမည့် နေရာ (၃) ခုရှိပါသည်။ ပြဒတ်ရွာတွင်

နွားခြေရာဘုရားနှင့် လီဆောင်းရွာတွင် နဘူးလည်စက်တော်ရာ ဘုရားခြေတော်ရာတို့ ဖြစ်ပါသည်။ မုဒုရွာတွင် ဘုန်းကြီးကျောင်းတစ်ကြောင်းရှိပြီး မင်းတပ်နှင့် ပန်းဒင်မြို့တွင် အခြားဘုရားနှစ်ဆူ ရှိပါသည်။

၁.၅ သက်ရောက်မှု၊ ထိခိုက်မှုအကဲဖြတ်ခြင်းနှင့် လျော့ပါးစေရေးနည်းလမ်းများ

ကဏ္ဍတစ်ခုစီအတွက် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများကို ဖြေရှင်းရန် သက်ရောက်မှုအကဲဖြတ်ခြင်း ရလဒ်များကို အောက်ပါအတိုင်း အမျိုးအစား (၆)ခု ခွဲခြားထားပါသည်။

- A- သိသာထင်ရှားသော ဆိုးကျိုးသက်ရောက်မှု
- B- အချို့ဆိုးကျိုးသက်ရောက်မှု
- C- သိသာထင်ရှားမှုမရှိဘဲ ဖော်ထုတ်ရန်လိုအပ်သော သက်ရောက်မှုများ
- D- သက်ရောက်မှုမရှိ (သို့) သက်ရောက်မှုများကို လျစ်လျူရှုရ၍ရ၊ အခြားလေ့လာမှုများ ထပ်မလိုအပ်ပါ။
- A+ သိသာထင်ရှားသော ကောင်းကျိုးသက်ရောက်မှု
- B+ အချို့ကောင်းကျိုးသက်ရောက်မှု

အကြိုဆောက်လုပ်ရေး၊ ဆောက်လုပ်ရေးကာလ (CO) နှင့် လုပ်ငန်းလည်ပတ်ဆဲကာလ (OP) အတွင်း သက်ရောက်မှုရလဒ်များနှင့် သင့်တော်သည့် လျော့ပါးစေရေးနည်းလမ်းများကို ဇယား ၁.၅-၁ တွင် ဖော်ပြထားပါသည်။

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုအကျဉ်းချုပ်နှင့် သင့်တော်သည့် လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ရှုထောင့်	အကဲဖြတ်မှု ရလဒ်		ရလဒ်ဖော်ပြချက်	သင့်တော်သည့် လျော့ပါးစေရေး နည်းလမ်းများ
		CO	OP		
ညစ်ညမ်းမှု	လေအရည်အသွေး	B-	A-	CO: ဆောက်လုပ်ရေးနှင့် ပို့ဆောင်ရေးယဉ်များမှ ထွက်လာသော ဖုန်မှုန့်၊ အမှုန်များ။	CO: ရေဖျန်းခြင်း၊ ကုန်တင်ယဉ်၊ ပစ္စည်းများကို မိုးကာဖြင့် ဖုံးအုပ်သယ်ဆောင်ခြင်း။
				OP: ဌာနရမ်းသူများ လုပ်ငန်းလည်ပတ်မှုနှင့် မီးရှို့စက်မှ ထွက်ရှိမှု။	OP: PM 10၊ NO_2၊ SO_2နှင့် Dioxin ထွက်ရှိမှု ထိန်းချုပ်ခြင်း။

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုအကျဉ်းချုပ်နှင့် သင့်တော်သည့် လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ရှုထောင့်	အကဲဖြတ်မှု ရလဒ် CO	အကဲဖြတ်မှု ရလဒ် OP	ရလဒ်ဖော်ပြချက်	သင့်တော်သည့် လျော့ပါးစေရေး နည်းလမ်းများ
				ယဉ်ကြောပိတ်ဆို့မှု။	အကောင်းဆုံး နည်းပညာ အသုံးပြုခြင်း။
	ရေအရည်အသွေး	B-	A-	CO: မြေအပြောင်ရှင်းခြင်း၊ ဆောက်လုပ်ရေးနှင့် အလုပ်သမားတဲများကြောင့် ရေစီးဆင်းမှုတွင် ညစ်ညမ်းခြင်း။ OP: ငှားရမ်းလုပ်ကိုင်သူများကြောင့် စွန့်ပစ်ရေများကို ဗဟိုစွန့်ပစ်ရေ သန့်စင်စက်သို့ ပို့ဆောင်ခြင်း။	CO: ဆောက်လုပ်ရေးနေရာနှင့် အလုပ်သမားတဲများမှ စွန့်ထုတ်မှု ထိန်းချုပ်ခြင်း။ OP: စွန့်ပစ်ရေသန့်စင်မှုမှ ရေဆိုးများကို ထိန်းချုပ်ပြီး စနစ်တကျ ထိန်းချုပ်ရန်။
	မြေအောက်ရေ အရည်အသွေး	B-	B-	CO: ဓါတုပစ္စည်းများ ယိုဖိတ်မှု၊ ဖိတ်စင်မှု။ OP: ယိုဖိတ်မှု (သို့) ဖိတ်စင်မှု (သို့) လက်ရှိ ညစ်ညမ်းမြေများ။ အမှိုက်ပုံနှင့် သန့်စင်စက်ရုံ။	CO: ယိုဖိတ်မှု၊ ဖိတ်စင်မှုများ တားဆီးမှု အစီအစဉ်နှင့် အလုပ်သမားနေရာ မိလ္လာရေဆိုးစနစ်။ OP: အန္တရာယ်ရှိနေရာများ ထိန်းချုပ်ခြင်းနှင့် ဖိတ်စင်၊ ယိုဖိတ်မှု ကာကွယ်ခြင်း အစီအစဉ်ကို အကောင်အထည်ဖော်ရန်။
	ဆူညံသံနှင့်	B-	B-	CO: စက်ယန္တယားများ၊ ယဉ်များသွားလာမှုကြောင့်	CO: ဆောက်လုပ်ရေးနေရာနှင့်

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုအကျဉ်းချုပ်နှင့် သင့်တော်သည့် လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ရှုထောင့်	အကဲဖြတ်မှု ရလဒ်		ရလဒ်ဖော်ပြချက်	သင့်တော်သည့် လျော့ပါးစေရေး နည်းလမ်းများ
		CO	OP		
	တုန်ခါမှု			ဆူညံသံနှင့် တုန်ခါမှု ဖြစ်ပေါ်ခြင်း။ OP: ငှားရမ်းသူများ လုပ်ငန်းလည်ပတ်ခြင်းနှင့် ယဉ်သွားလာခြင်း။	အလုပ်ချိန်သတ်မှတ်ခြင်း။ OP: ဆူညံသံ တိုင်းတာသည့် ကိရိယာများကို နီးစပ်သည့် အဆောက်အဦး (သို့) ခြံစည်းရိုးများတွင် တပ်ဆင်ထားရန်။
	အနံ့ဆိုးများ	D	B-	CO: အမှိုက်ပုံနှင့် အလုပ်သမားတဲများ။ OP: ငှားရမ်းသူများ လုပ်ငန်းလည်ပတ်မှုနှင့် စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုစနစ်။	CO: အလုပ်သမားတဲများ၏ မိလ္လာစနစ်ကို ထိန်းချုပ်ရန်။ OP: အနံ့လာရာ အရင်းအမြစ်များကို ထိန်းချုပ်ရန်။
	အောက်ခြေအနည်အနစ်	B-	B-	CO: မြစ်ကမ်းနားတွင် ရေလွှမ်းမိုးမှု ထိန်းချုပ်သည့်စနစ် တည်ဆောက်ခြင်း။ ခွန်ချောင်းမြစ် ညစ်ညမ်းမှု။ OP: စွန့်ပစ်ရေ သန့်စင်စက်ရုံမှ ထွက်လာသော စွန့်ပစ်ပစ္စည်းများကြောင့် အောက်ခြေအနည်များကို ညစ်ညမ်းမှု။	CO: ထိန်းချုပ်နည်းလမ်းများ (ဥပမာ- အနည်ထိုင်ကန် (သို့) အနည်စစ်ဇကာများ) OP: ထွက်ရှိမှုများ ထိန်းချုပ်ခြင်း။
သဘာဝပ	မြေမျက်နှာသွင်ပြင်နှင့်	A-	D	CO: ဆောက်လုပ်ရေးလုပ်ငန်းနှင့် ပစ္စည်းများ ထောက်ပံ့မှု	CO: မြေသားများ ပြန်လည်ဖြည့်တင်း၊

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုအကျဉ်းချုပ်နှင့် သင့်တော်သည့် လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ရှုထောင့်	အကဲဖြတ်မှု ရလဒ်		ရလဒ်ဖော်ပြချက်		သင့်တော်သည့် လျော့ပါးစေရေး နည်းလမ်းများ	
		CO	OP				
တ်ဝန်းကျင်	မြေဆီလွှာ				(ဥပမာ-သဲ၊ ကျောက်၊ မြေသား) မြေသားများ ပြောင်းရွှေ့မှုကြောင့် မြေဆီလွှာညစ်ညမ်းမှု။		ပြောင်းရွှေးခြင်းကို စီမံခန့်ခွဲမှု။ မြေပြင် ပြောင်းလဲမှုများကို လျော့နည်းစေသော ပုံစံ။
				OP:	လုပ်ငန်းလည်ပတ်ခြင်းကြေ ာင့် မြေသားပြောင်းလဲမှုများ မရှိနိုင်ပါ။ အချို့ဒုံးရမ်းလုပ်ကိုင်သူမျာ း လုပ်ငန်းလည်ပတ်မှုသည် မြေဆီလွှာ ညစ်ညမ်းနိုင်ပါသည်။	OP:	ဓါတုကိုင်တွယ်မှုနှင့် စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုကို အကောင်အထည်ဖေ ာ် ဆောင်ရွက်ရန်။
	မြေဆီလွှာ တိုက်စားမှု	B-	B-	CO:	မြစ်ကမ်းနားတွင် ရေလွှမ်းမိုးမှု ထိန်းချုပ်စနစ်များ ဆောက်လုပ်ခြင်း။	CO:	ဆောက်လုပ်ရေးနှင့် တိုင်စိုက်ထူမှုများကို စီမံခြင်း။
				OP:	စွန့်ပစ်ရေသန့်စင်စက်ရုံမှ စွန့်ထုတ်မှုများသည် ချောင်းမြစ်ကမ်းပါးနံရံမျာ းကို တိုက်စားနိုင်ပါသည်။	OP:	စွန့်ထုတ်မှု အရည်အသွေး ထိန်းချုပ်ခြင်း။

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများနှင့် သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ကဏ္ဍ	အကဲဖြတ်မှုရလဒ်		ရလဒ်ဖော်ပြချက်	သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ
		CO	OP		

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများနှင့် သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ကဏ္ဍာ	အကဲဖြတ်မှုရလဒ်		ရလဒ်ဖော်ပြချက်	သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ
		CO	OP		
	ရေ	B-	B-	CO: မြေသားပြုပြင်ခြင်းကြောင့် ယာယီ သက်ရောက်မှု OP: စက်မှုဇုန်ဧရိယာ ဖွံ့ဖြိုးတိုးတက်မှု (ဥပမာ- အများအပြား စွန့်ထုတ်ခြင်း)	CO: စောင့်ကြည့်မှုများ OP: ဆက်လက်ဆောင်ရွက်ရန်။
	ဘူမိဗေဒနှင့် လျှောင်လေ့လာခြင်း	D	D	CO: စီမံကိန်းသည် OP: မြေထုပေါ်တွင် မတည်ရှိသောကြောင့် သက်ရောက်မှု မရှိနိုင်ပါ။	CO: - OP:
	မြေအောက်အရာများ	D	B-	CO: သက်ရောက်မှုများ မရှိနိုင်ပါ။ တွင်းရေကို အသုံးပြုနိုင်ပါသည်။ OP: မြေအောက်ရေ ထုတ်ယူသုံးစွဲမှု ရေရှည်သုံးစွဲနိုင်သော်လည်း စီမံကိန်းက ထောက်ပံ့ပေးသော ရေကို အဓိက အသုံးပြုပါမည်။	CO: မြေအောက်ရေ ထိန်းချုပ်အသုံးပြုမှု။ OP: စက်ရုံအတွက် မြေအောက်ရေ ထုတ်ယူသုံးစွဲမှုကို ထိန်းချုပ်ခြင်း။
	မြေနာပြင်ရေ ဇီဝဗေဒ	B-	A-	CO: မျက်နှာပြင်ရေစီးဆင်းမှုနှင့် အလုပ်တဲများမှ စွန့်ထုတ်မှုများ သည် ရေဇီဝဗေဒကို ညစ်ညမ်းစေပါသည်။ OP: ရေထုထဲသို့ စွန့်ပစ်ပစ္စည်းများ စွန့်ထုတ်ခြင်း (ခွန်ချောင်းနှင့် ထားဝယ်မြစ်)	CO: စွန့်ထုတ်မှုအရည်အသွေးနှင့် အလုပ်တဲများ၏ မိလ္လာ စနစ်ကို ထိန်းချုပ်ရန်။ OP: စွန့်ပစ်ရေသန့်စင် စက်ရုံမှ စွန့်ထုတ်မှုများကို ထိန်းချုပ်ခြင်း။
စီးပွားရေး	အဆောက်အဦး	B-	B+	CO: အဆောက်အဦးများ	CO: ဆောက်လုပ်ရေးနှင့်

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများနှင့် သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ကဏ္ဍ	အကဲဖြတ်မှုရလဒ် CO	အကဲဖြတ်မှုရလဒ် OP	ရလဒ်ဖော်ပြချက်	သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ
ဖွံ့ဖြိုးတိုးတက်မှု	နှင့် ဝန်ဆောင်မှုများ	/B+		တိုးမြင့်ခြင်း (ဥပမာ- လမ်းဆက်သွယ်မှု)။ အလုပ်သမားတဲ မိလ္လာစနစ်မှလွဲ၍ ရေထောက်ပံ့မှုအပေါ် သက်ရောက်မှု၊ လျှပ်စစ်နှင့် စွန့်ပစ်ပစ္စည်း စွန့်ပစ်မှုတို့သည် လက်ရှိစွန့်ပစ်ပစ္စည်း ပြဿနာရပ်များကို ဖြေရှင်းနိုင်မည်ဟု မခန့်မှန်းထားပါ။ **OP:** ကျောင်း၊ ဆေးရုံနှင့် ဆိုင်များသို့ သွားလာရေးစနစ် မြင့်တင်ခြင်း။ အဆောက်အဦးများ အဆင့်မြင့်တင်ခြင်း။	အလုပ်သမားတဲများမှ မိလ္လာစနစ်ကို စီစဉ်ခြင်း။ **OP:** -
	ယဉ်လမ်းကြောနှင့် သယ်ယူပို့ဆောင်ရေး	B-	A-	**CO:** ဆောက်လုပ်ရေးယဉ်များ များလာမှုကြောင့် ယဉ်လမ်းကြော ပိတ်ဆို့မှုများ တိုးလာနိုင်ပါသည်။ **OP:** စီမံကိန်း ဖွံ့ဖြိုးတိုးတက်မှုကြောင့် ယဉ်လမ်းကြော ပိတ်ဆို့မှု။	**CO:** ယဉ်လမ်းကြောပိတ်ဆို့မှု ထိန်းချုပ်ရန် ဆိုင်းဘုတ်များ၊ အချက်ပြများ တပ်ဆင်ခြင်း။ **OP:** အလုပ်သမားများအတွက် လုံလောက်သော သယ်ယူပို့ဆောင်မှု (ဥပမာ- မြို့နှင့် အလုပ်နေရာကြား)။
	မြေအသုံးချမှု	B-	B-	**CO:** အပန်းဖြေအနားယူသည့်	**CO:** အလုပ်သမားတဲများ

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများနှင့် သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ကဏ္ဍာ	အကဲဖြတ်မှုရလဒ်		ရလဒ်ဖော်ပြချက်	သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ
		CO	OP		
				မြေနေရာများကို ကျူးကျော်ဆောင်ရွက်ခြင်း။ **OP:** စက်မှုဇုန်ပတ်ဝန်းကျင် ဖွံ့ဖြိုးတိုးတက်မှု။	အတွက် ယာယီ ဝန်ဆောင်မှုများ ဆောင်ရွက်ခြင်း။ **OP:** DSEZ မြေအသုံးချမှု အစီအစဉ်အတိုင်း ဆောင်ရွက်ခြင်း။
လူမှုပတ်ဝန်းကျင်	လူမှု-စီးပွား	B-/B+	B-/B+	**CO:** ဒေသခံများနှင့် ပဋိပက္ခများ ရှိသော်လည်း အိမ်ထောင်စုတွင် ဝင်ငွေတိုးလာမှု (ဥပမာ- PAHs) **OP:** အလုပ်သမားများလာမှုကြောင့် ဒေသခံနှင့် အလုပ်သမားကြား ပြဿနာများရှိလာနိုင်ပါသည် ။ သို့သော် ဒေသဖွံ့ဖြိုးရေးနှင့် ဒေသခံများ အလုပ်အကိုင်ရရှိပြီး ဝင်ငွေတိုးလာနိုင်ပါသည်။	**CO:** ပြောင်းရွှေ့အလုပ် **OP:** သမားများအတွက် လမ်းညွှန်ချက်များ မျှဝေပေးခြင်း။
	သမိုင်းဝင်နှင့် ယဉ်ကျေးမှုဆိုင်ရာ နေရာများ	D	D	**CO:** သမိုင်းဝင်နှင့် **OP:** ယဉ်ကျေးမှုဆိုင်ရာ နေရာများကို ထိခိုက်နိုင်မှု မရှိပါ။	**CO:** - **OP:**
	ဆန္ဒမပါပဲ နေရာပြောင်းရွှေ့မှု	A-	A-	**CO:** မြေယာပိုင်ဆိုင်မှုလိုအပ်ပြီး ဆန္ဒမပါပဲ နေရာပြောင်းရွှေ့ရမှုများ ရှိနိုင်ပါသည်။	**CO:** ပြန်လည်နေရာချထား **OP:** မှု အစီအစဉ် (RAP) ကို အကောင်အထည်

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများနှင့် သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ကဏ္ဍ	အကဲဖြတ်မှုရလဒ် CO	အကဲဖြတ်မှုရလဒ် OP	ရလဒ်ဖော်ပြချက်	သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ
				OP: ပြောင်းရွှေ့လာသော အိမ်ထောင်စုများ၏ နေထိုင်မှုနှင့် လုပ်ကိုင်စားသောက်မှု။	ဖော်ဆောင်ရွက်ရန်
	နေထိုင်မှုနှင့် လုပ်ကိုင်စားသောက်မှု	A-/B+	A-/B+	CO: OP: စိုက်ပျိုးရေးလုပ်ငန်းဖြင့် ဝင်ငွေရသော PAH များသည် ၄င်းတို့၏ ဝင်ငွေ ဆုံးရှုံးနိုင်သော်လည်း ဆောင်ရွက်ချိန်အတွင်း အလုပ်ကိုင်အခွင့်အလမ်းများ ရှိနိုင်ပါသည်။	CO: OP: ပြောင်းရွှေ့သူများ လုပ်ကိုင်စားသောက်မှု အစီအစဉ် ရေးဆွဲရန်။
	ကလေးများ ရပိုင်ခွင့်	B-	B-/B+	CO: အိမ်နှင့် ကျောင်းများ ပြန်လည်နေရာချထားမှုသည် ကလေးများ၏ ပညာရေးကို ထိခိုက်နိုင်ပါသည်။ OP: အဆောက်အဦးများ တိုးတက်လာခြင်းမှ သွယ်ဝိုက်သော အကျိုးကျေးဇူးများ ရရှိနိုင်ပါသည်။	CO: CSR အစီအစဉ် ဆောင်ရွက်ရန် OP:
	ဒေသခံများကြား အငြင်းပွားမှု	B-	A-	CO: ပြောင်းရွှေ့လာသော အိမ်ထောင်စုများနှင့် မူလရှိနေသောသူများကြား အငြင်းပွားမှုများ ဖြစ်လာနိုင်ပါသည်။	OP: ပြန်လည်နေရာချထားမှု အစီအစဉ် အကောင်အထည်ဖော် ဆောင်ရွက်ရန်။
				OP: ဒေသခံများကို အလုပ်အကိုင်အခွင့်အလမ်း	OP: သင်တန်းနှင့် အလုပ်အကိုင်များ

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများနှင့် သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ကဏ္ဍ	အကဲဖြတ်မှုရလဒ်		ရလဒ်ဖော်ပြချက်	သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ
		CO	OP		
				များ မပေးနိုင်ပါက အကျိုးအမြတ် အငြင်းပွားမှုများ တိုးလာနိုင်ပါသည်။ ပြောင်းရွှေ့လာသော အိမ်ထောင်စုနှင့် လက်ရှိလူများကြား အငြင်းပွားမှုများ မြင့်တတ်နိုင်ပါသည်။	တန်းတူ အခွင့်အရေးပေးရန်။
ကျန်းမာရေးနှင့် လုံခြုံရေး	AIDS/HIV ကဲ့သို့ ကူးစက်တတ်သော ရောဂါအန္တရယ်	B-	B-	**CO:** ဆောက်လုပ်ရေး လုပ်သားတိုးများလာမှုကြောင့် ကူးစက်အန္တရယ်များ ရှိနိုင်ပါသည်။ **OP:** ငှားရမ်းလုပ်ကိုင်သူများ၏ အလုပ်သမားများ များလာမှုနှင့် စီမံကိန်း၏ မြို့ပြချဲ့ထွင်မှုနှင့် ပတ်ဝန်းကျင် ဒေသဆိုင်ရာ ရောဂါများကြောင့် ကူးစက်အန္တရယ် များလာနိုင်ပါသည်။	**CO:** ဆောက်လုပ်ရေး လုပ်သားများအတွက် သင့်တော်သော ပစ္စည်းများနှင့် သင်တန်းများပေးရန်။ **OP:** STD နှင့် ပညာရေး အသိပေးမှုနှင့် ကူးလူးဆက်ဆံမှုဆိုင်ရာ ရောဂါများအကြောင်း အသိပညာပေးရန်။
	OHSA	B-	B-	**CO:** အလုပ်လုပ်ရသည့် အခြေအနေပေါ် မူတည်ပြီး သက်ရောက်မှုများ ရှိနိုင်ပါသည်။ **OP:** စီမံကိန်းနှင့် ငှားရမ်းလုပ်ကိုင်သူ၏ လုပ်ကိုင်မှု	**CO:** EHS နှင့် စံချိန်စံနှုန်းများကို လိုက်နာဆောင်ရွက်ရန်။ **OP:** အလုပ်သမားများအတွက် ကျန်းမာရေးအသိ

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများနှင့် သင့်တော်သော လျှော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ကဏ္ဍ	အကဲဖြတ်မှုရလဒ် CO	အကဲဖြတ်မှုရလဒ် OP	ရလဒ်ဖော်ပြချက်	သင့်တော်သော လျှော့ပါးစေရေး နည်းလမ်းများ
				အခြေအနေပေါ် မူတည်ပြီး သက်ရောက်မှုများ ရှိနိုင်ပါသည်။	ပးနှင့် သင်တန်းများ ဆောင်ရွက်ရန်။
	လူထုကျန်းမာရေးနှင့် လုံခြုံမှု	B-	B-	**CO:** လုပ်ငန်းလည်ပတ်သည့် စက်များနှင့် ယဉ်မတော်တဆဖြစ်ပွားမှုများ တိုးလာနိုင်ပါသည်။ **OP:** အလုပ်သမား များလာမှု၊ ယဉ်မတော်တဆဖြစ်မှုနှင့် မြို့ပြစနစ်ကြောင့် လူထုကျန်းမာရေးနှင့် လုံခြုံရေး သက်ရောက်မှုများ တိုးလာနိုင်ပါသည်။	**CO:** အလုပ်သမားတဲတွင် လိုက်နာရမည့်အချက်များနှင့် မိလ္လာစနစ်များ ဆောင်ရွက်ရန်။ **OP:** လုံလောက်သော ကျန်းမာရေး ဝန်ဆောင်မှုများ ထောက်ပံ့ပေးရန် (ဥပမာ- ဆေးရုံ) ကျန်းမာရေးနှင့် လုံခြုံရေး အသိပေးမှုများ ဆောင်ရွက်ရန်။
	ဓါတုပစ္စည်းများ အသုံးပြုမှု	D	B-	**CO:** ဓါတုပစ္စည်းများ အသုံးမပြုပါ။ **OP:** ငှားရမ်းလုပ်ကိုင်သူများ အသုံးပြုမှု၊ စီမံကိန်းလည်ပတ်မှု (သို့) မတော်တဆ ဖိတ်စင်၊ ယိုဖိတ်မှုများ။	**CO:** - **OP:** ဓါတုပစ္စည်းကိုင်တွယ်မှု စံနှုန်းများကို လိုက်နာပြီး ဖိတ်စင်၊ ယိုဖိတ်မှု ကာကွယ်ခြင်း အစီအစဉ်များကို အကောင်အထည်ဖော် ဆောင်ရွက်ရန်။
အရေးပေါ်	ရေကြီးမှု	B-	B-	**CO:** မိုးကြီးမှုနှင့် ဆိုက်ကလုန်း	**CO:** ရေကြီးရေလျှံ

ဇယား ၁.၅-၁ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများနှင့် သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ကဏ္ဍ	အကဲဖြတ်မှုရလဒ်		ရလဒ်ဖော်ပြချက်	သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ
		CO	OP		
အန္တရာယ်	အန္တရာယ်			OP: အန္တရာယ်။	ကာကွယ်မှု အစီအစဉ် အကောင်အထည်ဖော် ဆောင်ရွက်ရန်။ OP: ရေကြီးမှု ထိန်းချုပ်သည့်စနစ်နှင့် ကာကွယ်သည့်စနစ် ဆောင်ရွက်ရန်။

ဇယား ၁.၅-၂ ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများနှင့် သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ

အမျိုးအစား	ကဏ္ဍ	အကဲဖြတ်မှု ရလဒ်		ရလဒ်ဖော်ပြချက်	သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများ
	မီးဘေး	B-	B-	CO: ဆောက်လုပ်ရေးနှင့် အလုပ်သမားတဲများမှ။ OP: ငှားရမ်းလုပ်ကိုင်သူများ လုပ်ငန်းလည်ပတ်မှုနှင့် လူများကြောင့်။	CO: မီးကာကွယ်မှု အစီအစဉ် အကောင်အထည်ဖော်ဆောင်ရွက်ရန်။ OP: -
	လျှပ်နှင့် ဆူနာမီ	B-	B-	CO: ပြင်းထန်သော လျှပ်နှင့် OP: ဆူနာမီ။	CO: လျှပ်နှင့် OP: ဆူနာမီအတွက် ဆောင်ရွက်ရမည့် လမ်းညွှန်ချက်များ မျှဝေရန်။

အခြား	ကမ္ဘာကြီးပူနွေး လာမှု	B-	B-	**CO:** စက်နှင့် ယဉ်များမှထွက်လာသော GHG ဓါတ်ငွေ့များ။ **OP:** လုပ်ငန်းလည်ပတ်မှု၊ စွန့်ပစ်ရေ သန့်စင်သည့် စက်များ၊ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုကြောင့် GHGs ထုတ်လွှတ်မှု။ ပို့ဆောင်ရေးမှ အများအပြားထွက်ရှိမှု။	**CO:** ဆောက်လုပ်ရေးနှင့် စက်ပစ္စည်း ထိန်းသိမ်းမှု အစီအစဉ်။ **OP:** GHGs ထုတ်လွှတ်မှု နည်းသော စက်ရုံနှင့် ထိရောက်သော နည်းပညာများ တိုးတက်စေရန်။

၁.၅.၁ ဆောက်လုပ်ဆဲကာလ

၁.၅.၁.၁ လေအရည်အသွေး

ဆောက်လုပ်ဆဲကာလအတွင်း လေအရည်အသွေးပေါ် သက်ရောက်နိုင်မှုသည် အောက်ပါအကြောင်းအချက်များအားဖြင့် ဖြစ်နိုင်ချေ ရှိပါသည်။

- ကျောက်မခင်းထားသော သယ်ယူပို့ဆောင်ရေး လမ်းကြောင်းများမှ ဖုန်မှုန့်များ။
- ဆောက်လုပ်ရေးနေရာ၊ ကျောက်ကျင်းများနှင့် လမ်းရှင်းလင်းရေးမှ ဖုန်မှုန့်များ။

အထက်ပါအကြောင်းအချက်များကြောင့် သက်ရောက်မှုများသည် ဆောင်ရွက်မှုနှင့် အလွန်နီးကပ်သော နေရာတွင် ဖြစ်တတ်ပါသည်။ သက်ရောက်မှုများကို ဆောက်လုပ်ဆဲကာလအတွင်းတွင်သာ တွေ့ရပါသည်။ ရေဖျန်းခြင်းနှင့် ကုန်တင်ကားပေါ်တွင် အဖုံးအကာများတပ်ခြင်းကဲ့သို့သော ဖုန်မှုန့်လျော့နည်းစေရေး လုပ်ငန်းများများ ဆောင်ရွက်ရန် လိုအပ်ပါသည်။ အခင်းများ မီးရှို့ခြင်းကို တားမြစ်ထားပြီး လူနေထိုင်မှု အလုပ်သမားတဲများနှင့် ဝေးရာ ဇရိယာများတွင်သာ စုပုံ၍ မီးရှို့ရပါမည်။

၁.၅.၁.၂ ဆူညံမှုနှင့် တုန်ခါမှု

အမြင့်ဆုံး ဆူညံမှုအရင်းအမြစ်မှာ pile-driverမှ 101 dB(A) ဖြစ်ပြီး ခန့်မှန်းဆူညံမှုအဆင့်မှာ 1650 ft (500m) တွင် 70.6 dB(A) ဖြစ်ပါသည်။ ထို့ကြောင့် 101 dB(A) ထက် နိမ့်သော မည့်သည့်အသံမဆို 500m တွင် 70 dB(A)ထက် နိမ့်ပါသည်။ သို့သော်လည်း 500m ထက်နည်းသော အကွာအဝေးရှိ လူနေထိုင်မှုကို ဆူညံသံ သက်ရောက်နိုင်ပါသည်။ ထိုသို့ သက်ရောက်နိုင်သောကြောင့်

ဆောက်လုပ်ရေးလုပ်ငန်းများကို နေ့အချိန်သာဆောင်ရွက်ခြင်း၊ လုပ်ငန်းဆောင်ရွက်မှုအချိန်ကို အနီးအနားရှိ ဒေသခံများနှင့် သဘောတူညီမှုယူခြင်းအားဖြင့် ဆောက်လုပ်ရေးလုပ်ငန်းများကို ထိန်းချုပ်ရပါမည်။

ဆောက်လုပ်ရေးကြောင့် တုန်ခါမှုသည် ထိခိုက်လွယ်သောအနီးအနားတွင် ဖောက်ခွဲမှုများ၊ အစုအပြုံလိုက် မောင်းနှင်ခြင်း၊ vibratory compaction၊ ဖြိုချခြင်းနှင့် စမ်းသပ်တွင်းများ တူးဖော်ခြင်းများကြောင့် ဖြစ်ပေါ်နိုင်ပါသည်။ ဧရိယာ၏ လက်ရှိအခြေအနေအရ တုန်ခါမှုကြောင့် ထိခိုက်လွယ်သော အဆောက်အဦးမြင့်များ မရှိပါ။ ဘုရားနှင့် စေတီကဲ့သို့ အချို့ ဘာသာရေးဆိုင်ရာ နေရာများရှိပါသည်။ သို့သော် ဆောက်လုပ်ရေးလုပ်ငန်းများ ၄င်းနေရာများနှင့် မနီးခင် ၄င်းနေရာများကို ပြန်လည်နေရာချပေးသွားပါမည်။ ဆောက်လုပ်ရေးစက်ပစ္စည်းများမှ တုန်ခါမှုကြောင့် သက်ရောက်မှုအားလုံးသည် မပြောပလောက်ဟု ခန့်မှန်းရပါသည်။

၁.၅.၁.၃ မြေမျက်နှာသွင်ပြင်နှင့် မြေဆီလွှာ

စီမံကိန်း ဆောက်လုပ်ရေးတွင် မြေထုထည်လိုက် ပြောင်းရွှေ့မှုများ ပါဝင်ပါသည်။ တူးထုတ်ရာမှ ထွက်လာသော မြေစာအများစုကို စီမံကိန်းဧရိယာ မြေနိမ့်နေရာများတွင် မြေဖို့ခြင်းအတွက် အသုံးပြုပါသည်။

ဆောက်လုပ်ဆဲကာလအတွင်း မြေမျက်နှာသွင်ပြင် ပြောင်းလဲမှုများနှင့် သက်ရောက်မှုများသည် ကြီးမားနိုင်ပြီး ရှောင်လွှဲမရဟု ခန့်မှန်းထားပါသည်။ အနီးအနားဧရိယာတွင် အခြားမြစ်ဝှမ်းကိုဖြတ်၍ မြေဆီလွှာများ သယ်ယူခြင်းကို တားမြစ်ထားပါသည်။ အပေါ်ယံမြေဆီလွှာကို တတ်နိုင်သမျှ ထိန်းသိမ်းထားခြင်းနှင့် မြေလုပ်ငန်းများ ပြီးသွားသောအခါ ပြန်လည်အသုံးပြုခြင်းသည် မြေဆီသြဇာပြည့်ဝသော မြေဆီလွှာကို ထိန်းသိမ်းထားနိုင်ပါသည်။

၁.၅.၁.၄ မျက်နှာပြင်ရေနှင့် အနည်အနှစ်

ဆောက်လုပ်ဆဲကာလအတွင်း ရေအရည်အသွေးကို သက်ရောက်နိုင်သော ညစ်ညမ်းစေသော အရင်းအမြစ်များမှာ အလုပ်သမားများ၏ အိမ်သုံးစွန့်ပစ်ရေနှင့် စီးဆင်းရေမှ အနည်များဖြစ်ပြီး အထူးသဖြင့် အပင်ရှင်းလင်းရန် လိုအပ်သော မြေဖွံ့ဖြိုးရေးလုပ်ငန်းများတွင် တွေ့ရပါသည်။ ရေနုတ်မြောင်းများနှင့် မြစ်များအတွင်း အနည်အနှစ်များ များလာမှု၊ ရေညစ်ညမ်းမှုကို လျှော့ချရန် ဆောက်လုပ်ရေးနေရာတွင် အနည်အနှစ်ထိန်းချုပ်မှု ဆောင်ရွက်ရန် လိုအပ်ပါသည်။ မြေရှင်းလင်းမှုကို လိုအပ်မှသာ ဆောင်ရွက်သင့်ပါသည်။ အနည်ထိန်းကန်နှင့် အနယ်စစ်ဇယာများကဲ့သို့ ထိန်းချုပ်သည့် နည်းလမ်းများကို ဆောင်ရွက်သင့်ပါသည်။ ဆောက်လုပ်ရေးကာလအတွင်း အနည်အနှစ်များကြောင့် ဖြစ်လာနိုင်သော သက်ရောက်မှုများသည် ဆောက်လုပ်ရေး ကာလအတွင်းတွင်သာ ဖြစ်နိုင်ပါသည်။ သို့သော် ဒေသခံများသည် ၄င်းရေကို စိုက်ပျိုးရေးအတွက်သာ အသုံးပြုကြပါသည်။ ဆောက်လုပ်ရေးအတွက် ရေအသုံးပြုမှုမှာ ရေတိမ်တွင်းမှဖြစ်ပါသည်။ ထို့ကြောင့် သက်ရောက်မှုသည် နည်းနိုင်ပြီး တခဏသာ ဖြစ်ပေါ်နိုင်ပါသည်။

အခြားစိုးရိမ်မှုများမှာ ဝပ်ရှော့မှ ဆီအသုံးပြုမှုဖြစ်ပါသည်။ အသုံးပြုသည့် ဆီများကို ထိန်းချုပ်ရန် လိုအပ်ပါသည်။ ဆောက်လုပ်ရေး ကာလအတွင်း ယိုဖိတ်မှုများ ဖိတ်စင်မှုများ လျော့နည်းစေရေန် ၄င်းဆီများကို သင့်တော်သော သိုလှောင်နေရာတွင် ထိန်းသိမ်းထားရန် အကြံပြုထားပါသည်။

၁.၅.၁.၅ မြေအောက်ရေ

ရေတိမ်မြေအောက်ရေတွင်းများသည် ဆောက်လုပ်ရေးအတွက် အဓိက ရေအရင်းအမြစ်ဖြစ်ပါသည်။ အလုပ်သမားတဲနှင့် ဆောက်လုပ်ရေးမှ သန့်စင်မှုမပြုထားသော စွန့်ပစ်ရေများသည် မြေအတွင်း စိမ့်ဝင်နိုင်ပြီး ညစ်ညမ်းနိုင်ပါသည်။ အထူးသဖြင့် နွေရာသီတွင် မြေအောက်ရေ အများစုသည် ရာသီဥတုနှင့် အလွန်အကျွံသုံးစွဲမှုကြောင့် ခန်းခြောက်နိုင်ပါသည်။ ၄င်းမှဆက်၍ ရေပြတ်လပ်မှုများ ဆက်တိုက် ဖြစ်လာနိုင်ပါသည်။ ထို့ကြောင့် ဆောက်လုပ်ရေးနေရာနှင့် အလုပ်သမားတဲများမှ စွန့်ထုတ်မှုများ (ဥပမာ- အိမ်သာ၊ မိလ္လာ (သို့) မီးဖိုခြောင် စွန့်ထုတ်မှုများကို သန့်စင်မှု ပြုလုပ်သင့်ပါသည်။ ရွေ့လျားနိုင်သော မိလ္လာသန့်စင်မှုစနစ်ကို မြေအောက်ရေညစ်ညမ်းမှု ကာကွယ်ရန် တပ်ဆင်သင့်ပါသည်။ လျော့ပါးစေရေး နည်းလမ်းများကို လိုက်နာဆောင်ရွက်ပါက မြေအောက်ရေအပေါ် သက်ရောက်မှုများသည် နည်းနိုင်ပါသည်။

၁.၅.၁.၆ ဘူမိဗေဒနှင့် ငလျင်လှုပ်လာခြင်း

အခြေခံ အချက်အလက်များ လေ့လာချက်အရ စီမံကိန်းဧရိယာသည် ဇုန် (၁) အတွင်း တည်ရှိပြီး အသေးစားထိခိုက်မှု (မြေအရှိန် 0.075gအတွင်း ရှိပြီး) သည် MMI အတန်းအစား (5)နှင့် ညီမျှနိုင် (သို့) နည်းနိုင်ပါသည်။ ငလျင်တိုင်းတာမှု မှတ်တမ်းများအရ ထားဝယ်နှင့် စီမံကိန်းဧရိယာအတွင်း ငလျင်လှုပ်ရှားမှုများ မရှိခဲ့ပါ။ ထိခိုက်မှုနည်းနိုင်သော်လည်း စီမံကိန်းကို ငလျင်ဆိုင်ရာ အချက်အလက်များအရ ဒေသခံ အာဏာပိုင်များနှင့် ပူးပေါင်းဆောင်ရွက်သင့်ပါသည်။ ထိခိုက်မှု နည်းနိုင်ပါသည်။

၁.၅.၁.၇ အပေါ်ယံ ရေဇီဝဗေဒ

စီမံကိန်းဖွံ့ဖြိုးတိုးတက်မှုသည် လက်ရှိ သဘာဝသစ်တောနှင့် ပေါက်ပင်များအပါအဝင် ဂေဟဗေဒဆိုင်ရာ အခြေအနေများကို ပြောင်းလဲစေပါမည်။ မျက်နှာပြင် ရေစီးဆင်းမှုသည် ရေအရင်းအမြစ်များတွင် အနည်ကျမှုများလာစေပြီး phytoplankton နေရောင်ခြည်သုံး အစာချက်လုပ်မှုကို သက်ရောက်စေပြီး ရေထွက်ရှိမှုကို အတားအဆီး ဖြစ်နိုင်ပါသည်။ ဆောက်လုပ်ရေးနေရာမှ အနည်ထိန်းချုပ်ခြင်း လျော့ပါးစေရေးနည်းလမ်းများကို အကောင်အထည်ဖော် ဆောင်ရွက်ရန် လိုအပ်ပါသည်။

၁.၅.၁.၈ စီးပွားရေးဖွံ့ဖြိုးတိုးတက်မှု

(က) အဆောက်အဦး ဝန်ဆောင်မှုများ

မြေအောက်ရေ၊ ဒီဇယ်စက် (သို့) LNG ပါဝါစက်ရုံတို့သည် ရေနှင့် လျှပ်စစ်အတွက် အရင်းအမြစ်များ ဖြစ်ပါသည်။ ထို့ကြောင့် ဒေသခံများ၏ လက်ရှိ ရေနှင့် လျှပ်စစ် အသုံးပြုမှုများကို သက်ရောက်မှုမရှိပါ။

စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲခြင်းဝန်ဆောင်မှု မဆောင်ရွက်မီ အန္တရယ်ရှိ စွန့်ပစ်ပစ္စည်းများကို ယာယီထိန်းသိမ်းထားပါမည်။ ဆောက်လုပ်ရေး ကာလအတွင်း အန္တရယ်မရှိ စွန့်ပစ်ပစ္စည်းများ စွန့်ပစ်ရန် နေရာကို သတ်မှတ်ပေးရန် လိုအပ်ပါသည်။ ၎င်းသည် အကျိုးရှိသော သက်ရောက်မှု ဖြစ်ပါသည်။

(ခ) ရေထောက်ပံ့မှု

ဆောက်လုပ်ဆဲကာလအတွင်း ITD ရေထောက်ပံ့မှုစနစ်ဖြင့် ရေပိုက်သည် ဆောက်လုပ်ရေးတဲများအတွက် ရေအရင်းအမြစ် ဖြစ်ပါမည်။ ဆောက်လုပ်ရေးကာလတွင် အလုပ်သမား ၁၂၀၀ ယောက်အတွက် တစ်ရက်လျှင် ရေ ၁၂၀ ကုဗမီတာကို ထုတ်ပေးပါမည်။ ဆောက်လုပ်ရေးနေရာမှ မြေအောက်ရေတွင်းများသည် အကြမ်းသုံးရန် ဖြစ်ပါသည်။ ထို့ပြင် ဒေသခံများသည် ရေတိမ်တွင်းများမှလည်း အသုံးပြုကြပါသည်။ ထို့ကြောင့် ဆောက်လုပ်ရေးမစမီ အနီးအနားရွာများကို အပြီး ပြန်လည်နေရာချထားပေးပါက ပတ်ဝန်းကျင်လူထုကို သက်ရောက်မှု သိပ်မရှိနိုင်ပါ။ သို့သော်လည်း အပေါ်ယံရေနှင့် မြေအောက်ရေအတွက် အကြံပြုထားသော လျော့ပါးစေရေးနည်းလမ်းများကို ဆောက်လုပ်ရေးကာလအတွင်း တင်းတင်းကျပ်ကျပ် ဆောင်ရွက်ရပါမည်။

(ဂ) စွန့်ပစ်ရေ သန့်စင်မှု

လုပ်ငန်းခွင်မှ အလုပ်သမားများ အပါအဝင် ဝန်ထမ်း ၁၂၀၀၏ နေ့စဉ်လုပ်ဆောင်မှုမှ စွန့်ပစ်ရေထုတ်လွှတ်မှုသည် organic အနည်အဖတ် ၁၁၅ ကီလိုဂရမ်ပါဝင်သော ၉၆ ကုဗမီတာတွင် BOD ပါဝင်မှု ၂၀၀ mg/l ပါဝင်ပါသည်။ သန့်စင်မှုမပြုလုပ်ထားပါက ၎င်းအနည်အဖတ်များသည် အနံ့ဆိုးများ၊ မြင်မကောင်းသော အခြေအနေများ၊ စီးဆင်းရေညစ်ညမ်းခြင်းနှင့် မြေအောက်ရေအရည်အသွေး၊ နှင့် အောက်ဆီဂျင်မဲ့အခြေအနေမှ ထွက်လာသော မီသိမ်းဓါတ်ငွေ့ကြောင့် ကမ္ဘာကြီးပူနွေးလာမှုပါ ဖြစ်လာနိုင်ပါသည်။ တစ်ဆက်တည်းမှာပင် သဘာဝစီးဆင်းရေများသို့ မစွန့်ထုတ်ခင် ရေတစ်လီတာတွင် BOD ၂၀ မီလီဂရမ်ပါဝင်နေမှု လျော့နည်းစေရန် စွန့်ပစ်ရေသန့်စင်မှုစနစ်ကို တပ်ဆင်ရပါမည်။ မီးဖိုချောင်နှင့် ကန်တင်းစွန့်ပစ်ရေများကို သန့်စင်ရန် ဆီစစ်ကိရိယာ တပ်ဆင်ရန် အကြံပြုထားပါသည်။ ဆီနှင့် ဆီဂျီးများသည် ပမာဏများလာလျှင် ပိုက်လိုင်းများပိတ်ခြင်း၊ ရေပေါ်မျောနေသော ဆီများက Oxygen ပါဝင်မှုကို ပြောင်းလဲစေနိုင်ပြီး ငါးများ၊ ပုဇွန်များ အပင်များကို သက်ရောက်နိုင်ပါသည်။ သို့သော် လူနေမှု အဆောက်အဦး၊ ဆောင်ရွက်မှုများကို သက်ရောက်ခြင်း မရှိပါ။ သို့သော် ဆောက်လုပ်ဆဲကာလအတွင်း မြေပေါ်၊ မြေအောက်ရေများအတွက် လျော့ပါးစေရေးနည်းလမ်းများကို တင်းတင်းကျပ်ကျပ် ဆောင်ရွက်ရန် အကြံပြုထားပါသည်။

(ဃ) အစိုင်အခဲ အညစ်အကြေး စီမံခန့်ခွဲမှု

ထားဝယ်နှင့် စီမံကိန်းဧရိယာအနီးအနားတွင် သင့်တော်သော အစိုင်အခဲစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု မရှိပါ။ အလုပ်သမားများ နေထိုင်မှုမှ တစ်ရက်လျှင် အစိုင်အခဲ အညစ်အကြေး ၁၂၀၀ ကီလိုဂရမ် ထုတ်မည်ဟု ခန့်မှန်းထားပြီး ထုထည်အားဖြင့် ၃၆၀ လီတာရှိပါသည် (density of solid waste = 1,000 kg / 300 liter)။ ဤအစိုင်အခဲ စွန့်ပစ်မှု အနည်းငယ်ကို နေရာတွင်ပုံထားပြီး ၎င်းတို့ကို ရိုးရိုးအမှိုက်၊ ပြန်သုံးနိုင်သော

အမှိုက်နှင့် အန္တရယ်ရှိ အမှိုက်အဖြစ် ခွဲခြားပါမည်။ အရောင်သုံးရောင်နှင့် အမှိုက်ပုံးများကို အစိုင်အခဲအမှိုက်များအတွက် ထားရှိထားပါသည်။ စက္ကူ၊ ဖန်၊ ပလပ်စတစ်၊ သတ္တုကဲ့သို့ အစိုင်အခဲစွန့်ပစ်ပစ္စည်းများကို ပြန်အသုံးပြု၍ရပြီး အချိန်အနည်းငယ် သိုလှောင်ထားရန်အတွက် ဧရိယာ လိုအပ်ပါသည်။ ဘတ္တရီခြောက်၊ မီးလုံး၊ သုတ်ဆေးပုံး၊ စပရေးဘူးကဲ့သို့ အန္တရယ်ရှိ စွန့်ပစ်ပစ္စည်းများအတွက် စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု ဆောင်ရွက်ချက်များ မဆောင်ရွက်ခင်အထိ ယာယီ သိုလှောင်ထားရန် လိုအပ်ပါသည်။ အန္တရယ်မရှိသော ရိုးရိုးအမှိုက်များအတွက် စွန့်ပစ်ရာနေရာကို စီမံထားရန် လိုပါသည်။ စွန့်ပစ်ပစ္စည်းစွန့်ပစ်မှုကြောင့် အနီးအနားရွာများကို သက်ရောက်မှု မရှိသော်လည်း စီမံကိန်းပိုင်ရှင်သည် လျော့ပါးစေရေး နည်းလမ်းများကို ဆောင်ရွက်ရန် အကြံပြုပါသည်။

(င) ယဉ်သွားလာမှုနှင့် သယ်ယူပို့ဆောင်ရေး

စီမံကိန်းဧရိယာအတွင်း ဆောက်လုပ်ရေးပစ္စည်းများ သယ်ယူခြင်းသည် ဤအဆင့်အတွင်း အဓိက ယဉ်သွားလာမှု ဖြစ်ပါသည်။ ဘိလပ်မြေ၊ သံချည်သံကွေးနှင့် အခြားပစ္စည်းများကဲ့သို့ ဆောက်လုပ်ရေးပစ္စည်းများကို ထိုင်းနိုင်ငံမှ တင်သွင်းပါမည်။ ဆိပ်ကမ်းမှ အဓိကသယ်ယူရာလမ်းကြောင်းကို မည်သည့် ရွာများကိုမျှ ဖြတ်မသွားဘဲ ၃ ကီလိုမီတာကျော်ခန့်တွင် ရှိသော အဓိကလမ်းမကြီးနှင့် ဆက်သွယ်ထားပါသည်။

သို့သော်လည်း ကုန်တင်ယဉ်အသေးစားကဲ့သို့ ယဉ်အသေးများသွားလာမှုသည် စီမံကိန်းမတိုင်မီထက် စီမံကိန်းကာလတွင် ပိုများနိုင်သည်ဟု ခန့်မှန်းထားပါသည်။ ထို့ကြောင့် စီမံကိန်းတွင် အသုံးပြုသော ယဉ်များနှင့် ဒေသခံလူထု အဓိကအသုံးပြုသော မော်တော်ဆိုင်ကယ်နှင့် မတော်တဆထိခိုက်မှုများ တိုးလာနိုင်ပါသည်။

မတော်တဆထိခိုက်မှုများလျော့နည်းစေရန် စီမံကိန်းယဉ်များ မကြာခဏ အသုံးပြုသော လမ်းတလျောက်တွင် ဆိုင်းဘုတ်များ တပ်ဆင်ထားပါမည်။ လမ်း၏ အမြင်နှင့် ကွေ့ကြောများကို တဖြည်းဖြည်း အဆင့်မြင့်သွားပါမည်။

(စ) မြေအသုံးပြုမှု

ဆောက်လုပ်ရေး စတင်သောအခါ ပုဂ္ဂိုလ်ရေးဆိုင်ရာ ရွှေ့ပြောင်းမှုများ များလာပါမည်။ အဓိကမှာ လုပ်အားခနဲနဲနှင့် ဆောက်လုပ်ရေးအလုပ်သမားများဖြစ်ပါမည်။ ၎င်းတို့သည် အစားအစာ၊ သန့်ရှင်းရေး၊ ပို့ဆောင်ရေးနှင့် အထူးသဖြင့် ဆောက်လုပ်ရေးဝင်းတွင် တရားဝင်ခွင့်ပြုမထားသော ဖျော်ဖြေရေးနှင့် အပန်းဖြေခြင်းတို့ကဲ့သို့ အချို့တန်ဖိုးနည်း အခြေခံဝန်ဆောင်မှုများကို ဒေသခံများကို မှီခိုကြရပါမည်။ အဓိကလမ်းမနှင့် နီးသော နေရာ၊ အလုပ်သမားတဲနှင့် လုပ်ငန်းခွင် ဝင်ပေါက်ကဲ့သို့သော နေရာများတွင် ယာယီအဆောက်အဦးများ ရှိပါမည်။ ၎င်းအခွင့်မရှိသော အဆောက်အဦးများသည် အမြဲတမ်းအဆောက်အဦးများထက် အချိန်ပိုယူသော်လည်း သပ်ရပ်မှု၊ လုံခြုံမှု၊ မိလ္လာစနစ်များ မလိုအပ်ပါ။ သတ်မှတ်ထားသော မြို့နယ်ဖုံကို အစီအစဉ်အတိုင်း ဆောင်ရွက်နေစဉ်တွင် အလုပ်သမားဝန်ဆောင်မှုအတွက် တရားဝင် ဧရိယာများသည် တဲများနှင့် ဆောက်လုပ်ရေးနေရာသို့

အဆင်ပြေသော အကွာအဝေး အနေအထားကြောင့် မရရှိသေးပါ။ မြေအသုံးချမှုအရ အလုပ်သမားများအတွက် လိုအပ်သော ၄င်းယာယီဆောင်ရွက်မှု၊ အဆောက်အဦးများကို ပုံမှန်စောင့်ကြပ်ကြည့်ရှုရန် လိုအပ်ပါသည်။ နေရာပြန်လည်ချထားမှု လိုအပ်ပါသည်။ သို့မှသာ စီမံကိန်းအတွက် ဆောင်ရွက်မှုအများစု (သို့) အားလုံးသည် သတ်မှတ်ထားသော မြို့နယ်ဖုံ အပြင်ဘက်တွင် ပျံ့နှံ့နေခြင်းကို ခွင့်ပြုမည်မဟုတ်ပါ။

(ဆ) ပါဝါ အရင်းအမြစ်နှင့် ဆယ်သွယ်မှု

တဲများတွင် လျှပ်စစ်မီးကို ဆောက်လုပ်ရေးကာလအတွင်း တပ်ဆင်ထားသော ဒီဇယ်စက် (သို့) LNG ပါဝါစက်ရုံမှ ရရှိပါမည်။ ဒေသခံပြည်သူများ လက်ရှိအသုံးပြုမှုနှင့် နောင်အသုံးပြုမှုအတွက် သက်ရောက်မှု မရှိနိုင်ပါဟု ခန့်မှန်းရပါသည်။

၁.၅.၁.၉ လူမှုရေးနှင့် ယဉ်ကျေးမှုကဏ္ဍ

(က) လူမှုစီးပွားအခြေအနေ

စီမံကိန်းဆောင်ရွက်မှုနှင့် အစီအစဉ် ဗဟုသုတ မရှိခြင်းသည် လူထု တွေ့ဆုံညှိနှိုင်းဆွေးနွေးပွဲမှ ရရှိသော အဓိကအကြောင်းအချက် ဖြစ်ပါသည်။ ၄င်းသည် မကောင်းသော ကောလဟာလနှင့် စီမံကိန်း အယူအဆလွဲမှုများကို ဖြစ်ပေါ်စေပါသည်။ အချက်အလက်များသည် ဒေသခံများကို အပြည့်အဝ ချပြထားသည်ကို သေချာစေရန် ပြင်ဆင်ဆဲနှင့် ဆောက်လုပ်ဆဲကာလတွင် လုပ်ရိုးလုပ်စဉ်အတိုင်း စီမံကိန်းကို ဒေသခံများထံ အသိပေးရန် လိုအပ်ပါသည်။ ထိုသို့ လုပ်ဆောင်မှုသည် စီမံကိန်းနှင့် ဒေသခံများကြား ရင်းနှီးမှုနှင့် ယုံကြည်မှုများကို တိုးမြင့်လာနိုင်ပါသည်။ ပြည်သူလူထု၏ ပါဝင်ဆွေးနွေးမှုများကို စုစည်းပြီး တွေ့ဆုံပွဲအတွင်း ပြန်လည်ဖြေကြားပေးပါမည်။

စက်ရုံများသည် နှစ်စဉ် လုပ်သားအင်အားအားလုံး၏ ရာခိုင်နှန်းအချို့ကို မြန်မာလုပ်သားများ ခန့်ထားလျှင် ထားဝယ် အထူးစီးပွားရေးဇုန် ဥပဒေ လိုအပ်ပါသည်။ ယင်းအပြင် ဒေသခံများ၏ ဗဟုသုတနှင့် ကျွမ်းကျင်မှုသည် စက်ရုံလိုအပ်ချက်များနှင့် မကိုက်ညီပါက အခြားဒေသမှ မြန်မာအလုပ်သမားများကို ခန့်ထားရပါမည်။ ဒေသခံလူထု၏ ကျွမ်းကျင်မှုတိုးတက်စေရန် လုပ်ငန်းခွင်သင်တန်းနှင့် အလုပ်ရှုံဆွေးနွေးပွဲများကို ဆောက်လုပ်ရေးကာလတည်းက ပြင်ဆင်ဆောင်ရွက်ပေးရန် လိုအပ်ပါသည်။

(ခ) သမိုင်းဝင်နေရာများနှင့် ယဉ်ကျေးမှုဆိုင်ရာ နေရာများ

ယဉ်ကျေးမှုနှင့် သမိုင်းဝင်နေရာများကို ကွင်းဆင်းမှတ်သားပြီး စီမံကိန်းမြေပုံပေါ်တွင် ရှင်းလင်းစွာ မှတ်သားထားရန် လိုအပ်ပါသည်။ တပြိုင်တည်း မောင်းနှင်မှုကဲ့သို့ တုန်ခါမှုဖြစ်ပေါ်စေသော ဆောက်လုပ်ရေးလုပ်ငန်းများကို ဒေသခံများ၏ ခွင့်ပြုချက်မရဘဲ ၄င်းတို့အနီးတွင် ဆောင်ရွက်မှုများ မပြုရန် တားမြစ်ထားပါသည်။

လက်ရှိနေရာမှ စေတီဘုရားများ နေရာရွှေ့ပြောင်းမှုကို လူထုတွေ့ဆုံဆွေးနွေးပွဲမှ ရလဒ်များပေါ် အခြေခံ၍ ဆောင်ရွက်ရန် လိုအပ်ပါသည်။ ပြန်လည်နေရာချထားသော ဧရိယာတွင် အဆောက်အဦးသစ်များနှင့် အသုံးအဆောင်များ ပြီးစီးပါက လူထုပြောင်းရွှေ့မှုမပြီးခင် စေတီဘုရားအသစ်များ အရင်ပြီးစီးရန် လိုအပ်ပါသည်။

<u>လူထုနှင့် အလုပ်ခွင် ကျန်းမာရေး</u>

ဆောက်လုပ်ရေးကာလအတွင်း ဖြစ်နိုင်ချေရှိသော သက်ရောက်မှုများကို အောက်တွင် ဆွေးနွေးထားပါသည်။

(ဂ) လုပ်ငန်းခွင်ကျန်းမာရေးနှင့်လုံခြုံမှု

<u>မတော်တဆထိခိုက်မှုနှင့် ဒဏ်ရာရမှု</u>

ဆောက်လုပ်ရေးကာလအတွင်း မတော်တဆ ထိခိုက်မှုနှင့် ဒဏ်ရာရမှုများသည် အထူးသဖြင့် မလေ့ကျင့်ထားသော အလုပ်သမားများတွင် ဖြစ်နိုင်ပါသည်။ ထိခိုက်မှုများသည် အသေးအဖွဲမှ ဒုက္ခိတဖြစ်လောက်သော ထိခိုက်မှု (သို့) အသက်ဆုံးနိုင်လောက်သည်အထိ ရှိနိုင်ပါသည်။ လျှပ်စစ်ပစ္စည်းများ မှားယွင်းမှု၊ ထိခိုက်မှု၊ ပြတ်ရှဒဏ်ရာ၊ ပြုတ်ကျမှု၊ မျက်လုံးယားယံမှုနှင့် မီးလောင်မှုတို့သည် ဖြစ်နေကျဖြစ်ပြီး အရိုးကျိုးခြင်း၊ ပြင်းထန်စွာ ထိခိုက်မှုများလည်း တွေ့ရနိုင်ပါသည်။ ၄င်းအပြင် ယဉ်မတော်တဆဖြစ်မှုလည်း ဖြစ်လာနိုင်ပါသည်။ ထို့ကြောင့် တားမြစ်မှုနှင့် လျော့ပါးစေရေးနည်းလမ်းများ ဆောင်ရွက်ရန် လိုအပ်ပါသည်။

<u>လုပ်ငန်းခွင်ဆိုင်ရာ၊ လိင်ပိုင်းဆိုင်ရာနှင့် ကူးလူးဆက်ဆံမှုဆိုင်ရာ ရောဂါများ</u>

ဖုန်မှုန့်၊ ဂတ်စ်၊ ဓါတုပစ္စည်းများ (သို့) ပျော်ရည်ကဲ့သို့ အလုပ်ခွင်တွင် ညစ်ညမ်းပစ္စည်းများ ထိတွေ့နေရမှုကြောင့် အသက်ရှုလမ်းကြောင်းဆိုင်ရာ ရောဂါများ ပိုမိုဆိုးဝါးလာနိုင်ပါသည်။ အန္တရယ်ရှိ ဓါတုစွန့်ပစ်ပစ္စည်းများကြောင့် ပန်းနာရင်ကျပ်၊ ဓါတ်မတည့်ခြင်း၊ အစာအိမ်နာ (သို့) စိတ်ပုံမှန်မဟုတ်ခြင်းကဲ့သို့ နာတာရှည်ရောဂါများ ဖြစ်လာနိုင်ပါသည်။ ထို့အပြင် ဆူညံသံတုန်ခါမှုနှင့် လုပ်ငန်းခွင် အပူချိန်များလည်း ရှိနိုင်ပါသည်။ အလုပ်သမားများသည် အလုပ်အသစ်၊ ခက်ခဲသောအလုပ်နှင့် နေသားမကျသေးသော ပတ်ဝန်းကျင်နှင့် တွေ့ကြုံရနိုင်ပါသည်။ ထို့ကြောင့် စိတ်ပင်ပန်းမှု၊ စိုးရိမ်ပူပန်မှုနှင့် သွေးတိုးခြင်းတို့ ဖြစ်လာနိုင်ပါသည်။ အိမ်နှင့် ဝေးရာတွင်နေရသောကြောင့် အလုပ်သမားများသည် အရက်ယမကာ သောက်စားခြင်း၊ ဆေးလိပ်သောက်ခြင်းများ များလာနိုင်ပါသည်။

ထို့အပြင် တကိုယ်ရေသန့်ရှင်းမှုနှင့် ပတ်ဝန်းကျင်မိလ္လာစနစ်အားနည်းခြင်းတို့ကြောင့် ဝမ်းပျက်ဝမ်းလျော၊ အသည်းရောင်နာနှင့် ကူးလူးဆက်ဆံမှုရောဂါများ တိုးလာနိုင်ပါသည်။ ၄က်ဖျား၊ တုတ်ကွေးနှင့် ဒေသဆိုင်ရာ ရောဂါများသည် အလွယ်တကူ ကူးစက်ပျံ့နှံ့နိုင်ပါသည်။ လိင်ပိုင်းဆိုင်ရာ ကူးစက်ရောဂါနှင့် HIVs ရောဂါအတွက် ပြင်းထန်သော ကာကွယ်ထိန်းချုပ်မှုများ လိုအပ်ပါသည်။

အရေးပေါ်တုန့်ပြန်မှုနှင့် ရှေးဦးသူနာပြုနည်း

မီးတောက်သော ပစ္စည်းများကို မီးညှိခြင်း (သို့) ဓါတ်ပြုဓါတုပစ္စည်းများမှ မီးနှင့် ပတ်သက်၍ မတော်တဆများ ထိခိုက်မှုများ ဖြစ်နိုင်ပါသည်။ ထို့ကြောင့် မီး၊ ပေါက်ကွဲမှုနှင့် ဓါတုယိုစိမ့်မှုများနှင့် ပတ်သက်၍ အရေးပေါ်တုန့်ပြန်မှုအစီအစဉ်ကို ဆောင်ရွက်ထားသင့်ပါသည်။

စီမံကိန်းပိုင်ရှင်သည် လုပ်ငန်းခွင်တွင် အချိန်ပြည့် ရှေးဦးသူနာပြုပစ္စည်းများကို ထောက်ပံ့ထားပါသည်။ သို့သော်လည်း ဝေးလံသော နေရာတွင် ဆောက်လုပ်ဆဲကာလ အချိန်ပြည့်ဆောင်ရွက်နေသောအခါ သင့်တော်သော အဆင်ပြေသည့် ရှေးဦးသူနာပြုပစ္စည်းများကို ထောက်ပံ့သင့်ပါသည်။အရေးပေါ်အခြေအနေများနှင့် ကြုံသောအခါ သေချာစေရန် အရည်အသွေးကောင်းသော ရှေးဦးသူနာပြုပစ္စည်းများကို ထားရှိသင့်ပါသည်။ လူနာများကို အချိန်မှီ သင့်တော်သော ဆေးခန်းဆေးရုံများသို့ ပို့ဆောင်ပေးသင့်ပါသည်။

(ဃ) လူထုကျန်းမာရေး

ဆောက်လုပ်ဆဲကာလအတွင်း စီမံကိန်း ဆောင်ရွက်မှုများတွင် စီမံကိန်းဆောင်ရွက်မှု နယ်ပယ်ကို ကျော်လွန်ပြီး အချို့သက်ရောက်မှုများ ရှိနိုင်ပါသည်။ စီမံကိန်းဧရိယာ ပတ်ဝန်းကျင်ရှိ လူထုတွင် အမျိုးမျိုးသော ပြဿနာများ သက်ရောက်နိုင်ပါသည်။

လူနေထိုင်မှုနှင့် မိလ္လာစနစ်

စီမံကိန်းပိုင်ရှင်သည် ဆောက်လုပ်ရေးသမားများအတွက် သင့်တင့်သော နေထိုင်မှု ဝန်ဆောင်မှုများ ထောက်ပံ့ထားသော်လည်း အလုပ်သမားအရေအတွက်တိုးလာခြင်းနှင့် အခြားစက်ရုံများ တိုးလာခြင်းကြောင့် နေထိုင်မှု ဝန်ဆောင်မှု အများအပြား စီမံကိန်းအပြင်ဘက်တွင် များလာနိုင်ပါသည်။ ၄င်းသည် လူထုကျန်းမာရေး ဝန်ဆောင်မှုများ၊ ပြည်သူကျန်းမာရေး ဝန်ဆောင်မှုများနှင့် မိလ္လာစနစ်တို့တွင် အဆင်မပြေမှုများ ဖြစ်လာပါမည်။ လက်ရှိ ဒေသအာဏာပိုင်မှ ဆောင်ရွက်ပေးထားသော လူထုကျန်းမာရေးဝန်ဆောင်မှုသည် အကန့်အသတ်နှင့်သာ ဖြစ်ပါသည်။ မသင့်တော်သော ရေနုတ်မြောင်း၊ ရေဆိုးနှင့် အစိုင်အခဲစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုသည် ရောဂါများ ဖြစ်ပေါ်လာနိုင်ပါသည်။ ထို့ကြောင့် သက်ရောက်မှုများကို လျှော့ချရန် ပြည့်စုံလုံလောက်သော၊ နစ်လိုဖွယ်ကောင်းသော ဝန်ဆောင်မှုများကို ထောက်ပံ့ပေးသင့်ပါသည် (ဥပမာ- အစိုင်အခဲ စွန့်ပစ်ပစ္စည်းစွန့်ပစ်မှု)။

ပတ်ဝန်းကျင်ဆိုင်ရာ၊ ကူးလူးဆက်ဆံမှုဆိုင်ရာ ရောဂါများ

ဆောက်လုပ်ရေးလုပ်ငန်းနှင့် ပို့ဆောင်ရေး လုပ်ငန်းများကြောင့် အသက်ရှူလမ်းကြောင်းရောဂါနှင့် စိတ်အနှောင့်အယှက်ဖြစ်စေသော ဖုန်မှုန့်နှင့် ဆူညံသံများ ရှိနိုင်ပါသည်။

လုပ်သားပြောင်းရွှေ့မှုများကြောင့် HIV/ AIDS ကဲ့သို့သော လိင်ပိုင်းဆိုင်ရာ ကူးစက်ရောဂါများသည် ကူးလူးဆက်ဆံမှုဆိုင်ရာ ရောဂါများထဲတွင် အဖြစ်အများဆုံး ဖြစ်လာပါလိမ့်မည်။ ၄င်းရောဂါများသည် ကျယ်ကျယ်ပြန့်ပြန့် ပျံ့နှံ့နိုင်ပါသည်။ မိလ္လာစနစ် ညံ့ဖျင်းမှုကြောင့် ငှက်ဖျား၊ တုတ်ကွေး၊ ဝမ်းရောဂါ၊ အသည်းရောဂါ၊ အဆုတ်ရောင်နာနှင့် အဆုတ်ရောဂါများလည်း ဖြစ်လာနိုင်ပါသည်။

ပြောင်းရွှေ့လာသော အလုပ်သမားများသည် စီမံကိန်းဧရိယာသို့ ရောဂါများ သယ်လာနိုင်ပါသည်။ ထိုသို့ ဖြစ်လာလျှင် ဒေသခံများသို့ ရောဂါအသစ်များ ရောက်ရှိလာပါမည်။ အအေးပတ်ခြင်း၊ တုတ်ကွေးနှင့် အသက်ရှုလမ်းကြောင်းဆိုင်ရာကူးစက်မှုများလည်း ဖြစ်လာနိုင်ပါသည်။ အရက်သောက်သုံးမှုများလာခြင်း၊ ဆေးလိပ်သောက်သုံးမှု များလာခြင်း၊ အလုပ်သမားများ ရွှေ့ပြောင်းလာမှု တိုးလာခြင်းနှင့် လူမှုရေးဆိုင်ရာ အနှောင့်အယှက်များကိုလည်း ကြိုတင်မျှော်လင့်ထားရပါမည်။ ထိုသို့ ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများကို လျော့ချရန် သင့်တော်သော လျော့ပါးစေရေး နည်းလမ်းများကို အကောင်အထည်ဖော်သင့်ပါသည်။

<u>မတော်တဆထိခိုက်မှု၊ မီးဘေးနှင့် ဓါတုယိုစိမ့်မှု</u>

ညံ့ဖျင်းသော လမ်းအခြေအနေနှင့် စိတ်မချရသော ယဉ်ပို့ဆောင်မှုများကြောင့် လူငယ်များကြားတွင် ယဉ်ကြောင့် မတော်တဆ ထိခိုက်ဒဏ်ရာရမှုများ ဖြစ်ပေါ်စေနိုင်ပါသည်။ မတော်တဆထိခိုက်မှုများသည် ဆောက်လုပ်ရေးသုံး ပစ္စည်းများ သယ်ယူခြင်း (သို့) gasoline၊ ပျော်ရည်နှင့် ချောဆီများကဲ့သို့ ဓါတုပစ္စည်းများ သယ်ယူစဉ်အတွင်း ဖြစ်ပေါ်နိုင်ပါသည်။ ၄င်းမတော်တဆထိခိုက်မှုများမှတစ်ဆင့် မီးလောင်ခြင်း၊ ပေါက်ကွဲမှု (သို့) အဆိပ်ရှိ ဓါတုပစ္စည်းများ ပတ်ဝန်းကျင်သို့ ယိုစိမ့်ခြင်းများ ဖြစ်ပေါ်နိုင်ပါသည်။ ထို့ကြောင့် အရေးပေါ် တုန့်ပြန်မှု အစီအစဉ်ကို ဆောင်ရွက်သင့်ပါသည်။

<u>ကျန်းမာရေးဆောင်ရွက်ချက်များ ပြည့်စုံမှုနှင့် အသင့်ပြင်ဆင်ထားရှိမှု</u>

ဒေသကျန်းမာရေး ဆောင်ရွက်မှုနှင့် တစ်ဦးချင်းကျန်းမာရေးဆောင်ရွက်မှုများသည် လက်ရှိတွင် အကန့်အသတ်နှင့် ဖြစ်ပါသည်။ သို့သော်လည်း ဒဏ်ရာရရှိမှုနှင့် ဖျားနာမှုများသည် တိုးလာနိုင်ပါသည်။ ထို့ကြောင့် ကျန်းမာရေး ဆောင်ရွက်မှုများအပေါ် ဖိအားများ လျော့ချရန် လျော့ပါးစေရေး ဆောင်ရွက်ချက်များကို ဆောင်ရွက်သင့်ပါသည်။

၁.၅.၂ လုပ်ငန်းလည်ပတ်ဆဲအဆင့်

၁.၅.၂.၁ လေအရည်အသွေး

ထားဝယ်စက်မှုဇုန် စီမံကိန်း (SEATEC နှင့် UAE 2014) ၏ EIA အစီရင်ခံစာထဲတွင် AERMOD အမျိုးအစား တွက်ချက်မှုအရ လေထုထဲသို့ထုတ်လွှတ်မှုသည် အဆိုးဆုံး အခြေအနေတွင် ရှိနေပါသည်။ ထို့ကြောင့် ကနဦး အခြေအနေအတွက် ထုတ်လွှတ်မှုထိန်းချုပ်မှုအဖြစ် PM10၊ NO_2 နှင့် SO_2 ၏ ထုတ်လွှတ်မှုများကို အကြံပြုထားပါသည်။ PM10၊ NO_2 နှင့် SO_2 ထုတ်လွှတ်မှု နှုန်းသည် 0.0025, 0.003125

and 0.0075 kg/ha/day ထက်မကျော်လွန်စေဘဲ စက်မှုဇုန်ပတ်ဝန်းကျင် ဖွံ့ဖြိုးတိုးတက်မှုနှင့် အနီးအနားရှိ လူထု၏ ကျန်းမာရေးကို မထိခိုက်အောင် တင်းတင်းကျပ်ကျပ် စီစဉ်ထားသင့်ပါသည်။

သို့သော်လည်း 2.5 micron (PM2.5) ထက် သေးသော အမှုန်များ (သို့) သေးငယ်သော အမှုန်များသည် အသက်ရှူလမ်းကြောင်းတွင်းသို့ ဝင်နိုင်သဖြင့် WHO မှ ညစ်ညမ်းစေသည်ဟု သတ်မှတ်ထားပါသည်။ $PM_{2.5}$ နှင့် ကြာရှည် ထိတွေ့ရလျှင် နလုံးရောဂါဖြင့် သေဆုံးနှုန်း 10 μg/m3 of $PM_{2.5}$ တွင် 6-13 % ထိရှိနိုင်ပါသည်။ ရေဘူးယျအားဖြင့် $PM_{2.5}$ သည် အင်ဂျင်နှင့် မော်တော်ယဉ်များ ဒီဇယ်လောင်ကျွမ်းခြင်းကြောင့် ထွက်လာသော PM_{10}၏ ၅၀%နှင့် ညီမျှပါသည်။ စီမံကိန်း စောင့်ကြည့်မှုများအတွက် အထူးသဖြင့် စွန့်ပစ်ပစ္စည်း မီးရှို့စက်များကို အကြံပြုပါသည်။

ထို့ပြင် ဤစီမံကိန်းတွင် အခြားစဉ်းစားရန်လိုသော လေညစ်ညမ်းစေသော အခြားအရာမှာ မီးရှို့စက်မှ ထွက်လာသော dioxin ဖြစ်ပါသည်။ dioxin သည် ပတ်ဝန်းကျင်တွင် အမြဲရှိနေသော ညစ်ညမ်းမှုတစ်ခုဖြစ်ပြီး အစာကွင်းဆက်တွင် စုပုံလာနိုင်ပါသည်။ Dioxin သည် အပူချိန် 450 Degree Celsius (°C) တွင် ဖြစ်ပေါ်ပြီး အပူချိန် 850 Degree Celsius (°C)တွင် သိသိသာသာ လျော့ကျသွားပါသည်။ မီးရှို့စက်အတွင်း လုပ်ဆောင်မှုများမှာ အလွန် ရှုပ်ထွေးပြီး dioxin ဖြစ်ပေါ်စေနိုင်သော လောင်ကျွမ်းမှုအပူချိန်ဖြစ်ရန် အကြောင်းအချက် များစွာရှိပါသည်။ Dioxin ထုတ်လွှတ်မှုနည်းစေသော ထုတ်လုပ်မှုနှင့် မီးရှို့စက်များ ရွေးချယ်မှုကို အကြံပြုထားပါသည်။

လေမဲ့ leachate treatment လုပ်ခြင်းနှင့် အမှိုက်ပုံနေရာမှ ထွက်လာသော ဖန်လုံအိမ်ဓါတ်ငွေ့များထဲမှ တစ်ခုဖြစ်သော မီသိန်းဓါတ်ငွေ့ သည်လည်း ထည့်သွင်းစဉ်းစားရန်လိုပါသည်။ ဖန်လုံအိမ်ဓါတ်ငွေ့ထုတ်လွှတ်မှု ပမာဏကို လျော့ချရန်အတွက် မီသိန်းဓါတ်ငွေ့အပါအဝင် ဓါတ်ငွေ့စစ်ကိရိယာများကို တပ်ဆင်ရပါမည်။

၁.၅.၂.၂ ဆူညံသံနှင့် တုန်ခါမှု

လည်ပတ်ဆဲကာလအတွင်း ဆူညံမှုအရင်းအမြစ်များသည် ထုတ်လုပ်မှုပေါ် မူတည်ပြီး အမျိုးမျိုး ဖြစ်နိုင်ပါသည်။ ထိုအရင်းအမြစ်တွင် ဆူညံမှု ထိန်းချုပ်မှုသည် နယ်နိမိတ်အပြင်ဘက်တွင် သက်ရောက်မှုများကို ထိန်းချုပ်ရန် အထိရောက်ဆုံး ဖြစ်ပါသည်။ ဆူညံမှု မြင့်မားသော စက်များကို အများအားဖြင့် အလုံပိတ် အဆောက်အဦးများတွင် တပ်ဆင်ကြပါသည်။ ထုတ်လုပ်မှု တစ်ခုစီ၏ ခြံစည်းရိုးတွင် ဆူညံမှုအဆင့်ကို စောင့်ကြည့်စစ်ဆေးရန် လိုအပ်ပြီး Leq24hr သည် 70 dB(A) ထက် မကျော်လွန်စေရပါ။ ကနဦးအဆင့် စက်မှုဇုန် ဧရိယာအပြင်ဘက်တွင် ဆူညံသံ သက်ရောက်မှုသည် မပြောပလောက်ပါ။ 80 dB(A) ထက် ဆူညံမှုအဆင့် မြင့်မားသော နေရာတွင် အလုပ်လုပ်သော အလုပ်သမားများ၊ ဝန်ထမ်းများအတွက် နားကျပ် (သို့) နားအုပ်များ တပ်ဆင်ရန် လိုအပ်ပါသည်။

၁.၅.၂.၃ မြေမျက်နှာသွင်ပြင်နှင့် မြေဆီလွှာ

လုပ်ငန်းလည်ပတ်စဉ်တွင် အသုံးပြုသော ဓါတုပစ္စည်းများ ပါဝင်မှုကြောင့် မြေဆီလွှာ အရည်အသွေးအား သက်ရောက်နိုင်မှုသည် ဓါတုပစ္စည်းများအား စနစ်မကျ ကိုင်တွယ်ခြင်းနှင့် ယိုဖိတ်ခြင်းတို့ကြောင့် ဖြစ်ပေါ်နိုင်ပါသည်။ စုပေါင်း စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုကို မြေဆီလွှာ ညစ်ညမ်းမှု ဖြစ်နိုင်သော ဧရိယာတွင် ဆောင်ရွက်ပါမည်။

စက်ရုံတစ်ခုစီတွင် သင့်လျော်သော ဓါတုသိုလှောင်မှု ဧရိယာများ လိုအပ်ပါသည်။ အထည်ချုပ်၊ ရက်ထည်နှင့် လျှပ်စစ်ပစ္စည်း စက်ရုံများကဲ့သို့ ဓါတုပစ္စည်း စွန့်ပစ်မှုများသော စက်ရုံများသည် ယိုဖိတ်မှုနှင့် ကာကွယ်မှုနည်းလမ်းများပါသော ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှု အကဲဖြတ်ခြင်း (EIA) ဆောင်ရွက်ရန် လိုအပ်ပါသည်။ စီမံကိန်းသည် ယိုဖိတ်မှုနှင့် အရေးပေါ် တုန့်ပြန်မှု အစီအစဉ်ကို ဆောင်ရွက်ရပါမည်။ မြေဆီလွှာ ညစ်ညမ်းနိုင်မှုကို ၄င်းနည်းလမ်းများ ဆောင်ရွက်ခြင်းဖြင့် ကန့်သတ်ထားနိုင်ပါသည်။

၁.၅.၂.၄ မျက်နှာပြင်ရေနှင့် အနည်အနှစ်များ

ကနဦးအဆင့် လုပ်ငန်းလည်ပတ်မှုသည် စွန့်ပစ်ပစ္စည်း အမျိုးမျိုးကို ထုတ်လုပ်ပါလိမ့်မည်။ ကောင်းစွာ မကိုင်တွယ်ပါက အထက်ပါ ဘေးထွက်ပစ္စည်းများသည် ခွန်ချောင်းနှင့် ထားဝယ်မြစ်ရှိ ရေနှင့် အနည်အရည်အသွေးကို ညစ်ညမ်းစေနိုင်ပါသည်။ စက်မှုဇုန်တစ်ခုစီမှ စက်ရုံစွန့်ပစ်ရေအားလုံးကို စွန့်ပစ်ရေ သန့်စင်စက်ရုံတွင် သန့်စင်ပါမည်။ စက်ရုံဧရိယာမှ စွန့်ပစ်ရေကို စုဆောင်းပြီး ဗဟိုစွန့်ပစ်ရေသန့်စင်စက်ရုံသို့ ရွှေ့ပြောင်းပါမည်။

စက်ရုံမှ စွန့်ပစ်ရေများကို ထိုင်းနိုင်ငံ စက်မှုဇုန် အာဏာပိုင် (IEAT) (သို့) အခြား သင့်တော်သော လိုအပ်ချက်များကို ပြည့်မီရန် အကြိုသန့်စင်ပါမည်။ အကြိုသန့်စင်ထားသော စွန့်ပစ်ရေများကို စုပေါင်းပြီး ဇုန်တစ်ခုစီရှိ စွန့်ပစ်ရေ သန့်စင်စက်ရုံသို့ ပို့ပေးပါမည်။ စွန့်ပစ်ရေသန့်စင်စက်ရုံမှ ထွက်လာသော သန့်စင်ပြီး စွန့်ပစ်ရေများကို စက်ရုံနှင့် စက်မှုဇုန်များ (သို့) အခြား လိုအပ်ချက်များအတွက် စံချိန်စံညွှန်းများနှင့် လိုက်နာဆောင်ရွက်ပါမည်။ သန့်စင်ပြီး စွန့်ပစ်ရေကို ရေနုတ်မြောင်းမှ လွှဲပေးပြီး ခွန်ချောင်းမြစ်တွင်းသို့ စီးဝင်စေပြီး နောက်ဆုံးတွင် ထားဝယ်မြစ်ထဲသို့ ပို့ပါမည်။

၁.၅.၂.၅ မြေအောက်ရေ

မြေအောက်ရေ အရည်သွေးကို သက်ရောက်နိုင်သော စီမံကိန်း ဆောင်ရွက်ချက်သည် အမှိုက်ပုံနေရာများရှိသော စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုများ ဖြစ်ပါသည်။ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုများအတွက် မြေအောက်ရေ စောင့်ကြည့်မှု အစီအစဉ် လိုအပ်ပါသည်။ စီမံကိန်း တည်နေရာသည် တောင်တန်းများ ဝန်းရံထားသော မြေနိမ့်ဒေသဖြစ်ပြီး ဇလဗေဒအရ ကမ်းရိုးတန်း ဧရိယာသို့ စီးဝင်ပြီး လူနေထိုင်ရာနေရာရှိ မြေအောက်ရေကို သက်ရောက်မှုမရှိနိုင်ပါ။ စီမံကိန်း အပြည့်အဝ စတင်သည့်အခါ မြေအောက်ရေအသုံးပြုမှုသည် သင့်တော်သော အကန့်အသတ်နှင့်သာ ဖြစ်ပါမည်။ သို့သော်လည်း စက်မှုဇုန် ဧရိယာဝန်းကျင်နှင့် စီမံကိန်း ဧရိယာထဲရှိ ဒေသခံများ အသုံးပြုနေသော ရှိပြီးသား မြေအောက်ရေ၊

ရေတွင်းများ စောင့်ကြည့်မှု အစီအစဉ်ကို ဆောင်ရွက်သင့်ပါသည်။ အဘယ့်ကြောင့်ဆိုသော် စက်ရုံများ လုပ်ငန်းလည်ပတ်သည့်အခါ လက်ရှိနေထိုင်နေသော လူထုအားလုံး ပြောင်းရွှေ့ရမည်မဟုတ်သောကြောင့် ဖြစ်ပါသည်။

၁.၅.၂.၆ မြေပေါ်ရေဇီဝဗေဒ

ရေဇီဝဗေဒသည် လက်ခံမည့်ရေလမ်းကြောင်းအတွင်းသို့ စွန့်ပစ်ရေသန့်စင်ရာမှ သက်ရောက်နိုင်ပါသည်။ သင့်တော်သော သန့်စင်မှု မပြုလုပ်လျှင် စက်ရုံများမှ စွန့်ပစ်ရေသည် သက်ရှိနှင့် ၄င်းတို့၏ နေထိုင်ရာနေရာများကို သက်ရောက်စေနိုင်ပါသည်။

သက်ရောက်နိုင်မှုများကို လျှော့ချရန် စက်မှုဇုန်ဧရိယာအတွင်း ရှိသော စက်ရုံများသည် ဗဟိုရေဆိုးသန့်စင်စက်ရုံ၏ စံနှုန်းများနှင့် အညီ ၄င်းတို့၏ စွန့်ပစ်ရေများကို သန့်စင်ရန် လိုအပ်ပါသည်။ စက်မှုဇုန် ဗဟိုရေဆိုးသန့်စင်စနစ်သို့ ဦးစွာပို့ထားပြီးသော စွန့်ပစ်ရေများတွင် heavy metals များပါဝင်သော စက်ရုံများအတွက် ဓါတုသန့်စင်မှုကို ဆောင်ရွက်ရပါမည်။ အစားအစာနှင့် ဆီသွပ်ဘူးစက်ရုံများမှ အဓိက ညစ်ညမ်းမှုများမှ တစ်ခုဖြစ်သော ဆီနှင့် ဆီကြေးများကို ဗဟိုစွန့်ပစ်ရေသန့်စင်စက်သို့ မပို့မီ စွန့်ပစ်ရေများမှ အကြမ်းဖယ်ရှားရန် လိုအပ်ပါသည်။ ဇုန်တစ်ခုစီမှ စွန့်ပစ်ရေ အတန်းအစားနှင့် အရည်အသွေး ပြည့်မီစေရန် ဗဟိုစွန့်ပစ်ရေ သန့်စင်စနစ်ကို ဒီဇိုင်းရေးဆွဲထားပါသည်။ ဗဟိုစွန့်ပစ်ရေ သန့်စင်စက်ရုံ၏ စီးထွက်ရေ စံချိန်စံညွှန်း ဒီဇိုင်းသည် မြန်မာ စံနှုန်း (သို့) IEAT လိုအပ်ချက်များနှင့် ကိုက်ညီပါလိမ့်မည်။

၁.၅.၂.၇ စီးပွားရေးဖွံ့ဖြိုးတိုးတက်မှု

(က) အဆောက်အဦးဝန်ဆောင်မှုများ

<u>ရေထောက်ပံ့မှု</u>

လုပ်ငန်းလည်ပတ်ဆဲကာလတွင် ရေကို တလိုင်းဂတမှမှ ရရှိပါမည်။ ပယင်းဖြူရေလှောင်တမံကို ဇုန်(က) ဖွံ့ဖြိုးမှုအတောအတွင်း ယာယီ အသုံးပြုပါမည်။ ရေများကို စက်မှုဇုန် ဧရိယာအတွင်း မဖြန့်ဝေခင် WHO စံချိန်စံညွှန်းများနှင့် ကိုက်ညီရန် သန့်စင်ပါမည်။

ဖွံ့ဖြိုးမှု ကနဦးတွင် ဇုန် (က) စက်ရုံများအတွက် ပယင်းဖြူ ရေလှောင်တမံမှ တစ်ရက်လျှင် ရေ 18,000 m^3 ထုတ်လုပ်ရန် စီစဉ်ထားပါသည်။ ရေလှောင်တမံထုထည်သည် နှစ်လခန့် ရေထောက်ပံ့ပေးနိုင်သော 1,000,000 m^3 ရှိသောကြောင့် အနီးအနားရှိ လူထု ရေအသုံးပြုမှုကို သက်ရောက်နိုင်မှု မရှိပါ။ သို့သော်လည်း ဖွံ့ဖြိုးမှု အပြည့်အဝဆောင်ရွက်သည့်အခါ ထားဝယ် SEZ ကနဦး စက်မှုဇုန်ဝင်းတွင်း ထောက်ပံ့မှုများ၊ အဆောက်အဦးများ၊ စက်ရုံများအတွက် တစ်ရက်လျှင် ရေလိုအပ်မှု 180,000 m^3 ထိ မြင့်တက်လာနိုင်ပါသည်။ ထို့ကြောင့် စီမံကိန်း ဆောင်ရွက်သူသည် ၄င်းရေအသုံးပြုမှုအတွက် စီမံကိန်းအနီးရှိ ပယင်းဖြူ ရေလှောင်တမံမှ ရေကို ထောက်ပံ့ပေးရပါမည်။

စီမံကိန်းဧရိယာတွင် ရွာကျသော မိုးရေတင်သာမက သန့်သော သန့်စင်ပြီး စွန့်ပစ်ရေများသည် စီမံကိန်း စိန်းလန်းဧရိယာများကို ရေလောင်းခြင်း (သို့) ရေထောက်ပံ့မှု သန့်စင်စက်ရုံအတွက် အကြမ်းသုံးရေအဖြစ် အသုံးပြုပါသည်။ ထို့ပြင် ရေကုန်သက်သာသော စက်များ (သို့) ဆောင်ရွက်မှုများနှင့် စက်ရုံတွင် ရေအအေးခံခြင်းကဲ့သို့သော အချို့ရေများ ပြန်လည်အသုံးပြုခြင်းအားဖြင့် အသုံးပြုရေပမာဏကို လျော့ချနိုင်ပါသည်။

စွန့်ပစ်ရေသန့်စင်ခြင်း

စွန့်ပစ်ရေသန့်စင်စက် # 1 သည် တစ်ရက်လျှင် 12,712 m^3 စွန့်ပစ်ရေသန့်စင်မှုအတွက် ဇုန် A1နှင့် A2 ရှိ စက်ရုံများမှ စွန့်ပစ်ရေသန့်စင်မှုအတွက် ဆောင်ရွက်ပါမည်။ အချို့ အစိုင်အခဲများသည် မျှောနေဆဲအခြေအနေတွင်ရှိပြီး စီးထွက်ရေ စံနှုန်းကို မပြည့်မီသောကြောင့် အစိုင်အခဲ အနည်ထိုင်ခြင်းအတွက် အခြား သန့်စင်မှုများ လုပ်ဆောင်ရန် လိုအပ်ပါသည်။ ထို့ကြောင့် အစိုင်အခဲ အနည်ကျစေသော စစ်ဆေးကန် #1 ကို အကဲဖြတ်ရပါမည်။ ကန်၏ ထုထည်သည် 24,852 m^3 ရှိပြီး အနည်ထိုင်ချိန် နှစ်ရက်ရှိသောကြောင့် မျှောနေသော အစိုင်အခဲတိုးလာခြင်းကို ထိန်းချုပ်ရန် ရေညှိပေါက်ပွားမှုကို ထိန်းချုပ်နိုင်ပါသည်။ စစ်ဆေးကန် #2 သည် စီးထွက်ရေများ စွန့်ထုတ်မှု အချိန်ပြည့် စံချိန်စံညွှန်းများနှင့် ကိုက်ညီရန် စီးထွက်ရေ ထိန်းကန်အဖြစ် ဆောင်ရွက်ပါမည်။ ပိုသေချာစေရန် စီးဝင်နှင့် စီးထွက်ရေ နှစ်ခုလုံး၏ စီးဆင်းမှုများအတွက်နှင့် စီးထွက်ရေ BOD ပါဝင်မှုအတွက် online စောင့်ကြည့်မှုစနစ်ကို အကြံပြုထားပါသည်။

လိုအပ်ချက်ထက် ကျော်လွန်နေသော စီးထွက်ရေများအတွက် စီမံကိန်းက မလိုအပ်သော စီးထွက်ရေများကို ထိန်းထားရန် နှစ်ရက်စာလုံလောက်သော ကန်အလွတ်ကို စီမံပေးရပါမည်။ ထို့နောက် ပြန်လည်သန့်စင်ရန် aerated lagoon ဆီသို့ စုပ်တင်ပါမည်။ ၎င်းသန့်စင်မှုတွင် အောက်ဆီဂျင်ပိုလိုအပ်ပြီး အထူးစနစ်များကြောင့် ပိုကောင်းမွန်သော စီးထွက်ရေကို ရရှိပါမည်။

အစိုင်အခဲစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု

စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု ဆောင်ရွက်ချက်ကို ထားဝယ် SEZ စက်မှုဇုန် စီမံကိန်းတွင် ဆောက်လုပ်ရန် စီစဉ်ထားပါသည်။ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုသည် အန္တရာယ်ရှိစွန့်ပစ်ပစ္စည်းနှင့် အန္တရာယ်မရှိ စွန့်ပစ်ပစ္စည်း နှစ်ခုလုံးကို ကိုင်တွယ်နိုင်ပါလိမ့်မည်။ အကယ်၍ ပတ်ဝန်းကျင် ကာကွယ်မှု နည်းလမ်းများ ၎င်းဧရိယာတွင် လုံလောက်သောအခါ ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြည့်မှု အစီအစဉ်သည် စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု ဆောင်ရွက်ချက်နေရာတွင် ဆောင်ရွက်ပါလိမ့်မည်။

စက္ကူ၊ ဖန်၊ ပလပ်စတစ်၊ စတီး၊ အလူမီနီယမ်ကဲ့သို့ ပြန်သုံးနိုင်သော စွန့်ပစ်ပစ္စည်းနှင့် ပြန်သုံးနိုင်ရန် လုပ်၍ရသော စွန့်ပစ်ပစ္စည်းများကို လူ (သို့) ကုမ္ပဏီသို့ ရောင်းရန် စက်ရုံတစ်ခုစီမှ စုဆောင်းပါမည်။ ၎င်းသည် အမှိုက်ပုံနေရာတွင် အစိုင်အခဲ စွန့်ပစ်ပစ္စည်းပမာဏကို လျော့ကျနိုင်ပါသည်။ အစားအစာ စွန့်ပစ်ပစ္စည်းများအတွက် စုပုံခြင်းသည် နည်းလမ်းကောင်းတစ်ခုဖြစ်ပြီး မီသိန်းဓါတ်ငွေ့နှင့် ပုပ်သိုးပျက်စီးသော အရာများသည် ဒေသခံများအတွက် အသုံးဝင်စေနိုင်ပါသည်။ မီသိန်းဓါတ်ငွေ့သည်

ချက်ပြုတ်ရန်အတွက် လျှပ်စစ်နှင့် လောင်စာထုတ်လုပ်ရန် အသုံးဝင်ပါသည်။ ပုပ်သိုးပျက်စီးသော အရာများသည် အပင်များတွင် မြေဆီလွှာဖြည့်ခြင်း (သို့) မြေဆီလွှာ အားဖြည့်ခြင်းများ ပြုလုပ်နိုင်ပါသည်။

စွန့်ပစ်ပစ္စည်းများတွင် (စည်ပင်နှင့် စက်ရုံ အစိုင်အခဲစွန့်ပစ်ပစ္စည်း) နှင့် (အန္တရာယ်မရှိနှင့် အန္တရာယ်ရှိသော စွန့်ပစ်ပစ္စည်း) ဟူ၍ နှစ်မျိုးရှိပါသည်။ ဤစီမံကိန်းအတွက် အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု ဖွံ့ဖြိုးတိုးတက်မှု ဆောင်ရွက်စဉ်အတွင်း (သို့) ပထမအဆင့်တွင် စီမံကိန်းပိုင်ရှင်သည် အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများနှင့် စက်ရုံစွန့်ပစ်ပစ္စည်းများကို မြေမြှုပ်ခြင်းပြုလုပ်ပြီး အန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများကို သင့်တော်သော အဆောက်အဦးတွင် သိုလှောင်ထားရန် စီစဉ်ထားရပါမည်။ အစိုင်အခဲ စွန့်ပစ်ပစ္စည်းများ ဇီဝပျက်ဆီးမှုမှ ထွက်လာသော မီသိန်းဓါတ်ငွေ့ကို လေထုအလွှာထဲတွင် ဖန်လုံအိမ်ဓါတ်ငွေ့ လျော့ချရန်အတွက် စုဆောင်းပီး မီးရှို့ရပါမည်။ ချက်ပြုတ်မှုအတွက် မီသိန်းဓါတ်ငွေ့အသုံးပြုခြင်းသည် ရေရှည် ဖွံ့ဖြိုးတိုးတက်မှုအတွက် အခြားနည်းလမ်းတစ်ခု ဖြစ်ပါသည်။

ဖွံ့ဖြိုးတိုးတက်မှု ဒုတိယအဆင့်တွင် တစ်ရက်လျှင် 200 ton ဆောင်ရွက်နိုင်သော မီးရှို့စက်ကို အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်း အတွက် သုံးပြီး အန္တရာယ်ရှိသော စွန့်ပစ်ပစ္စည်းများကို မီးရှို့ရန် အခြား မီးရှို့စက်တစ်လုံးကို နောင်တွင် စီစဉ်ထားရမည်။ persistent environmental pollutants ဖြစ်သော Dioxin သည် စွန့်ပစ်ပစ္စည်း မီးရှို့ခြင်းမှ ထွက်လာပါသည်။ ၎င်းသည် အစာကွင်းဆက်တွင် စုနိုင်ပြီး အထူးသဖြင့် တိရိစ္ဆာန်များ၏ fatty တစ်ရှူးတွင် စုပါသည်။ Dioxin သည် မြင့်မားသော အဆိပ်ရှိ အရာတစ်ခုဖြစ်ပြီး မျိုးပွားခြင်းနှင့် ဖွံ့ဖြိုးမှုပြဿနာ၊ ရောဂါဖြစ်မှု၊ ဟော်မုန်းနှင့် ကင်ဆာရောဂါများကို ဖြစ်ပေါ်စေနိုင်ပါသည်။ လူသားနှင့် ထိတွေ့မှု လျော့ချခြင်း (သို့) တားမြစ်မှုများ (ဥပမာ- dioxin ဖြစ်ပေါ်မှု လျော့ချရန် စက်မှုဇုန် ဆောင်ရွက်မှုများကို တင်းတင်းကျပ်ကျပ် ထိန်းချုပ်ခြင်း)သည် အကောင်းဆုံးဖြစ်ပါသည်။ ထို့ကြောင့် စီမံကိန်း ပိုင်ရှင်သည် dioxin ဖြစ်ပေါ်မှု နည်းသော မီးရှို့စက်များကို ရွေးချယ်ရန်နှင့် အနီးအနား လူနေထိုင်ရာမှ လေထုနှင့် dioxin စောင့်ကြည့်မှုအပါအဝင် 850 Degree Celsius ထက်ပိုသော လောင်ကျွမ်းအခန်းများကို ဆောင်ရွက်ရပါမည်။

(ခ) ယဉ်အသွားအလာနှင့် သယ်ယူပို့ဆောင်ရေး

ဤပြဿနာနှင့်ပတ်သက်၍ ယခင်ဖြေရှင်းချက်များ အများအပြားရှိပါသည်။ လက်ရှိလမ်းနှင့် တတန်းတည်းနီးပါးရှိသော စက်မှုဇုန်ဝင်းအတွင်းရှိ ဒုတိယလမ်းကို ပြည်သူများ (သို့) ရွှေ့ပြောင်းဇရိယာတွင် နေထိုင်သော လူများအတွက် အသုံးပြုရန် ဖွင့်ပေးနိုင်ပါသည်။ သို့သော်လည်း ထိုသို့ ဆောင်ရွက်ခြင်းသည် နေရာ လုံခြုံမှုနှင့် စိတ်ချရမှုတို့ကို ထိခိုက်နိုင်ပါသည်။ နေရာ လုံခြုံမှုနှင့် စိတ်ချရမှုတို့ကို ထိန်းသိမ်းရန်နှင့် တချိန်တည်းတွင် ဒုတိယလမ်းကို ပြည်သူများ ဖြတ်သန်းသွားလာအသုံးပြုခွင့်ပြုရန် ဒုတိယလမ်းသည် အဓိကလမ်းကို ဖြတ်သန်းရန် သင့်တော်သော လမ်းကြောင်းအတိုင်း ဆောက်လုပ်ထားရန် လိုအပ်ပါသည်။

(ဂ) မြေအသုံးပြုမှု

မြေအသုံးပြုမှုတွင် ဆိုးကျိုးသက်ရောက်နိုင်မှုသည် ထားဝယ်မြို့ကိုလည်း သက်ရောက်နိုင်သည်ဟု ခန့်မှန်းထားပါသည်။ စီမံကိန်း လည်ပတ်ဆဲကာလတွင် မြို့နယ်ဇုန်အတွင်း ထောက်ပံ့သော

အခြားတစ်ရက်ပြီးတစ်ရက်ထက် ဆောင်ရွက်မှုများ လိုအပ်ပါလိမ့်မည်။ အတော်အတန် အဆောက်အဦးများနှင့် လူမှု ဝန်ဆောင်မှုများရှိသော ထားဝယ်မြို့နယ်သည် စီမံကိန်းရှိ လူပုဂ္ဂိုလ်များ၏ လိုအပ်ချက်များလိုက်ပြီး အမြန် ဖွံ့ဖြိုးလာပါမည်။ (ဥပမာ- စက်မှုဇုန်ဝင်းအတွင်း မနေထိုင်လိုသော ကြီးကြပ် (သို့) အကြံပေးများ၊ စီမံကိန်းအတွက်လာသော စီးပွားရေး လုပ်ငန်းရှင်နှင့် ဧည့်သည်များ၊ သို့မဟုတ် ဇုန်အတွင်း နေထိုင်ခွင့်မပြုထားသော စီမံကိန်းရှိလူများအတွက် ဆောင်ရွက်နေသော အလုပ်သမားများ နားနေရိပ်သာများ)။ စနေ၊ တနင်္ဂနွေရက်များတွင် အလုပ်သမားအင်အားအတွက် ဖျော်ဖြေရေး ဆောင်ရွက်မှုများကို ထားဝယ်က ဆောင်ရွက်ပေးသွားပါမည်။ မလိုလားအပ်သော အချို့ အသုံးပြုမှုများကို စီမံကိန်း မြို့နယ်ဇုန်တွင် ခွင့်မပြုထားသော်လည်း မြို့၏ အခြားနေရာများတွင် ရှာဖွေသွားပါမည်။ ဤဖျော်ဖြေမှုများအတွက် နယ်မြေသတ်မှတ် ထိန်းချုပ်မှုကို ထားဝယ်မြို့အတွက် ချပြသင့်ပါသည်။

အချုပ်အားဖြင့် စက်မှုဇုန်ပတ်ဝန်းကျင် မြေအသုံးပြုမှုကြောင့် အဓိကဆိုးကျိုးမှာ အထိန်းအချုပ်မရှိ အသုံးပြုမှု ပြဿနာ ဖြစ်ပါသည်။ စီမံကိန်းစတင်ခြင်းနှင့် ဆောက်လုပ်ဆဲ ကနဦးအဆင့်တွင် စိုက်ပျိုးမြေများ နိုင်ငံတော်ကသိမ်းယူထားသော ဒေသခံများကို အစားအစာများနှင့် ဝန်ဆောင်မှုများ၊ ယာယီနေထိုင်စရာများ စီစဉ်ပေးပါမည်။ ထိုယာယီနေထိုင်သူများသည် အချိန်မီ အတည်တကျနေထိုင်နိုင်ပါလိမ့်မည်။ သင့်တော်သော ထိန်းချုပ်မှုမရှိဘဲ စီမံကိန်း လည်ပတ်သည့်အချိန်တွင် ထိုယာယီမြို့များသည် လုံခြုံ စိတ်ချရသော အတည်တကျ လူနေထိုင်မှုများ ဖြစ်လာပါလိမ့်မည်။

(ဃ) ဓါတ်အားလိုင်းသွယ်တန်းမှုများ

ကနဦး စက်မှုဇုန်တွင် လျှပ်စစ်ကို 450 MW ဓါတ်အားရုံမှ ထုတ်ပေးပါမည်။ လက်ရှိ အသုံးပြုမှုများကို သက်ရောက်မှုမရှိဘဲ ဒေသခံများ လျှပ်စစ်ရရှိရန် မျှော်မှန်းထားပါသည်။**Social and Cultural Resources**

၁.၅.၂.၈ လူမှုရေးနှင့် ယဉ်ကျေးမှုဆိုင်ရာ အရင်းအမြစ်များ

(က) လူမှု-စီးပွားအခြေအနေများ

လုပ်ငန်းလည်ပတ်ဆဲကာလတွင် လူမှု- စီးပွားနှင့် လူမှုရေးဆိုင်ရာ ပြဿနာရပ်များသည် အလားတူကိစ္စများ ဖြစ်ပါသည်။

<u>လူထုနှင့် လုပ်ငန်းခွင်ကျန်းမာရေး</u>

လုပ်ငန်းလည်ပတ်ဆဲကာလအတွင်း လူထုနှင့် လုပ်ငန်းခွင် ကျန်းမာရေး အခြေအနေများသို့ သက်ရောက်နိုင်သော အရင်းအမြစ်များကို အောက်ပါအတိုင်း သတ်မှတ်ထားပါသည်။

- စက်မှုဇုန်ထဲတွင် စက်ရုံအမျိုးမျိုး ရှိပါမည်။ စက်ရုံအမျိုးအစား တစ်ခုစီတွင် ပတ်ဝန်းကျင်ဆိုင်ရာ၊ ကျန်းမာရေးနှင့် လုံခြုံရေး သက်ရာက်မှုများ ရှိပါမည်။ မတော်တဆ ထိခိုက်မှုများ အပါအဝင်

ပတ်ဝန်းကျင်နှင့် လုံခြုံရေးသည် အလုပ်သမားများနှင့် လူထုနှစ်ခုလုံးအတွက် ထင်ရှားသော အကြောင်းအချက် ဖြစ်လာနိုင်ပါသည်။

- စက်ရုံအများစုသည် အလုပ်သမား များစွာ လိုအပ်ပြီး နိုင်ငံခြားသား/ ပြောင်းရွှေ့လာသော အလုပ်သမားများနှင့် မကျွမ်းကျင်သေးသော အလုပ်သမားများအပါအဝင် အလုပ်သမားများစွာ ရှိနိုင်ပါသည်။
- စီမံကိန်း ပိုင်ရှင်သည် ဆေးရုံ၊ ကျောင်းနှင့် အခြား အဆောက်အဦးများကို စက်မှုဇုန်ဝင်းအတွင်းတွင် စီစဉ်ပေးရပါမည်။
- ပစ္စည်းများ၊ စက်ကိရိယာများနှင့် ဆက်စပ်နေသော အဆောက်အဦးအမျိုးအစားများလိုအပ်ပါသည်။ ထို့ကြောင့် သယ်ယူပို့ဆောင်ရေး ပမာဏသည် သိသိသာသာ ကျယ်ပြန့်လာပြီး လမ်းတွင် မတော်တဆဖြစ်မှုများနှင့် ဒဏ်ရာအနာတရများ ရရှိနိုင်ပါသည်။
- ပတ်ဝန်းကျင် ဧရိယာတွင် စက်မှုဇုန်ထောက်ပံ့မှုနှင့် လူနေထိုင်မှုများတိုးလာခြင်းသည် အဆောက်အဦးများ၊ လူထုကျန်းမာရေး ဝန်ဆောင်မှုများနှင့် မိလ္လာများလုံလောက်မှုတွင် ဖိအားများ ဖြစ်လာနိုင်ပါသည်။
- စက်ရုံအားလုံးမှ ပတ်ဝန်းကျင်သို့ ညစ်ညမ်းမှုထုတ်လွှတ်ခြင်းသည် လူထုကျန်းမာရေးနှင့် နေထိုင်မှုကို သက်ရောက်နိုင်ပြီး အထူးသဖြင့် ရေရှည်သက်ရောက်မှုများ ဖြစ်လာနိုင်ပါသည်။ အရေးပေါ်အခြေအနေအောက်တွင် ဓါတုပစ္စည်းနှင့် အန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်းများသည် မီးဘေး၊ ပေါက်ကွဲခြင်းနှင့် ဓါတုပစ္စည်း ယိုစိမ့်မှုများ ဖြစ်နိုင်ပါသည်။
- အထူးသဖြင့် သတ္တုသန့်စင်စက်၊ စတီးစက်ရုံ၊ ကျောက်မီးသွေးစက်ရုံနှင့် ရေနံဓါတုစက်ရုံများကဲ့သို့ အရေးကြီးစက်ရုံများတွင် မီးလောင်မှုနှင့် အဆိပ်ရှိ ဓါတုပစ္စည်းများ ယိုစိမ့်ခြင်း အဓိကအန္တရာယ်များ တွေ့ရနိုင်ပါသည်။

၁.၅.၃ ဘေးအန္တရာယ်အကဲဖြတ်ခြင်း

၁.၅.၃.၁ ပတ်ဝန်းကျင်ဆိုင်ရာ ဘေးအန္တရာယ်စီမံခန့်ခွဲမှု- ဆောက်လုပ်ဆဲအဆင့်

ဤစီမံကိန်းအတွက် IE ကန်ထရိုက်တာသည် (က) အသေးစိတ် ပုံစံပြင်ဆင်ခြင်းနှင့် ကိရိယာများနှင့် ဝန်ဆောင်မှုအားလုံး၏ သတ်မှတ်ချက်များ (ခ) စီမံကိန်းဖော်ဆောင်သူသို့ မလွှဲပြောင်းခင် ကုသမှုများနှင့် ဆောက်လုပ်မှုများ (ဂ) စမ်းသပ်မှုနှင့် ကတိကဝတ်များနှင့် ဆက်စပ်နေသော ဝန်ဆောင်မှုများအတွက် တာဝန်ရှိပါသည်။ စီမံကိန်းဆောက်လုပ်ခြင်းနှင့် လုပ်ငန်းလည်ပတ်ဆဲတွင် ပတ်ဝန်းကျင်ဆိုင်ရာ လိုအပ်ချက်များကို ဆောက်လုပ်မှု အသေးစိတ် ပုံစံတွင် ထည့်သွင်း ဆောင်ရွက်ရန် လိုအပ်ပါသည်။ နောက်ဆုံး EIA အစီရင်ခံစာတွင် အကြံပြုထားသော ပတ်ဝန်းကျင်ဆိုင်ရာ လျော့ပါးစေရေး နည်းလမ်းများနှင့် စီမံကိန်းအကောင်အထည်ဖော်သူနှင့် MOECAF မှ လက်ခံမှုများကို IE ကန်ထရိုက်တာနှင့်

၄င်း၏ တစ်ဆင့်ခံ ကန်ထရိုက်တာများမှ စီမံကိန်းအကောင်အထည်ဖော်သူ၏ ဆောက်လုပ်ရေးကြီးကြပ်အကြံပေး၏ ကြီးကြပ်မှုအောက်တွင် အကောင်အထည်ဖော် ဆောင်ရွက်သွားပါမည်။ IE ကန်ထရိုက်တာ၏ ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှုကို စီမံကိန်း အကောင်အထည်ဖော်သူ၏ စီမံကိန်း စီမံခန့်ခွဲမှုအဖွဲ့မှ ဆောင်ရွက်သွားပါမည်။

၁.၅.၃.၂ ပတ်ဝန်းကျင်ဆိုင်ရာ ဘေးအန္တရာယ်စီမံခန့်ခွဲမှု- လုပ်ငန်းလည်ပတ်ဆဲအဆင့်

လုပ်ငန်းလည်ပတ်ဆဲကာလအတွင်း စက်မှုဇုန် လုပ်ငန်းလည်ပတ်ရေး အဖွဲ့သည် နောက်ဆုံး EIA အစီရင်ခံစာတွင် အကြံပြုထားသော ပတ်ဝန်းကျင်ဆိုင်ရာ လျော့ပါးစေရေး နည်းလမ်းများနှင့် စီမံကိန်းအကောင်အထည်ဖော်သူနှင့် MOECAF မှ လက်ခံမှုများကို စက်မှုဇုန် လည်ပတ်မှု တစ်စိတ်တစ်ပိုင်းအဖြစ် အကောင်အထည်ဖော် ဆောင်ရွက်သွားပါမည်။ လုပ်ငန်းလည်ပတ်ဆဲအဆင့်၏ ပတ်ဝန်းကျင်ဆိုင်ရာ ဆောင်ရွက်မှု လိုအပ်ချက်များကို ဆောက်လုပ်ရေး အသေးစိတ် ပုံစံတွင် ထည့်သွင်း ဆောင်ရွက်သွားရန် လိုအပ်ပါသည်။ စက်မှုဇုန်၏ ပတ်ဝန်းကျင်ဆိုင်ရာ ဆောင်ရွက်မှု စောင့်ကြပ်ကြည့်ရှုမှုကို OEMP ရွေးချယ်မှု ဆွေးနွေးချက်အတိုင်း စက်မှုဇုန်အဖွဲ့မှ တာဝန်ယူ ဆောင်ရွက်သွားပါမည်။

လုပ်ငန်းဖြတ်သိမ်းခြင်းနှင့် လုပ်ငန်းလည်ပတ်ဆဲအဆင့်အတွင်း အဓိက ဖြစ်နိုင်ခြေများမှာ အန္တရာယ်ရှိ ဖြစ်ရပ်များ ဖြစ်ပြီး ထိုကဲ့သို့ဖြစ်ပေါ်လာပါက စက်မှုဇုန်ကို ထိခိုက်ပြီး အနီးအနားရှိ လူထုနှင့် လုပ်ငန်းလည်ပတ်သည့် လူများကို ထိခိုက်ဒဏ်ရာ သေဆုံးမှုများ ဖြစ်ပေါ်လာနိုင်ပါသည်။ စက်မှုဇုန်တွင်း အန္တရာယ်များကို ကောင်းစွာနားလည်ပြီး ပုံစံ၊ ဆောက်လုပ်မှု၊ တပ်ဆင်ခြင်း၊ စမ်းသပ်မှု၊ ဖျက်သိမ်းမှု၊ လုပ်ငန်းလည်ပတ်ခြင်းနှင့် ထိန်းသိမ်းမှုများတွင် လေ့ကျင့်မှုများ ဆောင်ရွက်ထားပါမည်။

၁.၆ စုပေါင်း သက်ရောက်မှု အကဲဖြတ်ခြင်း

စီမံကိန်း ဖွံ့ဖြိုးတိုးတက်မှုနှင့် ပတ်ဝန်းကျင်နှင့် သက်ရောက်လွယ်သော အရာများကို ဆန့်ကျင်ပြီး အခြား အတိတ်၊ လက်ရှိနှင့် နောက်ဆောင်ရွက်မည့် လုပ်ဆောင်ချက်များကြောင့် စုပေါင်းသက်ရောက်နိုင်မှုကို သတ်မှတ်ရန် ပတ်ဝန်းကျင်အခြေအနေကို အသုံးပြုနိုင်ပါသည်။ သက်ရောက်နိုင်ခြေ အဆင့်များကို အထက်ပါ ရွေးချယ်မှုများနှင့် အကောင်းဆုံး လက်တွေ့ကျကျ ဝေဖန်ပိုင်းခြားနိုင်မှုများမှ ရရှိသော သတင်းအချက်အလက်များအပေါ် အခြေခံ၍ အကဲဖြတ်ပါသည်။ ဇယား ၁.၆-၁ သည် တန်ဖိုးဖြတ်ခြင်း ရလဒ်ကို ပြသထားပါသည်။

ဇယား ၁.၆-၁ စုပေါင်းသက်ရောက်မှု တန်ဖိုးဖြတ်ခြင်း အခြေအနေ

သက်ရောက်နိုင်ခြေရှိသော ဧရိယာ	Proposed Action	Past Actions	Other Present Actions	Future Actions	Cumulative Impacts
ရုပ်ပိုင်းဆိုင်ဆိုင်ရာ အရင်းအမြစ်					
လေအရည်အသွေး	**			*	**

ဆူညံမှုနှင့် တုန်ခါမှု	*				*
မျက်နှာပြင်ရေနှင့် အနည်အနစ်	**	*	*	**	**
မြေအောက်ရေ	*	*	*	*	*
ဘူမိဗေဒနှင့် ငလျှင်					
ဇီဝဗေဒ အရင်းအမြစ်					
မျက်နှာပြင်ရေနှင့် ဇီဝဗေဒ	*				
စီးပွားရေး ဖွံ့ဖြိုးတိုးတက်မှု					
အဆောက်အဦး ဝန်ဆောင်မှုများ	+				+
ယဉ်သွားလာမှုနှင့် သယ်ယူပို့ဆောင်ရေး	*			**	**
မြေအသုံးပြုမှု	***			**	***
လူမှုရေးနှင့် ယဉ်ကျေးမှု အရင်းအမြစ်များ					
လူမှု- စီးပွား အခြေအနေများ	+			+	+
သမိုင်းဝင်နှင့် ယဉ်ကျေးမှုဆိုင်ရာ အရေးကြီးနေရာများ	**				**
လူထုနှင့် လုပ်ငန်းခွင်ကျန်းမာရေး	*	*	*	**	**

Note: * - ဆိုးကျိုးနည်း ** - ဆိုးကျိုးအတန်အသင့် *** - ဆိုးကျိုးမြင့်မား
+ - ကောင်းသော သက်ရောက်မှု

ဇယား ၁.၆-၁ စုပေါင်းသက်ရောက်မှု တန်ဖိုးဖြတ်ခြင်း အခြေအနေ

၁.၇ ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ်

၁.၇.၁ ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ် သတ်မှတ်ခြင်း

လျော့ပါးစေရေး နည်းလမ်းများ အကောင်အထည်ဖော်ခြင်းအတွက် အဓိက တာဝန်ရှိ အဖွဲ့အစည်းများမှာ မြန်နိုင်ငံ အစိုးရ၊ စီမံကိန်းပိုင်ရှင်၊ ဆောက်လုပ်ရေး ကန်ထရိုက်တာနှင့် တစ်ဆင့်ခံ ကန်ထရိုက်တာ (ဆောက်လုပ်ဆဲအဆင့်အတောအတွင်း) နှင့် ရင်းနှီးမြှုပ်နှံသူများ ဖြစ်ပါသည်။ သို့သော်လည်း စီမံကိန်း၏ ဖွံ့ဖြိုးတိုးတက်မှုသည် လေ့လာရေးကာလတွင် မြန်ဆန်စွာ ပြောင်းလဲသွားနိုင်သည်ကို သိထားသင့်ပါသည်။ ၎င်းတွင် စီမံကိန်း၏ အဖွဲ့အစည်းများနှင့် အခြား သက်ဆိုင်သော အဖွဲ့အစည်းများ ပါဝင်ပါမည်။ အခြေခံ အသုံးပြုသော အချက်အလက်များကို အစီရင်ခံစာ ပြင်ဆင်ချိန်တွင် ခိုင်လုံသော

အကြောင်းအရာအဖြစ် သတ်မှတ်ရပါမည်။ စီမံကိန်း အချက်အလက် ပြောင်းလဲခြင်းများကို အချိန်နှင့်အမျှ တွေ့ရနိုင်သောကြောင့် စစ်ဆေးခြင်းနှင့် အကောင်အထည်ဖော်ချိန်တို့တွင် စီမံကိန်း အသေးစိတ်အချက်အလက်များကို စစ်ဆေးပြီး အတည်ပြုရန် စာဖတ်သူနှင့် စီမံကိန်း အကောင်အထည်ဖော်သူများကို အကြံပြုထားပါသည်။

၁.၇.၂ စီမံကိန်း၏ EHS မူဝါဒနှင့် ကတိကဝတ်၊ နှင့် ဥပဒေဆိုင်ရာ လိုအပ်ချက်များ

ဤစီမံကိန်းအတွက် စီမံကိန်း ပိုင်ရှင်သည် မန်းထားဝယ် စက်မှုဇုန် (မြန်မာ) (MIE) ကိုကိုယ်စားပြုပြီး ၄င်းသည် မြန်မာ အထူးစီးပွားရေးဇုန် ဥပဒေ (၂၀၁၄) အရ ဖွံ့ဖြိုးတိုးတက်အောင်ဆောင်ရွက်သူ ကဏ္ဍအောက်တွင် ရှိပါသည်။ စီမံကိန်းတွင် MIE ကဏ္ဍတွင် ထားဝယ်စက်မှုဇုန်တွင်း ပုံစံ၊ ဆောက်လုပ်မှုနှင့် အဆင်ပြေစေရန်အဆောက်အဦးများ ပါဝင်ပါသည်။ MIE သည် နည်းပညာ စီစဉ်မှု၊ အတည်ပြုခြင်းနှင့် EMP တွင် ပြဌာန်းထားသည့်အတိုင်း ပတ်ဝန်းကျင်ဆိုင်ရာ လျော့ပါးစေရေး နည်းလမ်းများအားလုံးကို စောင့်ကြည့်ခြင်းအတွက် တာဝန်ရှိပါသည်။ စီမံကိန်း ပိုင်ရှင်သည် အုပ်ချုပ်ရေးပိုင်းကို အစီရင်ခံရပါသည်။

ဆောက်လုပ်ရေး ကန်ထရိုက်တာနှင့် တစ်ဆင့်ခံ ကန်ထရိုက်တာများသည် ထားဝယ် ကနဦးစက်မှုဇုန်၏ ကန်ထရိုက်တာနှင့် တစ်ဆင့်ခံ ကန်ထရိုက်တာများနှင့် လွှဲပြောင်းဆောင်ရွက်ပါမည်။ ၄င်းတွင် စုပေါင်း စနစ် ဆောက်လုပ်ခြင်းများ (ရေသန့်စင်ခြင်းနှင့် ဖြန့်ဝေခြင်းစနစ်၊ စွန့်ပစ်ရေ စုဆောင်းခြင်းနှင့် သန့်စင်ခြင်းစနစ်၊ ရေနုတ်မြောင်းစနစ်၊ လျှပ်စစ်ထုတ်လုပ်ခြင်းနှင့် ဖြန့်ဝေခြင်းစနစ်၊ အစိုင်အခဲနှင့် အန္တရာယ်ရှိ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု ဆောင်ရွက်ချက် စသည်ဖြင့်)၊ အတွင်းပိုင်းလမ်းများ၊ နှင့် စက်မှုဇုန်အတွက် အခြေခံ အဆောက်အဦးများ ပါဝင်ပါသည်။ ၄င်းတွင် စက်ရုံတစ်ခုစီ (သို့) ထုတ်လုပ်မှု ဆောင်ရွက်ချက်များ မပါဝင်ပါ။ ဆောက်လုပ်ရေး တစ်ဆင့်ကန်ထရိုက်တာ (CC) သည် ESIA အစီရင်ခံစာတွင် ပြဌာန်းထားသော လျော့ပါးစေရေး နည်းလမ်းများအတိုင်း ဆောင်ရွက်ရပါမည်။ CC သည် စီမံကိန်း ပိုင်ရှင်ကို အစီရင်ခံရပါမည်။

စက်ရုံ၊ ထုတ်လုပ်သူများသည် ရင်းနှီးမြှုပ်နှံသူများကို ကိုယ်စားပြုပြီး စက်မှုဇုန်တွင် ၄င်းတို့အတွက် ဝန်ဆောင်မှုများကို တည်ထောင်၊ လည်ပတ်ပါမည်။ လုပ်ငန်းလည်ပတ်ဆဲကာလအတွင်း စက်ရုံ၏ တာဝန်ရှိသူများ၊ ထုတ်လုပ်သူများ၏ တာဝန်ယူမှုများ ပါဝင်ပြီး ဆောက်လုပ်ဆဲနှင့် လုပ်ငန်းလည်ပတ်ဆဲကာလအတွင်း MIE ပတ်ဝန်းကျင်ဆိုင်ရာ လိုအပ်ချက်များနှင့်အညီ ဆောင်ရွက်ပါမည်။

၁.၇.၃ CEMP အကျဉ်းချုပ်နှင့် အကောင်အထည်ဖော်ခြင်းအတွက် အစီအစဉ်

၁.၇.၃.၁ ဆောက်လုပ်ရေး

ဆောက်လုပ်ရေးကာလအတောအတွင်း စီမံကိန်းသည် ကနဦး စက်မှုဇုန် တည်ဆောက်ခြင်းတွင် ကြုံတွေ့ခဲ့ရသော ပတ်ဝန်းကျင်ဆိုင်ရာ အနှောင့်အယှက်များမှလွဲ၍ အဓိက ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုများကို မျှော်မှန်းထားရပါမည်။ စီမံကိန်း အကောင်အထည်ဖော်သူသည်

ဆောက်လုပ်ဆဲကာလအတွင်း သက်ရောက်မှုများကို လျော့ကျစေရန် အကောင်းဆုံး ကြိုးစားအားထုတ်ပါမည်။ စီမံကိန်း အကောင်အထည်ဖော်သူသည် Contractor-CEMP သည် Owner-CEMP တွင် ဖော်ပြထားသည့်အတိုင်း ကနဦး စက်မှုဇုန်ပုံစံနှင့် ဆက်စပ်နေသော ဝန်ဆောင်မှုများ၊ ဆောက်လုပ်ရေး နည်းလမ်းများ၊ နှင့် အသေးစိတ်အချက်များကို လိုက်နာခြင်းဖြင့် လျော့ပါးစေရေး နည်းလမ်းများအားလုံးကို လိုက်နာဆောင်ရွက်ပါမည်။

ဆောက်လုပ်ရေးကာလအတွင်း လေထုအရည်အသွေးကို အဓိက သက်ရောက်နိုင်ခြေများမှ တစ်ခုမှာ ဆောက်လုပ်ရေးဧရိယာနှင့် ပလက်ဖောင်းမခင်းထားသော လမ်းများမှ ဖုန်မှုန့်များ ဖြစ်ပါသည်။ အခြား အရင်းအမြစ်များမှာ ဆောက်လုပ်ရေးတွင် အသုံးပြုသော စက်များမှ ထွက်လာသော အမှုန်များ ဖြစ်ပါသည်။ ဆောက်လုပ်ရေးသုံး စက်များသည် အနီးအနားရှိ လူထုကို သက်ရောက်စေနိုင်သော ဆူညံသံများကိုလည်း ထုတ်ပေးပါသည်။ MIE ဆောက်လုပ်ရေးကာလအတွင်း လေထုညစ်ညမ်းမှုနှင့် ဆူညံသံများ ထုတ်လွှတ်မှုကို လျော့ချရန် အောက်ပါနည်းလမ်းများကို CC သို့ သတိပေးကြေငြာပါမည်။ ဆောက်လုပ်ရေးသုံး ယဉ်များမှ အငွေ့များသည် လက်ခံနိုင်ပါသည်။ သို့သော်လည်း စက်ကိရိယာနှင့် ယဉ်များအားလုံးသည် စက်ပိုင်းဆိုင်ရာ အခြေအနေ၊ ဆူညံသံထွက်ပေါ်သည့် နေရာ (မီးအားပေးစက်၊ ရေစက်များကဲ့သို့) များကို ကောင်းမွန်နေအောင် ထိန်းသိမ်းထားပြီး ရွာ၊ ဆောက်လုပ်ရေးတဲများနှင့် ပြန်လည်နေရာချထားသော ဧရိယာများမှ ဝေးနိုင်သမျှ ဝေးအောင် ထားရပါမည်။ ဆောက်လုပ်ရေးကို ရွာမှ ၅၀၀ မီတာအကွာတွင် ဆောင်ရွက်ပြီး ပြန်လည်နေရာချထားရေး ဧရိယာကို 06:00 မှ 18:00 အတွင်း ဆောင်ရွက်ပါမည်။ အမှုန်များ ဖြစ်ပေါ်စေသော ဝန်ပါသည့် အမိုက်ကားများကို လူထုကြားဖြတ်သန်းသည့်အခါ ဖုံးအုပ်ထားပါမည်။ ဆောက်လုပ်ရေး ဧရိယာနှင့် မခင်းထားသော လမ်းများကို တစ်ရက်လျှင် နှစ်ကြိမ် ရေဖျန်းပေးရန် လိုအပ်ပါသည်။

MIE သည် အထက်တွင် ဖော်ပြထားသော နည်းလမ်းများအတိုင်း CC သည် လိုက်နာခြင်းရှိမရှိ စောင့်ကြည့်ခြင်းအတွက် တာဝန်ရှိပါသည်။ စောင့်ကြည့်မှုအစီအစဉ်သည်-

- CC၏ အရည်အသွေးမြင့် စက်များအားလုံးသည် အနည်းဆုံး ခြောက်လ အာမခံရှိပြီး စက်တစ်ခုခြင်းစီ၏ ထိန်းသိမ်းမှုမှတ်တမ်း စစ်ဆေးခြင်း
- ဖုန်မှုန့်လျော့နည်းစေရေး နည်းလမ်းများကို လျော့ပါးစေရေး နည်းလမ်းများအတိုင်း အကောင်အထည်ဖော်ထားမှုကို စစ်ဆေးခြင်း
- စွန့်ပစ်ပစ္စည်းများ မီးရှို့ခြင်းကို လျော့ပါးစေရေး နည်းလမ်းများအတိုင်း ဆောင်ရွက်ခြင်းကို စစ်ဆေးခြင်း
- ဖုန်မှုန့်နှင့် ဆူညံသံကြောင့် လူထုနစ်နာစေသည့် အကြောင်းအရာများကို စစ်ဆေးပြီး လျော့ပါးစေရေး နည်းလမ်းများအတိုင်း လိုက်နာဆောင်ရွက်မှု တုန့်ပြန်မှုများကို သေချာစေခြင်း
- ထပ်၍ နွေရာသီနှင့် မိုးရာသီများတွင် ခြောက်လတိုင်း စက်မှုဇုန် ဧရိယာနှင့် အနီးအနားရှိ ရွာများတွင် လေထု အရည်အသွေး နမူနာကောက်ယူခြင်းကို ဆက်လက်လုပ်ကိုင်ရန် အကြံပြုထားပါသည်။

၁.၇.၃.၂ လုပ်ငန်းလည်ပတ်ခြင်း

လုပ်ငန်းလည်ပတ်ဆဲ ကာလအတောအတွင်း စီမံကိန်းပိုင်ရှင်အဖြစ် MIEသည် စက်မှုဇုန်တစ်ခုလုံး၏ ပတ်ဝန်းကျင်ဆိုင်ရာ ဆောင်ရွက်မှုများ ဆောင်ရွက်ရမည့် ပတ်ဝန်းကျင်ဆိုင်ရာ မူဝါဒနှင့် ဥပဒေများကို အကောင်အထည်ဖော်ရပါမည်။ ထိုအချက်ကို အကောင်အထည်ဖော် ဆောင်ရွက်ရန် ဒေသပတ်ဝန်းကျင်ဆိုင်ရာ စည်းမျဉ်းစည်းကမ်းများ မရှိခြင်းမှာ အရေးအကြီးဆုံးဖြစ်ပြီး မြန်မာနိုင်ငံ ပတ်ဝန်းကျင်နှင့် ညစ်ညမ်းမှု ထိန်းချုပ်ခြင်းအတွက် အာဏာပိုင်များတွင် အပြည့်အဝ တာဝန်ရှိပါသည်။ တစ်ကြိမ် ပြဌာန်းပြီးပါက MIE သည် ထိုမူဝါဒနှင့် စည်းကမ်းများကို လိုက်နာဆောင်ရွက်ပါမည်။ သို့သော်လည်း အနာဂတ်တွင် ပတ်ဝန်းကျင်ဆိုင်ရာ ကာကွယ်ခြင်း ဥပဒေကို မြန်မာနိုင်ငံ အစိုးရအားက ကြေငြာ ထုတ်ဝေပြီး MIE သည် မူဝါဒတွင် ပြဌာန်းထားသော လိုအပ်ချက်အတိုင်း ဥပဒေကို လိုက်နာ ဆောင်ရွက်ပါမည်။

စက်ရုံမှ လောင်ကျွမ်းမှု ထုတ်လွှတ်မှုများသည် အဓိက အချက်များ ဖြစ်ပါသည်။ အထက်ပါ ဆောင်ရွက်ချက်များမှ လေထုညစ်ညမ်းစေမှုတွင် PM10, SO_x, NO_x, နှင့် VOCs တို့ ပါဝင်ပါသည်။ နိုင်ငံတကာ စံချိန်စံညွှန်းများကို မကျော်လွန်စေရန် စက်ရုံအပြင်ဘက် ညစ်ညမ်းမှုအများဆုံးပမာဏကို ကန့်သတ်ထားရန် ကိန်းဂဏန်းအချက်အလက်များ ကိုအခြေခံပြီး မြေဧရိယာတွင် လက်ခံနိုင်သော ပမာဏကို ခန့်မှန်းရပါမည်။

လေထု ထုတ်လွှတ်ခြင်းအတွက် လျော့ပါးစေရေး နည်းလမ်းများကို အောက်တွင် ဖော်ပြထားပါသည်။

- စုပုံထားသော အရင်းအမြစ်များမှ PM10 ထုတ်လွှတ်မှုသည် 0.0025 kg/ha/day ထက် မကျော်ရ။
- စုပုံထားသော အရင်းအမြစ်များမှ NO_2 ထုတ်လွှတ်မှုသည် 0.003125 kg/ha/day ထက် မကျော်ရ။
- စုပုံထားသော အရင်းအမြစ်များမှ SO_2 ထုတ်လွှတ်မှုသည် 0.0075 kg/ha/dayထက် မကျော်ရ။
- VOCs မြင့်မားစွာ ဆုံးရှုံးနိုင်ချေရှိသော (သို့) ပျော်ရည်များ အသုံးပြုသော စက်ရုံများအတွက် VOCs ပြည်ရယူမှုစနစ်များ တပ်ဆင်ရပါမည်။
- NO_x နည်းသည့် မီးရှို့စက်များ အသုံးပြုပါ။
- ဓါတ်အားစက်ရုံကဲ့သို့ SO_x ထုတ်လွှတ်မှုအဓိကဖြစ်သော စက်ရုံများအတွက် sulfur fuelsနှင့် SO_x ထုတ်လွှတ်မှု နည်းသော စနစ်ကို အသုံးပြုပါ။
- ဆူညံသံ မြင့်မားစွာ ဖြစ်ပေါ်စေသော စက်ကိရိယာများကို အလုံပိတ် အဆောက်အဦးများတွင် တပ်ဆင်သင့်ပါသည်။ သို့မှသာ ခြံစည်းရိုးမျဉ်းပေါ်တွင် ဆူညံသံသည် 70 dB(A) ထက် မကျော်လွန်မည် ဖြစ်ပါသည်။

ထုတ်လွှတ်မှု စောင့်ကြည့်ခြင်းစနစ် တပ်ဆင်ခြင်းနှင့် လည်ပတ်ခြင်း ကို အန္တရာယ်ရှိနှင့် အန္တရာယ်မရှိ စွန့်ပစ်ပစ္စည်းများ မီးရှို့စက် (သို့) စက်ရုံများက ကနဦး စက်မှုဇုန်တွင် စက်တပ်ဆင်ရန် သဘောတူသည့်အခါ ဆောင်ရွက်ပါမည်။ CEMS ရရှိသည့်အခါ (သို့) လုပ်ငန်းလည်ပတ်ခြင်း သုံးနှစ်ပြည့်သည့်အခါ စက်ရုံများမှ ဆက်တိုက် ကောက်ထားသော အချက်အလက်များနှင့် ခေတ်မီ ကိန်းဂဏန်းများ ရရှိပါမည်။ ၄င်းနှစ်စဉ် အချက်အလက်များသည် အမှန်တကယ် ကောက်ယူထားသော အချက်အလက်များပေါ် အခြေခံထားပါသည်။

အမိုက်ပုံနှင့် လက်ခံသူများတွင် လေအရည်အသွေး စောင့်ကြည့်မှုသည် ဤအဆင့်တွင် အဓိက လုပ်ဆောင်ရမည် ဖြစ်ပါသည်။ စက်ရုံနှင့် အနီးဆုံး လက်ခံသူများနှင့် ပြန်လည်နေရာချထားသော ဧရိယာတွင် လေအရည်အသွေး စောင့်ကြည့်မှုကို ဆောင်ရွက်ရပါမည်။ စောင့်ကြည့်မှု ပုံစံတွင်-

- ခြောက်လတစ်ကြိမ် စောင့်ကြည့်ခြင်း
- တိုင်းတာမှုများတွင် TSP (24-hour mean), PM10 (24-hour mean), PM2.5 (24-hour mean), SO_2 (1-hour and 24-hour mean, NO_2 (1-hour mean) တို့ ပါဝင်ပါသည်။
- နမူနာကောက်ယူသည့် နေရာသည် ပြန်လည်နေရာချထားသော ဧရိယာ၊ မြို့နယ်၊ နှင့် လည်ပတ်နေပြီးသော စက်ရုံနှင့် အနီးဆုံးဖြစ်ပြီး ပြန်လည်နေရာချထားသော ဧရိယာမဟုတ်သော လက်ရှိ လူနေထိုင်သည့် နေရာများ ပါဝင်ပါသည်။
- စက်ရုံများသည် အမိုက်ပုံရှိ လေညစ်ညမ်းမှုများကို ညစ်ညမ်းမှု တားဆီးရေးနှင့် လျော့နည်းစေရေး လက်စွဲစာအုပ် (World Bank, 1998) (သို့) ဒေသစည်းမျဉ်းစည်းကမ်းများအကြံပြုချက်အရ ခြောက်လတစ်ကြိမ် ဆောင်ရွက်ပြီး MIE သို့ အစီရင်ခံရပါမည်။
- CEM စနစ် တပ်ဆင်ထားသော စက်ရုံနှင့် စက်ရုံ စွန့်ပစ်ပစ္စည်း မီးရှို့စက်တပ်ဆင်ထားသာ စက်ရုံများမှ စောင့်ကြည့်မှုရလဒ်များ။

၁.၈ လူထု တွေ့ဆုံညှိနှိုင်းဆွေးနွေးခြင်းနှင့် ပြည်သူများအား ချပြခြင်း

၁.၈.၁ EIA အစီရင်ခံစာ ပြင်ဆင်ချိန်အတွင်း ညှိနှိုင်းဆွေးနွေးခြင်း ရည်ရွယ်ချက်

ပြည်သူလူထု ပါဝင်ဆောင်ရွက်ခြင်းနှင့် ထုတ်ဖော်ပြောကြားရခြင်း ရည်ရွယ်ချက်မှာ

- စီမံကိန်းအကြောင်း သက်ဆိုင်သူများကို အကြောင်းကြားရန်နှင့် တိုင်ပင်ဆွေးနွေးရန်။
- လူထု၏ အမြင်၊ စိုးရိမ်မှုနှင့် သဘောထားများ ရရှိရန်။
- လူထုယုံကြည့်မှု တိုးလာစေရန် နှင့်
- ဆုံးဖြတ်ချက် ဆောင်ရွက်ခြင်း ကိစ္စများတွင် ပွင့်လင်းမြင်သာမှုနှင့် တာဝန်ယူမှုတို့ကို တိုးမြင့်စေရန်။

၁.၈.၂ ပြည်သူလူထု တွေ့ဆုံဆွေးနွေးခြင်း

စီမံကိန်းသည် ပြည်သူလူထု တွေ့ဆုံဆွေးနွေးပွဲ ၃ ကြိမ်ပြုလုပ်ပြီး ပထမတစ်ကြိမ်ကို ၂၀၁၇ ခုနှစ် (နောက်ဆက်တွဲ ၉-၁ တွင်ကြည့်ပါ) တွင် ဆောင်ရွက်ခဲ့ပါသည်။ ဒုတိယတစ်ကြိမ်ကို ၂၀၁၅ ခုနှစ် မတ်လ ၂၁-၂၂ ရက်တွင် ဆောင်ရွက်ခဲ့ပြီး တတိယတစ်ကြိမ်ကို ၂၀၁၈ ခုနှစ် မတ်လ ၂၈ ရက်တွင် ဆောင်ရွက်ခဲ့ပါသည်။ ဆွေးနွေးပွဲများအားလုံးကို ထားဝယ် SEZ ရှိ သက်ရောက်ခံ ရွာများတွင် ကျင်းပခဲ့ပါသည်။

သက်ဆိုင်ရာ အာဏာပိုင်များ၊ ပညာရှင်ပုဂ္ဂိုလ်များ၊ NGOs/ CSOs များနှင့် ထားဝယ် SEZ ရှိ ဒေသခံလူများက အစည်းအဝေး တက်ရောက်ခဲ့ပါသည်။ အဓိကသက်ရောက်သော ရွာများ (မင်းတပ်၊ ပဂေါ်ရဲ) များတွင် ကွင်းဆင်းလေ့လာ ဆောင်ရွက်ခဲ့ပါသည်။ ရှင်းလင်းတင်ပြခြင်း၊ စာရွက်စာတမ်းများနှင့် မြန်မာဘာသာဖြင့် ကွင်းဆင်းလေ့လာခြင်းများကို ဒေသခံ လူကြီးများနှင့် ပူးပေါင်း၍ REM ကုမ္ပဏီဝန်ထမ်းများက ဆောင်ရွက်ခဲ့ပါသည်။

ဆွေးနွေးပွဲ တစ်ခုစီအတွက် စီမံကိန်းနှင့် ပတ်သတ်၍ စိုးရိမ်ပူပန်မှု၊ သဘောထားနှင့် မှတ်ချက်များမှာ ကွဲပြားပါသည်။ ၎င်းတို့အကျဉ်းချုပ်မှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်။

- ကျန်းမာရေးသက်ရောက်မှု
- ပတ်ဝန်းကျင်ဆိုင်ရာသက်ရောက်မှု အထူးသဖြင့် ရေညစ်ညမ်းမှု
- သီးနှံနှင့် မြေယာများအပေါ်တွင် အစိတ်တပိုင်း လျော်ကြေးပေးမှု
- ဒေသခံအလုပ်အကိုင်၊ သင်တန်းအစီအစဉ်၊ အလုပ်သမား ရပိုင်ခွင့်၊ သင့်တော်သော လုပ်ခလစာ၏
- အခြေခံအဆောက်အဦးများတိုးတက်မှု၊ လျှပ်စစ်၊ လုံလောက်သော ဆရာဝန်နှင့် ကျန်းမာရေး ဝန်ဆောင်မှုများ
- ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှု အကဲဖြတ်ခြင်း လုပ်ငန်းနှင့် ခွင့်ပြုချက် လုပ်ငန်းစဉ်

၂၀၁၈ မတ်လတွင် မကြာသေးမီက စီမံကိန်းအဆိုပြုသူ၊ DSEZ စီမံခန့်ခွဲမှုကော်မတီနှင့် MONRECရှိ ECD ဌာနများဖြင့် တွေ့ဆုံ ဆွေးနွေးပွဲ ကျင်းပခဲ့ပါသည်။ အစည်းအဝေးပွဲကို တနင်္သာရီဒေသ ထားဝယ် SEZ တွင် ကျင်းပခဲ့ပါသည်။ စီမံကိန်းနှင့် သက်ဆိုင်များအစုတွင် ဒေသဆိုင်ရာ အစိုးရ၊ အစိုးရအရာရှိများ၊ ဒေသခံနှင့် NGOs များ ပါဝင်ပါသည်။ ESIA လုပ်ငန်းစဉ်နှင့် ပတ်ဝန်းကျင်ဆိုင်ရာလိုက်နာမှု လက်မှတ်အထောက်အထား၊ စီမံကိန်းသတင်းအချက်အလက်နှင့် မြေယာပိုင်ဆိုင်မှု အချက်အလက်များနှင့် စီမံကိန်း၏ အချိန်နှောင့်နှေးမှုတို့ ပါဝင်ပါသည်။

ပြည်သူလူထု တွေ့ဆုံဆွေးနွေးပွဲတိုင်း၏ ရလဒ်များကို စီမံကိန်း အဆိုပြုသူက ထည့်သွင်းစဉ်းစားပြီး အလုပ်အကိုင်နှင့် သင်တန်းပေးခြင်း ကဲ့သို့ အဓိက လူမှုရေးဆိုင်ရာ သက်ရောက်မှုများ၊ အကြံပြုချက်များကို စီမံကိန်း၏ ကတိကဝတ်နှင့် EMP တွင် လူမှုရေးဆိုင်ရာ သက်ရောက်မှု လျော့ပါးစေရေးတွင်

ထည့်သွင်းသွားပါမည်။ ဆောက်လုပ်ရေး ကာလအတွင်း ပြည်သူလူထု လျော့ပါးစေရေး နည်းလမ်းများ ဥပမာကို ဇယား ၁.၈-၁ တွင် ဖော်ပြထားပါသည်။

ဇယား ၁.၈-၁ စီမံကိန်းကာလ အတွင်း ပတ်ဝန်းကျင်ထိခိုက်မှု လျော့နည်းသက်သာစေရေး နည်းလမ်းများ

လျော့နည်းသက်သာစေရေး နည်းလမ်းများ	နေရာ	ကာလ	တာဝန်ရှိအဖွဲ့အစည်းများ
၁။ ကျေးရွာ အုပ်ချုပ်ရေးမှူးထံ သို့ တည်ဆောက်မည့် အစီအစဉ် နှင့် ဆောင်ရွက်မည့် လုပ်ငန်းစဉ်။	• ၁၃ ရွာ	• အနည်းဆုံး (၂) ပတ် (တည်ဆောက်ရေး ကာလအတွင်း)	MIE
၂။ ရပ်မိရပ်ဖများအနေဖြင့် ကန့်ကွက်တိုင်ကြားမှုများကို ကန့်ကွက်တိုင်ကြားရန်ဖွဲ့စည်းထားသော အဖွဲ့အစည်း (သို့) ရပ်ကွက်/ ကျေးရွာ အုပ်ချုပ်ရေးမှူးများထံ ကန့်ကွက် တိုင်ကြားနိုင်ပါသည်။ နှစ်ဦးနှစ်ဖက် ညှိနှိုင်းမှု အဆင်ပြေပါက သင့်လျော် မှန်ကန်သော ကြေငြာချက်ကို ချက်ချင်း (သို့) တစ်လအတွင်းထုတ်ပြန်ပေးရမည်။	• ရပ်ကွက်/ကျေးရွာ အုပ်ချုပ်ရေးမှူး အိမ်မှတစ်ဆင့် • ကန့်ကွက်တိုင်ကြားရန် ပုံး • နှုတ်အားဖြင့် ကန့်ကွက်တိုင် ကြားရန် ဖွဲ့စည်းထားသော အဖွဲ့အစည်း သို့ တိုင်ကြားရန်	• တည်ဆောက်ရေး ကာလအပြီး	MIE
၁။ လုပ်ငန်းခွင်သင်တန်းများ နှင့် မြန်မာနိုင်ငံ အလုပ်သမား ဥပဒေ အတိုင်း လုပ်အားခများ	• ဆောက်လုပ်ရေး လုပ်ငန်းခွင်အတွင်း	• လုပ်ငန်းခွင်သင်တန်	MIE

ပေးချေရန်			

ဇယား ၁.၈-၂ လုပ်ငန်းလည်ပတ်သည့် ကာလ အတွင်း ပတ်ဝန်းကျင်ထိခိုက်မှု လျော့နည်းသက်သာစေရေး နည်းလမ်းများ

လျော့နည်းသက်သာစေရေး နည်းလမ်းများ	နေရာ	ကာလ	တာဝန်ရှိအဖွဲ့အစည်းများ
၁။ ကျေးရွာ အုပ်ချုပ်ရေးမှူးထံသို့ လုပ်ငန်းလည်ပတ်သည့် အစီအစဉ်နှင့် ဆောင်ရွက်မည့် လုပ်ငန်းစဉ်။	• ၁၃ ရွာ	• လုပ်ငန်းလည်ပတ်ဆဲ ကာလတွင် အနည်းဆုံး တစ်လတစ်ကြိမ်။	MIE
1.ဒေသခံများသည် စီမံကိန်း ဆောင်ရွက်မှုများကို လူထုခေါင်းဆောင်များ (သို့) ကိုင်တွယ် ဆောင်ရွက်ချက်များကို တိုင်ကြားနိုင်ပါသည်။ အမှန် ပြင်ဆင်မှုများကို ဒေသခံနှင့် ဖော်ဆောင်သူ သဘောတူသည့် တစ်ချိန်တည်းတွင် ဆောင်ရွက်ရပါမည်။	• ဒေသခံခေါင်းဆောင် နေအိမ် • အကြံပြုချက်များကို အကြံပေးပုံးထဲသို့ ထည့်ခြင်း။ • ကိုင်တွယ် ဆောင်ရွက်မှုများကို နှုတ်ဖြင့် အကြောင်းကြားခြင်း။	• လုပ်ငန်းလည်ပတ်ဆဲအဆင့်။	MIE
2.ဒေသခံများအတွက် စက်မှုကျွမ်းကျင် သင်တန်းများ ဖွင့်ပေးခြင်း။	• လူထုတွင် သွားလာမှု အခက်အခဲများကို လျော့ချခြင်း။	• လုပ်ငန်းနေရာတွင် သင်တန်းပေးခြင်း။	MIE
3.ဒေသခံများကို အလုပ်ကိုင်အခွင့်အလမ်း ပေးခြင်း။	•	• လုပ်ငန်းလည်ပတ်ဆဲအဆင့်	MIE

၁.၈.၃ အချက်အလက်များ ထုတ်ဖော်ပြောကြားခြင်း

မြန်းထားဝယ် စက်မှုဇုန် ဝက်ဘ်ဆိုက်တွင် စီမံကိန်းသတင်းအချက်အလက်များကို တင်ပြထားပါသည်။ ၎င်းတွင် စီမံကိန်း အဆိုပြုသူ၏ အချက်အလက်များ၊ ဝန်ဆောင်မှုနှင့် အဆောက်အဦးများ ပါဝင်ပြီး ဆက်သွယ်ရန် လိပ်စာများ ပါဝင်သော EIA/ SIA အစီရင်ခံစာများကို download ရယူနိုင်ပါသည်။

၁.၈.၄ အနာဂတ် ညှိနှိုင်းဆွေးနွေးမှုအတွက် အကြံပြုချက်များ

ရေဘူယျအားဖြင့် ဒေသခံများသည် ကနဦး စက်မှုဇုန် စီမံကိန်းကို သဘောတူကြပါသည်။ အဘယ့်ကြောင့်ဆိုသော် ဤစီမံကိန်းသည် မြန်မာနိုင်ငံကို တိုးတက်စေလိမ့်မည်ဟု ယုံကြည်ကြသောကြောင့် ဖြစ်ပါသည်။ ထို့ပြင် နေထိုင်မှုအဆင့်အတန်း၊ လျှပ်စစ်မီးနှင့် ကျန်းမာရေး ဝန်ဆောင်မှုများ တိုးတက်လာပါလိမ့်မည်။ လူထု ညှိနှိုင်းဆွေးနွေးပွဲမှ ရရှိသော အဓိက အကြောင်းအရာများမှာ စက်မှုဇုန်တွင် လျော်ကြေးနှင့် အလုပ်အကိုင်အခွင့်အလမ်းများ ပါဝင်ပါသည်။ လျော်ကြေးများတွင် ဒေသခံ ရွာသားများက လျော်ကြေး မျှတမှု ရှိစေရန် လိုအပ်ပြီး မြေတိုင်းခြင်းနှင့် အပင်များ ရေတွက်ပြီးပြီးချင်း လျော်ကြေးပေးစေလိုပါသည်။ ထို့ပြင် အချို့ ဒေသခံ ရွာသားများသည် စိုက်ပျိုးမြေများ ဆုံးရှုံးပြီး စိုက်ပျိုးရေးမှ စက်မှုကဏ္ဍာသို့ အလုပ်ကိုင်များ ပြောင်းလဲသွားခြင်းကို စိုးရိမ်နေကြပါသည်။ ပညာရေးနှင့် အလုပ်အကိုင် ကျွမ်းကျင်မှု မရှိသောကြောင့် ဒေသခံ ရွာသားများသည် စက်ရုံများတွင် လုပ်ကိုင်ရန် မသေချာကြပါ။ ထို့ကြောင့် စက်ရုံတွင် အလုပ်လုပ်နိုင်ရန် သင်တန်းစီစဉ်ပေးရန် တောင်းဆိုထားကြပါသည်။ ဒေသခံပြည်သူများမှ အဓိက အကြံပြုချက်မှာ လျော်ကြေးမျှတရန်၊ အလုပ်အကိုင်နှင့် စက်ရုံအလုပ်သင်တန်းတို့ ဖြစ်ပါသည်။

လူထု ညှိနှိုင်းဆွေးနွေးပွဲမှ နောက်ဆုံးတစ်ခုမှာ သတင်းအချက်အလက်များ ပြောင်းလဲပြီး စီမံကိန်းသည် ကြံ့ကြာနေပါသည်။ ဒေသခံ ရွာသားများသည် စီမံကိန်း အချိန်ဇယားနှင့် စီမံကိန်း အနစ်ကို မသေချာ မရေရာ ဖြစ်နေကြပါသည်။ လူထု ညှိနှိုင်းဆွေးနွေးပွဲမှ အဓိက အကြံပြုချက်မှာ စီမံကိန်းအချိန်ဇယား၊ သက်ရောက်မှုနှင့် ၎င်းသက်ရောက်မှုများကို လျှော့ချရန် လျော့ပါးစေရေးနည်းလမ်းများ ကို ဒေသခံ ရွာသားများသို့ အကြောင်းကြား အသိပေးရန်နှင့် ဒေသခံလူများကို သင့်တော်သော သင်တန်းများပေးရန် ဖြစ်ပါသည်။

၁.၉ ပြန်လည်နေရာချထားမှုနှင့် ပြောင်းရွှေ့မှု

၁.၉.၁ စီမံကိန်းကြောင့် ရုပ်ပိုင်းဆိုင်ရာ ပြောင်းလဲမှုနှင့် သက်ရောက်ခံများ

ကနဦးစက်မှုဇုန်ဖွံ့ဖြိုးတိုးတက်မှုသည် ထားဝယ်မြို့တွင်း ရွာလေးရွာကို သက်ရောက်နိုင်ပါသည်။ သက်ရောက်ခံအိမ်ထောင်စု ၂၉၁ စုနှင့် သက်ရောက်ခံလူဦးရေ ၁၁၆၄ဦးကို ဇယား ၈.၈-၁တွင် ဖော်ပြထားသည့်အတိုင်းနေရာရွှေ့ပြောင်းပေးပါမည်။ နယ်မြေအတွင်း သက်ရောက်ခံလူအများစုသည် မြေယာပိုင်ဆိုင်မှုနှင့် ၎င်းတို့ပိုင်ဆိုင်မှုများအတွက် လျော်ကြေးများ လိုအပ်ပါမည်။

ဇယား ၁.၉-၁ ကနဦးစက်မှုဇုန် ဖွံ့ဖြိုးတိုးတက်မှုကြောင့် သက်ရောက်ခံရွာများ

ကနဦးစက်မှုဇုန်	သက်ရောက်ခံရွာများ	နေရာပြောင်းရွှေ့ရမည့် ခန့်မှန်းလူဦးရေ	
		အိမ်ထောင်စု	လူဦးရေ
Zone A3	Pagaw Zoon, Yalai	၈	၃၂
Zone B1	Pagaw Zoon, Khamaung Chaung	၁	၄
Zone C1	Wat Chaung, Khamanung Chaung	၁၁၆	၄၆၄
Zone C2	Yalai	၁၀	၄၀
Zone C3	Yalai, Khamaung Chaung	၁၆	၆၄
Zone C4	Khamaung Chaung	၁၂၈	၅၁၂
Zone D2	Kamaung Chaung	၂	၈
Main Road	Pagaw Zoon, Yalai	၇	၂၈
North Road	Khamaung Chaung	၃	၁၂
Total		၂၉၁	၁၁၆၄

* ERM, 2015

ဇုန် A3, B1, C1, C2, C3, C4, D2, ဖွံ့ဖြိုးတိုးတက်မှုသည် စိုက်ပျိုးမြေများကို သက်ရောက်နိုင်ပါသည်။ အဓိကမှာ ဆီအုန်းစိုက်ပျိုးမှုဖြစ်ပြီး အလုပ်သမားအိမ် ၁၈အိမ်နှင့် ဆီအုန်းစက်ရုံနှင့် ဂိုဒေါင်အပါအဝင် ခန့်မှန်း ၃၉၀၅.၆၄၄ ဧက ရှိပါသည်(ဇယား ၉.၈-၂)။ အဓိကမှာ သီဟိုဠ်စိုက်ခင်းများ ဖြစ်ပါသည်။

ဇယား ၁.၉-၂ သက်ရောက်ခံဆီအုန်းစိုက်ခင်းနှင့် ဝန်ထမ်းအိမ်များ

ကဦးစက်မှုဇုန်	ခန့်မှန်းဆီအုန်းစိုက်ခင်းဧရိယာနှင့် သက်ရောက်ခံများ		
	ဆီအုန်းစိုက်ခင်း(ဧက)	အိမ်ထောင်စု	လူဦးရေ
Zone A2	၉၄၅.၄၄၁	၁၀	၁၀
Zone B2	၉၈၂.၉၅၃	၅	၂၀
Zone B3	၉၁၉.၅၃၀	၉	၃၆
Zone D1	၁၀၅၇.၇၂၀	၇	၂၈
Zone D2		၄	၁၆
Total	၂၉၀၅.၆၄၄	၃၅	၁၁၀

Source: ESIA Study Team

၁.၉.၂ သက်ရောက်မှုအဆင့်

အိမ်ထောင်စုအဆင့်တွင် စက်မှုဇုန်အားဖြင့် သက်ရောက်ခံလူများ ၁၁၆၄ ဦး၊ ၂၉၁ အိမ်ထောင်စု ရှိပါသည်(ဇယား ၁.၈-၄)။ PAPs များပိုင်ဆိုင်သော မြေဆုံးရှုံးမှု၊ လယ်ကွင်း၊ နစ်ရှည်ပင်၊ အိမ်နှင့် အဆောက်အဦးများဆုံးရှုံးမှုကို ကွင်းဆင်း စာရင်းကောက်ယူပါမည်။

ပြည်သူလူထုအဆင့်တွင် စီမံကိန်း မြေယာပိုင်ဆိုင်မှုသည် အဆောက်အဦး၊ ဝန်ဆောင်မှုများ ဆုံးရှုံးမှု ဖြစ်ပေါ်နိုင်ပါသည်။ ဆုံးရှုံးမှုတွင် မူလတန်းကျောင်း (၃) ကျောင်း၊ အထက်တန်းကျောင်း (၁) ကျောင်း၊ ဘုန်းကြီးကျောင်း (၆)ကျောင်း၊ ရုံး (၄)ရုံးနှင့် သုသာန် (၅)ခု ပါဝင်ပါသည်။

ဇယား ၁.၉-၃ သက်ရောက်ခံရွာရှိ လက်ရှိ အခြေခံ အဆောက်အဦးများ

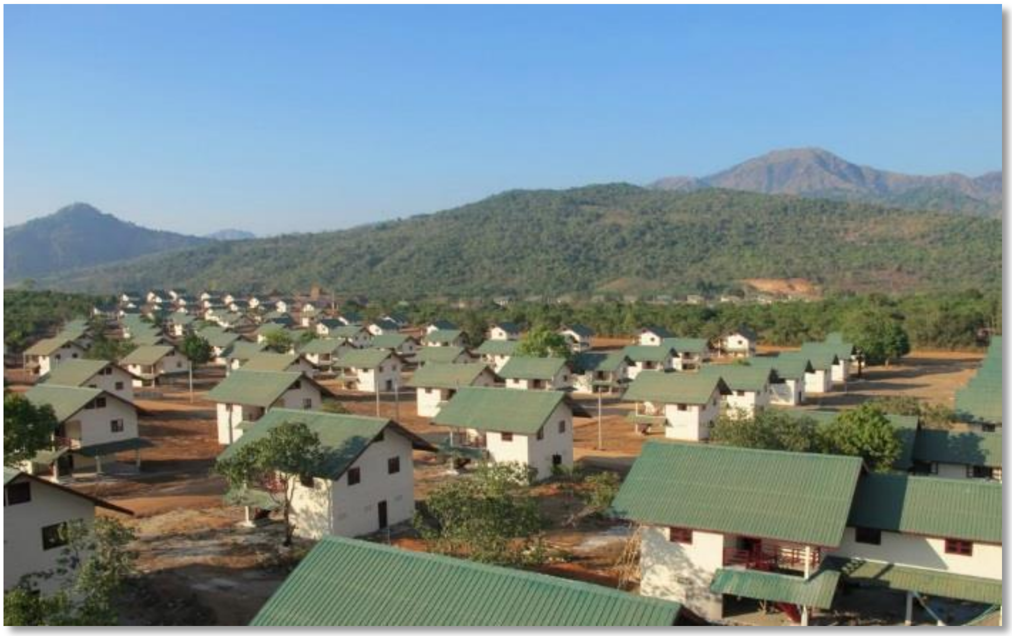
စဉ်	ရွာအမည်	သက်ရောက်ခံပြည်သူပိုင် အဆောက်အဦးများ				
		မူလတန်းကျောင်း	အထက်တန်းကျောင်း	ဘုန်းကြီးကျောင်း	ရုံးများ	သုသာန်
၂	ပဂေါ်ဇွန်း	၁	မရှိ	၂	၁	၁
၃	Yalai	မရှိ	၁	၂	၁	၁
၄	ဝက်ချောင်း	၁	မရှိ	၁	မရှိ	၁
၅	ခမောင်ချောင်း	၁	မရှိ	မရှိ	၁	၁

၁.၉.၃ လျော်ကြေးပေးချေမည့် မူဝါဒ

ရွှေ့ပြောင်းရသော တစ်ဦးချင်းစီအတွက် စီမံကိန်းက လျော်ကြေးပေးသွားပါမည်။ လျော်ကြေးတွင် ရွှေ့ပြောင်းစရိတ်အပြည့်အဝနှင့် အခြားဆုံးရှုံးနစ်နာမှုများ ပါဝင်ပါမည်။ ပြောင်းရွှေ့မှုအထောက်အပံ့များကို (ပိုင်ရှင်၊ နေထိုင်သူ၊ ကျူးကျော်သူ) အားလုံးကိုပေးပါမည်။ အထောက်အပံ့များမှာ ပို့ဆောင်မှု၊ အစားအစာ၊ နေထိုင်စရာနှင့် အခြားလူမှုရေးဆိုင်ရာ ဝန်ဆောင်မှုများပါဝင်ပါသည်။ ပြောင်းရွှေ့မှုတွင် သင့်တော်သော ပြောင်းရွှေ့ရမည့်မြေနေရာ၊ အိမ်၊ စီးပွားရေးဆိုင်ရာ အထောက်အဦးနှင့် ရွှေ့ပြောင်းစရိတ်၊ အထောက်အပံ့များ ပါဝင်ပါသည်။ ကွင်းဆင်းလေ့လာမှု အသေးစိတ်နှင့် လျော်ကြေးကို နောက်ဆက်တွဲ ၉-၂ တွင်ဖော်ပြထားပြီး နေရာပြန်လည်ချထားမှု အစီအစဉ် ၂၀၁၆ အစီရင်ခံစာ ပါဝင်ပါသည်။

၁.၉.၄ ပြန်လည်နေရာချထားသည့်နေရာ

သက်ရောက်ခံရွာများအားလုံးအတွက် ပြန်လည်နေရာချထားသည့် နေရာများကို စီစဉ်ထားပါသည်။ ရွှေ့ပြောင်းရန် သဘောတူရွေးချယ်ထားသော သက်ရောက်ခံ ဒေသခံအားလုံးအတွက် ပြောင်းရွှေ့ရမည့်ဧရိယာ (ပုံ ၁.၈-၁) သည် အဆင်သင့် ပြီးစီးနေပြီး ဖြစ်ပါသည်။



Source: MIE (2015)

ပုံ ၁.၈-၁ ပြန်လည်နေရာချထားသည့် နေရာရှိ အိမ်များ (UAE, 2016)

ပြန်လည်နေရာချထားမည့် ဧရိယာ စုစုပေါင်းသည် ၁၁၂၅ ဧက ရှိပါသည်။ ဧရိယာအတွင်း အပင်ရေတွက်ခြင်းသည် ၁၀၀% ပြီးစီးပြီးဖြစ်ပြီး လျော်ကြေးအားဖြင့် ၈၆၇.၂၃ ဧက (၇၈%)၊ ငွေသားအားဖြင့် ကျပ်သန်းပေါင်း ၂၅၁၆.၅၆ သန်း လျော်ကြေးပေးပြီး ဖြစ်ပါသည်။ ပြန်လည်နေရာချထားသည့်နေရာသည်

မူလတန်းကျောင်း၊ ဆေးခန်း၊ ဝန်ထမ်းအိမ်ယာ၊ ဘုန်းကြီးကျောင်း၊ မိလ္လာစနစ်၊ လမ်းစနစ်၊ ဝါယာကေဘယ်လ်ကြိုးများနှင့် ရေတိုင်ကီများ ပါဝင်ပြီး အိမ်ပေါင်း ၄၈၀ ရှိပါသည်။

အိမ်များတွင် အကြီး၊ အလတ်နှင့် အသေးဟူ၍ (၃)မျိုး ရှိပါသည်။ အိမ်အသေးသည် ၁၂၈ စတုရန်းမီတာ ရှိပါသည်။ အလတ်သည် ၁၆၀ စတုရန်းမီတာနှင့် အကြီးသည် ၁၉၅ စတုရန်းမီတာ ရှိပါသည်။ အားလုံးတွင် အိပ်ခန်းနှစ်ခန်းပါဝင်ပြီး အရွယ်အစားပေါ်မူတည်၍ အခန်းအရွယ်အစား ကွာသွားပါသည်။ အမျိုးအစားတစ်ခုစီအတွက် ဆောက်လုပ်မှု ကုန်ကျစရိတ်မှာ ၁၅၅၂၄၂၃၀၊ ၁၈၀၆၉၉၀၄ နှင့် ၂၀၆၄၃၂၃၅ ကျပ် အသီးသီး ဖြစ်ပါသည်။

၁.၉.၅ အသက်မွေးဝမ်းကျောင်း ပြန်လည်ဆောင်ရွက်ပေးရေး အစီအစဉ်

ဒေသခံများ နေထိုင်စားသောက်မှု ပြောင်းရွှေ့မှုအတွက် နှစ်သက်ရာ အလုပ်အကိုင်များကို အကောင်အထည်ဖော်ပေးသင့်ပါသည်။ ၎င်းတို့ စိတ်ဝင်စားသော အလုပ်အကိုင်အတွက် လိုအပ်သော ကျွမ်းကျင်မှုဆိုင်ရာ သင်တန်းများကိုလည်း စီစဉ်ပေးရပါမည်။ စတင်ဆောင်ရွက်ရန် ချေးငွေအသေးစားများကိုလည်း ထောက်ပံ့ပေးရမည်။ ဒေသခံအဖွဲ့အစည်းသည် ၎င်းတို့၏ အကျိုးအမြတ်အတွက် အလုပ်အကိုင် ပူးပေါင်းဆောင်ရွက်ခြင်းများ လုပ်ကိုင်ပေးရပါမည်။

ပြောင်းရွှေ့ဆဲနှင့် ပြောင်းရွှေ့ပြီးနောက် ဝင်ငွေပုံမှန်ရစေရန် ဆောက်လုပ်ဆဲနှင့် လုပ်ငန်းလည်ပတ်သည့် ကာလ နှစ်ခုစလုံးတွင် အိမ်ထောင်စုတစ်ခုစီကို အရင်ဆုံးဖွင့်သည့် စက်ရုံတွင် အလုပ်ကိုင်အခွင့်အလမ်းများ ပေးသင့်ပါသည်။ အိမ်ထောင်စုတစ်ခုစီမှ အနည်းဆုံး လူတစ်ယောက်ကို အလုပ်ခန့်အပ်သင့်ပါသည်။ စက်ရုံဆောက်လုပ်ဆဲကာလတွင် အနည်းဆုံး လူ ၁၀၃၇ ယောက် (အိမ်ထောင်စုတစ်ခုလျှင် တစ်ယောက်) အလုပ်ခန့်နိုင်ရန် မျှော်မှန်းထားပါသည်။ ထို့ကြောင့် အလုပ်ခန့်အပ်မှုသည် DDC၊ သက်ဆိုင်ရာ အစိုးရ အေဂျင်စီများနှင့် ကျေးရွာများကြားတွင် ပုံသေ စည်းမျဉ်းများဖြင့် ဖြစ်သင့်ပါသည်။ ဝင်ငွေရရှိမှု ကို အထောက်အကူပြုရန် ဒေသခံများသည် ဆောက်လုပ်ရေး လုပ်ငန်းများအတွက် လိုအပ်သော ကျွမ်းကျင်မှုဆိုင်ရာ သင်တန်းများကို လက်ခံတက်ရောက်သင့်ပါသည်။

၁.၉.၅.၁ စိုက်ပျိုးရေး တိုးတက်မှု

အသက်ရှင်နေထိုင်မှုနှင့် ဝင်ငွေအပေါ် သက်ရောက်မှုများ လျော့နည်းစေရန် လယ်ယာမြေများ ဆုံးရှုံးသော အိမ်ထောင်စုအားလုံးသို့ စိုက်ပျိုးမြေများ ထောက်ပံ့ပေးရန် လိုအပ်ပါသည်။ ဒေသခံများ မြေယာပိုင်ဆိုင်မှုသည် အိမ်ထောင်စုတစ်ခုလျှင် ၈.၇ ဧကခန့် ရှိသောကြောင့် ယခင်ရှိခဲ့သော မြေယာအစား လျော်ကြေးအဖြစ် အိမ်ထောင်စုတစ်ခုလျှင် ၉ ဧက ပေးအပ်သင့်ပါသည်။ အကယ်၍ မဖြစ်နိုင်ပါက မြေဆုံးရှုံးမှုအတွက် ညီမျှသော လျော်ကြေးပေးရပါမည်။ ထို့ပြင် လယ်သမားများသည် ၎င်းတို့၏ အလုပ်ကိုင်နှင့် နေထိုင်မှုပုံစံ ပြောင်းလဲရန် လိုအပ်ပါသည်။ လယ်လုပ်ငန်းမဟုတ်သော အခြားအလုပ်အကိုင်များအတွက် ကျွမ်းကျင်မှု သင်တန်းများ လိုအပ်ပါလိမ့်မည်။

စိုက်ပျိုးရေးဆက်လက်လုပ်ကိုင်လိုသော ဒေသခံများသည် ပေါင်းစပ်စိုက်ပျိုးစနစ် (ဓါတုပစ္စည်းများ အသုံးမပြုပဲ)ကဲ့သို့ ရေရှည်ဖွံ့ဖြိုးတိုးတက်သည့် စိုက်ပျိုးမှုစနစ်ကို အခြေခံသည့် စိုက်ပျိုးမှုပုံစံများကို လေ့ကျင့်ရပါမည်။ သင်တန်းများသည် စိုက်ပျိုးသည့်မြေဆီလွှာ၊ ရေစီမံခန့်ခွဲမှု၊ ပိုးမွှားကျရောက်မှု၊ ကုန်ကျစရိတ်၊ ထုတ်ကုန်ကြော်ငြာခြင်းနှင့် လယ်သမားများ ပူးပေါင်းဆောင်ရွက်ခြင်းကဲ့သို့သော ဘာသာရပ်များကို သင်ကြားပေးပါမည်။ အချို့ဆောင်ရွက်ပေးမည့် သငင်တန်းများမှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်။

- အိမ်တွင်း သီးနှံစိုက်ပျိုးမှုသင်တန်း
- မှိုစိုက်ပျိုးမှုသင်တန်း
- အစားအစာ၊ သီးနှံပြင်ဆင်ခြင်းနှင့် တာရှည်ခံထားနည်းသင်တန်း

ဤအစီရင်ခံစာတွင်ပါဝင်သော RAP အချက်အလက်များကို ၂၀၁၇ မေလ RAP အချက်အလက်များအပေါ် အခြေခံ၍ ပြင်ဆင်ထားပါသည်။ RAP အချက်အလက်များသည် တစ်နှစ်စီအတွက် RAP အစီအစဉ်များ၏ အခြေအနေနှင့် ဖွံ့ဖြိုးမှုအလိုက် ပြောင်းလဲရန် ရည်ရွယ်ထားပါသည်။

၁.၁၀ ကျွမ်းကျင်မှုဆိုင်ရာ သင်တန်းအစီအစဉ်

စီမံကိန်းကြောင့် ရလာသော အလုပ်အကိုင်များနှင့် စီးပွားရေး အခွင့်အလမ်းအသစ်များအတွက် ပြင်ဆင်ရန် ပထမဦးစွာဆောင်ရွက်မည့် စက်မှုဇုန်အတွက် သင့်တော်သည့် ကျွမ်းကျင်မှုဆိုင်ရာ ကာလတို သင်တန်းများကို ဆောင်ရွက်ပေးသင့်ပါသည်။ ကျွမ်းကျင်မှုဆိုင်ရာ သင်တန်းများကို အလုပ်ရှင်အလုပ်သမားကြား အကောင်းဆုံးဖြစ်မည့် အစီအစဉ်ကို ရွေးချယ်ပြီး သဘောတူဆောင်ရွက်သွားပါမည်။ အခြားသင်တန်းအစီအစဉ်မှာ နေထိုင်စားသောက်မှုပုံစံ ပြောင်းလဲမှုအတွက် ဖြစ်ပြီး စိတ်ပါဝင်စားသူများ တတ်ရောက်နိုင်ပါသည်။ အဆိုပြုထားသော ကျွမ်းကျင်မှုဆိုင်ရာ သင်တန်းများမှာ-

- ဆိုင်ကယ်နှင့် ကားဝပ်ရှော့
- အိမ်တွင်း အသုံးပြုပစ္စည်းများ ပြင်ဆင်ခြင်း
- လက်မှုပညာ
- လုံခြုံရေးသင်တန်း
- ဂဟေဆက်အတတ်ပညာ
- အစားအစာထုတ်လုပ်မှု
- ကားမောင်းသင်တန်း

- လျှပ်စစ်ပညာ
- ကွန်ပျူတာနှင့် ဘာသာစကားသင်တန်း
- Forklift လုပ်ဆောင်မှု

အခန်း (၃)တွင် ဖော်ပြထားသည့်အတိုင်း သက်ဆိုင်ရာ ဥပဒေများအရ သင်တန်းအစီအစဉ်များကို ဆောင်ရွက်ပေးပါမည်။ စင်တာသည် ကျောင်းသားများ၊ ဒေသဆိုင်ရာ အေဂျင်စီများ အပါအဝင် အလုပ်နှင့် ဝန်ထမ်းများအတွက် အသက်မွေးပညာ သင်တန်းများ ဆောင်ရွက်ပေးရန် အာဏာရှိပါသည်။

၁.၁၁ လူမှုရေးဆိုင်ရာ ပူးပေါင်းဆောင်ရွက်ရန် တာဝန်ယူမှု အစီအစဉ် (CSR)

၁.၁၁.၁ လူမှုရေးဆိုင်ရာ ပူးပေါင်းဆောင်ရွက်ရန် တာဝန်ယူမှု မူဝါဒ

စီမံကိန်းတွင် လူမှုရေးဆိုင်ရာ ပူးပေါင်းဆောင်ရွက်ရန် တာဝန်ယူမှုအတွက် လမ်းညွှန်ချက်များမှာ-

- ပူးပေါင်းဆောင်ရွက်မည့်အစိုးရ- စီမံကိန်း၏ စီမံခန့်ခွဲမှုစနစ်တွင် ပြည့်စုံမှု၊ ပွင့်လင်းမြင်သာမှုနှင့် တာဝန်ယူမှုတို့ ရှိပါသည်။
- စီးပွားရေးဆိုင်ရာ ကျင့်ဝတ်- စီမံကိန်းလည်ပတ်မှုသည် ရေရှည်တွင် စီမံကိန်းအကျိုးအမြတ်များ ရှိနိုင်ပါသည်။
- လူ့အခွင့်အရေးနှင့် အလုပ်သမား တန်းတူညီမျှရှိမှု- စီးပွားရေးလုပ်ငန်းဆောင်ရွက်ရန် လူ့အရင်းအမြစ်သည် အရေးကြီးပါသည်။ စီမံကိန်းသည် အလုပ်ခွင်ပတ်ဝန်းကျင်ကို မြင့်တင်ပေးပြီး ကျွမ်းကျင်မှုအတွက် သင်တန်းအခွင့်အလမ်းများ ထောက်ပံ့ပေးရပါမည်။
- စားသုံးသူများသို့ တာဝန်ယူမှု- စီမံကိန်းသည် ၎င်း၏ ထုတ်ကုန်နှင့် ဝန်ဆောင်မှုများကို စံချိန်စံညွှန်းနှင့်အညီ ထိန်းသိမ်းထားပြီး လူမှုရေးဆိုင်ရာ ပြဿနာရပ်များကို လျော့ချမည့် လူမှုရေးဆိုင်ရာ တစိတ်တပိုင်း ဖြစ်နိုင်ပါသည်။
- ဒေသဖွံ့ဖြိုးတိုးတက်မှု- ဒေသရေရှည်ဖွံ့ဖြိုးမှုသည် အရေးကြီးသော အချက်တစ်ခုဖြစ်ပြီး ကုမ္ပဏီ၏ စီးပွားရေးကို ထောက်ပံ့ပေးနိုင်ပါသည်။
- ပတ်ဝန်းကျင်ဆိုင်ရာ ထည့်သွင်းစဉ်းစားမှု- စီမံကိန်းသည် ပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှု ကာကွယ်ခြင်းစနစ်ကို ဆောင်ရွက်ပြီး ဥပဒေနှင့် နည်းဥပဒေများကို လိုက်နာပြီး ပတ်ဝန်းကျင်ဆိုင်ရာ ဆောင်ရွက်ချက်များကို ဆောင်ရွက်ရပါမည်။

၁.၁၁.၂ လူမှုရေးဆိုင်ရာ ပူးပေါင်းဆောင်ရွက်ရန် တာဝန်ယူမှု အစီအစဉ်

စီမံကိန်းသည် ထားဝယ်မြို့နှင့် ဒေသခံများအတွက် လူမှုရေး၊ ပတ်ဝန်းကျင်နှင့် နေထိုင်မှု အဆင့်မြင့်တင်ခြင်းကဲ့သို့ ဖွံ့ဖြိုးမှုလုပ်ငန်းများကို CSR အဖြစ် ဆောင်ရွက်ရန် စီစဉ်ထားပါသည်။

အစီအစဉ်များမှာ-

- ပညာရေး
- အရေးပေါ် ဆောင်ရွက်ချက်
- ငွေရေးကြေးရေး

၁.၁၁.၂.၁ ပညာရေး

စီမံကိန်းသည် စီမံကိန်းအနီးအနားနေထိုင်သော Q3 အဆင့်ဝင် ကျောင်းသား/သူများအတွက် ကျောင်းနေအရွယ်မှ တက္ကသိုလ်အဆင့်အထိ နှစ်တိုင်း ပညာသင်ထောက်ပံ့ကြေးများ ပေးရန် ရည်ရွယ်ထားပါသည်။

၁.၁၁.၂.၂ သဘာဝဘေးအန္တရာယ် အရေးပေါ် ဆောင်ရွက်မှု

စီမံကိန်းသည် မီးဘေး၊ သဘာဝဘေးအန္တရာယ်နှင့် အကြမ်းဖက်မှုများကဲ့သို့ အရေးပေါ် ဖြစ်ပေါ်မှုအတွင်း ထားဝယ်မြို့နယ် (သို့) ဒေသခံအဖွဲ့အစည်းများကို လှူဒါန်းခြင်း ထောက်ပံ့ခြင်းများ ဆောင်ရွက်ရန် ရည်ရွယ်ထားပါသည်။ လှူဒါန်းမှုတွင် အသက်ကယ်ပစ္စည်း၊ အစားအစာနှင့် ရေ၊ ထောက်ပံ့မှုပစ္စည်းများ ပါဝင်ပါသည်။ ပြန်လည်ကုစားရေး ကာလအတွင်း ရှင်းလင်းခြင်း၊ ရေနုတ်မြောင်း ပိတ်ဆို့မှုများ ရှင်းလင်းခြင်းများ ဆောင်ရွက်ပေးပါမည်။

၁.၁၁.၂.၃ ငွေရေးကြေးရေး

- အသေးစား ချေးငွေဆောင်ရွက်ပေးမှုသည် ရင်းနှီးမြှုပ်နှံမှု အသေးစား ဆောင်ရွက်လိုသော တစ်ဦးချင်းစီအတွက် ထိရောက်သော အကူအညီ ဖြစ်ပါမည်။
- အဖွဲ့အစည်း ဆောင်ရွက်မှုအစီအစဉ်သည် အချိန်ပြည့် ဒေသဖွံ့ဖြိုးမှု ဆောင်ရွက်နေသော ကျွမ်းကျင်သူနှစ်ဦးကို ထောက်ပံ့ပေးမည်ဖြစ်ပြီး ထုတ်လုပ်မှုရည်ရွယ်ချက်အတွက် (အထူးသဖြင့် စီးပွားရေးလုပ်ငန်းအသစ်များအတွက်) ကူညီဆောင်ရွက်ရန် ဖြစ်ပါသည်။

CHAPTER 1

EXECUTIVE SUMMARY

1.1 CONTEXT OF THE PROJECT

1.1.1 Propose of the Study

Objective of the Environmental and Social Impact Assessment (ESIA) is to assess the environmental and social impacts caused by development of the "*Initial Industrial Estate*" (hereinafter referred to as "*the Project*") in Dawei Special Economic Zone by Myandawei Industrial Estate Company Limited (MIE) and consider the Environmental Management Plan (EMP) including mitigation measures to reduce and minimize the negative impacts.

Approximately, 27 square kilometers in DSEZ (Figure 1.1-1) will be developed an eco-friendly industrial park that will support logistics growth, mid-stream petrochemical industries and trading in DSEZ. The Project plans to have infrastructure, utilities and facilities by phases in accordance with the demand growth in DSEZ. These will be achieved through construction and operation of the following components:

- Road network
- Flood protection and drainage system
- Power and transmission system
- Water treatment and supply system
- Central wastewater treatment system
- Solid waste management system
- Fire prevention and emergency response system
- Communication system
- Security system
- Transportation hub and
- Recreation.

According to the Environmental Conservation Law (2013) and the Environmental Impact Assessment Procedure (No.616/2015) issued by the Ministry of Natural Resource and Environmental Conservation (MONREC), the EIA study is required for the Project as "*Industrial Zone Construction and Development*". Meanwhile, the Project relates to social aspects in various disciplines; therefore, social assessment is embedded in the EIA study and herein referred to as "*Environmental and Social Impact Assessment*" (ESIA).

To implement the legal compliance, MIE delegates International Engineering Consultant (IEC) in association with United Analyst and Engineering Consultant Co., Ltd. (UAE) in conducting the ESIA for the Project. In this report, UAE is referred to "*the ESIA Study Team*".

Source: MIE (2015)

Figure 1.1-1 Project location in Dawei SEZ

1.1.2 Related Projects

The DSEZ project had been developing since 2010, started from the framework agreement of deep sea port and industrial estate. In late 2015, the Initial Phase of DSEZ was concreted with the recent features, more substantial and attractive for foreign investors. The recent projects (Figure 1.1-2) were emerged with the following components:

- Road linked to Thailand
- Ports and LNG terminal
- Initial power plants
- Reservoir and weir
- Initial township
- Telecommunication lines

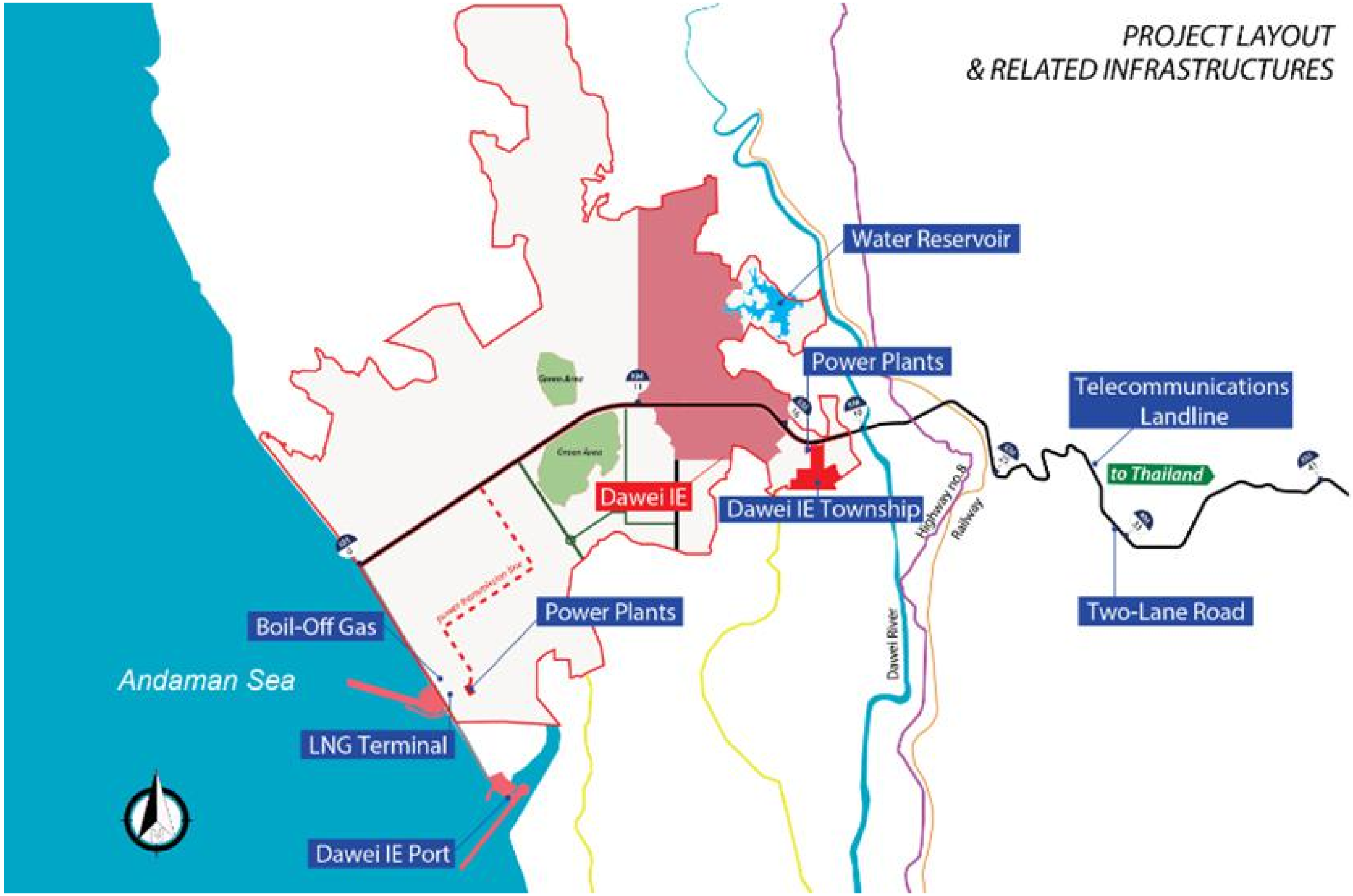
Two-lane road is a key connection between the DSEZ and Thailand, and the other regions in South East Asia. The road is a major linked land transport from coast of The Andaman Sea through the Gulf of Thailand and The South China Sea. The project is 138 kilometers in length starting from Km.18+500 main road in DSEZ crossing through Thai-Myanmar border and finishing at Hti Hkee. The road linked to Thailand at Ban Phu Nam Ron district in Kanchanabuiri. Most of sections are in Myanmar and only 5 kilometers of section 3 is in Thailand. Once, the road operates, toll pass, tax and custom will be applied.

Dawei port consisting of 100-m long jetty berth for multi-purpose vessels (approx. 400 TEU or 13,000 DWT) with estimated capacity of 330,000 ton per year has been recently completed. In order to enlarge the port capability, this commercial berth is planned to improve for Panamax vessel, 60,000 DWT with approximate capability of 14 million ton per year. The berth is now under construction and planned to operate in 2020.

LNG terminals located in vicinity of Dawei port will supply economical and clean energy for the region. Total capacity of the LNG terminals are 6 million ton per year and majority of this gas will supply gas fire power plants. A 450 MW Power plant is major electricity supply for Dawei SEZ industries e.g. Initial Industrial Estate, Township and Heavy Petrochemical industry. The power plant features conclude switch yards, emergency diesel generators, diesel loading storage tanks and 115-kV transmission lines.

Pa Yain Byu Reservoir and Ta Laing Gya Weir are main water supply serving as water consumption for early industries construction and Initial Industrial uses. The reservoir has 7.14 square kilometers of catchment with maximum capacity of 8.54 million cubic meter. Centralized conventional water treatment plant located in vicinity of the reservoir has capacity of 36,000 m^3 consumable per day.

Landline and high-speed internet with speed up to 10 Gbps including the basic telephone (IP Phone), CCTV, Virtual Private Network (VPN), video conference, etc. Mobile Services is to be provided by the existing operators of the country. Initial Township is residential and commercial area in the DSEZ. The Township located at km 17 of the main road of DSEZ, offer living environment with apartments and convenient utilities and facility.



Source: ITD (2012)

Figure 1.1-2 Related projects in Dawei SEZ

1.2 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

Environmental legislation is superior key in operation and management of the project. Therein, the principle for environmental management are formulated based on consideration of related national Policies, Laws and Regulations. Most of the legislation listed here are recent and still implement in the Union while some Acts are enacted since the union was under administration of the British India. The considerations in this chapter will be deliberately implemented and mandated through various stages of the Project development, from pre-construction, construction, operation and decommissioning.

1.2.1 Myanmar Regulatory Framework

1.2.1.1 Institutional Setting of National Level

Myanmar has 21 ministries under the Office of the president as of May 2017. The leading ministries in-charge for environmental and social considerations are the Environmental Conservation Department of the Ministry of Natural Resources and Environmental Conservation (MONREC), is derived from the Ministry of Environmental Conservation and Forestry (MONREC).

1.2.1.2 Legislation Related to Environmental Social and Health Considerations

The fundamental laws and regulations related to the environmental social and health considerations are show in Table 1.2-1. Also, major international agreement and treaties that Myanmar government has ratified are show in Table 1.2-3.

Table 1.2-1 Legislation Related to Environmental Social Considerations in the Project

No.	Laws and Regulations as of May 2017
Environmental Framework	
1	The National Environmental Policy (1994)
2	The Environmental Conservation Law (2012)
3	The Environmental Conservation Rule (2014)
EIA / Environmental Standards	
4	Environmental Impact Assessment Procedure (2015)
5	National Environmental Quality (Emission) Guidelines (2015)
Natural Resources and Utilization	
6	The Land Acquisition Act (1894)
7	The Embankment Act (1909)
8	The Farmland Law (2012)
9	The Farmland Rules (2012)
10	The Vacant, Fallow and Virgin Lands Management Law (2012)
11	The Vacant, Fallow and Virgin Lands Management Rules (2012)
12	The Forest Policy (1995)
13	The Forest Law (1992)
14	The Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994)

15	The Conservation of Water Resources and Rivers Law (2006)
16	The Conservation of Water Resources and Rivers Rules (2013)

Table 1.2-1 Legislation Related to Environmental Social Considerations in the Project

No.	Laws and Regulations as of May 2017
17	The Territorial Sea and Maritime Zone Law (1977)
Waste Management	
18	The Underground Water Act (1930)
19	The Water Power Act (1927)
20	The City of Rangoon Municipal Act (1922)
21	The City of Rangoon Development (1922)
22	The Development Committee (1993)
23	The Myanmar Mines Law (2014)
Social and Cultural	
24	The Protection and Preservation of Cultural Heritage Regions Law (1998)
25	The Protection and Preservation of Ancient Monuments Law (2015)
26	The Protection and Preservation of Antique Objects Law (2015)
27	The Rights of National Races Law (2015)
Public Health and Safety	
28	The Public Health Law (1972)
29	The National Health Policy (1993)
30	The Prevention and Control of Communicable Diseases Law (1995)
31	The Control of Smoking and Consumption of Tobacco Product Law (2006)
32	The Motor Vehicles Law (2015)
33	The Motor Vehicles Rules (1987)
34	The Myanmar Fire Brigades Law (2015)
Employment and Working Environment	
35	The Factory Act (1951)
36	The Worker's Compensation Act (1923)
37	The Payment of Wages Act (2016)
38	The Employment and Skill Development Law (2013)
39	The Minimum Wage Law / Rules (2013)
40	The Leave and Holiday Act (1951, partially revised in 2014)
41	The Labor Organization Law (2011)
42	The Labor Organization Rule (2012)
43	The Labor Dispute Settlement Law (2012)
44	The Social Security Law (2012)
45	The Shops and Establishment Act (1951)
Industrial Law	
46	The Explosive Act (1884)
47	The Explosive Substances Act (1908)

Table 1.2-1 Legislation Related to Environmental Social Considerations in the Project

No.	Laws and Regulations as of May 2017
48	The Marine Fisheries Law (1990)
49	The Freshwater Fisheries Law (1991)
50	The Prevention of Hazard from Chemicals and Related Substances Law (2013)
51	The Petroleum Act (1934)
52	The Petroleum Rules (1937)
53	The Fertilizer Law (2002)
54	The Myanmar Investment Law (2016)
55	The Foreign Investment Law (2012)
56	The Myanmar Citizen Investment Law (2013)
57	The Myanmar Insurance Law (1993)
58	The Private Industrial Enterprise Law (1990)
59	The Essential Supplies and Services Law (2015)
60	The Law on Standardization (2014)
61	The Electricity Law (2014)
62	The Boiler Law (2015)
63	The Myanmar Engineering Council Law (2013)
64	The Export and Import Law (2012)
65	The Myanmar Port Authority Law (2015)
Special Economic Zone Law	
66	The Myanmar Special Economic Zone Law (2014)
67	The Myanmar Special Economic Zone Rule (2015)
68	Dawei Special Economic Zone Law (2012) 2011

Source: ESIA Study Team

Table 1.2-2 Legislation Related to Environmental and Social Considerations in Myanmar

No.	Notifications as of May 2017
1	Notification No. 1/2013 and No.50/2014: Economic activities which require environmental impact assessment by Myanmar Investment Commission
2	Notification No. 81/2014: For the issuance of permit on the application to invest in the Dawei Special Economic Zone by Ministry of National Planning and Economic Development
3	The Business for Ozone Depleting Substances: Notification No. 37/2014
No.	**Codes of Practice as of May 2017**
1	The Myanmar National Building Code, Part 1, 2 and 5 (2012)

Source: ESIA Study Team

Table 1.2-3 Ratified Major International Agreements related to Environmental Social Considerations.

No.	International Agreements and Treaties	Date Ratified
1	Basel Convention, 1989	2015
2	Ramsar Convention, 1971	2005
3	Stockholm Convention on Persistent Organic Pollutants, 2001	2004
4	Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1979	1997
5	United Nations Framework Convention on Climate Change, 1992	1994
6	Convention on Biological Diversity, 1992	1994
7	Montreal Protocol on Substances that Deplete the Ozone Layer, 1989	1993
8	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, 1990	1993

Source: ESIA Study Team

1.2.2 Guidelines and Standards

The Myanmar National Environmental Quality (Emissions) Guidelines was enacted in 2015. This emission (or discharge) guideline applied for air and water quality, noise and vibration is core standard for target values or tentative values in this study. Where some parameters i.e. NO_2, CO or ambient water quality are absence from the Myanmar NEQG, the strictest standard among Japan, Indonesia, Thailand and Vietnam will be adopted. IFC EHS Guidelines is applied for Social and Health standard containing water quality and availability, structural and infrastructure, life and fire and traffic safety.

1.2.3 Corporate Environmental and Social Policies

The Project proponent will formulate a corporate environmental and social management policy to guide its environmental and social management during the construction phase and the operation phase of the Project. In this regard, the project Proponent will manage environmental aspects of the Project in accordance with the ISO 14001 Environmental Management System. Consequently, the Project Proponent will establish an Environmental Management System (EMS) for the project and will operate the EMS to meet the requirement of ISO14001. The EHS Management will be activated starting from the commencement date of the construction.

1.2.4 MONREC's Comments on Scoping and Draft Report

The draft report was last commented by the MONREC on 17th July 2017. The Environmental Conservation Department (ECD) suggested to revise and re-consider various sections i.e. resettlement plan and compensation, emergency response plan to natural disaster, environmental, health and safety plan and legal commitments, training and CSR program. The comments were summarized in *Section 2.6*.

1.3 PRESENTATION OF THE PROJECT

1.3.1 Project Description

Land plots in the Project will be leased for medium to light industries. The Project will develop and install utilities systems by phases, from phase A, phase B, phase C and to phase D. Zone A and Zone B will be firstly developed for the initial phase and followed by the other zones. As shown in Figure 1.3-2**,** target industries for phase A and phase B will be among the auto-parts, electronics, home appliances, garment and textiles, food and beverages, cannery and frozen seafood, agriculture and rubber products, pharmaceutical products and construction materials and for phase C and phase D will be glass products, plastics, auto-mobile and assembly manufacturing. In this EIA, development of Zone A will be focal.

Table 1.3-1 Industrial zone in the Dawei SEZ Initial Industrial Estate

PHASE & ZONE	AREA (Km^2)
A	7.00
B	7.00
C	7.00
D	6.00

Source: ITD (2012)

1.3.1.1 Project Location

The Project is located in Dawei province (Tavoy) in the Tanintaryi region and in Dawei Special Economic Zone, which is bounded by the Andaman Sea in the west and the Dawei River in the east. The Project is approximately 30 kilometers north of the Dawei airport and the Dawei city center. The Project can be accessed by two lanes concrete road which connects Dawei city and the Kanchanaburi province, Thailand from the west. The Project can be accessed by the seaport from the east and from Yangon city in the north, the Project can be accessed by the Yangon-Mandalay highway. The Project can be accessed by the highway no. 8 and also from the Dawei airport from the south.

1.3.1.2 Project Time Schedule

The Project schedule begins with period of the EIA. The Project has 50 years of the concession agreement for the entire project. Construction of Phase A will start around 2017 or as soon as the EIA approval. Phase B is planning to start in 2018. Phase C is planning to start in 2020 and Phase D is planning to start in 2022. However, extension of phase B, C and D will depend on market demand. Operation of the Phase A will probably start in 2020. Decommissioning will take a few years before the concession agreement is end. The Project is organized by the Project Proponent, Myandawei Company Limited. Board of management is presented in Figure 1.3-1.

1.3.1.3 Construction Phase

Each phase will be completed with infrastructure and utilities system that are sufficient to support the expected demand of water supply, wastewater treatment, waste management and power generation. Further details on infrastructure and utilities system are described in *Section 4.2*, *Chapter 4*. The Project is planned to be complete in 2023. Construction will be related to following activities.

(a) *Earthworks and Clearing Vegetation*

Large quantity of earth are moving. All the existing vegetation in the Project area will be clear except area designed for recreation and green. Dry excavated quarry located approximately 10 kilometers northwest of the Project will supply 20 million m^3 of earth materials for construction. Subbase Borrow Pits supplying materials for construction of road are located in the Project area near the Main Road. Sands Borrow Pits supplying materials for general construction are outside the Project area but still in the DSEZ, near coastal road and the ITD Campsite.

(b) *Construction Work Camp, Workshop, and Yards*

Work Camp is planned to construct in order to accommodate around 500 workers during construction. The workers will be employed by Myandawei Industrial Estate Co.Ltd. and main construction subcontractor. The Accommodation area will also be used for construction activities, concrete batching plants, mechanic workshop, warehouse, precast and reinforced concrete yard, and office. Workers camp will be constructed in accordance with Standard of the Engineering Institute of Thailand and sanitary management will be in accordance with Standard and Layout for Temporary Construction Worker Camp issued by the Engineering Institute of Thailand Under H.M. the King's Patronage (Wor Sor Tor. 1010-34 Standard). Construction of worker camp will be sufficient for number of workers and comply the building and electricity regulation.

(c) *Transportation of Construction Materials and Equipment*

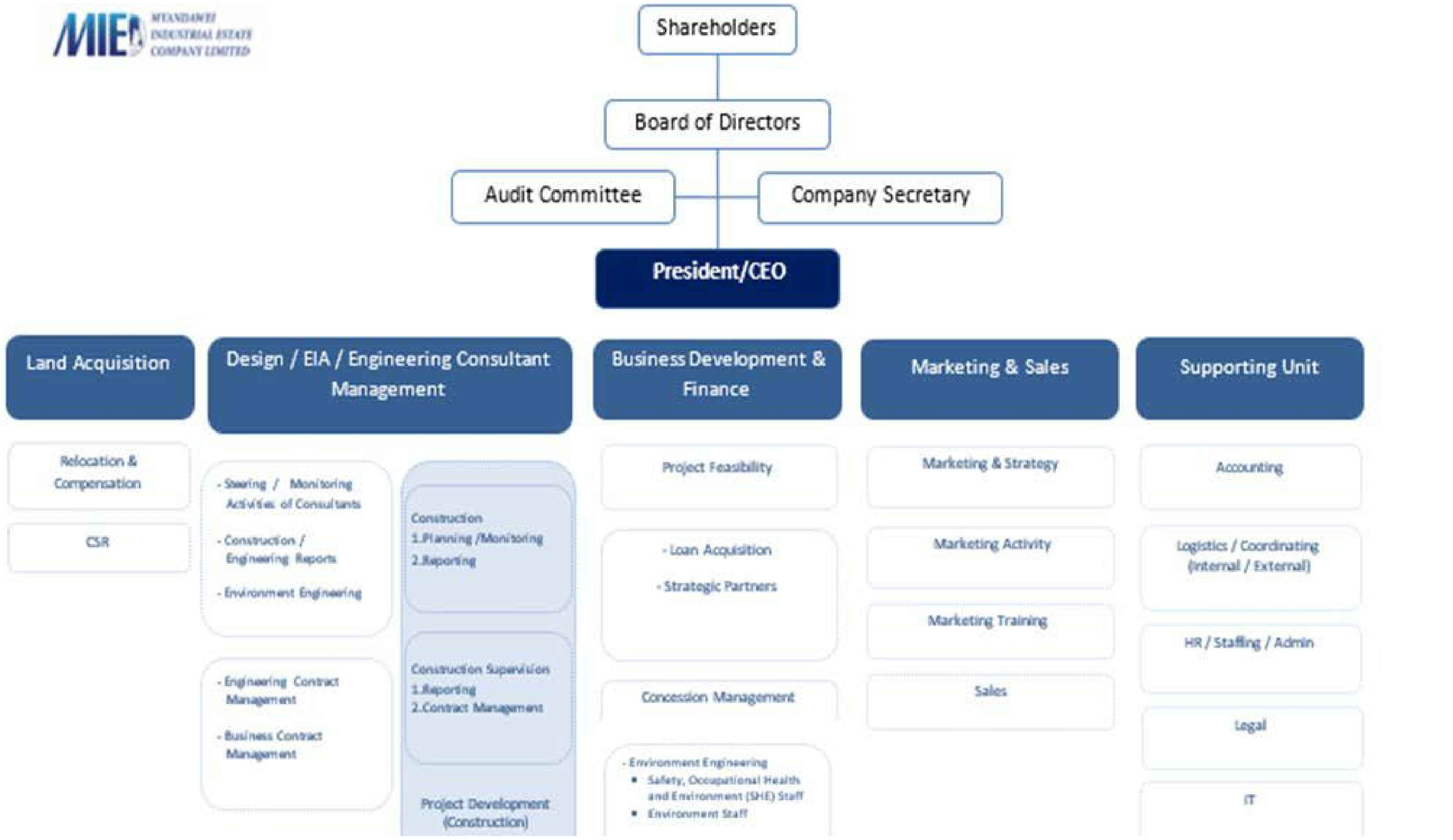
Construction materials, machines and equipment are planned to be transported from Thailand by vessel. Marine barges or tugs will deliver the materials and machines to small port of the DSEZ. The Dawei port is about 100 acres and has two platforms berths, which are 100 and 150 meters length in size. Existing Main Roads of DSEZ connecting the Project area and the small port. The road has been improved and widened to accommodate transportation of materials and machines and equipment, dump trucks and trailers.

(d) *Construction of Utilities and Facilities System*

Construction of utilities and facilities will include necessary earthwork, concrete work, commissioning, and procurement of necessary equipment and machines for the following infrastructure and utility systems. Further details of infrastructure and utilities system are described in *Section 4.2, Chapter 4*.

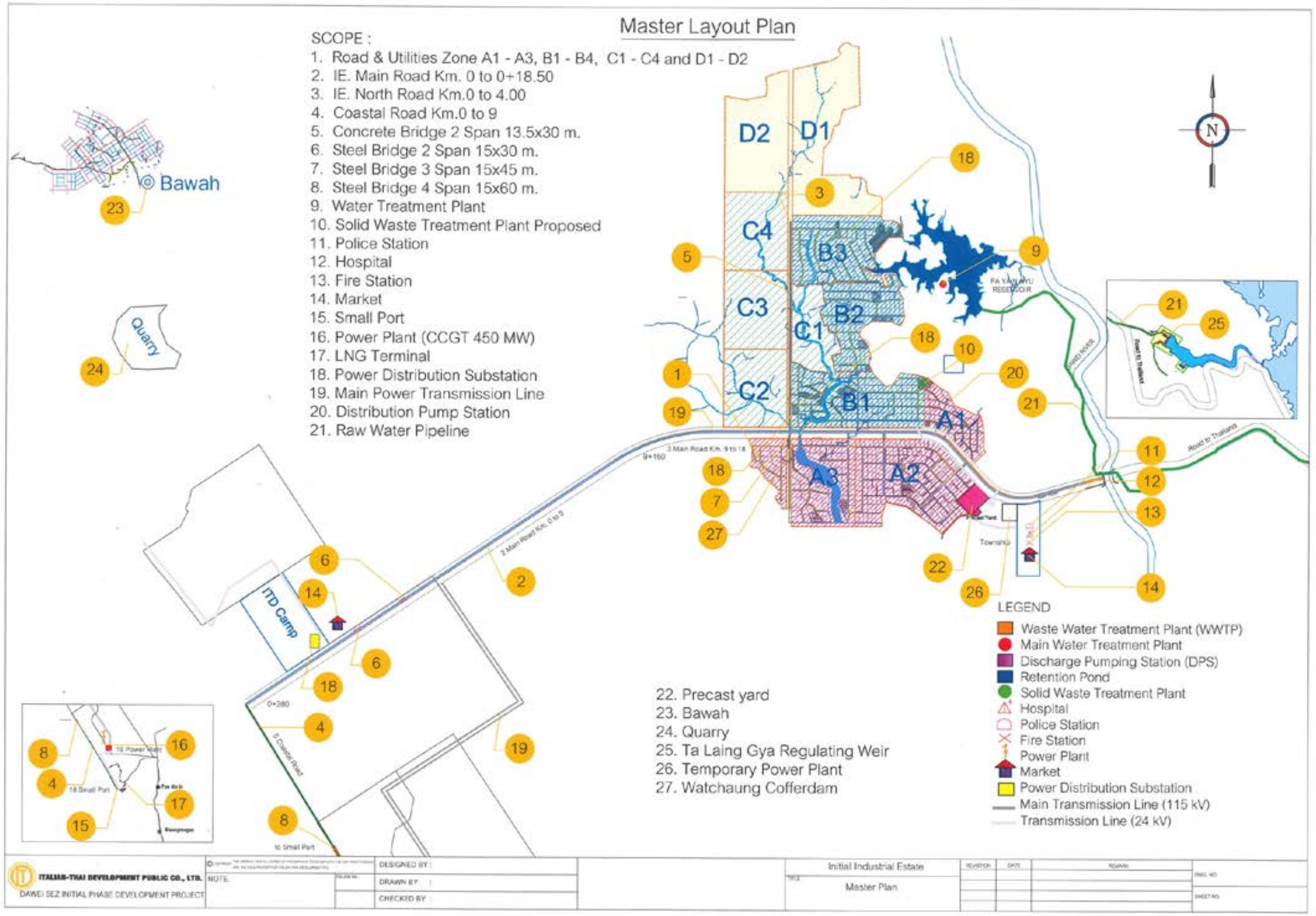
1.3.1.4 Operation Phase

The integrated Dawei Initial Industrial Estate Project will comprise of four phases, A, B, C and D. Zone A1, A2 and A3 will be firstly operate in Phase A. Subsequently, zone B, C and D will be operated and developed in concurrent utilities and facilities to support the industries capacity. Expected factories or manufacturing are different in each zone. Zone A and B are the same and targeted Auto-parts, Electronics, Home appliances, Garment and Textiles, Food and Beverages, Cannery and Frozen Seafood, Agriculture and Rubber products, Pharmaceutical products, Construction Materials industry and Factory for rent while zone C and D are targeted for Glass products, Plastics, Auto-mobile, Assembly industry and Factory for rent as presented in Table 1.3-2 and Figure 1.3-2.



Source: MIE (2015)

Figure 1.3-1 Project management and organization chart of Myandawei Industrial Estate Company Limited



Source: ITD (2012)

Figure 1.3-2 Layout shows components in the Dawei SEZ Initial Industrial Estate

Table 1.3-2 Operational Phases and Development of Dawei Initial Industrial Estate

PHASE	FACTORY OPERATION YEAR	ZONE	AREA (Km^2)	TARGET FACTORIES
A	2016 - 2017	A1 A2 A3	1.01 3.16 2.83	Auto-parts, Electronics, Home appliances, Garment and Textiles, Food and Beverages, Cannery and Frozen Seafood, Agriculture and Rubber products, Pharmaceutical products, Construction Materials industry and Factory for rent
B	2018 - 2019	B1 B2 B3	2.78 1.55 2.68	
C	2020 - 2021	C1 C2 C3 C4	1.70 1.85 1.76 1.69	Glass products, Plastics, Auto-mobile, Assembly industry and Factory for rent
D	2022 - 2023	D1 D2	3.83 2.17	

Source: ITD (2012)

The Project focus on export-oriented light and medium industries in order to transform the Dawei Special Economic Zone (DSEZ) into one of the major exporting and logistic hub of the AEC region and employment for the local people.

(a) *Electricity and Power lines*

Consumption of electricity is chiefly from operation of manufacturing and facilities in the Project, from operation of lights on roads, Water Treatment Plants, Central Wastewater Treatment System, Solid Waste Management System and manufacturing of target industries in each phase. Estimated electricity consumption for each phase of development are following:

- Phase A demands 102.9 MW.
- Phase B demand 103.8 MW.
- Phase C demands 103.9 MW.
- Phase D demands 92.8 MW.
- Full Phase demands totally 403.4 MW.

Power will be supply by the Initial Power Plant of Dawei SEZ, which operate Dawei Power Company Limited. Estimated, approximately 450 MW of electricity will be generated from the Central GT/CCGT power plant to serve the demand of the industrial estate and the others components in Dawei SEZ. The electricity will be contributed to the Project by the 115 kV / 24 kV Power Transmission Line with high voltage power installed along the road network with a number of substations.

(b) *Water and Water Treatment System*

Water treatment system is conventional and will supply 36,000 of consumable water per day in phase A. and 130,000 m^3 per day in full phase. Construction and operation of the water treatment system will be by phases and totally 8 units in full phase. Pa Yain Byu reservoir is a major supply of raw water. Raw water from the reservoir will be pumped into the plant at the pumping station details are in *Chapter 4.2*. The treated water is ready to consume and will be stored in the storage tanks. Approximately 800 kilograms per day of sludge will be generated; however, the sludge will be dewatering and then disposing in the solid waste management system. Chemicals need to be added for hygiene. Water will be distribute by the GDS pumping station in zone A1. The water will be deliver by pipeline underneath the access road and from the GDS pumping station will be distribute to manufacturing and the other facilities by water pipes network in each zone.

(c) *Central Wastewater Treatment System*

The Central Wastewater Treatment Plant will operate by phases. There have 4 phases of the plant. For the initial phase in Zone A. There will have 2 Wastewater Treatment Plant. Plant 1 is located in Zone A2 will receive wastewater from Zone A1 and A2. Plant 2 is located in Zone A3 will receive wastewater from Zone A3. Total volume of wastewater in phase A is 21,597 cubic meters per day.

Wastewater will be treated until achieved the National Emission Guidelines of effluent discharging from Wastewater Treatment Facility. Wastewater will be coarse filtrated before chemical treatment. Then flow rate will be adjust at the Pershallfume before aerated in the lagoons and the polishing ponds. The wastewater will be sedimentation and will be inspected for its water quality, if it can comply by the National Environmental Quality (Emission) Guidelines for effluents as presented in the previous *Chapter 3*. Once the treated wastewater comply the Guidelines for effluents it will be rest in a holding ponds for less than 24 hours before discharge or discharge directly to the public water/pipeline.

Discharge of the effluents will be concurrently by phases of the Central Wastewater Treatment Plants. The effluent from Phase A in zone A will be discharged into Kun Chung River and the effluents from Phase B, C and D will be discharged into Dawei River. The effluents will be delivered by the gravity flow of the effluent' pipelines. In case emergency, the Central wastewater treatment plant in zone A can hold 24 hours of wastewater.

(d) *Chemicals Uses*

Majority of chemicals used in the Project' facilities are mostly from the Water Treatment Plant and the Central Wastewater Treatment system in the treatment processes. Also, in the Solid Waste Management System in stabilizing of some hazardous waste. Alum, Lime Chlorine and Polymer are main chemicals used in Water Treatment Plants. Some chemicals will be used in naturalizing ponds in the Central Wastewater Treatment Plants and Leachate Management System in the waste management. Sludge that are solid to semi-solid waste usually generated by chemical reactions of the mentioned facilities will be disposed in the waste management system. The other source of chemicals usage will depend on each type of manufacturing in each Phase and that the manufacturing are probably required to declare during their own EIA approvals.

(e) ***Road Networks***

Highway no. 8 will be the main road connecting the Dawei SEZ and the rest of Myanmar. Extension of the Dawei SEZ Main Road to Thailand will link the Project and Thailand and the mainland of the Southeast Asia Country. Main Road of Dawei SEZ also linked the Project and the seaport on the Andaman Sea coast. The Dawei SEZ road is 4-lane. North-South Road (N-SR) will connect and link each zone of the Project together. The roads are 4-lane and 2-lane. Internal roads are linking land plots for each manufacturing with the other roads. All the roads will be lighted by the light poles and will operate once it is dawn. After the construction phase that access road is used as a main road will connect to Dawei SEZ Main Road. The road will still operate in this phase.

(f) ***Flood Protection System***

Precipitation or rains fall in open area of the Project will be drained into floodways and collected in the Flood Controlling System in normal situation. The retention ponds will retain the rainwater before it will be discharged into the existing tributaries in upstream of the Kun Chung River. In case emergency of storms or severely rainfall, each of the retention ponds can hold 6 hours of rainwater before it will be gradually drained into the River. Precipitation or rains fall in open area of manufacturing and facilities will be collected through the manufacturing and utilities themselves' drainages and required to treat until achieve the National Environmental Quality (Emission) Guidelines for effluent of each industry / manufacturing sectors in *Chapter 3* (*Annex 3.2*) or alternatively delivery to treat at the Central Wastewater Treatment Plant before discharging to public wastewater pipes and then draining to the public water.

(g) ***Solid Waste Management System***

Solid waste will be collected on daily basis from manufacturing area and the initial township by the facility vehicles. Some waste are expected to separate at source for non-hazardous and hazardous. Separation and processing plants will truly manage solid waste in accordance of their characteristics. Non-hazardous waste will be initially disposed in the non-hazardous waste landfill and hazardous waste will need to be stabilized or treated before dispose in hazardous waste landfill. At this stage infectious waste will have to be initially stored and will dispose by Dawei Hospital or directly delivery to Yangon dumping sites.

Solid waste will be disposed in the landfills to until their maximum capacity it will dispose in incinerators, which will be considered in the future. Landfill leachate, waste product of landfills will be treated in the facility until achieve a level of standard before delivery to the Central Wastewater Treatment Plant. Landfill gases will be collected and monitor using passive gases collection system and active gases collection system and flaring system. Once the incinerators operate, their air emission will have to comply by the National Environmental Quality (Emission) guideline for air emission. Residual from the incinerations; for example, bottom ash will be disposed in non-hazardous waste landfill and fly ash will have to be treated/stabilized before disposing in hazardous waste landfills.

(h) ***Fire Fighting and Emergency Response System.***

Fire Fighting station will be shared between the Initial Township and is located in Facility Center in the Initial Township. Initially there will have only one fire truck and one pumper truck. Number of fire trucks, pumper trucks, fire equipment are planned to develop and increase in concordance with phases of the Initial Industrial Estate and number of population growth in the initial township. These amounts of the Project's resource is evaluated to be sufficient in controlling fire emergency inside a plant/factory or in area of the initial industrial estate. However if severe fire occurs, the Project will need a support from local facilities or agencies from the nearest Township such as Yebyu Fire station.

1.3.2 Emergency Response Plans

According IFC EHS Guidelines standard for community health and safety, the Project Proponent has prepared the Emergency Response Plans (ERPs) for cases of fires hazards (both anthropogenic and fire vegetation or bush fire), natural disasters; earthquakes, tsunamis, flooding and landslides. The Project's ERPs are also required for the ESIA as a part of the Myanmar Action Plan on Disaster Risk Reduction (MAPDRR) in order to prevent, relief and recovery from the threatening disaster. As promulgated in the related laws and regulations, each plants / factories including the Project Proponent must form the reserve fire brigade team (Emergency Response Team) in order to manage emergency and co-ordinate in with several parties including preparation of fire apparatus and emergency equipment. Financial supporting for impacted communities during emergency is planned. Details in CSR of the Project.

1.3.2.1 Emergency Level

General emergency response plan of the Dawei Initial Industrial Estate can be categorized into 3 levels; Tier 1, Tier 2 and Tier 3 levels.

- **Tier 1 level** is a small scale of emergency that will occur in limited in area of factory or plant and incident can be controlled by supporting facility and team of the factory or the plant itself. The plants/factories have to perform the best in order to control and mitigate the impact. The incidents must be reported to the Initial Industrial Estate Emergency Response Center / Team.
- **Tier 2 level is** a medium scale of emergency that likely to extend to the other plants or factories or in the Industrial Estate. However, the emergency trends to be controllable by supporting facility of the Industrial Estate itself or nearby township facilities. The Initial Industrial Estate have to perform the best in order to control and mitigate the impact and the incidents must also be reported to executive of the Initial Industrial Estate or PIC for this level.
- **Tier 3 level** is a large-scale of emergency that likely to extend to the nearby community and surrounding environment. There need outsource supporting facilities and cooperation of nearby agencies in order to control and mitigate the impact. The incidents must also be reported to Myanmar Industrial Estate Authority or the in charged Myanmar Departments.

1.3.2.2 Fire and Explosive Plan

Firefighting / Explosive plan consists of 3 stages; prevention, evacuation and recovery plans. Establishment of the factories/plants and the Project's proponent must comply code of practices which define in Myanmar legislation i.e. Building Codes and/or Notifications. Each factories shall have annual fire rehearsal, fire prevention system as defined in the said laws. In case emergency, fire and explosive plan must be proceeded accordingly level of the fire emergency.

1.3.2.3 Strom and Flooding Plan

Strom and Flooding plan consists of 3 stages; prevention, warning and evacuation and recovery plans. Drainage and flood retention system shall be prepared before storms and

rainy season. In addition, follow up the meteoric condition and emergency announcement during flooding or rainy period shall be on action.

1.3.2.4 Chemical Spills Plan

Chemical Spills plan consists of 3 stages; prevention, warning and evacuation and recovery plans. Evacuation plans have 2 types, Spill and Overflows at the loading rack and Spill and Overflows in the loading rack. Handling of chemicals and storages shall be complied by the relevant laws and regulations including EHS policy and guideline. Overall, the plants/factories or Project Proponent has to perform the best in controlling of leaks or spills and limited their contaminated area.

1.3.3 Occupational Health and Safety Administration

The Project has formulated Safety Health Environment Master Plan in order to manage the Project, effectively under standards i.e. ISO14001, ISO9001 and OHSA 18001. The safety plans are Permit to Work System (PTW), Personnel Protective Equipment (PPE), land transportation system, safety system during construction, preventive maintenance including health policy and measures; annual health checkup, drug check, smoking area, standard working condition and food. Standard for environment and waste management e.g. 3 Rs, waste separation and chemical handling. Details of the SHE master plan achievement in period of 10 years is in *Section 4.4.3, Chapter 4*.

1.3.4 Description of Project Alternatives

1.3.4.1 The Project Site Selection

Three locations along the coast of the Tanninthari north were initially considered for the Dawei project. The comparative outcome can be summarized in Table 1.3-3.

Table 1.3-3 Comparative Site Section for the Project.

Map	Site	Location	From Dawei	Engineering Perspectives
	Site A	Maungmagan Bay	28 km (N)	is a natural sand beach, backed by a huge open coastal plain. The site shall be able to develop the industrial estate, which can be linked between port facility and the other components but the area has no natural protection against monsoon. So, breakwaters will be required.
	Site B	San Lan Bay	20 km (SW)	is protected against westerly monsoon by an island. Thus, no large scale breakwater will be required but due to, water depth is shallow, a considerable amount of dredging will be needed. The area has narrower coastal plain and shorter beach compared with Site A resulting in smaller potential development of port and industrial estate facilities.
	Site C	Nyaw-Byin Bay	48 km (S)	is fully exposed to Andaman Sea and will require a breakwater to protect the port area. Land reclamation may be needed in parts of the bay where water depth is shallow.

Source: ITD (2012)

Following criteria in the Matrix Evaluation by ITD (2010), see Table 4.5-1 in Chapter 4, the port location should be well-protected and have a sufficient natural water depth to accommodate large-size vessels. The site should also have sufficient backup area inshore and free of seasonal flooding. The site should have good access to the main roads for transportation in terms of distance and road alignment, both vertical and horizontal. The port site should be as near as practically possible to the industrial estates. The site should be wide enough both inland and offshore that will allow future expansion, and the subsoil of the site shall be suitable to allow land reclamations. Hence, Site A was selected as the most appropriate site for the construction of the port and the Industrial Estate.

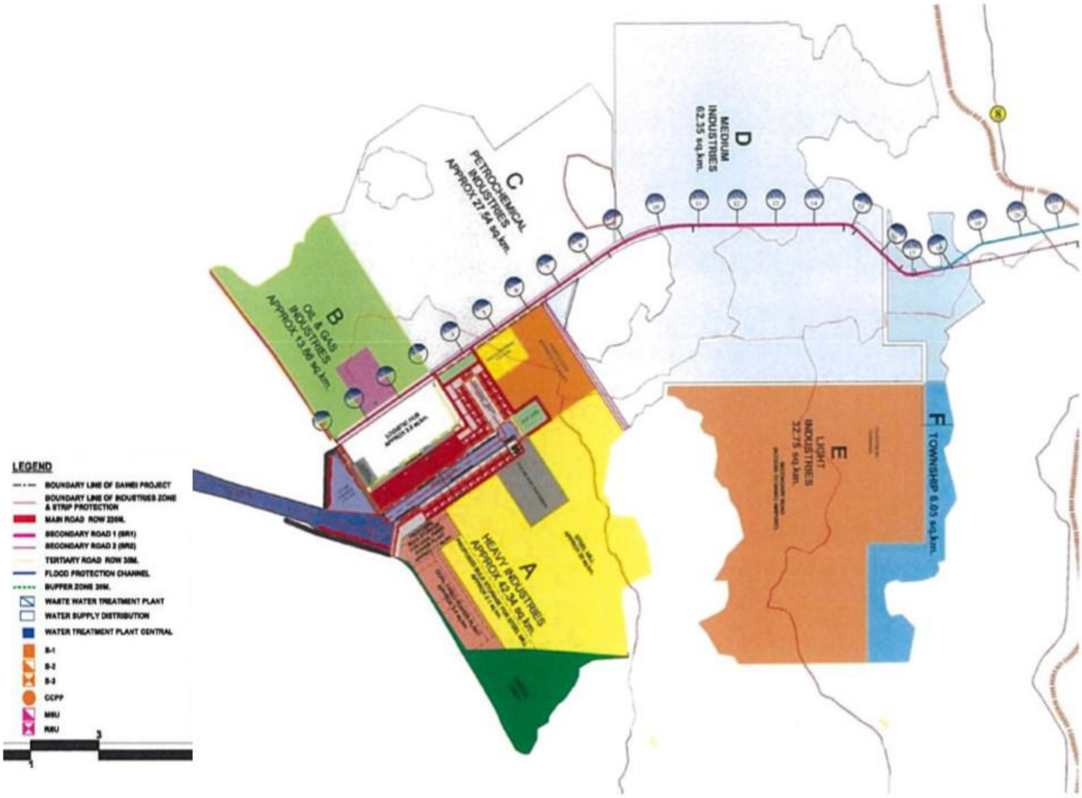
1.3.4.2 The Project Layout

Three (3) alternatives of the Project layout were considered following:

- Alternative 1: Zone D Medium Industry (Pale blue)
- Alternative 2: Zone E Light Industry (Pink)

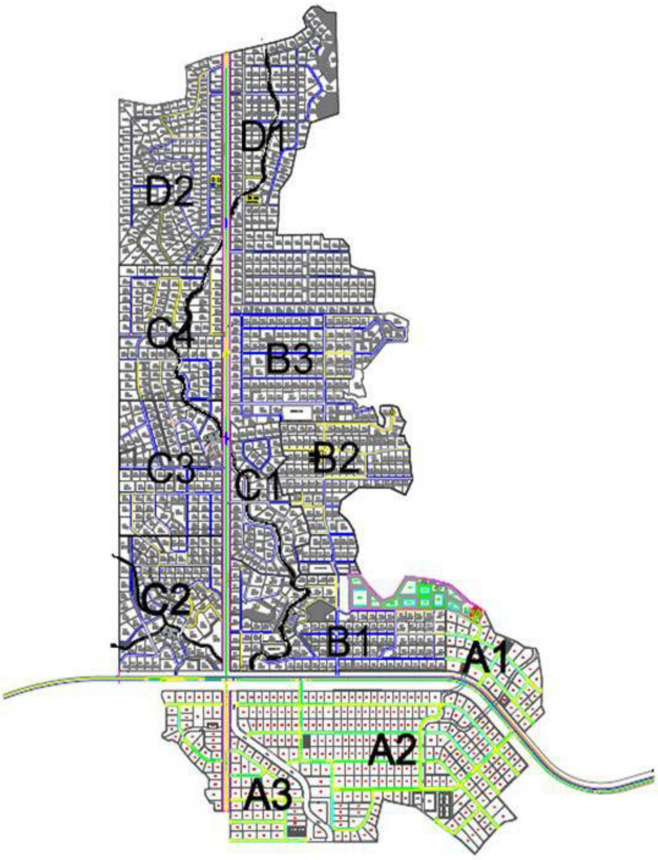
- Alternative 3: The Present Master plan

From social impacts perspective, a comparison between Zone D, Zone E and the Present Master Plan reveals that Zone E will result in higher social impacts than in Zone D and in the Present Master plan. This is due to settlement of villages in Zone E resulting in high ratio of developing area and relocation villages (See Table 4.5-3 in Chapter 4). Therefore, Alternative 3, the present Project Master Plan is the finally selected as the best alternative. Figure 1.3-4 is presented the Final Master Plan of The Dawei SEZ Initial Industrial Estate.



Source: SEATEC (2012)

Figure 1.3-3 The Previous Layout of the Project shows Alternative 1 and 2



Source: IEC (2015)

Figure 1.3-4 Final Master Plan of The Dawei SEZ Initial Industrial Estate

1.4 DESCRIPTION OF THE ENVIRONMENT

1.4.1 SETTING AND STUDY LIMITS

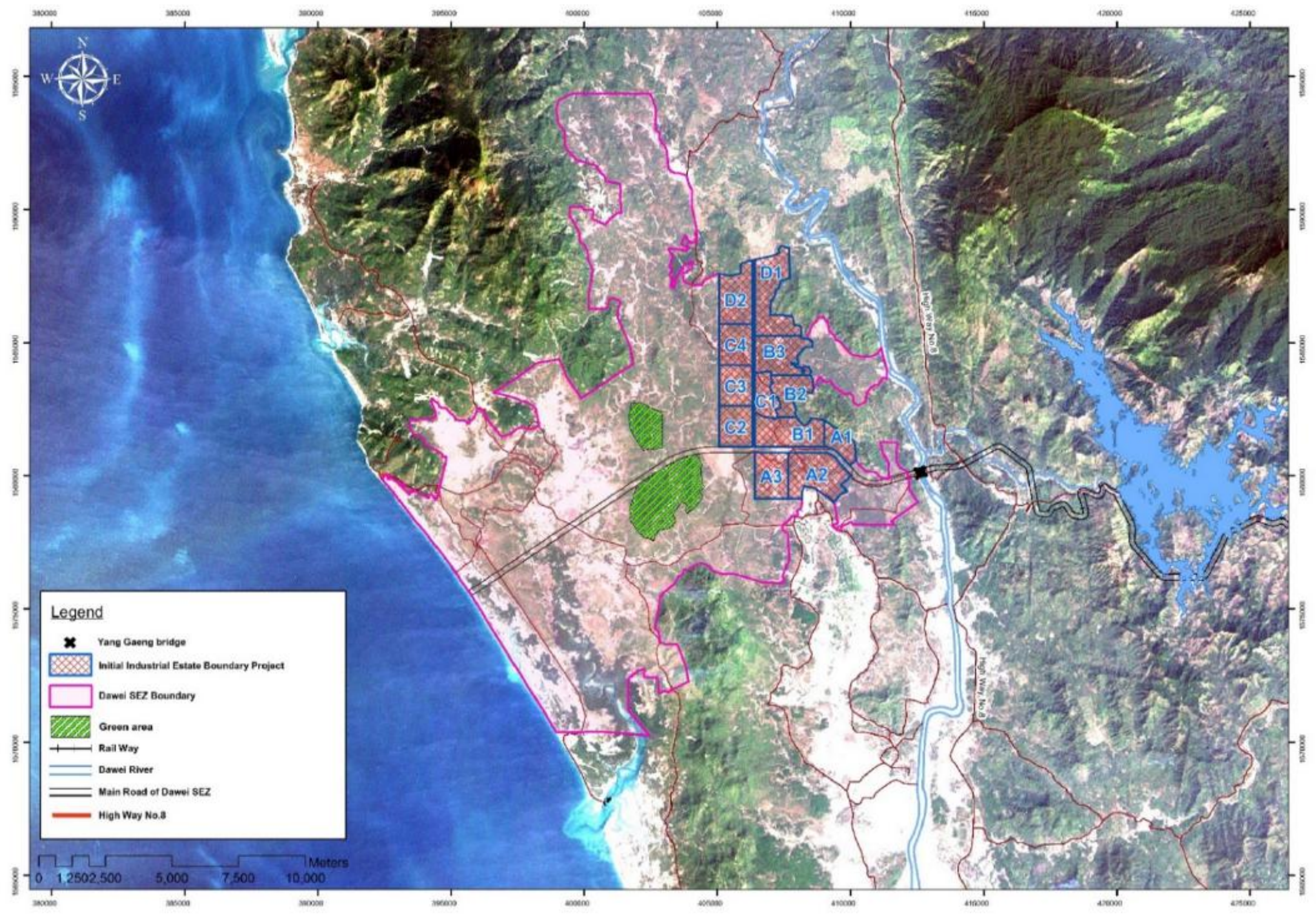
1.4.1.1 Geographical Study Limit

The geographical study limit is defined an area surrounding the project which the baseline information shall be collected. In this ESIA study, the geographical study limit is about 5 km extending from the center of the project site. This geographical study limit covers 78.57 km^2 of circular area from center of the project site, as shown in a map in Figure 1.4-1.

1.4.1.2 Contextual Study Limit

The contextual study limit in this ESIA study consists of four groups:

- Physical components;
- Biological components;
- Socio-economic components;
- Cultural components.



Source: SEATEC (2012)

Figure 1.4-1 The geographical study limits

1.4.2 PHYSICAL COMPONENTS

1.4.2.1 Topography

The project area is entirely flat. Kunchanug River is the only on flowing within the area, from the north to the south. The other 3 rivers nearby the project area are Nabule River; Dawei River and Pan Din In Chaung River.

1.4.2.2 Geology

The project area is situated on Q2-alluvial Holocene sediments, referring to the Geological map of the Socialist Republic of the Union of Burma (USACE, 1977). The Holocene strata is graded from fine to coarse gravel and sand, silt, and light-to medium-gray and yellowish-gray clay.

1.4.2.3 Seismology and Earthquake

The project area is located in moderate hazard zone for earthquake but it is still classified as minor damages zone. This zone has a range of ground acceleration less than 0.075 g and most of frequent earthquake occurrence is lower than 6.0 Richter. Severe earthquake over 6.0 to 9.0 have been occurred in the past but with long return period.

1.4.2.4 Tsunamis

The Project area is also located in moderate hazard for Tsunami but due to location of the Project is situated in landward, further 10 km, it will not be exposed for the scale of Tsunami, less than 3 meters. In addition, the area is sheltered by offshore islands and green areas and have never been reported about devastated damages from any historical Tsunami.

1.4.2.5 Hydrology

There are two basins, Andaman basin in the west and Dawei River basin in the east Dawei River and Kunchaung River are in the Dawei basin. Kunchuang River flows into the Dawei River and then to the Andaman sea in the west.

1.4.2.6 Air Quality

- There are 4 sampling stations nearby the project area for air quality measurement from the previous studies:
- The concentration of TSP and PM_{10} average 24 hours were quite high, especially during the dry season.
- The concentration of SO_2, NO_2 and CO were compiled within the World Bank Group, U.S.EPA and WHO standards.
- The THC, MHC and NMHC were measured in preparation of baseline data, even though there were no standards given.

1.4.2.7 Noise and Vibration

The L_{Aeq} 24 hours. And L_{Amax} in both dry and wet seasons were compiled within the U.S.EPA.and Thai standards; The results of the Peak Particle Velocity of vibration, which do not affect any buildings, were more than 2.0 mm/s.

1.4.2.8 Groundwater quality

Twice groundwater sampling were underwent from 2 sampling stations near the project area, in March 2015. All results were complied with the standard of surface water for agricultural purpose excepting lead is exceeding the standard. Overall water from shallow well in villages (unconfined aquifer) is found not suitable for drinking due to pathogens.

1.4.2.9 Surface water quality

Five surface water samples were carried out on February 2015. Two samples were taken from Dawei River and the other 3 samples were taken from river and stream near by the project area. SW1 is from the Ekani River station, which is located in northern part of the project and SW2 is from Yalai Chuang creek located in southern part of the project.

Most of the parameters were complied with the proposed surface water standard of Thailand (Details in Chapter 5). Only one sample, SW1 had 5.8 mg/l of DO, low quantity of solids and 0.0002 mg/l of total mercury. Whereas, SW2 characterized with yellow color and had 4.2 mg/l of DO and low BOD and COD. Samples from the Dawei River had quite high DO concentration (nearly 6 mg/l) and suspended with solids. Their TSS ranged from 1,417 to 1,836 mg/l. Coliform bacteria and E. coli were not found in both samples from the Dawei River.

1.4.2.10 Sediment quality

All sediment samples were complied with the proposed sediment quality standard except mercury was found in every sampling station. SW1 and SW2 mainly composed of sands around 54.9 and 44 %, respectively and some quantity of heavy metals were found. SW3 station mainly composed of clay (58.39%) with elevated of mercury and iron (0.719 and 26,078 mg/kg, respectively). SW4 and SW5 were sampled from the Dawei River composed of indicated that the clay (47 and 63.7 %, respectively). Heavy metals detected in the sediment samples were arsenic, zinc, copper, iron, lead, nickel and total chromium.

1.4.3 BIOLOGICAL COMPONENTS

1.4.3.1 Aquatic Ecology and Fisheries Activities:

- Green algae and diatom were dominant taxa of phytoplankton. Indicated by Wilhm and Dorris (1968) diversity index (H') suggesting that surface water quality near by the project area was in moderate condition and acceptable for aquatic organisms.
- *Nauplius* Copepod and *Arcella* protozoan were abundance.

- Segmented worms is dominant benthos in all stations especially littoral fauna.
- Freshwater shrimp was a dominant littoral fauna in all stations.
- *Actinoscirpus grossus* (coarse bulrush) was dominant species in water body; whereas, *Acanthus ebracteatus* (sea holly) and *Nypa fructicans* (nipa palm) were dominant in tidal zone of the Dawei River stations.
- Cyprinid fishes (Cyprinidae: Barb and Minnow) and Gobiidae (Goby) were dominant. Total density of fishes ranged from 1,400 to 4,400 of individual/hectare and total abundance of fishes ranged from 6.795 to 8.510 kg/hectare
- Fisheries activities : Pushnet boats, gillnet ,fish trap, dip net, fish net and hook were small fishing gears that used by the local fishermen.

1.4.3.2 Forests

Forest in the project area can be divided into 3 types: mangrove forest, reserved forest, and natural forest. According to the IUCN Red list, one specie, *Ceriops decandra* was found in the mangrove forest. None of the species in the reserved forest was in the IUCN Red list. One endangered tree species and two critically endangered species from the natural forest were in the IUCN Red list. The former was *Diospyros crumentata* and the latter was *Dipterocarpus kerrii* and *Dipterocarpus turbinatus*. *Hopea odorata* was a valuable species also found in this forest.

1.4.3.3 Wildlife

Four types of vertebrates were investigated, reptiles; amphibians; avis (birds); and mammals. Burmese python (*Python molurus bivittatus*) is an endangered species reptile listed in the IUCN Red-list. East asian porcupine (*Hystrix brachyuran*) and long-tail goat (*Naemorhedus caudatus*) were mammals listed in vulnerable species in the IUCN Red-list.

1.4.4 SOCIO – ECONOMIC COMPONENTS

- There were 5,834 households in 18 villages. Total population was 35,443 that could be divided into 16,628 males and 18,805 females. The highest population (7,700) is in Pagaw Zoon village while the lowest population is in Nyaung Bin Seik village, only 328 persons.
- No data indicated the ethnic group in the 18 affected villages by the REM's village survey in 2013.
- The education system in Myanmar is divided into 4 levels; pre-school, primary, secondary, and higher education According to the field survey. Each village has one school except Kya Khat Tabin village has two schools.
- Land use survey undertaken in Yebyu and Laung Lone. The survey for Yebyu revealed that the area was still unoccupied and preserved as forest, around two –third of the area. Only 12 percent were converted to an active agricultural land. The survey

for Laung Lone, one-third of total area was utilized for agricultural purposes; whereas, nearly two-third of the area were still in their nature.

- In Lae Shaung and Pan Din In village, the rural health centers were assisted by seniors blue nurse (LHV Lady Health Assistance).
- 70.8% of people still smoke tobacco and 12% of people drink alcohol, regularly.
- Major source of food for the respondents was from the self-plantation (84.72%), buying from market (9.94%) and natural resources/fishery/forest/river (5.56%).
- Water supply in the study area was the shallow well groundwater. Other sources of water for local villages were from artesian wells and rain fall storages. Most households in the studied area such as Bawah village had good water source from shallow wells and streams.
- Situation of water for drinking around the project area was in good. More than 50% of the villagers used the filter treatment and 26.5% boil water before the consumption.
- None of the electricity supply in the studied area. Only some households had electricity from small generators. Main generators of the camp were used in the project area during pre-construction.
- In Dawei area, solid waste and sanitation were still poorly managed.Results from the field survey also indicate that public health services in local communities were quite limited. For example; wastewater from households of the respondents were directly discharged into the ground (82.2%). Discharge into public drainage system was around 5.9%, discharge in the garden was 5.1% and discharge into the public river was 4%.
- Disposal of solid waste from most of the respondents were by open burnning (93.8%). Piled up outside the house was 2.7%, in landfills was 2.2% and threw away in pubic area was 0.8%.
- Condition of roads in the project site and local villages were still unpaved. Width of the roads were about 4 m.
- Highway no.8 is a 2-lane road that connect the project and the other part of Myanmar. This road also links to the Dawei airport. International flight is operated by Myanmar Airways International. Domestic flights are operated by Air Mandalay, Air Kanbawza, Asian Winds, Air Bagan and Yangon Airways. Flight from Yangon to Dawei is about one hour. Dawei-Yay railway has a service running through Yebyu Township. The railway is in North-South direction parallel to the Dawei – Yay Highway. Cargo can be transported by boats using the Dawei jetty.
- Land use survey was conducted by ITD. The survey reveals that there were three major types of land use in vicinity of the project area.
  - Land for agriculture was flat and extensively cultivated, crops and paddy fields. Plantations were in quite elevated altitude, hilly and undulated

terrains. Major type of the plantations are oil palm, cashew nut, rubber, coconut and betel palm.

– Rural Settlement area by the villagers. There were 16 villages in the project area.

1.4.5 CULTURAL COMPONENTS

The village profile survey by REM (2013) reveals that three spots of cultural highlights in the project vicinity. "*Foot Print of Buffalo Pagoda*" in Payadat Village and "*Nabule Settawyar or Buddha Foot Print*" in Lae Shaung Village. There was also one monastery in Mudu Village and the other two pagodas in Min Dut in Pan Din.

1.5 IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES

In order to justify significant level of the environmental and social impacts for each aspects, the impact assessment results are classified in to 6 categories following:

- A- : Significant negative impact
- B- : Some negative impact
- C : Impacts are not clear, need more investigation
- D : No impact or impacts are negligible, no further study required
- A+: Significant positive impact
- B+: Some positive impact

Summary of impact result and relevant mitigation measures during pre-construction and construction phase (CO) and operation phase (OP) is presented in Table 1.5-1.

Table 1.5-1 Summary of the environmental and social impacts and relevant mitigation measures

Category	Aspects	Assessment Result		Result Description	Relevant Mitigation Measures
		CO	OP		
Pollution	Air Quality	B-	A-	**CO:** Fugitive dust generated from construction site and transportation of vehicles. **OP:** Emission from operation of tenants and incinerator. Exhaust from traffics.	**CO:** Water spray and covering truck or materials with canvas. **OP:** Control emission loads for PM10, NO_2, SO_2 and Dioxin. Use Best Available Technology
	Water Quality	B-	A-	**CO:** Turbidity from run off due to clearing land, construction area and worker camp. **OP:** Wastewater generated from tenants and centralized wastewater treatment plant	**CO:** Control discharge from construction site and worker camp. **OP:** Control effluents from wastewater treatment facility and intensive monitoring.
	Groundwater Quality	B-	B-	**CO:** Spills or leaks of chemicals, leaching from existing contaminated soil and work camp **OP:** By spills or leaks or existing contaminated soil. Landfills and treatment plants	**CO:** Spill/Leaks Prevention Plan and sanitary of work camp. **OP:** Control risk area and implement spill/leak prevention plan

Table 1.5-1 Summary of the environmental and social impacts and relevant mitigation measures

Category	Aspects	Assessment Result		Result Description	Relevant Mitigation Measures
		CO	OP		
	Noise and Vibration	B-	B-	**CO:** Increase of noise and vibration levels due to machineries and travelling of vehicles.	**CO:** Plan construction location and period of work.
				OP: Operation of tenants and transportation of vehicles.	**OP:** High level of noise instrument has to operate in enclosed building or fence line.
	Offensive Odor	D	B-	**CO:** Waste dump of work camp **OP:** Operation of some tenants and waste management facilities.	**CO:** Control sanitary of work camp. **OP:** Control odor sources
	Bottom Sediment	B-	B-	**CO:** Construction of Flood Controlling System near river banks i.e. Khun Chuang River tributary. **OP:** Discharge of effluents from Wastewater treatment plant may deteriorate bottom sediments.	**CO:** Control measures e.g. sedimentation ponds or silt fences. **OP:** Control quality of effluent.
Natural Environment	Topography and Soil quality	A-	D	**CO:** Construction activities and materials supply e.g. subbase pit/ sand pit or grading land. Cross contamination of soil from moving earth. **OP:** No operation activities are expected to cause topography alteration. Operation of some tenants is expected to contaminate soil.	**CO:** Manage backfilling and earth moving. Design minimize topographic alteration. **OP:** Implement chemical handling and waste management.
	Soil erosion	B-	B-	**CO:** Construction of flood controlling system near river banks. **OP:** Discharge of effluents from wastewater treatment plants may erode banks of the river Khun Chuang.	**CO:** Planning construction and piling of soil. **OP:** Control quality of effluent
	Hydrology	B-	B-	**CO:** Temporary impact from land modification **OP:** Development of the industrial area e.g. volume of discharge.	**CO:** Keep monitoring **OP:**
	Geology and Seismology	D	D	**CO:** **OP:** No expected impacts due to the Project is overlain on passive earth.	**CO:** - **OP:**

Table 1.5-1 Summary of the environmental and social impacts and relevant mitigation measures

Category	Aspects	Assessment Result		Result Description	Relevant Mitigation Measures
		CO	OP		
	Ground Subsidence	D	B-	**CO:** Well water may be use but no impact is expected due to temporary abstraction. **OP:** Severe abstraction of groundwater may cause subsidence but groundwater may be use only if water supply by the Project is critical.	**CO:** Control uses of groundwater. **OP:** Control abstraction of groundwater for Industry purpose.
	Surface Water Biology	B-	A-	**CO:** Turbidity from run off and discharge of work camp can affect aquatic ecosystem **OP:** Discharge of wastewater into water bodies e.g. Khun Chung River or Dawei River.	**CO:** Control discharge quality and sanitary of work camp. **OP:** Control effluents quality from wastewater treatment plants.
Economic Development	Infrastructure and Services	B-/B+	B+	**CO:** Improvement of infrastructure e.g. road network. Impacts on supply of water, electricity and waste disposal capacity are not expected except sanitary of work camp can magnify the exiting waste problem. **OP:** Increase accessibility to services, school, hospital or shop. Improvement of infrastructure.	**CO:** Planning the construction and sanitary of camp site. **OP:** -
	Traffic and Transportation	B-	A-	**CO:** Traffic congestion due to increase of construction vehicles is expected **OP:** Traffic congestion due to development of the Project.	**CO:** Install sign board or signal to manage traffic **OP:** Provide sufficient mass transport for workers e.g. between township and their work.
	Land use	B-	B-	**CO:** Encroachment of surrounded green area for leisure. **OP:** Development of the area surrounded the industrial estate.	**CO:** Provide temporary service for worker camp. **OP:** Engage in DSEZ land use planning.
Social Environment	Socio-Economic	B-/B+	B-/B+	**CO:** Some conflicts with locals but increase some household income e.g. PAHs **OP:** Conflicts between workers and local due to influx of worker but increase household income due to employment of locals and development of the area.	**CO:** **OP:** Acknowledge booklet guide for migrant workers.

Table 1.5-1 Summary of the environmental and social impacts and relevant mitigation measures

Category	Aspects	Assessment Result		Result Description	Relevant Mitigation Measures
		CO	OP		
	Historical and Cultural Site	D	D	**CO:** **OP:** No historical and cultural site is expected	**CO:** **OP:** -
	Involuntary Resettlement	A-	A-	**CO:** Land acquisition is partially required and some scale of involuntary resettlement is expected. **OP:** Living and livelihood of relocated households.	**CO:** **OP:** Develop and implement Resettlement Action Plan (RAP)
	Living and Livelihood	A-/B+	A-/B+	**CO:** **OP:** PAHs who earn income from agriculture will lose their income but increase of job opportunity during this phase is expected.	**CO:** **OP:** Develop and implement Livelihood Restoration Plan
	Children's Right	B-	B-/B+	**CO:** Relocation of house and school may disturb children education **OP:** Shall gain indirect benefit from the improvement of infrastructure.	**CO:** Conduct CSR Program **OP:**
	Local Conflict of Interest	B-	A-	**CO:** Conflict also may raise due to relocated households and host community.	**OP:** Develop and implement Resettlement Action Plan (RAP)
				OP: Local conflict of interest may happen if job opportunity increased by the Project is misdistributed to local community. Conflict also may raise due to relocated households and host community.	**OP:** Implement training program and equal job opportunity.
Health and Safety	Risks for Infectious Disease such as AIDS/HIV	B-	B-	**CO:** Possibility to increase of risk due to influx of construction workers. **OP:** Possibility to increase of risk due to influx of workers of tenants and urbanization of the Project and surrounding area.	**CO:** Conduct a training session for construction workers with appropriate materials. **OP:** Educate workers and raising awareness of STD and communicable diseases.
	OHSA	B-	B-	**CO:** Impact on working condition is expected **OP:** Impact on working condition of the Project and tenants is expected.	**CO:** Implement EHS system and the standards. **OP:** Conduct health surveillance and training program for workers.

Table 1.5-1 Summary of the environmental and social impacts and relevant mitigation measures

Category	Aspects	Assessment Result CO	Assessment Result OP	Result Description	Relevant Mitigation Measures
	Community Health and Safety	B-	B-	**CO:** Impacts i.e. increase of traffic accidents and operation of machineries are expected. **OP:** Impacts on community health and safety are expected due to influx of workers, traffic accident and urbanization of the surrounding areas.	**CO:** Implement worker camp rules and sanitation. **OP:** Provide sufficient health services e.g. hospital. Raising health and safety campaign.
	Usage of Chemicals	D	B-	**CO:** No plan to use chemicals. **OP:** Use by tenants and the Project operation or spills and leaks accidents.	**CO:** - **OP:** Standard handling of chemicals must be perform and implement of spills and leaks prevention plan.
Emergency Risk	Flood Risk	B-	B-	**CO:** **OP:** Severe rainstorm and Cyclone	**CO:** Implement Flood Prevention Plan. **OP:** Maintenance Flood Controlling System and Flood Prevention Plan.
	Risk of Fire	B-	B-	**CO:** Construction activities and worker camps. **OP:** Operation of tenants and open burning of human activities.	**CO:** Implement Fire Prevention Plan **OP:** -
	Earthquake and Tsunami	B-	B-	**CO:** **OP:** Severe earthquake and tsunami	**CO:** **OP:** Acknowledge safety guide for Earthquake and Tsunami
Other	Global Warming	B-	B-	**CO:** Emission of GHGs from operation of machineries and vehicles. **OP:** Emission of GHGs from operation of tenants and wastewater treatment plants and waste management facilities. Cumulative exhaust from transportation.	**CO:** Planning construction and maintenance of instruments. **OP:** Promote low GHGs emission industries and effective technology for facilities.

Remarks: Source: ESIA Study Team

Evaluation: A- : Significant Negative Impact A+ : Significant Positive Impact

B- : Some Negative Impact B+ : Some Positive Impact

C : Impact are not clear and need more investigation

D : No impacts or impacts are negligible, no further study is required

1.5.1 Construction Phase

1.5.1.1 Air Quality

Potential impacts on air quality during construction activities are generally generated from the following sources:

- Dust from transportation routes, which are unpaved and transported materials;
- Dust from construction site, quarry, and land clearing;

Impacts caused by the above activities are commonly localized to the area close to the source. Impacts occurred only during construction period. Dust suppression methods, such as water spray and cover of bulk materials on trucks, have to be implemented to reduce the impacts. Burning of vegetation shall be limited to only other methods are not practical, and the vegetation has to be piled and burned in the area away from the sensitive receptors such as communities and work camps.

1.5.1.2 Noise and Vibration

The highest noise source is 101 dB(A) from pile-driver (impact type) and the estimated noise level is 70.6 dB(A) at 1650 ft (500m). Therefore, any noise sources lower than 101 dB(A) will result in noise level lower than 70 dB(A) at 500 m. However, the community in the distance of less the 500 m may be affected from noise. Construction within 500 m from the any sensitive receptors such as communities, school or hospital; therefore, have to be controlled either by restricting the construction to day-time only, or an agreement has to be made with the nearby villagers should extended working hours are needed.

Construction vibration may be generated from blasting, pile-driving, vibratory compaction, demolition, and drilling or excavation in close proximity to sensitive structures. The existing conditions of the area do not have any high-rise buildings or structures that may be sensitive to vibration. Some religious places, such as pagodas and temples, exist in the Project vicinity (but not in the Project development area) and presumably these places will be relocated before the construction activities of the Project can commence close to them. Overall impacts due to vibration from construction equipment are expected to be negligible.

1.5.1.3 Topography and Soil

Construction of the project involves large amount of earth moving. Most of the materials obtained from the excavation will be used for backfilling of the low areas of the project. Changes and impacts to topography during the construction are expected to be unavoidable. Practices on sourcing material from nearby area will limit transferring soil material across different basins. Top soils will be preserved wherever possible and reused when earthworks are completed, which will help preserving fertile soil.

1.5.1.4 Surface Water and Sediment

Source of pollutants that may impact water quality during construction period include: domestic wastewater from workers camp and turbid runoff, particularly in the land development activities where vegetation clearing is needed. The reclamation of land may impair water quality from the transported sediments in runoff during rainy season. Control of sediments from the construction sites is required during this period in order to reduce turbid water and influx of sediments into water drainage and the rivers. Vegetation clearing shall be conducted only necessity. Control measures such as sedimentation pond and silt fence shall be constructed to reduce sediment loading to the natural waterways. Potential impacts due to sediments during construction will be limited in only the construction period. However, local villagers rely on surface water for only agricultural purpose. Source of water for consumption is from shallow (groundwater) wells; therefore, the impact is expected to be low and limited in short-term.

The other concerns may be used oils from workshop i.e. maintenance of machines and equipment. Used oils need to be controlled and accounted for. It is recommended that the used oil shall be kept on site in proper storage before appropriate disposal; for example, secondary containment shall be constructed in order to reduce risk of leakage and spill during the construction period.

1.5.1.5 Groundwater

Shallow groundwater wells are main source of water for consumption, for both persisted villages and the worker camp, which 120 m^3/day of tap water are producing from a shallow well. The untreated wastewater from the worker camp and construction can seep down on ground and deteriorate unconfined aquifer. Especially in dry season when most of the groundwater source is depressed by climate and intensive abstraction. This coincident phenomenon can be consequence in water supply crisis. Thus, effluents from construction site and worker camp e.g. toilets and lavatories or kitchens shall be preliminary treated. Mobile sewage treatment unit, septic tank and/or pit latrine shall be installed to prevent groundwater contamination. If the mentioned mitigation measures are well performed, the impact on groundwater is expected to be low.

1.5.1.6 Geology and Seismology

According to the review of baseline information, the project area located in Zone I, minor damage, which is the range of ground acceleration less than 0.075 g, which is equivalent to MMI class V and less. Also, the seismic records indicated that none of earthquake situation in Dawei and project area. Although the risk is considered low, the project may consider cooperating with the local authority in updating and exchange of the seismological information. It results in no effect during construction and operation phase.

1.5.1.7 Surface Water Biology

The project development will change the existing ecological conditions including loss natural forest and vegetation. The surface runoff will increase sediment into surface water resources. This will result in increased levels of turbidity and suspended solids affecting

photosynthesis of phytoplankton and productivity of water resources. Mitigation measures controlling release of sediment from construction sites need to be implemented to limit the amount of sediment being released to the environment.

1.5.1.8 Economic Development

(a) *Infrastructure Facilities*

Infrastructure facilities include water supply, wastewater treatment, drainage and flood control and solid waste management systems in the area and if these facilities will be affected by the project activities during construction and operation phases. Local villagers rely on shallow groundwater wells as source of water for general use and consumption. Wastewater from households still is low treatment technology and no drainage and flood control system. Hence, they need to be concerned. Solid waste management system is not well established in the area yet and open burn or dumping is still being used. Project owner including contractor, subcontractor should take people's concerns seriously and work towards sustainable development by improving the livelihood security of the local communities and environmental sustainability.

(b) *Water supply*

During construction, tap water by ITD water supply system will be the source of water for construction camps. About 120 m^3/day of clear water will be produced in the site to supply total number of 1,200 workers in the construction period, which ground water well at construction camp will be raw water source. Moreover local people take water from shallow well for living. Therefore, impact to surrounding communities is no significant if nearby villages are fully relocated before the construction is started. However, mitigation measures that recommended for surface water and ground water must be strictly conducted during construction period.

(c) *Wastewater treatment*

Mainly generated wastewater from routine activities of 1,200 staffs including labor in the site will have average BOD concentration of 200 mg/l with 96 m^3 in quantity which calculated to be 115 kg of organic loading. Unless it is treated, these loads can have effects on bad odors, eyesore conditions, worsen surface water and ground water quality and also global warming caused by methane gas generated from anaerobic condition. Consequently wastewater treatment system must be provided to get the treated wastewater having BOD less than 20 mg/l before discharged to natural water course. Grease trap is also recommended to treat kitchen and canteen wastewater, large amounts of fat oil and grease (FOG) can cause sewer line to clog, floating oil in the surface water course inhibit oxygen dissolve capability that affect living of aquatic animals such as fish, shrimp, planktons. However, there is no impact on infrastructure facilities of communities. However, mitigation measures that recommended for surface water and ground water must be strictly conducted during construction period.

(d) ***Solid waste management***

As there is no adequate solid waste management system in Dawei or near project area. Solid waste in quantity of 1,200 kg is expected to be generated per day from activities of workers, that having 360 liters in volume (density of solid waste = 1,000 kg / 300 liter). This few solid waste will be sorted at site, which be classified into general waste, recycling waste and hazardous waste. Three colors of plastic garbage containers will be provided for solid waste separation. Some portion of generated solid waste such as paper, glass, plastic, metal, can be reused and recycled, that need storage area for short time. For hazardous waste: dry battery, light bulb, paint bucket, spray paint canister, need to be stored temporarily until the waste management facilities are operated. Disposal site for general solid waste that be non-hazardous waste needs to be established. Although there is no affect to waste disposal of local nearby villages, project owner must do the recommended mitigating measure.

(e) ***Traffic and Transportation***

Transportation of construction materials within the project area is the main traffic volume during this stage. Transportation of construction materials such as cement, rebar, and other materials that cannot be sourced from within Myanmar will be imported from Thailand. The main transportation route from the Small Port connects with the Main Road at approximately Km +3.000 and does not cross any permanent villages.

However, the volume of traffic from smaller vehicles, such as pick-up trucks, is expected to be higher than the period before the project, thus increased risk of accident between the vehicles used in the project and motorcycles, which is the most common transportation mean of the local villagers.

To reduce the risk of accidents, the project will install sign boards along the roads that most frequently used by the project's vehicles. Ling of sight and curvature of the road will be progressively improved.

(f) ***Land Use***

When construction starts, there will be a large number of personnel moving in. The majority will be construction crews with low wages. They will likely depends in part on the locals to provide certain low cost basic services, such as food, cleaning, transportation and especially those entertainment or relaxation not allowed on the official construction camps. Naturally there will be temporary structures set up to provide such services at the place most convenient to the clients, predictably nearest to the main route, crew camps and the entrance to the site, due to the limited mobility and road access of the crews. These squatted temporary settlements will overtime take more permanent forms but not necessary are tidy, safe, or sanitary. While designated township zone is already provided under the proposed plan, the legitimate area for labor services may not be located according to the zone due to convenient distance to the camps and construction sites. In terms of land use, it is important such temporary service activities and structures set up for workers' needs be planned out monitored regularly. Relocation may be needed in intervals as

appropriate so that eventually most or all services for project personnel will not be allowed to scatter outside the designated township zone.

(g) *Power source and transmission*

Electricity in the camps will be generated either by diesel generators or the LNG power plant installed during construction period. No impact to the existing use and electricity generation of the local villagers is expected.

1.5.1.9 Social and Cultural Components

(a) *Socio-Economic Conditions*

Lack of knowledge of project activity and planning is one of the key concerns received from the public consultation activities. This may lead to negative rumors and misconception of the project. The project will need to be proactive and engage the local villagers routinely throughout the preparation and construction phase to ensure that the information is sufficiently disseminated to the villagers. This will also help promote the relationship and trust between the project and the villagers. Concerns of the public can also be collected and addressed during this routine engagement.

Dawei Special Economic Zone Law requires that the factories employ Myanmese at a certain percentage of all workforces every year. Despite this requirement, if the knowledge and skills of local villagers do not meet the requirements of the industries, the industries will have to employ Myanmese from other regions such as from Yangon resulting in lost opportunity for the local populations. Career training and workshop aiming to improve skills of local populations need to be established to prepare them for future employment in the industrial estate since the construction phase.

(b) *Sites of Historical and Cultural Importance*

Sites of cultural and historical importance have to be surveyed, recorded, and clearly marked on project maps. Construction activities that may generate vibration such as pile driving may need to be avoided close to the site unless permission from the local villagers is granted.

Relocation of temples from the existing villages subject to resettlement is also required based on the feedback from public consultation meetings. Apart from completion of new housing and utilities in the resettlement area, the new temples need to be completed prior to relocation of the communities.

<u>Public and Occupational Health</u>

Potential impacts during construction phase under each important aspect are discussed below:

(c) *Occupational Health and Safety*

Accidents and Injuries:

During the construction phase, accidents and injuries will be notable for workers, especially among untrained ones. The wide range of injuries may be found from minor or medical aid required only to serious cases, disabling injuries and/or death. Faulty electrical devices, blunt injuries, cut wounds, falling, as well as eye irritation and burns are common, however, broken limbs, trauma and or serious injuries can also occur. Besides, increased number of traffic accidents can be expected. Therefore, the prevention and mitigation measures need to be provided.

Occupational, Sexual Transmission and Communicable Diseases:

Potential respiratory diseases may be aggravated, due to pollutants exposure in the workplace, such as dust, exhaust gas, chemicals or solvents. Underlying chronic diseases: asthma, allergy, peptic ulcer, or mental disorder, can be exacerbated by the exposure of hazardous/chemical wastes. Moreover, noise vibration and workplace temperature are likely to be expected. Workers will experience new jobs, hard work and an unfamiliar environment. Hence, they may encounter stress, anxiety, and hypertension. Being away from home, workers easily turn to drink more alcoholic beverages, smoking and/or substance abuse.

Moreover, unhygienic habits, poor personal hygiene and environmental sanitation, may possibly increase diarrhea, hepatitis and communicable diseases. Malaria and dengue fever and local disease from the affected area, can be easily spread. Sexually transmitted disease and HIVs are also expected and needed to be seriously concerned to designate prevention and control measures.

Emergency Response and First-Aid:

Fire may occur from ignition of flammable materials or other reactive chemicals which can lead to accident and injuries as well as loss of properties. Thus, emergency response plan dealing with fire, explosion and chemicals leaks should be established.

Project owner, has provided the first-aid unit in the campsite at all times. However, when the construction phase is at full scale with some activities at remote sites, additional first-aid units with comprehensive and appropriate equipment should be provided as appropriate. The qualified first-aid units should also be established to ensure that can properly handle with serious or trauma cases. Patients should be taken care and transferred to appropriate medical facilities in time.

(d) *Community Health*

The project activities during the construction phase possibly have certain impacts beyond the project boundaries. Communities around the project area may be affected in various issues.

Housing and Sanitation:

Even though project owner has provided adequate accommodations for the construction workforce, increasing of numbers of workers and also growth of other supporting industries and surrounding areas, possibly numerous accommodations will be constructed outside the estate. This will create pressure on public health services, public health facilities, and sanitation. Currently the public health services provided by local authorities are rather limited. Improper management of sewage, wastewater and solid waste may generate sources of diseases. Therefore, the sufficient infrastructure amenities and services should be provided, e.g. solid waste disposal, to mitigate the impact.

Environmental/Communicable Diseases:

According to construction activities and transportations, communities will be exposed to excessive dust and noise that can lead to increase of respiratory diseases and nuisances.

Due to mobility of workforce, sexually transmitted diseases, such as HIV/AIDS, will be the most concerned communicable diseases. These diseases can be spread widely. Increasing of malaria, dengue fever, dysentery, hepatitis, pneumonia, and tuberculosis is also expected due to the poor sanitation.

The migrated workers may bring emerging diseases to the project area. If this happens, local villagers will be likely exposed to new strains of diseases. Common cold and flu as well as respiratory tract infection caused by probably new strains are also possible. An increase of alcoholic drinking, smoking and substance abuse and increasing of migrated labors, violence and social disturbance are expected as well. Appropriate mitigation measures should be implemented to reduce these impacts that may occur.

Accident/Fire/Chemical Leaks:

Unsafe vehicle transport with poor road conditions can trigger vehicle accidents and injuries, particularly among young adults. Accidents may occur while transporting construction materials and supplies including chemicals such as gasoline, solvents or lubricants. These accidents will lead to releases of hazardous materials that may result in fire, explosion and/or toxic chemical leaks into the environment. Thus, the emergency response plan should be established.

Adequacy and Readiness of Healthcare Services:

Local healthcare services and healthcare personnel, in quantitative and potentiality dimension are quite limited at present. However, the injuries and illness will be increased in term of quantity and complexity. The mitigation measures should be, therefore, provided to reduce pressure on the healthcare facilities.

1.5.2 OPERATION PHASE

1.5.2.1 Air Quality

Emission loading of air pollutants by AERMOD model calculation reported in the EIA report of Dawei Industrial Estate Project (SEATEC and UAE,2014) which the model expert applied the air pollutants loading in worst case situation (maximum load). Hence, we can apply the recommended emission load of PM10, NO_2 and SO_2 as the emission load control for this initial phase. The emission rate of PM10, NO_2 and SO_2 shall be no greater than 0.0025, 0.003125 and 0.0075 kg/ha/day, respectively, must be strictly controlled to protect health status of nearby people and also preventing the problem of industrial estate development to surrounding communities.

However, particulate matter less than 2.5 micron (PM2.5) or fine particulate that is concerned pollutant by WHO due to it can pass through respiratory system into alveoli. Long-term exposure to $PM_{2.5}$ is associated with an increase in the long-term risk of cardiopulmonary mortality by 6 – 13 % per 10 µg/m3 of $PM_{2.5}$. Generally, $PM_{2.5}$ is equal to 50% of PM_{10} concentration which can be generated from both fuel combustion engines and vehicles. It is recommended additional parameter for monitoring of this project especially stack of waste incinerators.

Furthermore, another air pollutant that need to concern for this project is dioxin which be generated from waste incinerator. Dioxin is known as persistent environment pollutant and be accumulated in the food chain. It is obvious that dioxin formation occurred at temperatures above 450 Degree Celsius (°C) and was reduced significantly at temperatures above 850 Degree Celsius (°C). The reaction occurring in an incinerator is extremely complex, and there are many factors in addition to combustion temperature influencing dioxin formation. Selection of manufacturing process and incinerator with low dioxin emission are recommended to reduce formation of dioxin.

Methane gas, one of greenhouse gas group, generated from landfill sites and leachate treatment by anaerobic process is also concerned. Gas flaring must be provided to cope with this methane gas for reduction of emitted greenhouse gas quantity.

1.5.2.2 Noise and Vibration

Noise sources in the operation phase vary depending on the production processes of each facility. Control of noise at source is the most effective approach to control impact to the receptors outside the boundary of the facility. Equipment that generates high level of noise is usually installed in enclosed building. Noise level in the fence line of each manufacturing facility need to be routinely monitored so that the Leq24hr does not exceed 70 dB(A). Effects from noise to the receptors outside the initial phase of industrial estate area are negligible. Nevertheless it is necessary for each factory to provide ear plugs and/or ear muffs for employees or workers who work in place that having noise level exceed 80 dB(A).

1.5.2.3 Topography and Soil

Potential impact to soil quality due to contamination of chemicals used in the operation may happen due to inappropriate handling of chemicals and spills. Integrated waste management facility is another area where potential soil contamination may occur.

The project will require that each individual manufacturer and factory have appropriate chemical storage area with secondary containment on impervious ground. Industries with higher risk of chemicals release, such as garment and textiles also electronics industries, will need to conduct specific Environmental Impact Assessment that will include identifying risk of spill and preventive measures. The project will also develop spill and emergency response plan. Potential contamination of soil can be limited through these measures.

1.5.2.4 Surface Water and Sediment

The operation of initial phase development will produce various types of waste. If not properly handled, the above by-products can contaminate to water and sediment quality in Kunchaung and Dawei Rivers. All industrial wastewater from each zone will be treated by the wastewater treatment plants. Wastewater from industries area will be collected and transferred to the central treatment plant, designed with appropriated treatment techniques.

The wastewater from industries will be pretreated to meet the requirements according to Industrial Estate Authority of Thailand (IEAT) or other relevant/designated requirements. The pretreated wastewater will then be combined and transferred in to wastewater treatment located in each zone. The treated wastewater from all wastewater treatment plants will have to comply with Effluent Standards for Factories and Industrial Estates or other relevant/designated requirements. The treated wastewater is then transferred through drainage system, and discharged into Kunchaung River, finally flow to Dawei River.

1.5.2.5 Groundwater

The project activity that might impact to groundwater quality is the waste management facilities where sanitary landfill and secure landfill sites are located. Groundwater monitoring program will be required particularly for the waste management facilities. Considering that the project location is a low-lying land surrounded by mountain ranges and that the hydro-geological gradient is likely to be drained into the coastal area and is unlikely to be connected with groundwater system of the resettled communities, when the project is fully developed, the impact of groundwater use is considered an appropriate limits. However, monitoring programs of existing groundwater wells that are being used by local populations in the area surrounding the industrial estates and also inside the initial industrial estates area should be followed up, due to the existing communities are not fully relocated when the operation of some of the industries starts.

1.5.2.6 Surface Water Biology

Fresh water biology can be affected mainly from discharging of wastewater into the receiving waterways. Wastewater from the industries, if not properly treated, is expected to contain mainly organic matters, which will affect the living organisms and also the quality of their habitats.

To minimize the potential impact, the project requires that the industries located within the initial industrial estate project have to pre-treat their wastewater to meet the receiving requirement of the central wastewater treatment plants. Chemical treatment such as chemical precipitation will be required for those industries that may have heavy metals in their wastewater stream prior to sending to the central wastewater treatment systems of the industrial estate. Oil and grease, which will be one of the main pollutants from food and cannery industries, also need to be removed from the raw wastewater prior to transferring the wastewater through the collection system to the wastewater treatment plants. The central wastewater treatment systems are designed with expected quantity and characteristics of wastewater from each zone. The design and effluent criteria of the central wastewater treatment will well within either IEAT requirements or Myanmar standard

1.5.2.7 Economic Development

(a) *Infrastructure Facilities*

Water supply

During operation phase, sources of raw water will be from Ta Laing Gya Weir. Pa Yain Byu reservoir will be temporary used during development of zone A. The raw water will be treated to meet WHO water quality guidelines before distributed to the initial industrial estate area.

In the early period of development, 18,000 m^3/day of water was planned to produce for industries/factories of zone A that raw water pumped from Pa Yain Byu reservoir. Since volume of the reservoir is approximately 1,000,000 m^3 which can supply raw water for about 2 months of water production, this will not affect to water usage of nearby communities. However, high volume of product water at 180,000 m^3/day, when full phase developed, for supply all activities, buildings, industries/factories in the Dawei SEZ Initial Industrial Estate. Hence, project owner must provide raw water from surface water source nearby the project to fulfil Pa Yain Byu reservoir that need to compromise with local people for this water usage.

Not only rain water that fall in the project area and treated wastewater which having good quality are options to be raw water source for water supply treatment plant and/or watering green areas of the project . But also water quantity reduction by water saving equipment or machines or processes applications and re-usage of some water such as cooling water in the industries/factories must be practiced.

Wastewater treatment

Wastewater treatment plant # 1 will be operated for treatment of discharged wastewater from industries in zone A1 and A2 that having capacity for treating flow rate of wastewater at 12,712

m^3/d. Some solids in partial mixed aerated lagoon are kept in suspension that require another treatment unit for solid settling unless supernatant do not meet the effluent standard. Therefore, inspection pond # 1 will be assessed that allowing solid settling to occur. Since the volume of the pond about 24,852 m^3 is enough to have 2 days retention time that also can limit algae growth to control suspended solid increasing. It means that inspection pond # 2 will act as effluent holding pond for assuring that discharged effluent meet the standard all time.For more confident, installation of online monitoring system for flow measurement of both influent and effluent and BOD concentration of the effluent are recommended.

In case characteristic of effluent higher than requirements, the project must provide an empty pond that has at least 2 days storage capacity to retain the undesired effluent. Then pump it back to aerated lagoon for retreating that may require more oxygen to add in or special techniques in treatment process to get the better effluent.

Solid waste management

A waste management facility is planned to construct in Dawei SEZ Initial Industrial Estate Project. The waste management facility will be capable of handling both hazardous and non-hazardous waste. Environmental monitoring program will be in place at the waste management facility to monitor if the environmental protection measures at the site is efficient.

Reusable and recycle wastes include; paper, glass, plastic, steel, aluminum etc, will be collected at each factory for selling to involved person or company. This can help to reduce quantity of solid waste to landfill site. Composting is a good technique to cope with the food waste, methane gas and stabilized organic matters are useful product for locals. Methane gas can be used to produce electrical and/or as fuel for cooking. Stabilized organic matter can be soil conditioner or soil filling in the green and required low-lying area.

There are 2 main types of solid wastes: municipal and industrial solid waste, which classified into non-hazardous and hazardous waste. During development or first stage of solid waste management development for this project, project owner has planned to bury non-hazardous municipal and industrial waste in sanitary landfills, whereas hazardous waste was planned to store in the proper building. It will be stabilized, solidified and buried in the secure landfill site later. Methane gas from biodegradation of solid waste must be collected and burnt to reduce greenhouse gas released to the atmosphere layers, methane application for cooking is another way for sustainable development.

In the second stage of development, incinerator that having capacity of 200 ton/day will be applied for non-hazardous waste disposal, while hazardous waste also being burnt by another incinerator is planned for installation in the future. Dioxin, a group of chemically-related compounds that are persistent environmental pollutants (POPs), is normal generated from waste incineration. It can accumulate in the food chain mainly in fatty tissue of animal. Dioxin is known as highly toxic substance and can cause reproductive and developmental problems, damage the immune system, interfere with hormones and also cause cancer. Prevention or reduction of human exposure is best done via source-directed measures, i.e. strict control of industrial processes to reduce formation of

dioxin. Hence, project owner need to select the incinerator with low dioxin formation and control temperature in the burning chamber more than 850 Degree Celsius including monitoring of dioxin from stack and ambient air at nearby communities.

(b) *Traffic and Transportation*

There are a number of potential solutions to this issue. The secondary road inside the industrial estate that has similar alignment to the existing road can be opened to general public or only people living the settlement areas to use. However, this approach may jeopardize the site safety and security. To maintain the integrity of site safety and security and at the same time allow local populations to travel to use a secondary road to trespass the project area, the special pass issued for resettlement community or a specific secondary road may need to be constructed with an appropriate way to cross the Main Road.

(c) *Land Use*

Potential negative impacts on land use are predicted to affect the town of Dawei also. As the project is in operation, there will be needs for services other than those day-to-day services that can be provided within the township zone. Naturally, it can be predicted that the town of Dawei, with certain level of infrastructure and social services, will rapidly grow to accommodate requirements of project personals such as, residences for the supervisors or consultants who prefer not to stay within the industrial estate, business clients and guests who visit the project estate shortly for specific purposes, or other workers who perform services to the project personnel but are not allowed to stay in the township zone. Dawei will also provide entertainment activities for the workforces when off-duty on the weekend. These sometimes undesirable uses are not allowed in the township zone of the project but will find their places in the town. Zoning and control for such entertainment district should be laid out ahead of time for the town of Dawei.

In conclusion, the major negative impact due to land use changes around the estate is the problem of uncontrollable uses. Beginning at the stage of project preparation and construction, it is highly likely that those locals whose agricultural land were confiscated will thrive for livelihood by providing food and services and even temporary shelters for construction crews. These squatters, in time, will grow larger and become more permanent. Without proper control, at the time of the project operation, these shanty towns will become permanent communities over time at the location unfitted and even endangering both efficient and safe operations of the project and also the squatters themselves.

(d) *Power source and transmission*

Electricity in the initial industrial estate area will be generated by 450 MW power plant. No impact to the existing use and electricity generation of the local villagers is expected.

1.5.2.8 Social and Cultural Resources

(a) *Socio-Economic Conditions*

Issues related to the socio-economic and social issues during operation phase are similar

Public and Occupational Health

Potential sources of impact to public and occupational health conditions during operation phase can be identified as follow

- There will be diversified industries in the industrial estate. Each type of industry will have different environmental, health and safety risks. Working environment and safety including accidents may become the significant causes of injuries and fatalities for both of workers and communities.
- Most of industries are labor intensive; therefore, numerous workers, including foreign/migrated and untrained workers, are expected.
- Project owner has set a plan to provide a township consists of hospital, school and other infrastructure amenities located inside the industrial estate boundary.
- Materials, machinery and associated infrastructure items are required therefore volume of transportations may escalate significantly and may lead to an increase of road accidents and injuries.
- Increase of accommodation and growth of supporting industries in the surrounding areas will create pressure on adequacy of infrastructure amenities, public health services, public health facilities as well as sanitation, especially around the project area.
- Pollutions due to emission from all industries to the environment may affect health and living condition of communities, especially long-term effects. Chemicals and hazardous waste, under emergency situation, may be the sources of fire, explosion or chemical leakages.
- Major hazards, fire explosions and toxic chemical leaks, from crucial industries particularly oil refinery, steel mills, coal fired-power plant, and petrochemicals plants may occur.

1.5.3 RISK ASSESSMENT

1.5.3.1 Environmental Risk Management-Construction Phase

For this Project, the IE contractor would be contractually responsible for: (i) preparation of detailed designs and specification of all equipment and facilities; (ii) procurement and construction; and (iii) testing and commissioning the industrial estate and associated facilities before handling over to the Project Proponent. The environmental performance requirements of the Project construction and operation will need to be adequately incorporated in the designs, specifications,

and construction. All environmental mitigation measures recommended in this Final EIA Report and accepted by the Project Proponent and MONREC will be implemented by the IE contractor and his subcontractors under the supervision of construction supervision consultants of the Project Proponent. Monitoring of the environmental performance of the IE contractor will be carried out by the project management team of the Project Proponent.

1.5.3.2 Environmental Risk Management-Operational Phase

During the operational phase, the industrial estate operational team will routinely implement, as part of the industrial estate operation, all environmental mitigation measures recommended in this Final EIA Report and accepted by the Project Proponent and MONREC. It is essential that the environmental performance requirements of the operational phase will need to be adequately incorporated in the designs, specifications, and construction. Monitoring of the environmental performance of the industrial estate operation will be carried out by the industrial estate team as discussed in the OEMP section

During the commissioning and operational phases, the major concerns are on possible hazardous events which, if occur, would seriously damage the industrial estate and could cause injuries and fatalities to operational personnel and people in the nearest communities. The hazards in the industrial estates are generally well understood resulting in numerous standards and codes of practice to cover the design, construction, installation, testing, commissioning, operation and maintenance of the industrial estate facilities.

1.6 CUMULATIVE IMPACT ASSESSMENT

A simple matrix can be used to identify and evaluate cumulative impacts due to project development and other past, present, reasonably foreseeable activities against elements of environment or sensitive receptors. The levels of potential impacts are assessed qualitatively based on available information from the above sections and the best professional judgment. Table 1.6-1 shows the results of the evaluation.

Table 1.6-1 Cumulative Impact Evaluation Matrix

Potential Impacts Area	Proposed Action	Past Actions	Other Present Actions	Future Actions	Cumulative Impacts
Physical Resources					
Air Quality	**			*	**
Noise and Vibration	*				*
Surface Water and Sediment	**	*	*	**	**
Groundwater	*	*	*	*	*
Geology and Seismology					
Biological Resources					
Surface Water Biology	*				
Economic Development					
Infrastructure Facilities	+				+
Traffic and Transportation	*			**	**
Land Use	***			**	***
Social and Cultural Resources					
Socio-Economic Conditions	+			+	+
Sites of Historical and Cultural Importance	**				**
Public and Occupational Health	*	*	*	**	**

Remarks: * - low adverse impact ** - moderate adverse impact *** - high adverse impact
+ - beneficial impacts

Source: ESIA Study Team

1.7 ENVIRONMENTAL MANAGEMENT PLAN

1.7.1 Scope of Environmental Management Plan

The key organizations responsible for implementation of the mitigation measures include: the Governing Bodies of the Government of Myanmar, the Project Owner, the Construction Contractor and sub-contractors (during construction phase), and the Investors. However, it should be noted that the planning and development of the Project has been dynamic throughout the study period. This includes also the organization of the project and other relevant agencies. The information used as the based scenario is considered the most valid one at the time of the report preparation. Changes to the project information may occur overtime and, therefore, readers and project implementers are advised to check and confirm the project details at the time of review and implementation.

1.7.2 EHS Policy and Commitments and Legal Requirement

The Project Owner for this project refers to Myandawei Industrial Estate (Myanmar) (MIE), which falls under the category of 'Developer' according to Myanmar Special Economic

Zone Law (2014). MIE roles in the project include design, construction, and operation of infrastructure and amenities in the Dawei Initial Industrial Estate. MIE will be responsible for technical planning, enforcing, and monitoring of all environmental mitigation measures as stipulated in the EMP. The Project Owner reports to the Governing Body.

Construction Contractor and sub-contractors (CC) refer to the Contractor and sub-contractors for the development of Dawei Initial Industrial Estate, which include constructions of utility systems (i.e. water treatment and distribution system, wastewater collection and treatment system, irrigation system, electricity generation and distribution system, solid and hazardous waste management facilities etc.), internal roads, and basic infrastructure for the industrial estate. This does not include the construction of an individual factory or manufacturing facility. CC must operate in accordance with the mitigation measures stipulated in this ESIA report. CC must report of the Project Owner.

The factories / manufacturers refer to the investors build and operate their facilities in the industrial estate. Responsibilities of the factories / manufacturers, which will be during the operating phase, include: Comply with environmental requirements of MIE during construction and operation of their facility.

1.7.3 CEMP and Arrangements for Implementation

1.7.3.1 Construction

During construction period, the Project is not expected to have major environmental impacts apart from environmental disturbances normally experienced in Initial Industrial Estate construction. Nevertheless, the Project Proponent will ensue that the Contractor will make best efforts to minimize the impacts during the construction phase despite their insignificant levels. In this regard, the Project Proponent will ensure that the Contractor-CEMP will incorporate all mitigation measures as prescribed in the Owner-CEMP in preparing detailed designs of the Initial Industrial Estate and its associated facilities, construction methods, and specifications.

One of the main potential impacts to air quality during construction activities is fugitive dust generated from the construction areas and unpaved roads. Other sources include exhaust from machineries used in the construction activities. Construction machineries also generate noise which may affect nearby communities and receptors. MIE shall formally notify CC and enforce the following measures to reduce emission of air pollutants and noise during construction activities. Exhaust gas from construction vehicles are acceptable. However, all equipment and vehicles will need to be maintained in good mechanical conditions; Stationary noise sources (such as generators, batching plants etc.) shall be sited as far as possible from villages, construction camps and resettlement areas; Construction works within the distance of 500 m from villages and resettlement areas will be carried out between 06:00 to 18:00; Dump trucks with loads that may generate dust will be covered when travelling through communities; Water spraying at least twice a day in the construction areas and unpaved roads is required.

MIE is responsible for monitoring that the CC is complying with the measures mentioned above. The monitoring program can be

- Machineries are inspected at least every 6 months with a written certificate / maintenance records of each machinery provided by qualified mechanics of the CC,
- Inspect that the dust suppression measures are implemented according to the mitigation measures,
- Inspect that the burning of waste materials are conducted according to the relevant mitigation measures,
- Monitor the Community Grievance Record related to dust and noise and ensure that the complaints are responded to and closed appropriately according to the relevant mitigation measures.
- Additionally, it is recommended that the project continue sampling of ambient air quality in industrial area and nearby villages every 6 months, dry and rainy season.

1.7.3.2 Operation

During operation period, MIE as the project owner has to establish the environmental policy and rules that will govern environmental practices and performance of the industrial estate as a whole. The establishment and implementation of this component is of utmost important absence of local environmental regulations and authorities fully responsible for environment and pollution control in Myanmar. Once established, MIE shall adhere to these policy and rules. However, in the future, when the environmental protection laws may be announced and published by the Government of Myanmar, MIE shall ensure that the requirements as set in the policy and rules are fully in compliance with the laws.

Combustion of industries and emissions are the main concern. Important air pollutants from the above activities include PM10, SO_x, NO_x, and VOCs. Allowable loading per land area has been estimated based on broad calculation and numerical modeling to limit the maximum concentration of pollutants outside the industrial estate area to not exceeding the relevant international standards.

Mitigation measures for air emission and noise can be listed below:

- The emission rate of PM_{10} for stack sources shall be no greater than 0.0025 kg/ha/day.
- The emission rate of NO_2 for stack sources shall be no greater than 0.003125 kg/ha/day.
- The emission rate of SO_2 for stack sources shall be no greater than 0.0075 kg/ha/day.
- VOCs recovery system shall be equipped for the industries that or use solvents or have potential to release high amount of VOCs.
- Encourage use of low NO_x burners.
- Encourage use of low sulfur fuels and SO_x removal system for industries where release of SO_x is of concern such as power plants.

- Equipment and machine that generate high level of noise shall be installed in an enclosed building so that, when operated, noise level at the fence line of the industries do not exceed 70 dB(A).

Provision of installation and operation of Continuous Emission Monitoring System (CEMS) when hazardous and non-hazardous waste incinerators or concerned industries agree to set up a plant in the initial industrial estate project. Continual collect data from the industries and update the numerical model when data from the CEMS is available or at the 3rd year of the operation, whichever comes first. Then runs updated model every year afterwards based on the actual measured data.

Monitoring of air quality from stack and at the sensitive receptors are the main activities in this phase. Monitoring of air quality at the sensitive receptor nearest to the industries and at the resettlement area has to be conducted. The framework of monitoring design include:

- Monitoring frequency is every 6 months.
- The parameters include TSP (24-hour mean), PM10 (24-hour mean), PM2.5 (24-hour mean), SO_2 (1-hour and 24-hour mean, NO_2 (1-hour mean).
- Sampling stations include the resettlement area, township, and existing community, that has not been resettled, located closest to the industries already operated.
- The industries shall monitor the concentration of air pollutants in the stack according to the parameters recommended by the Pollution Prevention and Abatement Handbook (World Bank, 1998) or relevant local regulations every 6 months and report to MIE.
- Continuous monitoring results from the concerned industries and industrial waste incinerators where CEM system are installed.

1.8 PUBLIC CONSULTATION AND DISCLOSURE

1.8.1 Purposes of Consultation during the Preparation of ESIA Report

The objectives of public participation and disclosure are;

- to inform and consult with the stakeholders about the project,
- to gain public views, concerns and values,
- to increase public confidence, and
- to improve transparency and accountability in decision-making process.

1.8.2 Public Consultation

The Project carried out 3 public consultation, the first one was conducted in 2013 (See Annex 9-1). The second consultation was conducted during 21th-22th March 2015 and the Third consultation was on 28th March 2018. All the consultation were held in Dawei SEZ and the impacted villages.

Key stakeholders such as regulatory authorities, private sectors, NGOs/CSOs and local people in Dawei SEZ were participated in consultation meeting. Main affected villages, Mindut and Pagaw Yun were also participated in attitude survey. Media and communication used i.e. presentation, handouts and attitude survey were conducted in Myanmese and by cooperation of local partner consultant, Resource Environmental Management Myanmar Staff.

Concerns, opinions and recommendations for the Project were different for each consultations. They can be summarized following:

- Health impact
- Environmental impacts especially water pollution
- Impartial compensation on crops and lands
- Local employment/ training program/ labor rights/ reasonable salary
- Improvement of infrastructure, electricity, sufficient doctors and healthcare facility
- Environmental Impact assessment process and approval procedure

For the recent consultation on 28th March 2018, which was hosted by the Project Proponent, DSEZ Management Committee and Environmental Conservation Department, MONREC. The meeting was held in Dawei SEZ auditorium, in Dawei, Tanintayi region. Stakeholder groups in this meeting consisted of regional government, government officers, villagers and NGOs. Issues raised in the meeting were concerning the ESIA procedure and the Environmental Compliance Certificate, updated project information and data for land acquisition and delay of the Project's timeline.

The result from every phases of the public consultation meeting were considered by the Project proponent and the significant social impacts/recommendation i.e. employment and training and public information etc. were embedded in the social mitigation measures, the Environmental Management Plan and the project's commitments. Example of public mitigation measure in construction phase is shown in Table 1.8-1.

Table 1.8-1 Mitigation measures for construction phase

Mitigation Measures	Place	Period	Responsible Agency
1. Inform head of villagers about construction plan and activities	• 13 Villages	• At least 2 weeks prior to the construction	MIE
2. Local people can complain about the project activities directly to the complaint handling unit or via the community leader. The corrective actions of each complaint must be done within a month or at the period of time that developer and local people mutually agree	• via community leader house • putting complaint in the comment boxes • Oral inform at complaint handling unit	• Over construction phase	MIE
3. Provide on-site construction skill training for local people and give them wages at least those indicated by Myanmese labor law	• At the construction site	• On-site training	MIE

Source: ESIA Study Team

Table 1.8-2 Mitigation measures for operation phase

Mitigation Measures	Place	Period	Responsible Agency
1. Inform head of villagers about the operation plan and activities in the operation phase	• 13 Villages	• At least once a month over operation phase	MIE
2. Local people can complain about the project activities directly to the complaint handling unit or via the community leader. The corrective actions of each complaint must be done within a month or at the period of time that developer and local people mutually agree	• via community leader house • putting complaint in the comment boxes • Oral inform at complaint handling unit	• Over operation phase	MIE
3. Provide industrial skill skill training for local people	• In the community to avoid difficulty of travelling	• On-site training	MIE
4. Contract all tenants to give the first priority for local employment	•	• Over operation phase	MIE

Source: ESIA Study Team

1.8.3 Information Disclosure

The project disclose information on the Myandawei Industrial website, which consists of project proponent information, facilities and infrastructure, download of the EIA/ESIA report including contact information.

1.8.4 Recommendations for Future Consultations

Generally, the villagers agree and support the Initial Industrial Estate Project because they believe that Myanmar will be much developed because of this project. In additions, their living standards, electricity, and health facilities will be consequently developed. The major concerns obtained from the public consultation meetings included compensation and employment in the industrial estate. Regarding compensation, the villagers need the justly compensation and requested that the project owners pay for compensation immediately after measuring the land and counting the trees. In additions, some villagers have realized that they will lose the agricultural land and feel insecure of changing occupation from agricultural to industrial sector. Due to lack of education and working skills, the villagers do not sure whether they are qualified to work in the factories. Thus, a training program that can help them work in the industry is strongly requested. The main suggestions from local people included justly compensation, local employment and vocational training for industrial works.

One conclusion from public consultations is that the information has often been changed and the project is delayed, the villagers are confused about uncertainty of project schedule and scope of the project. The ambiguous information makes people feel uncertain about their future. The key recommendations from public consultations are to inform the villagers about project schedule, impacts, and mitigation measures to minimize the impacts from Initial Industrial Estate as well as to provide appropriate training to the local people.

1.9 RESETTLEMENT AND RELOCATION

1.9.1 PHYSICAL DISPLACEMENT AND AFFECTED ASSETS BY PROJECT COMPONENTS

Development of the Initial Industrial Estate will affect four (4) villages within Dawei Township. As of May 2017, two hundred and ninety one (291) of Project Affected Households (PAHs) and one thousand, one hundred and sixty four (1,164) of Project Affected People (PAPs) will be physically displaced as presented in Table 1.9-1. Development of zone A3, B1, C1, C2, C3, C4, D2, Main Road (MR) and North-South Road (N-SR) accounting for 58.5 percent of the Project's land. Almost affected people within these lands will required land acquisition and compensation for their assets.

Table 1.9-1 Affected villages from development of Initial Industrial Estate

Initial Industrial Estate - Zone	Affected Village	Estimated number of resettlement	
		Households	People
Zone A3	Pagaw Zoon, Yalai	8	32
Zone B1	Pagaw Zoon, Khamaung Chaung	1	4
Zone C1	Wat Chaung, Khamanung Chaung	116	464
Zone C2	Yalai	10	40
Zone C3	Yalai, Khamaung Chaung	16	64
Zone C4	Khamaung Chaung	128	512
Zone D2	Kamaung Chaung	2	8
Main Road	Pagaw Zoon, Yalai	7	28
North Road	Khamaung Chaung	3	12
Total		**291**	**1,164**

Source: ERM, 2015

As of May 2017, development of zone A1, A2, B2, B3, D1 and D2 will affect almost agricultural land. Majority of the land is palm oil plantation covering approximately 3,905.644 acre including 18 buildings which are labor houses, oil palm factory and garage as presented in Table 1.9-2. Minority of the land is cashew plantation.

Table 1.9-2 Affected oil palm plantation and staff quarters' houses

Initial Industrial Estate - Zone	Estimated area of oil palm plantation and asset		
	Oil palm plantation (Acre)	Households	People
Zone A2	945.44	10	10
Zone B2	982.95	5	20
Zone B3	919.53	9	36
Zone D1	1,057.72	7	28
Zone D2		4	16
Total	**3,537.82**	**35**	**110**

Source: ESIA Study Team

1.9.2 IMPACT LEVEL

On household level, people to be affected by the Project, or Project Affected People (PAPs) are 1,164 persons, living in 291 households, as shown in Table 1.8-4. Inventory loss of land plot, paddy field, perennial trees, houses and associate residential structures belong to the PAPs were estimated by the census and land survey.

As of May 2017, on community level, the project land acquisition will result in the loss of existing infrastructures and facilities. The losses include 3 primary schools, 1 high schools, 6 monastery, 4 administrative office, 5 cemeteries.

Table 1.9-3 Existing basic infrastructures in affected villages

No.	Village Name	Affected Public Infrastructure				
		Primary school	High school	Monastery	Administration office	Cemetery
1	Pagaw Zoon	1	None	2	1	1
2	Yalai	None	1	2	1	1
3	Wet Chuang	1	None	1	None	1
4	Kha Muang Chuang	1	None	None	1	1

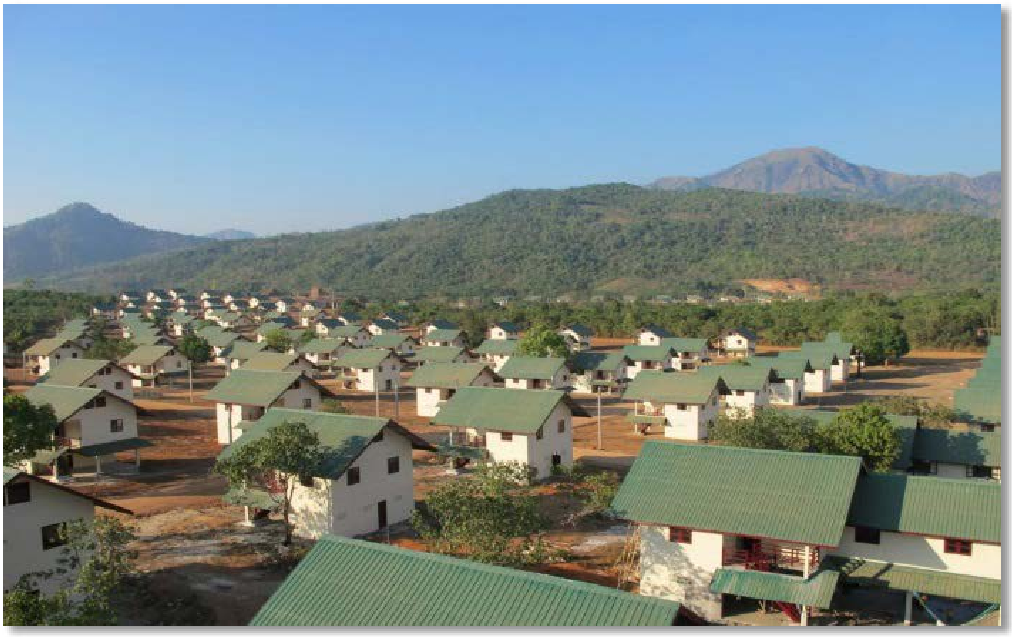
Source: ESIA Study Team

1.9.3 COMPENSATION POLICY

The Project will compensate all individuals who will be physically displaced as a result of land acquisition and other Project related impacts that may entail displacement. The compensation will be at full replacement cost for land and other assets lost depends upon supervision and consideration of independence experts and the Compensation and Relocation Committee and in accordance with International Standard. Resettlement assistance will be provided to all eligible people (owner, resident, encroachers, and squatters). Assistance may be in the form of transportation, food, shelter, and other social services. Details of entitlements and asset inventories and compensation is in Annex 9-2, Resettlement Action Plan 2016.

1.9.4 RESETTLEMENT SITES

Resettlement site has been preparing for all affected villages. Bawah relocation area (Figure 1.8-1) has been completed and ready for the affected villagers who choose this option to be moved in.



Source: MIE (2015)

Figure 1.9-1 House units in Bawah resettlement site

The total area of Bawah relocation site is 1,125 acres. Tree counting in this area had been 100%completed and compensation was paid up to 867.23 acre (78%), with an amount of 2,516.56 million kyats (March,2013). Bawah resettlement site consists of 480 units of house including facilities of primary school, clinic, staff house, monastery, sanitary work, roadwork, wiring cable and water tank.

House units have three (3) features, small, medium and large. The small size unit is 128 m^2. The medium size unit is 160 m^2. The large size unit is 195 m^2. All are two bedrooms units with different size of family room accordingly the unit's size. Construction cost for each unit are 15,524,231, 18,069,904 and 20,643,235 KYATs, respectively.

1.9.5 LIVELIHOOD RESTORATION PROGRAM

Livelihood restoration of the villagers should be implemented in line with their preferred occupations listed above. Training should also be provide to develop skills needed for their interested occupations. In addition, start-up capital should also be provide in the form of low-cost loans. Community organization should also be promoted to enable the settlers to work in collaboration for their benefits.Employment at Early Industry

To ensure a stable source of income during the transitional period and beyond, each household should be guaranteed employment at the Early Industry, both during construction and operation periods, At least, one person from each household should be employed. It is expected that construction works in Early Industry could employ at least 1,037 persons (one person one household). Therefore, an employment guarantee should be formalized between DDC, responsible government agencies, and target villagers. To support this income restoration component, the villagers should receive training in skills needed for the construction works.

1.9.5.1 Agricultural Development

To minimize the impacts on livelihood and income, agricultural land may be offered case by case per agreement with PAHs who will lose their farmlands. However, this entitlement will depend upon and under supervision of the Experts and consideration of RAP committee on the Resettlement Action Plan each year. The farmers, who will need to change their occupations may need intensive training to develop skills for new non-farm occupations. The villagers who are still interested in continuing their agricultural occupation may be trained about their selected farming model based on the concept of sustainable farming such as integrated farming system (i.e. no chemical use). The training would cover such subjects as on-farm soil and water management, integrated pest management, farm cost management, product marketing, and farmer co-operatives. Some offered training program are following:

- Training in Home Vegetable Gardening
- Training in Mushroom Cultivation
- Training in Food/Fruit Preparation, Processing and Preservation

To notify that RAP information within this report / disclosed here is prepared base on available RAP information as of May 2017. The RAP information is subjected to change according to stage and development of RAP program for each year.

1.10 SKILL TRAINING PROGRAM

To prepare the employment in Early Industry and new business opportunities that come with the Project, short-term training should be provide in various skills that would be in demand in the Early Industry development. The project aims to establish the Dawei Skill Training Center to support demand of skilled workers pursuant the type of Factories that will raise in the Initial Industrial Estate. This type of skill training will be agreement between employers and employee, in choosing the best program for themselves. Another skill training program will establish for the livelihood restoration due to resettlement and relocation or/and for general people who interest. Such proposed skill program are:

- Motorcycle and car repair
- Home appliance repair
- Handicraft making
- Security Training
- Welding Training
- Food Production Training
- Car Driving Course
- Electrical Training
- Computer and language skill Training
- Forklift operation

Training program will legal establish in accordance with the relevant laws as mentioned in Chapter 3. The center will also authorize to conduct vocational training for works and staff including students; provide outsourcing services and agencies in the region.

1.11 COOPERATE SOCIAL RESPONSIBILITIES PROGRAM

1.11.1 COOPERATE SOCIAL RESPONSIBILITIES POLICY

The Project has a guideline for the Corporate Social Responsibility as follows;

- The Corporate Governance: The management system of the Project has efficiency, transparency, and accountability.
- The Business Ethics: The Project believed that moral in business operation can benefit the Project in the long-term.
- The Respect to Human Right and Labor Equity: Human resource is the effective factor to drive the business and add value for the corporate. The Project, support improving their working environment and provide them a chance to training for skill enhancement.

- The Responsibility to the Consumer: The Project maintain its standard of goods and services and can be the part of society to mitigate the social problems.
- The Community Development: The community's sustainability is one of the significant factors which can support the Company's business.
- The Environmental Concern: The Project set the environmental impact protection system comply with laws and regulation and participate in environmental activities with other part of society.

1.11.2 COOPERATE SOCIAL RESPONSIBILITIES PROGRAM

The Project plans to conduct CSR programs that will support development in Dawei region and local communities such social, environmental and standard of living.

The program are

- Education;
- Emergency;
- Finance.

1.11.2.1 Education

The project aims to donate scholarships for students who live in vicinities of the project from school level until university level in every Q3 of every years.

1.11.2.2 Natural Disaster Emergency

The project aims to donate and support the local communities or in the Dawei region during the emergency such as fire, natural disaster and epidemic or terrorism. The donation will conclude such life supporting bags and food and water and rescue equipment. Supports during recovery period, such as cleaning, clearing blocking drainages or cannels.

1.11.2.3 Finance

- Micro-credit program has proved to be an effective means to help financing small investment by persons with no collaterals.
- Organization program will provide two full-time rural development specialists to help organize communities for productive purposes, particularly for new business ventures.

CHAPTER 2

CONTEXT OF THE PROJECT

2.1 PROPOSE OF THE EIA STUDY

This proposed project entitled "*The Initial Industrial Estate Project*" (herein referred to as "*the Project*") is established by Myandawei Industrial Estate (MIE) Myanmar. A 27 square kilometers in Dawei Special Economic Zone (DSEZ) will be developed an eco-friendly industrial park that will support industry in concurrent development of the other business in the DSEZ e.g. mid-stream photochemical industry, port and logistics as a pivotal place for trading and transportation of the South East Asia region.

The Environmental Impact Assessment Procedure (No.616/2015) (hereinafter referred to as "*EIA Procedure*"), which was issued by the Ministry of Environmental Conservation and Forestry (MOECAF) (predecessor of Ministry of Natural Resources and Environmental Conservation (MONREC)) on 29th December 2015 defines the detailed legal process regarding EIA procedures including preparation of EIA/IEE report, environmental management plan (EMP), public involvement, approval of EIA/IEE report by MOECAF, and monitoring process in accordance with the EIA report.

In this EIA Procedure, all size of "*Industrial Zone Development*" projects are requested to conduct full EIA study. Therefore, the Project Proponent has to conduct the EIA study based on the EIA procedure. As the project relates to many social aspects, especially in early phases development such land acquisition, relocation and resettlement and restoration. The social study is embedded in the EIA study and herein will refer to as "*Environmental and Social Impact Assessment*" (ESIA) study.

2.2 PRESENTATION OF THE PROJECT DEVELOPMENT

Development of the project (Figure 2.2-1) is expected to instigate not only national economic but also to create employment opportunities for public and development of infrastructure in the Dawei region. By applying state-of-art and technologies and sustainability approaches in order to improve living standards of Myanmar citizen, the project will be developed in phases. Until completion, the Project will occupy by operation of many factories in a modern and efficient industrial estate.

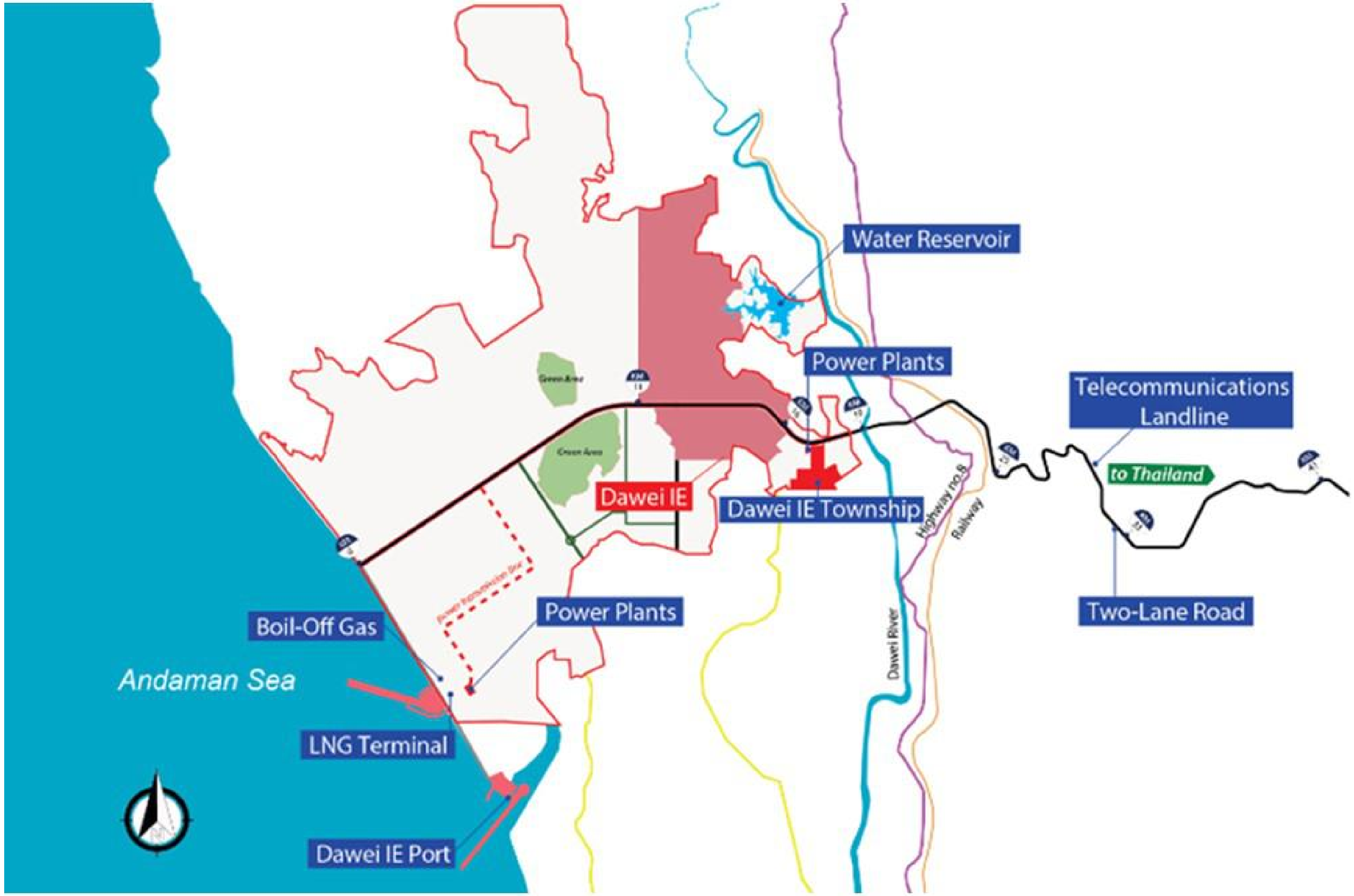
2.2.1 Project Background

In 2010, the Italian-Thai Development Public Company Limited (ITD) signed a Framework Agreement with the Myanmar Port Authority for "*The Dawei Sea Port and Industrial Estate Development Project*". The Framework Agreement granted the concession for the Project including the others several projects, which were a cross border road and rail link with connecting transmission line; and a township for residential and commercial.

In July, 2012, Government of the Kingdom of Thailand and Government of the Republic of the Union of Myanmar signed a Memorandum Of Understanding (MOU) on the comprehensive development of "*The Dawei Special Economic Zone (DSEZ) and its related project areas*", in order to enhance cooperation of the two governments in development of the Dawei Projects; however, the Dawei Projects were suspended during 2013.

Later year in 2015, ITD had been granted the concessionaire contract to develop "*the entire DSEZ Industrial Estate-Initial Phase*" from the Myanmar Government. Due to the fact that scale of the new development was large and too complex. Thus, each component was spited into separated Environmental and Social Impact Assessment (ESIA) and Initial Environmental Examination (IEE). The environmental studies were assigned following.

- Two-Lane Road that connects between the DSEZ in Dawei and Thailand. The road is 138 kilometers starting from Phu Nam Ron in Kanchanabuiri divided into 3 sections. Section 1 is 50.9 kilometers and section 2 is 42.9 kilometers and section 3 is 44.2 kilometers, respectively. Most of the road sections are in Myanmar, only 5 kilometers in Thailand.
- Small Ports with 2 platforms that length in size are 100 and 150 meters and 25 meters of width.
- Small Water Reservoirs will supply water treatment plant consisting of Pa Yain Byu Reservoir and Ta Laing Gya Weir (Approved IEE).
- Initial Phase Power Plant will generate electricity supply from gas-engine power plant, gas-turbine power plants and combined cycle power plants.
- Telecommunication Landline for Information Technology (IT) including fixed line and high-speed internet with fiber optic cable from the Myanmar-Thailand Border will be installed.
- LNG Terminal once when complete will provide sufficient clean and economical price of natural gas to the power plants in the industrial estates.
- Initial Township that will not only build for commercial and residential accommodation to support the Initial Industrial Estate, but to establish an actual Initial Township which has all needed functions and facilities in order to create good environment and livelihood.



Source: ITD (2012)

Figure 2.2-1 The Dawei Industrial Estate Project (Dawei IE) in the Dawei Special Economic Zone

Prior to conduct the Project ESIA, a number of environmental studies have been conducted in the DSEZ, in accordance with the stage of the entire industrial estate – initial phase development. The literatures are reviewed and incorporated into this ESIA study. They are following:

- The Initial Environmental Examination (IEE) for Dawei Sea Port and Industrial Estate Development (TEAM, 2012);
- The Social Impact Assessment (SIA) for Dawei Sea Port and Industrial Estate Development (TEAM, 2012);
- The Environmental Impact Assessment (EIA) for Main Road (SEATEC, 2012).
- Environmental Impact Assessment for Dawei Industrial Estate-Initial Phase Project (SEATEC in association with UAE, 2012)
- The Social Impact Assessment (SIA) for Medium and Light Industrials for Dawei Development (TEAM, 2013)
- The Environmental and Health Impact Assessment (EHIA) for the Dawei Sea Port (TEAM, 2013).

However, the Project information used in this ESIA report bases on the current scenario and is considered the most valid at the time of the report preparation. Changes in the Project information may occur overtime and, therefore, readers and project developers are advised to check and confirm the update details at the time of review and implementation.

2.2.2 Status of Project Preparation

The existing infrastructure are unpaved road. The road is linked between Dawei SEZ and Thailand. The Project can be accessed by this road from Ban Phu Num Ron, Kanchanaburi by 4-WD type car. Land plot within the Project boundary has almost been clear of vegetation and some area are leveled grade. Water is supplied by the Pa Yain Byu Reservoir and Ta Laing Gya Weir. Power will be soon supplied by the power plants but at the present electricity still relies on diesel generator.

MIE plan to develop infrastructure and install facilities by phases in accordance with the demand growth in DSEZ. This will be achieved through construction of the following components. Infrastructure are Main Roads (MR), Secondary Roads (SR), Tertiary Road (TR) and steel bridge. Flood protection and drainage systems are Floodway, Retention Pond, Polder Dike and Box Culvert. Wastewater Treatment Plant are Lift pumps, Aeriated Lagoons, Polishing and Inspecting ponds. Waste Management System will consist of Non-Hazardous Waste landfills; Secure landfills, Landfill Leachate and Gases Management System and Incinerators. Firefighting and Emergency Response System are firefighting apparatus; hydraulic platform, major, special pumpers and water and foam tankers and Emergency Response Plan. The project will install power and electricity distribution system from the central power plant and distribution pump station from the water treatment plant and pipelines.

Details of these facilities, their feasibility study and designed concepts are presented in *Chapter 4-Project Description and Alternatives*. Some detailed designs have been submitted to Dawei Special Economic Zone Management Committee (DSEZMC) since November 2, 2015 in compliance with the requirement under the Concession Agreement. The ESIA study has been conducted in accordance with such submitted technical information, especially in the detailed description for each facility.

2.2.3 Related Projects

The Dawei Special Economic Zone is located in northern part of Maungmagan Bay, Andaman coastline and approximately 28 km northwest of the provincial city of Dawei, in Tanintharyi Region, Myanmar. Since the Italian-Thai Development signed the Concession Agreement (CA) with the DSEZMC, development of the entire DSEZ consists of the other 9 related projects following:

1. Two-Lane Linked Road;
2. Small Port;
3. Initial Industrial Estate;
4. Initial Phase Power Plant;
5. Initial Township;
6. Small Water Reservoir;
7. Telecommunications Landline;
8. LNG Terminal; and
9. Boil-off Gas and Temporary Power Plants.

2.3 RESENTATION OF THE PROJECT PROPONENT

Myandawei Industrial Estate (MIE), herein this ESIA report referring as "*The Project Proponent*" is awarded by the DSEZMC in developing the Initial Industrial Estate Project. The Project Proponent is established on April 9th, 2015 in the Republic of the Union of Myanmar" by jointed investment between Italian Thai Development Public Company Limited (ITD) and Rojana Industrial Park Public Company Limited (ROJANA). Brief information on the Project Proponent is presented in *Annex 2-1.* The Project Proponent has following registered address.

- Yangon Head Office is at 6th Floor, Salomon Business Center, 224/A, U Wisara Road, Bahan Township, Yangon, Myanmar. Telephone number is +951-535-421. Fax number is + 951-535-421. Company website is http://www.daweiindustrialestate.com. Google GPS coordinate is 16.804441, 96.142993.

2.4 RESENTATION OF THE ESIA STUDY TEAM

The Project Proponent has hired International Engineering Consultants Co., Ltd. (IEC) to carry out engineering design of the Project development meanwhile to support the Italian-Thai Development Public Company Limited (ITD). As part of the contract, IEC has to conduct Environmental and Social Impact Assessment (ESIA); therefore, United Analyst and Engineering Consultant (UAE) engaged IEC in association to conduct the Environmental and Social Impact Assessment (ESIA) of the project. In this report, UAE is referred to "*the ESIA Study Team"*

The United Analyst and Engineering Consultant (UAE) is formed by environmental professionals. UAE provides complete loop of environmental services from project conception through project planning and feasibility study, environmental samplings, analytical laboratory, environmental assessments, auditing and monitoring and public participation. The service provider experiences various physical and utility infrastructures including urban mass transit system, ports, power plants, oil and gas and industrial estate. Consequently, UAE can provide comprehensive services covering all aspects of development projects and business management (see *Annex 2-2*). UAE has completed assignments not only in Thailand but also in neighboring countries in the AEC, particularly Lao PDR, Viet Nam, Cambodia and Myanmar. The ESIA Consultant has following registered address:

- 81 Udomsuk 41, Bangchak, Phrakhanong, Bangkok, Thailand 10260 Telephone number is +66-2763-2835. Fax number is +66-2763-2830. Company website is www.uaeconsultant.com. Google GPS coordinate is 14.25897, 98.04296.

2.4.1 Implementation Organization for the ESIA

Organization in charge of the implementation of the ESIA is presented in Table 2.4-1. The members of ESIA Study Team are listed in.

Table 2.4-1 Implementation Organization of EIA

	Organization	Responsibility
International Lead Consultant	United Analyst and Engineering Consultant Ltd. (UAE)	Overall management and technical aspect of ESIA
Local Consultant	Resource and Environmental Myanmar Ltd. (REM)	Public Consultation Meeting

Source: ESIA Study Team

The ESIA study is conducted by a multidisciplinary ESIA team consisting of professionals in various related disciplines The ESIA study team consists of a core study and planning group and a technical support group. A simple organizational structure for conducting and managing the ESIA study is shown in Figure 2.4-1. The Team Leader manages technical aspect of the ESIA study. The Team Coordinator assists the Team Leader in coordinating among members of the ESIA team, Project Proponent and the Myanmar Environmental Conservation Department (ECD).

Source: ESIA Study Team

Figure 2.4-1 Organization of the ESIA Study Teams

The core study and planning group of the ESIA study team consists of qualified and experienced professionals in various technical areas relevant to major environmental and social impacts of the Project, including (i) air pollution; (ii) water pollution; (iii) terrestrial ecology forest and wildlife; (iv) waste management; (v) public participation; (vi) social impact assessment; (vii) occupational health and safety; and (viii) environmental management planning. The environmental management planning experts will assist the Team Leader, to ensure that scoping and final ESIA report will meet all requirements prescribed in the administrative instruction of EIA, EIA Procedure and the EIA Guidelines, and ECD comments and recommendation including a practical environmental management plans and mitigation measures are enable to implement.

The core study and planning group will be supported by the technical support group consisting of professionals in various disciplines relevant to the environmental and social contexts, including; (a) environmental sciences; (b) socio-economics; (c) public health; (d) terrestrial ecology; (e) civil engineering and environmental engineering; and (f) industrial estate engineering.

The members of ESIA Core Specialist Team are listed in Table 2.4-2 and Technical Expert Team are listed in Table 2.4-3. The profile of each organization and the curriculum vitae of the key experts of the EIA Study Team are attached in *Annex 2-3*.

Table 2.4-2 Members of the ESIA Specialist Team

Name of Organization	Name	Position	Background	Years of Experiences
United Analyst and Engineering Consultant Ltd. (UAE)	Mrs. Suparatana Jotisakulratana	EIA & Public Consultation Specialist (EIA Registered)	M.Sc. (Environmental Biology) B.Sc. (Sanitation)	36 years
	Ms. Wilasinee Anomasiri	Socio-Economic and Indigenous Specialist	Ph.D. (Environmental Management) M.A. (Social Science) B.A. (Geography)	30 years
	Ms. Pensri Watchalayan	Occupational Health and Safety Specialist	Ph.D. (Environmental Management) M.Sc. (Toxicology) B.Sc. (Occupational Health & Safety)	27 years
	Ms. Nathinee Srinate	Environmental and Waste Management Specialist	Ph.D. (Chemical Engineering) M.Eng. (Chemical Engineering) B.Sc. (Chemical Technology)	11 years
	Ms. Rujiroj Anambutr	Land Use Specialist	Ph.D. (Urban & Environmental Planning) M.Sc. (Urban Planning) M.Sc. (Landscape Architecture) B. Arch.	27 years
	Ms. Ratata Timmanee	Air and Noise Specialist	M.Sc. (Industrial Public Health) B.Econ. (Economy)	23 years
	Mr. Watana Sukasem	Water Resources Specialist	M.Sc. (Oceanography) B.Sc. (Oceanography)	27 years
	Mr. Kanchit Womgsaengchan	Wastewater and Water quality Management Specialist	M.Sc. (Environmental Management & Technology) B.Sc. (Sanitary Science)	28 years
Resource and Environmental Myanmar Ltd. (REM)	Mrs. Khin Ohnmar Htwe	Social Specialist	M.A. (Geography) B.A. (Geography). Dip. (English)	14 years

Source: ESIA Study Team

Table 2.4-3 Members of the ESIA Expert Team

Name of Organization	Name	Position	Background	Years of Experiences
United Analyst and Engineering Consultant Ltd. (UAE)	Ms. Pornwipa Klangsin	Team Leader, Project Director Environmental, Health and Water Expert	Ph.D. (Environmental Health Science) M.Sc. (Environmental Health Management) B.Sc. (Medical Technology)	27 years
	Ms. Nawarat Kieomat	Sub-Team Leader, Project Manager EIA & Public Consultation Expert (Thai EIA Registered Expert)	M.Sc. (Tech. Information Sys. Management) B.Sc. (Marine Science)	19 years
	Ms. Krittika Bunyachatphisuth	EIA Expert (Air, Noise and Vibration)	M.Sc. (Environmental Science) B.Sc. (Marine Science)	24 years
	Mr. Pat Thepasit	Public Consultation Expert (Socio-Economy)	M.Sc. (Environmental Management) B.A. (Forestry and Environmental Extension) B.Sc. (Resource & Agricultural Economics)	14 years
	Mr. Somchai Suravit	Project Coordinator EIA Expert (Natural Environment)	M.Sc. (Fisheries Science) B.Sc. (Fisheries Science)	24 years
	Ms. Nannapat Natchakunlasap	Sub-Project Coordinator EIA Expert (Natural Environment)	M.Sc. (Environmental Management) B.Sc. (Geology)	9 years
	Mr. Weerawat Thongkeatcharoen	Sub-Project Coordinator Public Consultation Expert	B.Sc. (Environmental Resource Studies)	3 years
	Ms. Orapan Shumnanrum	EIA Expert (Soil Expert)	B.Sc. (Soil Resource & Environmental Management)	3 years
	Mr. Mongkol Mirutanaphai	EIA Expert (Natural Environment)	B.Sc. (Environmental Resource Studies)	3 years
Resource and Environmental Myanmar Ltd. (REM)	Ms. Phyu Phyu Shein	Social Expert (Social Science)	Dip. (Business LCCI) B.Sc. (Physics)	4 years

Source: ESIA Study Team

2.5 SCOPE OF THE ESIA

Most of project activities during construction and operation phases will be restricted in the proposed area of 27 square kilometers of the Project. Therefore, evaluation of impacts on environment will be emphasized in the Project and adjacent areas. Impacted area assessed in this ESIA study are vary depending on the environmental and social aspects and concerned issues.

In principal the impact area is assessed within 5 kilometers in radius from the Project boundary. Primary data (2012-2015) are gathered from the project sites and secondary data are gathered from previous studies and the other related ESIA and IEE projects in DSEZ. Size of data or area of samplings are confirmed to cover scope of the ESIA study in all aspects.

4 types of resources are conducted environmental and social impact assessment; physical, ecological, economic development and social and cultural resources. Table 2.5-1 presents the resources that may be relevantly impacted or benefited from the Project activities. Twenty of concerned aspects are assessed both during construction phase and operation phases. Materials and methodology in this ESIA assessment are presented in Table 2.5-2.

Table 2.5-1 Scope of Environmental Impact Assessment for the Dawei SEZ Initial Industrial Estate

Physical Resources	Ecological Resources
1.Climate and Air Quality	1.Surface water
2. Noise and Vibration	2.Biology and Forest
3. Topography and Soil	3.Wildlife
4. Hydrology	
5. Surface water and Sediment	
6. Groundwater	
7. Geology and Seismology	
Economic Development	**Social and Cultural Resources**
1.Initial Industrial Estate Development	1.Communitites and population
2.Infrastructure Facilities	2.Health Facilities
3.Traffic and Transportation	3.Education Facilities
4.Land Use	4.Facilities and Infrastructure
	5.Land Use and Land Holding
	6.Historical and Archeological Sites

Source: EIA Study Team

Table 2.5-2 Martials and methods in ESIA of The Initial Industrial Estate Project

Environmental Issues	Study Methods	
	Existing Environment	**Impact Assessment**
1. Physical Resources		
1.1. Air Quality and Climate	• Review climate record from The Geology of Burma (Myanmar): An Annotated Bibliography of Burma's Geology, Geography and Earth Science, US Army Corps of Engineers, September, 2008. • Review air quality measurements from relevant environmental studies.	• Indicate the study boundaries; • Assess the types of pollutants and emission concentrations released after during the construction and operation periods, and compare them with the combined impacts from the proposed project and other existing sources in the vicinity.
1.2. Noise and Vibration	• Review noise and vibration measurement from relevant environmental studies.	Noise • Identify the potential noise sources, and levels, during the construction and operation periods; • Evaluate change in the noise level in the project area and surrounding communities; • Use of internationally recognized methods or models to evaluate potential noise impacts. Vibration • Identify the potential vibration sources and levels during the construction and operation periods; • Assess the vibration impacts on nearby communities and buildings.
1.3. Topography and Soil	• Review topography from relevant environmental studies; • Review topographical map of Tavoy Burma 1:250,000 Series U542, Sheet ND 47-6, Edition 1-AMS, 1957. • Review Myanmar Dominant Soils (*http://www.tec.army.mil/Burma/maps/SoilMap_Myanmar_300dpi.jpg*).	• Evaluate the impacts from project's activities; e.g., changes in topography, land subsidence, changes in slope, and soil erosion.

Table 2.5-2 Martials and methods in ESIA of The Initial Industrial Estate Project (Cont.)

Environmental Issues	Study Methods	
	Existing Environment	**Impact Assessment**
1.4. Hydrology surface water and sediment quality	• Review the main rivers near, and within, the project area from Port of Map Sheet No.1497_15, 1498_03 & 04, Vertical Datum: MSL at Kyaikkami. • Conduct surface water quality and sediment sampling during February, 2015 (before monsoon season). The surface water and sediment quality are collected and analyzed at 11 sampling stations. The water quality parameters analyzed: Temperature; pH; Salinity; Electrical Conductivity; DO; BOD; Turbidity; COD; TSS; TDS; TS; Nitrate-Nitrogen; Ammonia-Nitrogen; Phosphate-Phosphorus; TKN; Oil&Grease; Phenol; TPH; Iron, Manganese; Cadmium; Hexavalent Chromium; Lead; Zinc; Nickel; Copper; Cyanide; Arsenic; Total Mercury; TCB; FCB; and E.Coli. The sediment quality parameters analyzed: Oil&Grease; Iron; Arsenic; Cadmium; Total Chromium; Copper; Mercury; Nickel; Lead; and Zinc.	• Evaluate potential change in the hydrology of the surface water quality due to land excavation and/or reclamation, during project site preparation and construction; • Describe the impact of the treated wastewater on the receiving water quality, with respect to possible change in the water and sediment quality, along the course of the receiving water, at and below the point of discharge due to BOD loading; • Assess the change in the receiving water quality for different seasons of the year in Dawei River, through evaluation of DO sag curve; • Identify potentially affected communities, in case the receiving water is polluted.
1.5. Groundwater	• Review groundwater quality from relevant environmental studies. • Conduct groundwater quality sampling during December 2012 (after monsoon season) and March 2013 (before monsoon season).The groundwater quality is collected and analyzed at the two sampling stations. The parameters analyzed: pH; Turbidity; Electrical Conductivity; TS; TDS; TSS; Fluoride; Iron; Cyanide; Total Hardness; Non-carbonate hardness; Selenium; Sulfate; Nitrate-Nitrogen; Manganese; Cadmium; Hexavalent Chromium; Arsenic; Lead; Zinc; Mercury; Nickel; Copper; TCB; and E.Coli.	• Evaluate potential changes in groundwater quality due to project activities; e.g., contamination from landfill leachate.

Table 2.5-2 Martials and methods in ESIA of The Initial Industrial Estate Project (Cont.)

Environmental Issues	Study Methods	
	Existing Environment	**Impact Assessment**
1.6. Geology and Seismology	• Review the geological map of the Socialist Republic of the Union of Burma (scale 1:1,000,000), prepared under the auspices of the earth sciences research division, 1977; • Review Burma Rock Types, accessed from (*http://www.tec.army.mil/Burma/maps/RockTypes1990.jpg* accessed on 8 November, 2012); • Review report on Regional Geology of Myanmar conducted by Department of Geological Engineering, Faculty of Engineering, Gadjah Mada University, April, 2010 (*http://kyawlinnzaw.weebly.com/uploads/4/5/1/3/4513060/regional_geology_of_myanmar.pdf* accessed on 22 November, 2012); • Review the volcanic occurrences in relation to tectonics in Central Myanmar Basin, posted on December 5, 2011 (*http://www.hlahlaaung.com/?p=42*accessed on 22 November, 2012); and • Review the Seismic and Tsunami Activities in Myanmar, Kyaw Kyaw Lin, Department of Meteorology and Hydrology, Ministry of Transport (*http://www.seis.nagoya-u.ac.jp/kimata/jica/kyawkyaw.pdf* accessed on 22 November, 2012).	• Assess the potential of seismic effects on the project site and adjacent areas. • Recommend a solution, in case significantly adverse impact is found.
2. Ecological Resources		
2.1 Fisheries	• Review fisheries data from other environmental studies. • Conduct fish sampling in Dawei River in February, 2015 to estimate capability to catch fish by the fishing gear used in the sampling.	• Assess the potential impacts on fisheries during construction and operation periods from discharging wastewater (if any); e.g., reduced productivity due to an increase in turbidity during construction.
2.2 Aquatic Biology	• Review aquatic biological data from other environmental studies. • Conduct plankton and fish sampling in Dawei River in February, 2015 to estimate fish capability to catch fish by the fishing gear used in the sampling.	• Assess the potential impacts on aquatic biology during construction and operation periods from discharging wastewater, which may affect aquatic biology.

Table 2.5-2 Martials and methods in ESIA of The Initial Industrial Estate Project (Cont.)

Environmental Issues	Study Methods	
	Existing Environment	**Impact Assessment**
2.3 Terrestrial Biology and Protected Area	• Review terrestrial biological information from other environmental studies.	• Assess the potential impacts on wildlife habitats, forest resources, endangered species, and protected areas from project activities.
3. Economic Development		
3.1 Industries and Mineral Development	• Review economic activity and land use map (*http://www.mapcruzin.com/free-maps-burma-myanmar /burma_econ_1972.jpg* accessed on 8 November 2012).	• Evaluate potential positive impacts on industries and mineral developments in terms of transportation system.
3.2 Infrastructure Facilities	• Site visit in March, 2015, and. • Collect information regarding existing infrastructure facilities from relevant environmental studies	Water Supply • Evaluate any change in the water quality and in the availability that may prevent the surrounding communities from normal use of the water. • Focus on the adequacy and appropriateness of the proposed water supply for the project, and how it might affect the availability of water for the adjacent communities. • Include any potential conflict between the project, and other concerned parties when utilizing the common water resources. Electricity • Evaluate potential effect of local electrical power supply. • Identify the planned area, and capacity, of the high-voltage power generation facilities; and possible methods of resolving adverse impacts, due to facility activity.
3.3 Transportation	• Review transportation network in Myanmar, from Burma (Myanmar) – Infrastructure, power, and communications (*http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Burma-Myanmar-INFRASTRUCTURE-POWER-AND-COMMUNICATIONS.html* accessed on 22 November, 2012). • Collect transportation information from relevant environmental studies.	• Evaluate the effects of the project's transportation activities on adjacent communities. • Investigate capacity, traffic volume, and accident rates of the existing transportation systems, in the study area. • Propose measures to accommodate an increase in traffic volumes, due to project activities, during the construction and operation phases of the project.

Table 2.5-2 Martials and methods in ESIA of The Initial Industrial Estate Project (Cont.)

Environmental Issues	Study Methods	
	Existing Environment	**Impact Assessment**
3.4 Land Use	• Review land use information from other environmental studies. • Review land use information collected by the Project. • Review land use information, collected from the existing maps, prepared by local authorities.	• Assess any potential changes in land use patterns surrounding the project location, and ensure compliance to any relevant law or government policy on land use allocations. • Summarize the actions needed for fair and just compensation, and relocation, for any parties resettled due to the project.
3.5 Agricultural Development	• Review agricultural development, from the Geology of Burma (Myanmar): An Annotated Bibliography of Burma's Geology, Geography and Earth Science, Topographic Engineering Center, US Army Corps of Engineers, September, 2008. • Site visit in March, 2015. • Review the agricultural area within the project area using the land use survey map from Italian Thai Development.	• Evaluate potential impact on agricultural development; e.g., agricultural area, or the potential positive impact on transporting agricultural products.
3.6 Drainage System	• Review the existing drainage systems in the project, and the surrounding area, from relevant environmental studies. • Review the designed flood prevention measures and capacity of the drainage system; evaluate the potential impacts to the project and surrounding areas.	• Evaluate the potential of floods in the project area.

Table 2.5-2 Martials and methods in ESIA of The Initial Industrial Estate Project (Cont.)

Environmental Issues	Study Methods	
	Existing Environment	Impact Assessment
4. Social and Cultural Resources		
4.1 Population and Communities	• Review secondary information from local authorities. • Collect information related to population and communities, from the potentially affected villages in the project area via site surveys and questionnaires.	• Evaluate the potential impacts due to the project's development and its activities on the population density and friction between labor and the native population.
4.2 Health Facilities	• Review public health information; i.e., the number of hospitals, common diseases, mortality, etc., from local authorities.	• Evaluate the potential impacts due to the project's development, and its activities on the status of public health services and occurrence of illnesses in the adjacent communities.
4.3 Socio-economic Conditions	• Review secondary information from local authorities. • Collect information related to socio-economic conditions, from the potentially affected villages in the project area, by utilizing site surveys and questionnaires.	• Assess the potential impacts on local socio-economic conditions, including job employment and generated income.
4.4 Physical and Cultural Heritage	• Review secondary information from other environmental studies. • Review secondary information from local authorities.	• Evaluate the potential impact from project activities of recreational, or tourist, value.

Source: ESIA Study Team

2.6 MONREC'S COMMENTS ON SCOPING AND DRAFT ESIA REPORT

As required in the ESIA process, MIE submitted the scoping ESIA Report to the Environmental Conservation Department (ECD) of the Ministry of Natural Resources and Environmental Conservation (MONREC). ECD commented on the scoping reports for 2 times, in February 2016 (the 1st comments) and the 10th March 2016 (the 2nd comments), see *Annex 2-4*. The comments and recommendations were added and corrected within the report.

Then, MIE re-submitted 1st draft final ESIA Report and ECD commented on 3rd February 2017 as presented in Table 2.6-1 and MIE lastly submitted the revised final ESIA Report and ECD commented on 17th July 2017. The aspects to be implemented in the Initial Phase of DSEZ Industrial Estate were summarized in Table 2.6-2.

Table 2.6-1 3rd Comments from MONREC on draft ESIA Report (3rd February 2017)

Comments	Responses
• Executive Summary in Myanmar language	Chapter 1, Myanmar version Page 1-59 to 1-136
• To describe member list of the consulting team of EIA including resume	Chapter 2, Section 2.4, Annex 2-3 Page 2-6 to 2-9
• To describe the National Environmental Quality Emission Guideline, 2015	Chapter 3, Section 3.4.1 Page 3-27 to 3-30. Or Annex 3-3
• To add the Project commitments and sign of endorsement commitments	Chapter 2, Section 2.9, Page 2-24 Chapter 3, Section 3.5.2 Page 3-41 to 3-54 Signed on pre-face letter of undertaking commitments.
• To describe resettlement action plan, compensation and livelihood restoration plan	Chapter 10, Section 10.4 to 10.9, Page 9-11 to 9-14, Page 10-15 to 10-36. Or in RAP Report
• To describe all round monitoring plans	Chapter 8, Section 8.4, 8.2 to 8.5 Page 8-2 to 8-85, 8-75
• To describe complying for environmental management plan and commitments	Chapter 8, Section 8.8.2 Page 8-92
• To describe specific responsibilities for environmental, health and safety of the Project Proponent (MIE).	Chapter 4, Section 4.4.4 Page 4-220 to 4-221

Table 2.6-1 3rd Comments from MONREC on draft ESIA Report (3rd February 2017) (Cont.)

MONREC 3rd Comments	Responses
• To describe compensation details	Chapter 10, Section 10.4.2 Page 10-17. Or in RAP Report
• To describe job opportunities for local people	Chapter 10, Section 10.5.3 Page 10-20. Or in RAP report
• To describe job training for local people	Chapter 4, Section 4.5.1 Page 4-222 to 2-223 Chapter 10, Section 10.5.3 Page 10-20 to 10-22. Or in RAP Report

Source: MONREC (2017) and ESIA Study Team

Table 2.6-2 4th Comments from MONREC on revised Final ESIA Report (17th July 2017)

Comments	Responses
• Recommended that laws and regulations in Table 3.1.3 are to comply with	Chapter 3, Section 3.1.2 Page 3-8 to 3-21
• To describe resettlement action plan, compensation plan and livelihood restoration plan.	Chapter 10, Section 10.4 to 10.9 Page 9-11 to 9-14, Page 10-15 to 10-36 Or in RAP Report
• To confirm consistency of affected villages through the RAP report.	Chapter 10, Section 10.1 to 10.4 Page 10-1 to 10-27. Or in RAP Report
• To describe expenditure of the RAP and amount of such item	Chapter 10, Section 10.9 Page 10-35 to 10-36. Or in RAP Report
• To describe details of the RAP.	Chapter 10, Annex 10-1:RAP Report
• It is recommended to employ one member each of the relocated and affected households by the project.	Chapter 10, Section 10.5.3 Page 10-20. Or in RAP Report
• To present a plan to give job opportunity to indirectly affected people such as those who do not have to relocate but whose access and use of the farmland for cultivation, work for livelihood and natural resources are affected by the project.	Chapter 10, Section 10.5.3 Page 10-20 Or in RAP Report
• To state the undertaking to comply with EMP and Project commitments	On pre-face in letter of sign undertaking.

Table 2.6-3 4th Comments from MONREC on revised Final ESIA Report (17th July 2017)

Comments	Responses
• To state to comply with mitigation measures	Chapter 8, Section 8.8.2 Page 8-92
• To prescribe how the grievances relating to feedback/concern of local will be taken in account.	Chapter 10, Section 10.8 Page 10-31 to 10-35 Or in RAP Report
• To state percentage of the investment to be used in CSR program.	Chapter 4, Section 4.5.2 Page 4-223 to 4-225
• To included land use map	Chapter 5, Section 5.4.7 Page 5-132 to 5-136
• To disclose/publish the ESIA report to obtain feedback from public on company website/web link.	Chapter 9, Section 9.6 Page 9-10 to 9-11
• To include statement to incorporate and implement the ESIA and EMP in accordance with the EIA Procedure (2015)	Chapter 2, Section 2.1 Page 2-1
• To organize public consultation one more time in 2017	To be advised by MONREC
• To state the implementation of ESE occupational safety master plan timeline.	Chapter 4, Section 4.4.3 Page 4-217 to 4-220
• To commit the CSR to give assistance to disaster risk reduction activities.	Chapter 3, Section 3.5.2 Page 3-47 Chapter 4, Section 4.5.2.3 Page 4-224
• To state mitigation measures in disaster management in case of flood, storm/cyclone, fire and chemical incidents.	Chapter 4, Section 4.3 Page 4-191 to 4-201 Chapter 8, Section 8.2.11 and 8.3.9 Table 8.3-5 and 8.3-6 Page 8-25, 8-49, 8-59 and 8-69
• To prescribe specific function and responsibilities of the Environmental Health and Safety Unit.	Chapter 4, Section 4.4.4 Page 4-220 to 4-221

Source: MONREC (2017) and ESIA Study Team

2.7 STRUCTURE OF THE ESIA REPORT

The ESIA Report has been structured according to the Environmental Impact Assessment Procedure (2015), as well as the Administrative Instruction of Environmental Impact Assessment Procedure (2015). The structure of the remainder of this ESIA is prepared according to the approved Scoping Report, as shown Table 2.7-1.

Table 2.7-1 Proposed ESIA Report Structure

Chapter Number	Chapter Title	Contents
1	Executive Summary	• Summary of significant findings both in English and Myanmar languages. The section will provide concise essence for executives.
2	Context of The Project	• Background and Project justification are prescribed and Presentation of Project Proponent (MIE) and the ESIA Experts. • Scope of the ESIA, the Project's timelines, ECD's comments and endorsement of the ESIA report.
3	Overview of Policy and Institutional Framework	• Compilation of relevant environmental policies, laws and regulations that implementing in the Project and consolidation of institutional framework. • Key international and national guidelines applicable to the Project and detailed legal commitments.
4	Project Description and Alternatives	• Description of the Project setting location, phase development and management of construction and operation. • Details and designs of Project infrastructure and facilities including; calculation and simulation, engineering designs, layouts; and drawings. • Emergency response plans for fire and incidents. Plans and prevention for natural disaster. Implementation of SHE Policy and Master Plans. • Comparisons of the Projects' alternatives.
5	Description of Environment	• Study limit of the ESIA. Baselines and existing condition of each environmental components; physical, biological, socio-economic and cultural. • Research methodologies and the results of studies.
6	Impact and Risk Assessment and Mitigation Measures	• Assessment of the impacts for each components. Determination and prediction of such significant impacts according to their phases, construction and operation. • Mitigation measures and recommended solutions for residual impacts. • Risks assessment.
7	Cumulative Impact Assessment	• Evaluation of incremental and combined impacts for entire project's life span.

Table 2.7-1 Proposed ESIA Report Structure

Chapter Number	Chapter Title	Contents
8	Environmental Management Plans	• Summary for each phase EMPs i.e. proposed mitigation measures, EMoPs and their methodology. • Budgets and institutional arrangement. • Implementation on mitigation measures' policies and commitments.
9	Public Consultation and Disclosure	• Summary for consultation activities, public opinions and recommendations. • Information Disclosure
10	Involuntary Resettlement	• Status and development plans for resettlement and relocation by phases. • Identification of PAPs and PAHs, relevant laws and regulations. Census, assets inventory and socio-economic survey. • Entitlement Matrix, compensation and restoration policies and plans. • Public consultations with Project affected people, grievances redress and RAP Monitoring plans.
11	Conclusions and Recommendations	• Major conclusions and recommendations for future actions.
12	References	• Citation and sources of data and information.

2.8 SCHEDULE OF ESIA

Activities during scoping and draft final reports are presented in Table 2.8-1 and Table 2.8-2, respectively.

Table 2.8-1 Schedule of activities in ESIA Scoping Report Preparation in 2016

	Activities in Scoping Report	2016																																			
		JAN				FEB				MAR				APR				MAY				JUN				JUL				AUG				SEP			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	Methodology																																				
1.	Review relate environmental impact studies	■	■	■	■	■	■	■	■																												
2.	Develop guideline for performing ESIA					■	■	■	■																												
3.	Study the existing environment (Field)					■	■	■	■	■	■	■	■																								
4.	Initial examination of environmental (IEE) report									■	■	■	■																								
5.	Impact assessment						■	■																													
6.	Mitigation measures & Monitoring programs								■	■																											
7.	Study final development plan of the project													■	■	■	■																				
8.	Preparing ESIA report													■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
9.	Public consultation									■	■	■	■																								
10.	Meeting/Presentation in Myanmar													■	■	■	■																				
	Report Delivery																																				
1.	Progress report (40 days)					●																															
3.	Draft ESIA report (120 days)																●																				
4.	Final ESIA report (180 days)																								●												

Source: ESIA Study Team

Table 2.8-2 Schedule of activities in ESIA Study for Final Report in 2017 and 2018

Activities in Draft Report	2016	2017												2018				
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
Public consultation 2nd	■																	
Approval of Final Scoping Report by DSMC	●																	
Preparation of the 1st Draft ESIA Report	■																	
Submission of Draft ESIA Report	●																	
EIA Review Committee	■	■																
Presentation to ECD			■															
Comments Letter of 1st Draft ESIA Report			■															
Preparation of the 2nd Draft ESIA Report				■	■	■												
Public Disclosure					■													
Submission of Final ESIA Report						●												
ESIA Review Committee							■	■										
Comments Letter of Final ESIA Report								●										
Preparation of the Final ESIA Report									■	■	■	■	■	■	■	■	■	■
ESIA Review Committee									■	■								
Approval of ESIA Report											●(red)							
Public Disclosure																■		
Final Public Consultation 3rd																■		
Final Submission of ESIA Report																		●(red)

Source: ESIA Study Team

2.9 PROJECT DEVELOPER' S ENDORSEMENT OF THE ESIA REPORT

MIE on behalf of the Project consortium gives full endorsement of this ESIA report is precise and accurate. MIE is fully committed to the implementation of all measures, including the provision of the necessary funds and human resources.

MIE will at all times comply fully with the commitments, mitigation measures, and plans that have been presented in this ESIA Report.

MIE shall fully implement the EMP, all Project commitments, and conditions, and is liable to ensure that all contractors and subcontractor 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.

List of commitments are prescribed in *Chapter 3, Section 3.7* and EMP and mitigation measures commitments are prescribed in *Chapter 8, Section 8.8.*

CHAPTER 3
OVERVIEW OF THE POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 MYANMAR REGULATORY FRAMEWORK

Environmental legislation is superior key in operation and management of the project. Therein, the principle for environmental management are formulated based on consideration of related national Policies, Laws and Regulations. Most of the legislation listed here are recent and still implement in the Union while some Acts are enacted since the union was under administration of the British India. The considerations in this chapter will be deliberately implemented and mandated through various stages of the Project development, from pre-construction, construction, operation and decommissioning.

The National Commissions for Environmental Affairs (NCEA) formed in February 1990 outlined the *Myanmar Agenda 21*, which contains social, economic, institutional and infrastructure including environmental conservation program. 56 environmental policies and regulations related with environmental conservation and protection and sustainable development were formulated under the National Environmental Conservation Committee (NECC), in April 2011.

As of May 2017, Myanmar has 21 ministries under the Office of the president. The leading ministry, as the focal and coordinating agency, for overall environmental management are the Environmental Conservation Department (ECD) of the Ministry of Natural Resources and Environmental Conservation (MONREC), is derived from the Ministry of Environmental Conservation and Forestry (MOECAF).

3.1.1 Legislation Related to Environmental Social and Health Considerations

The implementing agencies are required to make efforts to mitigate impacts to physical and biological environment, social and cultural environment including to enhance human quality in sustainable environment in concurrent with the Project development. The fundamental laws and regulations related to the environmental social and health considerations in the Project are summarized in Table 3.1-1.

Table 3.1-1 Legislation Related to Environmental Social Considerations

No.	Laws and Regulations as of May 2017
Environmental Foundation	
1	The National Environmental Policy (1994)
2	The Environmental Conservation Law (2012)
3	The Environmental Conservation Rule (2014)

Table 3.1-1 Legislation Related to Environmental Social Considerations (Cont.)

No.	Laws and Regulations as of May 2017
EIA / Environmental Standards	
4	Environmental Impact Assessment Procedure (2015)
5	National Environmental Quality (Emission) Guidelines (2015)
Natural Resources and Utilization	
6	The Land Acquisition Act (1894)
7	The Embankment Act (1909)
8	The Farmland Law (2012)
9	The Farmland Rules (2012)
10	The Vacant, Fallow and Virgin Lands Management Law (2012)
11	The Vacant, Fallow and Virgin Lands Management Rules (2012)
12	The Forest Policy (1995)
13	The Forest Law (1992)
14	The Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994)
15	The Conservation of Water Resources and Rivers Law (2006)
16	The Conservation of Water Resources and Rivers Rules (2013)
17	The Territorial Sea and Maritime Zone Law (1977)
Waste Management	
18	The Underground Water Act (1930)
19	The Water Power Act (1927)
20	The City of Rangoon Municipal Act (1922)
21	The City of Rangoon Development (1922)
22	The Development Committee (1993)
23	The Myanmar Mines Law (2014)
Social and Cultural	
24	The Protection and Preservation of Cultural Heritage Regions Law (1998)
25	The Protection and Preservation of Ancient Monuments Law (2015)
26	The Protection and Preservation of Antique Objects Law (2015)
27	The Rights of National Races Law (2015)
Public Health and Safety	
28	The Public Health Law (1972)
29	The National Health Policy (1993)
30	The Prevention and Control of Communicable Diseases Law (1995)
31	The Control of Smoking and Consumption of Tobacco Product Law (2006)
32	The Motor Vehicles Law (2015)
33	The Motor Vehicles Rules (1987)
34	The Myanmar Fire Brigades Law (2015)

Table 3.1-2 Legislation Related to Environmental Social Considerations

No.	Laws and Regulations as of May 2017
Employment and Working Environment	
35	The Factory Act (1951)
36	The Worker's Compensation Act (1923)
37	The Payment of Wages Act (2016)
38	The Employment and Skill Development Law (2013)
39	The Minimum Wage Law / Rules (2013)
40	The Leave and Holiday Act (1951, partially revised in 2014)
41	The Labor Organization Law (2011)
42	The Labor Organization Rule (2012)
43	The Labor Dispute Settlement Law (2012)
44	The Social Security Law (2012)
45	The Shops and Establishment Act (1951)
Industrial Law	
46	The Explosive Act (1884)
47	The Explosive Substances Act (1908)
48	The Marine Fisheries Law (1990)
49	The Freshwater Fisheries Law (1991)
50	The Prevention of Hazard from Chemicals and Related Substances Law (2013)
51	The Petroleum Act (1934)
52	The Petroleum Rules (1937)
53	The Fertilizer Law (2002)
54	The Myanmar Investment Law (2016)
55	The Foreign Investment Law (2012)
56	The Myanmar Citizen Investment Law (2013)
57	The Myanmar Insurance Law (1993)
58	The Private Industrial Enterprise Law (1990)
59	The Essential Supplies and Services Law (2015)
60	The Law on Standardization (2014)
61	The Electricity Law (2014)
62	The Boiler Law (2015)
63	The Myanmar Engineering Council Law (2013)
64	The Export and Import Law (2012)
65	The Myanmar Port Authority Law (2015)
Special Economic Zone Law	
66	The Myanmar Special Economic Zone Law (2014)
67	The Myanmar Special Economic Zone Rule (2015)
68	Dawei Special Economic Zone Law (2012) 2011

Source: ESIA Study Team

Principle for the legislation listed above in relation to the project is fully prescribed in *Annex 3-3*. Overall, the legislation related to environmental social and health considerations are grouped and summarized in the following:

3.1.1.1 Environmental Foundation

The National Environmental Policy (1994), the Environmental Conservation Law (2012) and the Environmental Conservation Rules (2014) are foundation of environmental management and considerations. The National Environmental Policy aimed to establish a sound of environmental policies in the utilization of water, land, forests, mineral, marine, and other natural resources, in order to conserve the environment and prevent its degradation. The Policy calls for the integration of environmental development and to achieve sustainable development within the country, as well as giving environmental protection a priority in promoting economic development.

Followed by The Environmental Conservation Law (ECL) enacted in March 2012. This law is a fundamental law of environmental management and conservation in Myanmar. The law was prepared by MOECAF (MONREC) and deliberately mandated to the Environmental Conservation Rules (ECRs), as details enforcement regulations. Besides, ECL stipulates MONREC's responsibility for environmental policy, administration, management plan and implementation of environmental monitoring, setting of environmental standards, management of hazardous waste, and EIA procedures.

3.1.1.2 EIA and Environmental Standard

Environmental Impact Assessment (EIA) is mandated by the Environmental Conservation Law 2012 in No.9/2012 Section 42 (b). It is legal requirement for all projects that may pose significant adverse impacts on the environment and social. The EIA Procedure formulated by MONREC in coordination with Asian Development Bank (ADB) was enact in December 2015.

This Procedure (See *Annex 3-1*).covers the following contents: screening of project, qualification for conducting the Initial Environmental Examination (IEE) or EIA Environmental Management Plan (EMP), preparation of report, Environmental Monitoring Plan (EMP), public involvement, and approval procedure from ECD under MONREC, Environmental Compliance Certificate (ECC) including monitoring process after the IEE/EIA approval.

MONREC formulated the National Environmental Quality (Emission) Guidelines (NEQG) in coordination with ADB in December 2015. The NEQG determines the guideline values for general emission such as air emissions, wastewater, noise levels, odor specific to sector of the Project activities i.e. food production, chemicals, infrastructure, manufacturing and power. The NEQG is prescribed in *Section 3.6.3* of this Chapter and details specific to industries are in *Annex 3-3*.

3.1.1.3 Natural Resources and Utilization

(a) Land Use

The Land Acquisition Act (1894) serves as the principle law for land acquisition in Myanmar in order to formulate procedure for land acquisition and compensation. The act further outlines relevant procedures, including notice periods, procedures for objections to acquisition (Article 5), method of valuation of land, process for taking possession of land (Article 16 and 17), court processes and appeals (Article 18 and 24), procedures for the temporary occupation of land (Article 35), and the acquisition of land for companies (Articles 38). The act requires that compensation "*at market value*" is provided to those from whom the land is acquired (Article 23).

The Farmland Law and Rules (2012) determines the land use rights of farmland and the granting of land use rights to eligible farmers. It allows the right to sell, mortgage, lease exchange, and give either whole or part of the right to use the farmland. The law determines the formation as well as the roles/responsibilities of farmland administrative bodies at various levels. The Farmland Law and Rules determine procedures such as the application for farmland registration and obtaining land use certificates, application of transfer of farmlands for other purposes, and indemnities and compensation.

(b) Water Environment

The Conservation of Water Resources and River Law (2006). The aims of this law are to conserve and protect the water resources and river system for the beneficial utilization of public, enabling smooth and safe waterways navigation along rivers and creeks, contributing the development of the state economy through improving water resources and protecting river system from environmental impact.

(c) Forestry / Biodiversity

Objectives of the Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994) are to implement the government policy for wildlife protection and natural areas conservation and to carry out in accordance with the relevant International Conventions and to protect endangered species of wildlife and their natural habitats, to contribute for the development of research on natural science, and to protect wildlife by the establishment of zoological/botanical gardens. It prescribes the formation of the committee for protection of wildlife and natural areas with its function and duties and the determination of natural areas and endangered species of wild animal which are to be protected.

The Forest Law (1992) supports conservation, sustainable forestry and socio-economic benefits while also partially decentralizing and encouraging the private sector and community participation in forest management.

3.1.1.4 Social and Cultural

The Protection and Preservation of Cultural Heritage Region Law (1994) prescribes the determination of cultural heritage regions for protection and preservation so as not to deteriorate due to natural disaster or man-made destruction. The Protection and Preservation

of Ancient Monuments Law (2015) and the Protection and Preservation of Antique Objects Law (2015) are enacted to protect the antique objects, monuments and their information. The Protection of Rights of National Races Law (2015) promulgates to protect human right and equity of national race in such obtaining information and treatment.

3.1.1.5 Public Health and Safety

The Public Health Law (1972) is concerned with protection of people health by controlling the quality and cleanliness of food, drugs environment sanitation, epidemic diseases and regulation of private clinics. The Prevention and Control of Communicable Diseases Law (1995, revised in 2011) describes functions and responsibilities of health personnel and citizens in relation to prevention and control of communicable disease. It also describes measures to be taken in relation to environmental sanitation, reporting and control out breaks of epidemics and penalties for those failing to comply. The law also authorized the Ministry of Health to issue rules and procedures when necessary with approval of government.

The Control of Smoking and Consumption of Tobacco Product Law (2006) enacted to convince the public that smoking and consumption of tobacco product can adversely affect health in order to make them refrain from the use and to protect the public by creating tobacco smoke free environment including to protect public, children and youth from smoking and consuming tobacco product.

The Motor Vehicle Law (2015) and the Motor Vehicle Rules (1987). The project proponent has to promise to abide by the nearly all provisions of said law and rules, especially the provisions related to air pollution, noise pollution and life safety.

3.1.1.6 Employment and Working Environment

The Worker's Compensation Act (1923) stipulates that employer is required to make payments to employees who become injured or who die in any accidents arising during and in consequence of their employment. Such compensation also must be made for disease which arise as a direct consequence of employment, such as carpal tunnel syndrome.

The Payment of Wage Act (1936) defines the payment obligation to the workers employed in the factories or railway administration. In stipulates the method of payment stating that the payment should be made in cash on a regular payday, and allows legal action against delayed payment or un-agreeable deduction.

The Factory Act stipulates the work condition of the workers in the factory such as working hours, worksite safety and health measures. According to the act, worker at age 18 or over shall not work exceed 8 working hours per day or 44 hours per week, and the working days shall not exceed 6 days per week. As for worksite safety, the factory shall be kept clean with proper ventilation, light and heat and the workspace shall be situated away from drains, latrines or other things which create a bad or unhealthy smell.

The Leave and Holidays Act (1951, partially revised in 2014) has been used as the basic framework for leaves and holidays for workers with minor amendment in 2006 and 2014. This defines the public holidays that every employees shall be granted with full payment. It

also defines the rules of leaves for workers including medical leave, earned leave and maternity leave.

The Labor Organization Law (2011) replaced the Trade Union Act enacted in 1927 for protecting the right of the workers, having good relations among the workers or between the employer and the worker, and for forming and carrying out the labour organization systematically and independently. Under the law, the labour organization has the right to carry out freely in drawing up their constitution and rules. It has the right to negotiate and settle with the employer if the workers are unable to obtain the right of the workers contained in the labour laws. On the other hand, the employer shall recognize the labour organizations and assist as much as possible if the labour organizations request for help for the interest of his workers.

The Social Security Law (2012) enacted in 2012, was amended the Social Security Act in 1954. It stipulates the formation and implementation of social security system. The Labour Dispute Settlement Law (2012) was enacted for safeguarding the right of workers or having good relationship between employer and workers and making peaceful workplace or obtaining the rights fairly, rightfully and quickly by settling the dispute of employer and work justly. It stipulates that employer in which more than 30 workers are employed shall form the workplace coordinating committee consisting of the representatives of workers and the representative of employer.

The Minimum Wage Law (2013) passed in March 2013, was replaced the 1949 Minimum Wage Act. The law provides a framework for minimum wage determination: the presidential office establishing a tripartite minimum wage committee shall decide minimum wage with industrial variation based on a survey on living costs of workers possibly every two years. This also stipulates equal payment.

3.1.1.7 Industrial Laws

The Foreign Investment Law (2012) is set up to delineate the statutory characteristics of investment into Myanmar. There are specific requirements in the law that stipulate the protection of the environment.

The Export and Import Law (2012) was enacted and the Control of Imports and Exports Act (1947) was abolished. It aims to implement the economic principles of the State successfully, to lay down the policies to export and import that support the development of the State, and that are to be in conformity with the international trade standards.

The Electricity Law (2014) was replaced by the new Electricity Law, a comprehensive piece of legislation covering licensing, a new regulatory commission, standards, inspection, tariff, and restrictions. The electricity law divides projects into “small” (up to 10 MW), “medium (between 10 MW to 30 MW) and large (up to 30 MW); the states and regions can issue permits for small and medium power plants. In case these plants are not connected to the nation grid, the Union Government Ministry is not the primary authority involved. The authorities have a legal right to use land for purpose of power plants under the Electricity Law, and have th right to expand and maintain their facilities. The law also provides that the authorities can build transmission lines in accordance with existing laws.

The Boiler Law (2015) was enacted for protection of the accidents related to the boiler, building up skill resources, and mitigation of the long-term environmental and health impacts generated from boilers. It is described that the boiler that is to be used should meet international requirements.

3.1.1.8 Special Economic Zone Laws

The Myanmar Special Economic Zone Law (2014), which was enacted in 2013 and revised in January 2014, provides the basis for the governments' establishment to SEZs to encourage economic growth and foreign investment through several incentives such as a five-year tax exemption and 50% income tax relief on items exported overseas for five years. Article 35 of this law stipulates that investors shall abide by the environmental standards described in the Myanmar Environmental Conservation Law and International Standards.

3.1.2 The Application of Laws and Legal Commitments

The necessity for the Project Proponent in application of permissions prior executing the development is to ensure that the Project will be effectively managed, with facilities and mitigation measures and be sufficient and sustain the union environment. Application of the following policy, laws, rules procedure and guideline that relates to the DSEZ Initial Industrial Estate are suggested in Table 3.1-3 .

Table 3.1-3 Application of relevant environmental social and health laws and to be implemented commitments

No.	Legislation	Proposes	To be implemented commitments
1.	The Environmental Conservation Law (2012)	To construct a healthy and clean environment and to conserve natural and cultural heritage for the benefit of present and future generations and to maintain the sustainable development through effective management of natural resources and to enable to promote international, regional and bilateral cooperation in the matters of environmental conservation.	• The project proponent has to pay the compensation for damages if the project will causes injuries to environment under the sub-section (o) of section 7 of said law. • The project proponent has to purify, emit, dispose and keep the polluted materials in line with the stipulated standards, under section 14 of said law • The project proponent has to install or use the apparatus which can control or help to reduce, manage, control or monitor the impacts on the environment, under section 15 of said law. • The project proponent has to allow relevant governmental organization or department to inspect whether performing is conformity with the terms and condition included in prior permission, stipulated by the ministry, or not, under section 24 of said law. • The project proponent has to comply with the terms and conditions included in prior permission, under section25 of said law. • The project proponent has to abide by the stipulations included in the rules, regulation, by-law, order, notification and procedure issued by said law, under section 29.
2.	The Environmental Conservation Rules (2014)		• The project proponent has to avoid emit, discharge or dispose the materials which can pollute to environment, or hazardous waste or hazardous material prescribed by notification in the place where directly or indirectly injure to public under sub- rule (a) of rule 68. • The project proponent has to avoid performing to damage to ecosystem and the environment generated by said ecosystem under sub-rule (b) of rule 68.
3.	Environment Impact Assessment Procedure (2015)		• The project proponent has to be liable for all adverse impacts caused by doing or omitting of project owner or contractor, sub-contractor, officer, employee, representative or consultant who is appointed or hired to perform on behalf of project owner, under sub-paragraph (a) of paragraph 102. • The project proponent has to support, after consultation with effected persons by project, relevant government organization, government department and other related persons, to resettlement and rehabilitation for livelihood until the effected persons by the project receiving the stable socio-economy which is not lower than the status in pre-project, under sub-paragraph (b) of paragraph 102. • The project proponent has to fully implement all commitments of project and conditions included in EMP. Moreover the project proponent has to be liable for contractor and sub-contractor who perform on behalf of him/her have to fully abide by the relevant laws, rules, this procedure, EMP and all conditions, under paragraph 103.

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
			• The project proponent has to be liable and fully & effectively implement all requirements included in ECC, relevant laws and rules, this procedure and standards under rule 104. • The project proponent has to inform the completed information, after specifying the adverse impacts caused by the project, from time to time, under paragraph 105. • The project proponent has to continuously monitor all adverse impacts in the pre-construction phrase, construction phrase, operation phrase, suspension phrase, closure phrase and post-closure phrase, moreover has to implement the EMP with abiding the all conditions included in ECC, relevant laws & rules and this procedure, under paragraph 106. • The project proponent has to submit, as soon as possible, the failures of his or her responsibility, other implementation, ECC or EMP. If dangerous impact caused by this failure or failure should be known by the Ministry the project proponent has to submit within 24 hours and other than this situation has to submit within 7 days from knowing it, under paragraph 107. • The project proponent has to submit the monitoring report dually or prescribed time by Ministry in line with the schedule of EMP, under paragraph 108. • The project proponent has to prepare the monitoring report in accord with the rule 109. • The project proponent has to show this monitoring report in public place such as library, hall and website and office of project for the purpose to know this report by public within 10 days from the date which the report is submitted to the Ministry. Moreover has to give the copy of this report, by email or other way which way agreed with the asked person, to any asked person or organization, under paragraph 110. • The project proponent has to allow inspector to enter and inspect in working time and if it is needed by Ministry has to allow inspector to enter and inspect in the office and work-place of project and other work-place related to this project in any time, under paragraph 113. • The project proponent has to allow inspector to immediately enter and inspect in any time if it is emergency or failure to implement the requirements related to social or environment or caused to it, under paragraph 115. • The project proponent has to allow inspector to inspect the contractor and sub-contractor who implement on behalf of project, under paragraph 117.
4.	Emission Quality Standards Guideline (2015)		• The project proponent has to emit, discharge or dispose in line with the standards stipulated in said guideline.

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
5.	The Myanmar Investment Law (2016)	To ensure the appointing of employees, fulfilling the rights of employees, avoiding any injury to environment, social and cultural heritage, insure the prescribed insurance in line with the above law.	• The project proponent has to lease the land or building owned by government or private with lease agreement and register it by the registration of deeps law under sub- section (a) and (d) of section 50 of said law. • The project proponent has to appoint the nationalities in the various levels of administrative, technical and expert work by the arrangement to develop their expertise, in line with the sub-sectio (b) of section51of said law. • The project proponent has to appoint the nationalities only in normal work without expertise, in line with the sub-section (c) of section 51of said law. • The project proponent has to appoint either foreigner or nationality with the appointment agreement in accord with the law, in line with the sub-section (d) of section51of said law. • The project proponent has to comply with the international best practices, existing laws, rules and procedures to not damage, pollute, and injure to environment, cultural heritage and social, in line with the sub-section (g) of section 65 of said law. • The project proponent has to close the project after paying the compensation to the employees in accord with the existing laws if violates the appointment agreement or terminate, transfer or suspend the investment or reduce the number of employees , in line with the sub-section (i) of section 65 of said law. • The project proponent has to pay the wages or salary to the employees in accord with the laws, rules, order and procedures in the suspension period, in line with the sub-section (j) of section 65 of said law. • The project proponent has to pay the compensation or injured fees to the respected employees or their inheritors if injury in or loss of part of body or death caused by work, in line with the sub-section (k) of section 65of said law. • The project proponent has to stipulate the foreign employees to respect the culture and custom and abide by the existing laws, rules, orders, directives, in line with the sub-section (l) of section65of said law.. • The project proponent has to abide by labour laws, in line with the sub-section (m) of section65of said law. • The project proponent has to pay the compensation to the injured person for damages if damages of environment or socio-economy is occurred by misuse of project, in line with the sub-section (o) of section65of said law. • The project proponent has to allow to inspect in anywhere of project if Myanmar Investment Commission inform to inspect the project, in line with the sub-section (p) of section 65 of said law..

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
			• The project proponent has to obtain the permission of MIC before EIA process and report back this process to MIC, in line with the sub-section (q) of section 65of said law. • The project proponent has to insure the prescribed insurance by rules, under section 73 of said law.
6.	Protection the Rights of National Races Law (2015)	To ensure to disclose to residents ethnic nationalities about the project fully, moreover to ensure to cooperate with them.	• The project proponent has to disclose to the residents national races all about the project fully, under section 5 of said law. • The project proponent has to cooperate with the residents national races.
7.	The Public Health Law (1972)	To ensure the public health include not only employees but also resident people and cooperation with the authorized person or organization of health department.	The project owner will cooperate with the authorized person or organization in line with the section 3 and 5 of said law. • The project proponent has to abide by any instruction or stipulation for public health, under section 3 of said law. • The project proponent has to allow any inspection, anytime, anywhere if it is needed, under section 5 of said law.
8.	Prevention and Control of Communicable Diseases Law (1995)	To ensure the healthy work environment and prevention the communicable diseases by the cooperation with the relevant health department.	• The project proponent has to build the housing in line with the health standards, distribute the healthful drinking water & using water and arrange to systematically discharge the garbage & sewage, under clause (9) of sub-section (a) of section 3 of said law. • The project proponent has to abide by any instruction or stipulation by Department of health and Ministry of Health, under section 4 of said law. • The project proponent has to inform promptly to the nearest health department or hospital if the following are occurred: (section 9) (a) Mass death of animals included in birds or chicken; (b) Mass death of mouse; (c) Suspense of occurring of communicable disease or occurring of communicable disease; (d) Occurring of communicable disease which must be informed. • The project proponent has to allow any inspection, anytime, anywhere if it is need to inspect by health officer, under section 11 of said law.
9.	The Control of Smoking and Consumption of Tobacco Product Law (2006)	To ensure the creation of smoking area and non-smoking	• The project proponent has to keep the caption and mark referring that is non- smoking area in the project area, under sub-section (a) of section 9 of said law.

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
		area in the power plant area for health and control of smoking.	• The project proponent has to arrange the specific place for smoking in the project area and keep the caption and mark in accordance with the stipulations, under sub-section (b) of section 9 of said law. • The project proponent has to supervise and carry out the measures so that no one shall smoke at the non-smoking area, under sub-section (c) of section 9 of said law. • The project proponent has to allow the inspection of supervisory body in the power plant area, under sub-section (d) of section 9 of said law.
10.	The Myanmar Fire Force Law (2015)	To ensure to prevent the fire, to provide the precautionary material and apparatuses, if the fire caused in the project area to be defeated because the project is business in which electricity and any inflammable materials such as petroleum are used. So, the project owner has to institute the specific fire service in line with the above law.	• The project proponent has to institute the specific fire services, under sub-section (a) of section 25 of said law. • The project owner has to provide materials and apparatuses for fire precaution and prevention, under Sub-section (b) of section 25 of said law.
11.	The Motor Vehicles law (2015) and Rules (1987)	When the construction period and if it is needed in operation and production period for the all vehicles.	• The project proponent has to promise to abide by the nearly all provisions of said law and rules, especially the provisions related to air pollution, noise pollution and life safety.
12.	The Myanmar Insurance Law	The project can cause the damages to the environment and injuries to public so to ensure the needed insurances are insured at Myanmar Insurance.	• If the project proponent uses the owned vehicles the project owner has to insure the insurance for injured person, under section 15 of said law. • The project proponent has to insure the insurance to compensate for general damages because the project may cause the damages to the environment and injury to public, under section 16 of said law.
13.	Labour Organization Law (2011)	To ensure protection the rights of the employees, having the good relationships between the employees and employer and enabling to form and carry out the labour organizations systematically and independently.	• The project owner has to allow the labour organization to negotiate and settle with the employer if the workers are unable to obtain and enjoy the rights of the workers contained in the labour laws and to summit demands to the employer and claim in accord with the relevant law if the agreement cannot be reached, under section 17 of said law. • The project proponent has to allow the demand for the re-appointment of worker who is dismissed by the employer without the conformity with the labour laws, under section 18.

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
			• The project proponent has to send the representatives to the Conciliation Body in settling a dispute between the employer and the worker, under section 19 of said law. • The project proponent has to allow the labour organization to participate and discuss in discussing with the government, the employer and the complaining employees in respect of employee's rights or interest contained in the labour laws, under section 20 of said law. • The project proponent has to allow the labour organization to participate in solving the collective bargains of the employees in accord with the labour laws, under section 21 of said law. • The project proponent has to allow the labour organization to carry out the holding the meetings, going on strike and other collective activities in line with the procedure, regulation ,by-law and directive of relevant Chief Labour Organization, under section 22 of said law.
14.	The Settlement of Labour Dispute Law,2012	To ensure negotiation and discussion between employees and project proponent, abiding the decision of Tribunal.	• The project proponent has to not absent to negotiation within the stipulated time for complaint, under section 38 of said law. • The project proponent has to not change the existing stipulations for employees within conducting period before Tribunal, under section 39 of said law. • The project proponent has to not close the work without negotiation, discussion on dispute in accord with this law, decision by Tribunal, under section 40 of said law. • The project proponent has to pay the compensation decided by Tribunal if violates any act or any omission to damage the interest of labour by reducing of product without efficient cause, under section 51 of said Law.
15.	Employment and Skill Development Law (2013)	To ensure the job security and to develop the employee's skill with the fund of project owner.	• The project proponent has to appoint employees with the contract in line with the provision of section 5 of said law. • The project proponent has to carry out the training programs with the policy of Skill Development Body to develop the employment skill of employees who is appointed or will be appointed, under section 14 of said law. • The project proponent has to monthly pay to the fund, which is fund for development of skill of employees, not less below 0.5 percentage of the total payment to the level of worker supervisor and the workers below such level, under sub-section (a) of section 30 of said law. • The project proponent has to deduct from the payment of employees for above mentioned fund, under sub-section (b) of section 30 of said law.

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
16.	The Minimum Wages Law (2013)	To ensure the project owner pay the wages not less than prescribed wages and notify obviously this wages in work place, moreover to be inspected.	• The project proponent has to pay the wages in line with section 12 of said law. • The project proponent has to notify the prescribed wages obviously in work place, under sub-section (a) of section 13 of said law. • The project proponent has to correctly record the lists, schedules, documents and wages and report these to the relevant department and give if these are asked while inspecting, in accord with the stipulations, under sub-section (b)(c)(d) of section13 of said law. • The project proponent has to allow to be inspected by the inspector, under sub-section (d) and (e) of section 13 and section 18 of said law. • The project proponent has to allow holiday for medical treatment if the employee' health is not fit to work, under sub-section (f) of section 13 of said law. • The project proponent has to allow holidays without deducting from the wages if one of parents or one of family dies, under sub-section (g) of section 13 of said law.
17.	Payment of Wages Law (2016)	To ensure the way of payment and avoiding delay payment to the employees.	• The project proponent has to pay the wages in accord with the section 3 and 4 of said law, under section 3 & 4 of said law. • The project proponent has to submit with the agreements of employees & reasonable ground to department if it is difficult to pay because of force majeure included in natural disaster, under section 5 of said law. • The project proponent has to abide by the provisions of section 7 to 13 in chapter (3) in respect of deduction from wages. • The project proponent has to pay the overtime fees, prescribed by law, to the employees who work over working hours, under section 14 of said law.
18.	Workmen's Compensation Act (1923)	To ensure the compensations to injured employee while implementing in line with the above law. To pay the prescribed compensations in various kinds of injury.	• The project proponent has to pay the compensation in line with the provisions of said law base on kind of injury and case by case.
19.	The Leaves and Holiday Act (1951)	The employees can take the leaves and get the holidays legally and to ensure the right to get the holidays and leaves.	• The project proponent has to allow the leaves and holidays in line with the law.

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
20.	Social Security Law	The project proponent has to create the social security for the employees because the project is the business under the Myanmar Citizen Investment Law. To ensure the social security for employees of the project, the project owner has to register to the social security offices and to pay the prescribed fund.	• The project proponent has to register to the respected social security office, under sub-section (a) of section 11 of said law • The project proponent has to pay the social security fund for at least four types of social security included in sub-section (a) of section 15, under section 15 of said law. • The project proponent has to pay the fund which has to be paid myself and together with the fund which has to be paid from their salary by the employees .Moreover the project owner will pay the cost for paying the above mentioned fund only myself under sub-section (b) of section 18 of said law. • The project proponent has to pay the fund for accidence, under sub-section (b) of section 48 of said law. (but this fund is not related to workmen compensation) • The project proponent has to make correctly and submit the list and record provided in section 75 to respected social security office, under section 75 of said law.
21.	Petroleum Act (1934)	The project will carry the oil in any phase and may import it. So, to ensure to take the license for importation and storage and abide by the stipulations in the license.	• The project proponent has to obtain the license for importation, transportation and storage of the fuel under section 3 of said law and abide by the stipulations in the license.
22.	The Petroleum Rules (1937)	To ensure the project owner has to abide by the stipulations for transportation of oil.	• The project proponent will abide by the provision of chapter (3) of the Petroleum Rules for transportation and the provisions of chapter (4) of said rules for storage.
23.	The Underground Water Act (1930)	To ensure to obtain the license before sinking the groundwater if it is needed to sink the ground water.	• The project proponent has to obtain the licence granted by the water officer for sinking the underground water before sinking water, under section 3 of said law •
24.	Conservation of Water Resources and Rivers Law (2006)	The project proponent will avoid the disposal of stipulated materials into river-creek.	• The project proponent has to avoid any performing to damage to the river, creek and water resource, under sub-section (a) of section 8 of said law. • The project proponent has to avoid the violation of conditions stipulated by the directorate for prevention of water pollution, under sub-section (b) of section 24 of said law.
25.	Freshwater Fisheries Law (1991)	According to the sub-section (e) of section 2 of said law, the freshwater area includes any	• The project proponent has to avoid any water pollution and disturbing to fish &other aquatic lives in any fresh-water such as river or creek, under section 40 of said law.

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
		river, creek, pond and water area so the project will be near by the river or creek which is freshwater area the safety of freshwater and aquatics.	
26.	Myanmar Marine Fishery Law (1990)	According to the sub-section (f) of section 2 of said law, the Myanmar marine fishery water area includes the water area along the sea cost of Myanmar from the high tide mark toward the open sea and on the seaside of the straight line drawn from one extreme end of one bank to the extreme end of the other bank of the river and creek mouths so the project will be nearby Myanmar marine water area, river or creek which is freshwater area.	• The project proponent has to avoid any water pollution and disturbing to fish &other aquatic lives in any Myanmar marine-water under section 39 of said law.
27.	The Protection and Preservation of Cultural Heritage Regions Law (1998)	To ensure the protection of cultural heritages and the cultural heritage area from the damage by the natural disaster or man-made.	• The project proponent has to apply to get the prior permission of Directorate of Ancient-Research to build the road, bridge or dam in the cultural heritage area, under section 13 of said law. • The project proponent promises not to build the building which is not in line with the stipulations prescribed by the Ministry of Culture in the cultural heritage area.
28.	The Protection and Preservation of Antique Objective Law (2015)	To ensure the protection of ancient monument and information about it if it was in the project area.	• The project proponent has to inform to the village-tract or ward administrator if any antique objective is found in project area under section 12 of said law.
29.	The Protection and Preservation of Ancient Monument Law (2015)	To ensure the protection of ancient monument and information about it if it is in the project area.	• The project proponent has to report to the village-tract or ward administrators if the project proponent will find any ancient monument under the ground or on the ground or under the water under section 12 of said law.

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
			• The project proponent has to obtain the prior permission of Department of Ancient Research Museum if the project area is in the prescribed area of Ancient monument under section 15 of said law. • The project proponent has to obtain the prior permission, by written, of Department of Ancient Research and National Museum if the project proponent dispose the chemical and solid waste in the Ancient Monument area under sub-section of section 20 of said law.
30.	The Forest Law (1992)	To sustain forest resources and ensure perpetual supply of benefits from forest for next generation and to protect soil, water, wildlife, biodiversity and environment	• Under sub-section (a) of section 12, the project proponent has to obtain the approval of Ministry if the project area is included in the forest land or the land administrated by the government which covers the forest under section 1 of said law.
31.	The Special Economic Zone Law (2014)	The project locates in Dawei special economic zone. According to section 89 of said law the project has to abide by said law so to ensure the responsibilities of project proponent.	• The project proponent has to abide by the any stipulation included in the notification, order, directive and procedure issued by special economic zone administrative committee, under sub-section (f) of section 11 of said law. • The project proponent has to comply with the stipulations of SEZ administrative committee, under sub-section (p) of section 11 of said law. • The project proponent has to abide by the standards included in the environmental conservation law and international standards, moreover has to abide by the existing laws to not injure to social and health, under section 35 of said law. • The project proponent has to appoint the nationalities only for normal work without expertise, under section 27 of said law. • The project proponent has to appoint the nationalities in the high- technical work and expert work at least 25 % in first two years later the date which is commencement of project, and at least 50% in second two years later, and at least 75% in third two years later, under section 75 of said law. • The project proponent has to abide by the negotiation by the administrative committee if the dispute, between employees and me, is occurred, under sub-section (a) of section 76 of said law. • The project proponent has to obtain the work permit for foreign employees issued by representative office of labour department before starting to work, under section 77 of said law.

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
			• The project proponent has to obtain the approval of administrative committee before appointment if it is needed to appoint the foreign employees in administrative and technical work over the limited numbers, under section 78 of said law. • The project proponent has to pay the cost for compensation and resettlement for project land if housing, buildings, farm, garden, fruit trees or other plantation is in the project area, in accord with the agreement, under sub-section (a) of section 80. • The project proponent has to coordinate with the administrative committee to facilitate in resettlement process for to not low the original living standards and fulfill their basic needs, under sub-section (b) of section 80 of said law. • The project proponent has to use the project land in accord with the stipulations under sub-section (c) of section 80 of said law. • The project proponent do not change the physical features of land without the approval of administrative committee, under sub-section (d) of section 80 of said law. • The project proponent has to inform to the administrative committee if any antique objective or any natural resource or treasure trove is found on or under the land in project area, moreover has to move to the replaced land for project if the original land cannot be allowed to continue the project, under sub-section (e) of section 80 of said law.
32.	The Engineering Council Law (2013)	To ensure the safety in technical and engineering work in the project.	• The project proponent has to appoint the employees, who obtained the registration certificate issued by the Myanmar Engineering Council, in the technical and engineering work, under section 37 of said law. • The project proponent has to ensure the employees who are engineers abide to the provisions of Myanmar Engineering Council law, prohibitions included in the rules, order and directive issued under said law, conditions included in the registration certificate issued by the Myanmar engineering council, under section 34 of said law.
33.	Prevention of Hazardous from Chemical and Related Substances Law, 2013	To ensure to use the hazardous chemical and related substances safely and safety for the employees. Moreover to be safe in carrying the hazardous chemical and related substances and storage place of it. If it is needed to train how to use the safety dresses which provided to the employees with free of	• The project owner will be inspected for the safety and resistance of the machinery and equipment by the respective Supervisory Board and Board of Inspection before starting the business, under sub-section(a) of section 15 of said law • The project owner will assign the employees, who will serve with the hazardous chemical and substances, to attend the trainings on prevention of hazardous chemical and substances in local or abroad, under sub-section(b) of section 15 of said law • The project owner will abide by the conditions included in the licensee, under sub-section(a) of section 16

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
		charges. To ensure that compensate for injury to person or damage to environment. The project has to be inspected for safety use of hazardous chemical and related substances before starting the project.	• The project owner will abide by and assign to the employees who serve in this work to abide by the instructions for safety in using the hazardous chemical and related substances, under sub-section(b)of section 16 • The project owner will arrange the enough safety equipment in the work-place and provide the safety dresses to the employees who serve in this work with free of charge, under sub-section(c)of section 16 • The project owner will train, in work-place my arrangement ,the know-how to use the occupational safety equipment, personal protection equipment and safety dresses systemically in the work-place, under sub-Section(d) of section 16 • The project owner will allow the receptive Supervisory Board and Board of Inspection to inspect whether the hazard may be injured to health of human or animal or damaged to environment, under sub-section(e) of section 16 • The project owner will assign the healthy employees who have obtained the recommendation that is fit for this work after taken medical check- up and keep systematically the medical records of employees, under sub-section (f) of section 16. • The project owner will inform the copy of storage permission for hazardous chemical and related substances to the relevant township administrative office, under sub-section (g) of section 16. • The project owner will obtain the approval with instructions of relevant fire force before starting the work if the project will use the fire hazard substances or explosive substances, under sub-section (h) of section 16. • The project owner will transport only the limited amount of the chemical and related substance in accord with the prescribed stipulations in local transportation under sub-section (i) of section 16. • The project owner will insure, in accord with the stipulations, to pay the compensation if the project cause injury to person or animals or damage to environment, under section 17. • The project owner will abide by the conditions included in the registration certificate. Moreover will abide by the orders and directives issued by the Central Supervisory Board from time to time, under section 22. • The project owner will classify the level of hazard to protect it in advance according to the properties of chemical and related substances, under sub-section (a) of section 27.

Table 3.1-3 Application of relevant environmental social and health laws and suggested legal commitments (Cont.)

No.	Legislation	Proposes	To be implemented commitments
			• The project owner will provide the safety equipment, personal protection equipment to protect and reduce the accident and assign to attend the training to use the equipment systematically, under sub-section(c) of section 27. • The project owner will transport, possess, store, use and discharge the chemical and related substances in accordance with the stipulations, under sub-section (d) of section 27. • The project owner will abide by the conditions included in rules, order, notification, directive and procedure which issued under this law, according to section 30.
34.	Myanmar Port Authority Law (2015)	To abide by the conditions included in permit if it is needed to import the material for project and export products from the project.	• The project proponent has to abide by the conditions included in permit, under section 7 of said law.

Source: ESIA Study Team

3.1.3 International Agreements and Treaties

Myanmar has signed and been a member of several international conventions, treaties and agreements related to environment is shown in Table 3.1-4.

Table 3.1-4 Ratified recent international agreements related to environmental and social considerations.

No.	International Agreements and Treaties	Date Ratified
1	Basel Convention, 1989	2015
2	Ramsar Convention, 1971	2005
3	Stockholm Convention on Persistent Organic Pollutants, 2001	2004
4	Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1979	1997
5	United Nations Framework Convention on Climate Change, 1992	1994
6	Convention on Biological Diversity, 1992	1994
7	Montreal Protocol on Substances that Deplete the Ozone Layer, 1989	1993
8	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, 1990	1993

Source: ESIA Study Team

3.2 MYANMAR INSTITUTIONAL FRAMEWORK

Myandawei Industrial Estate (MIE) is an organization that govern initial industry in the DSEZ as shown in Figure 1.3-1. It consists of five divisions that are managed under the MIE president. Generally, the president is supervising the investment and one of his prominent roles and duties is implementation the legislations, by supervising, inspecting and managing the other matters in land use, environmental conservation, health, education, finance and taxation, development, transport, communication, security, electricity, energy and water supply including coordinating with the relevant government departments and organizations.

It should be noted that the planning and development of the Project is dynamic. During the time of this EIA report preparation, the governments of Thailand and Myanmar are evaluating an establishment of Special Purpose Vehicles (SPV) as a major driver for the project development. Should the SPV is established, significant changes to the organization and responsibilities of the parties involved in the Project may be changed.

3.2.1 Arrangement at the National and Sector Level

At the national level, the Environmental Conservation Committee (ENCC) serves as mechanism for inter-ministerial coordination. Authorities and functions of ENGG are prescribed in Articles 7 to 13 of the Environmental Conservation Rules. One of ENCC's main functions related to this Project is to oversee the management of the EIA process by MONREC through ECD. ECD will serve as coordinator among various concerned sector departments to ensure that the EIA and implementation of EMP will address environmental and social issues of concerns of relevant sector departments.

The EIA process for this Project will be administered by the central ECD in coordination with the regional ECD and various government to organizations at the regional, township, and district levels.

3.2.2 Arrangements at the Project Area

In Dawei Special Economic Zone Management Committee (DSEZMC), the Project will be implemented as a Public-Private Participation (PPP) project under a concessional arrangement between the Project proponent and the DSEZ Management Committee. The organizational structure for the development of DSEZ is prescribed by the DSEZ Law (2011). The development of the DSEZ is carried out under the framework set by the DSEZ Law. Under this law, two bodies were established the DSEZ Management Committee and the DSEZ Working body to take charge of DSEZ management and general administration affairs.

The DSEZMC is essentially responsible for facilitating resolving issues between the Government, the Central Body and developers/investors. The Committee's wide-ranging and important responsibilities include, but are not limited to: supervising and inspecting matters regarding implementation of investment and establishment plans, land-use, environmental conservation, waste control, health, education, finance and taxation, development, communication, security, infrastructure and coordinating with the relevant governmental departments. Other relevant agencies are 14 representatives of government agencies and organizations from respective ministries involved in development activities of the Supporting Working Body (SWB) in the project area. Their key responsibilities are summarized in Table 3.2-1.

Table 3.2-1 Roles and responsibilities of relevant departments functioning in DSEZ

No.	Department	Roles and Responsibilities
1.	Department of General Administration	Management and monitoring to cooperate and negotiate with local peoples
2.	Department of Human Settlement and Housing	The Department of Human Settlement & Housing Development is upgrading the living standard of the people by promoting the urban and regional development, by establishing industrial zones at the new satellite towns.
3.	Department of Immigration and National Registration	Responsible for checking and permission for immigrant staffs, workers and visitors to the project area
4.	Myanmar Police Force	Establish civil jurisdictions in the project area
5.	Department of Labor	Workers' legal rights and privileges and encourage fair labour practices with a view to establishing cordial relations between employers and workers according to the existing Laws in Myanmar Registering foreign workers in Myanmar according to directive of the Myanmar Foreign Investment Commission
6.	Directorate of Trade	Responsible for the formulation of trade policies and plans with the aim to regulate the smooth flow of internal and external trade
7.	Department of Development Affairs	Responsible for the urban development
8.	Department of Road Transportation	Passenger transportation service for inter-city transportation and intra-city transportation, to carry out the transportation services of local goods and export items. The Directorate of Road Transport carries out registration of motor vehicles and driving licenses

Table 3.2-1 Roles and responsibilities of relevant departments functioning in DSEZ

No.	Department	Roles and Responsibilities
9.	Department of Investment and Company Administration	Responsible for register the incorporation and administration of companies, in accordance with the provisions of the Myanmar Companies Act, 1914
10.	Department of Custom	Responsible for levy duty on imported goods in accordance with the existing laws, rules and regulations, to oversee the imports and exports whether they are complied with the existing laws and regulations or not and to investigate and prevent illegal imports and exports
11.	Department of Law, Court and Justice	For giving legal advice on matters relating to international conventions and regional agreements, and also on matters of bilateral or multilateral treaties, memorandums of understanding, memorandums of agreement, local and foreign investments and other instruments that are to be ratified by the Union of Myanmar
12.	Department of Municipality	Dealing with locally affairs, to the close contact with the daily life of the citizens
13.	Representative from Tanintharyi Division	To communicate with Local Government

Source: SETEC (2012)

3.3 INTERNATIONAL POLICIES, GUIDELINES AND STANDARDS

The relevant international policies, guidelines and standards for environmental and social impacts of project referred by most countries are those issued by the World Health Organization (WHO), the U.S. Environmental Protection Agency (EPA), the World Bank, and the International Finance Corporation (IFC). The policies, guidelines and standards of the World Bank and IFC are cross referenced and complementary as the IFC, is an organization of the World Bank Group. There are also adopted by most development organizations such as the Asian Development Bank. It should be noted that the guidelines and standards recommended by the World Bank and IFC, especially those related to environmental pollution, also gave due consideration to the guidelines and standards of the EPA and WHO.

Only those international policies, guidelines and standards relevant to this Project are discussed here in 3.4.1 IFC's Standard and Guidelines IFC's standards. The guidelines relevant to this Project are described in two documents: The Performance Standards on Environmental and Social Sustainability 1st January, 2012 and Environmental, Health, and Safety-General Guidelines 30th April, 2007, respectively. The former document describes eight performance standards on environmental and social sustainability which IFC requires its clients to apply throughout the project life cycle. The later document provides general guidelines for environmental, health and safety (EHS) for development projects. Essential requirements in the three IFC documents pertaining to this Project are summarized below:

3.3.1 Performance Standards on Environmental and Social Sustainability, 1st January, 2012

IFC prescribes eight Performance Standards to which the Project proponent will need to comply throughout the investment life. The eight performance standards (PS) are:

- **PS1-Assessment and Management of Environmental and Social Risks and Impacts** requires the Project proponent, in coordination with other responsible government agencies and third parties as appropriate; to conduct a process of environmental and social management system (ESMS) " appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts ". The ESMS will incorporate the following elements: (i) policy; (ii) identification of risks and impacts; (iii) management programs; (iv) organizational capacity and competency; (v) emergency preparedness and response; (vi) stakeholder engagement; and (vii) monitoring and review. These requirements are explained in details in the PS document and associated guidelines.
- ***PS2-Labor and Working Conditions*** requires the Project proponent to : (i) formulate and implement human resources policies and procedures appropriate to its size and workforce that set out its approach to manage workers consistent with the requirements of this Performance Standard and National Law; (ii) provide reasonable working conditions and terms of employment; (iii) treat migrant workers on substantially equivalent terms and conditions to non-migrant workers carrying out similar work; (iv) establish grievance mechanism; (v) refrain from using child labor and forced labor; and (v) provide a safe and healthy work environment, taking into account inherent risks in its particular sector and specific classes of hazards in the clients work areas, including physical, chemical;, biological, and radiological hazards, and specific threats to women. These requirements will also be applied to workers of the contactors through effective contractual agreements between the client and the contactors.
- **PS3-Resource Efficiency and Pollution Prevention** requires the Project proponent to: (i) efficiently uses energy and water; and (ii) uses Best Available Techniques (BAT) in pollution control.
- **PS4-Community Health, Safety, and Security** requires the Project proponent to: (i) evaluate the risks and impacts to the health and safety of the affected communities during the project lifecycle; and (ii) establishes preventive and control measures in consistent with good international industry practice (GIIP), such as in the World Bank Group Environmental, Environmental, health and Safety Guidelines (EHS Guidelines) or other internationally recognized sources. The requirements are elaborated in the PS document. Some of the requirements, such as hazardous materials management, are similar to those in PS3. In essence, safety aspects to construction and operations of all Project facilities, including support facilities or infrastructure. Health risks will also be included.
- **PS5-Land Acquisition and Involuntary Resettlement** requires the Project proponent to avoid land expropriation, physical displacement, and adverse impacts on livelihoods and ways of life of people in the project are. The process of land acquisition has to ensure community engagement, fair compensation for loss of land, properties, and livelihood; grievance mechanism, and appropriate resettlement and livelihood restoration planning and implementation.

- **PS6-Biodiversity Conservation and Sustainable Management of Living Natural Resource** requires the EIA to consider direct and indirect project related impacts on biodiversity and ecosystem services and identify any significant residual impacts. As matter of priority, the Project proponent should seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimize impacts and restore biodiversity and ecosystem services should be implemented. Given the complexity in predicting project impact on biodiversity and ecosystem services over the long term the Project proponent should adopt practice of adaptive management in which the implementation of mitigations measures are responsive to changing conditions and the results of monitoring throughout the projects life cycle.
- **PS7-Indigenous Peoples** requires the EIA to identify all communities of indigenous people within the project area of influence who may be affected by the project, as well as the nature and degree of the expected direct and indirect economic, social, cultural (including cultural heritage), and environmental impact on them. Adverse impacts on affected communities of Indigenous Peoples should be avoided where possible. Where alternatives have been explored and adverse impacts are unavoidable, the Project proponent will minimize, restore, and/or compensate for these impacts in a culturally appropriate manner commensurate with the nature and scale of such impacts and the vulnerability of the affected communities of indigenous people.
- **PS8-Cultural Heritage** requires the Project proponent to: (i) protect cultural heritage from the adverse impacts of project activities and support its preservation; and (ii) promote the equitable sharing of benefits from the use of cultural heritage. The EIA will need to identify sites of heritage and assess their value or importance at the community, provincial and national levels. It should be noted that all the eight PS are in line with the Government's policy and regulations.

3.3.2 Environmental, Health, and Safety-General Guidelines, 30th April, 2006. This publication provides general EHS guidelines covering the following subjects:

- **Environment** covering: (i) air emissions and ambient air quality; (ii) energy conversation; (iii) wastewater and ambient water quality; (iv) water conservation; (v) hazardous materials management; (vi) waste management; (vii) noise; and (viii) contaminated land.
- **Occupational Health and Safety** covering: (i) general facility design and operation; (ii) communication and training; (iii) physical hazard; (iv) chemical hazards; (v) biological hazards; (vi) radiological hazards; (vii) personal protective equipment; (viii) special hazard environments; and (ix) monitoring.
- **Community Health and Safety** covering; (i) water quality and availability; (ii) structural safety of project infrastructure; (iii) life and fire safety (L&FS); (iv) traffic safety; (v) transport of hazardous materials; (vi) disease prevention; and (vii)

emergency preparedness and response. Construction and Decommissioning covering; (i) environment; (ii) occupational health and safety; and (iii) community health and safety.

- **Construction and Decommissioning** coving: (i) environment; (ii) occupational health and safety; and (iii) community health and safety.

3.3.3 World Bank's Pollution Prevention and Abatement Handbook 1998 Toward Cleaner Product

The World Bank's Pollution Prevention and Abatement Handbook (PPAH) is a comprehensive document providing guidelines for industrial pollution control and recommends emission and ambient standard to be applied in environmental management. The recommended standards have taken into account the standards enforced by the EPA and recommended by WHO. They are referred to in the IFC's EHS Guidelines.

3.4 GUIDELINES AND STANDARDS APPLICABLE TO THIS PROJECT

The country has recently established the environmental quality standards. The latest version announced on December 2015, "*The National Environmental Quality (Emission) Guidelines 2015*" is mainly used in this report and in assessing environmental impacts of the project. In case, where the national quality standard of some subjects such as groundwater and sediments are absent, the international standard is applied.

3.4.1 National Environmental Quality (Emission) Guidelines

The National Environmental Quality (Emission) Guidelines 2015 is divided into sections, which is specific to purpose of factories and facilities. The project has different types of facilities. The levels of emissions regarding to these facilities will concordance the guidelines. However, the guidelines for "*general purpose*" is applied in overall area of the project, "besides the facility areas" such as on drainage canals or water ways or in non-contaminated run-off areas, the guidelines for general purpose is presented in Table 3.4-1. These levels of parameters are subjected to both construction and operation phases.

Table 3.4-1 Emissions Guidelines Values for general purpose during construction and operation phases.

Parameters		Guideline Values		References
Air Emissions				[a/] Air quality guidelines global update. 2005. World Health Organization. [b/] Air quality guidelines for Europe. 1997 WHO regional publications, European series No. 23. World Health Organization.
Particulate matter, PM_{10}[a]	1-year 24-hour	20 50	$\mu g/m^3$ $\mu g/m^3$	
Particulate matter, $PM_{2.5}$[b]	1-year 24-hour	10 25	$\mu g/m^3$ $\mu g/m^3$	
SO_x	24-hour 10-minute	20 500	$\mu g/m^3$ $\mu g/m^3$	
NO_x	1-year 1-hour	40 200	$\mu g/m^3$ $\mu g/m^3$	
Ozone	8-hour daily maximum	100	$\mu g/m^3$	
Site Runoff and Wastewater Discharges (Construction Phase)				[a/] Pollution prevention and abatement handbook. 1998. Toward cleaner production. World Bank Group in collaboration with United Nations Environment Programme and the United Nations Industrial Development Organization. [b/] Environmental, health, and safety guideline for health care facilities.2007. International Finance Corporation, World Bank Group.
Biological Oxygen Demand		30	mg/L	
Chemical Oxygen Demand		125	mg/L	
Wastewater, Strom Water Runoff, Effluent and Sanitary Discharge (Operation Phase)				
5-day Biochemical Oxygen Demand		50	mg/L	
Chemical Oxygen Demand		250	mg/L	
Ammonia		10	mg/L	
Arsenic		0.1	mg/L	
Cadmium		0.1	mg/L	
Chlorine (Total residual)		0.2	mg/L	
Chromium (Hexavalent)		0.1	mg/L	
Chromium (Total)		0.5	mg/L	
Copper		0.5	mg/L	
Cyanide (Free)		0.1	mg/L	
Cyanide (Total)		1	mg/L	
Fluoride		20	mg/L	

Table 3.4-1 Emissions Guidelines Values for general purpose during construction and operation phases. (Cont.)

Parameters	Guideline Values	References
Heavy metals (Total)	10 mg/L	
Iron	3.5 mg/L	
Lead	0.1 mg/L	
Mercury	0.01 mg/L	
Nickel	0.5 mg/L	
Oil and grease	10 mg/L	
pH	6-9	
Phenols	0.5 mg/L	
Selenium	0.1 mg/L	
Silver	0.5 mg/L	
Sulfide	1 mg/L	
Temperature increase	<3[b/] °C	
Total Coliform Bacteria	400 MPN/ 100mL	
Total phosphorus	2 mg/L	
Total Suspended Solids	50 mg/L	
Zinc	2 mg/L	
Noise Levels – Leq (1hr)		[a/] Environmental, Health, and Safety Guidelines: General EHS GUIDELINES: ENVIRONMENTAL NOISE MANAGEMENT of International Finance [b/] Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, U.S. EPA (U.S. Environmental Protection Agency). 1974 [c/] Notification of Guidelines for Community Noise, World Health Organization (WHO), 1999
Residential Area	55 [a/] dB(A) Daytime 45 [a/] dB(A) Nighttime	
Commercial Areas	70 [b/c/] dB(A)	
Odor Level	2-10 Odor unit	Industrial odor control. 2002. Environmental guideline No.9, Danish Environmental Protection Agency, Ministry of Environment.

Source: ESIA Study Team

3.4.1.1 Factories

The DESZ is divided into zones and the Project is classified into "*medium-industries*" (SEATEC in association with UAE, 2012) At this stage, area of the factories are initially divided into zones, A, B, C and D and will be developed phase by phase. To begin with, Phase A in Zone A and will finish in Phase D in Zone D.

Each zone targets different types of the Factories as shown in Table 4.1-6. Auto parts, Electronics, Home appliances, Garments and Textiles, Food and Beverages, Cannery and Frozen seafood, Agriculture and Rubber products, Pharmaceutical products and Construction materials are potential industries that will develop in phase A and B (in Zone A and B. Glass products, Plastics, Auto mobile, Assembly industries and Factories for rent are targets industries and will be developed in the later phases, C and D, in Zone C and D.

The National Environmental Quality Guidelines for effluent levels in construction and operation phases in the factories area is summarized in Table 3.4-2 and The National Environmental Quality (Emission) Guidelines (NEQG) for air emission during construction and operation phases in the factories area is summarized in Table 3.4-3.

Each plant or factory that will establish in the Initial Industrial Estate will obligate to comply air emission and effluent level that is specific to the NEQG, accordingly its own activities, as listed in the National Environmental Quality (Emission) Guidelines 2015 (*Annex 3-3*).

3.4.2 International Ambient Environmental Quality Standards

Table 3.4-4 presents the International Ambient Environmental Quality Standards which is guided by the International organizations, WHO, USEPA and IFC etc.

Table 3.4-2 Effluent Guideline Values for target manufacturing in the Dawei Industrial Estate Project

No.	Parameters	Units	Food, Beverages, Cannery, Frozen Seafood & Agricultural Products	Garment, Textiles and Leathers	Pharmaceuticals & Biotechnology	Auto-parts, Electronics, Home Appliances & Construction Materials and Automobile Assembly	Glass & Ceramics
1.	1,2-Dichloroethane	mg/L	x	x	0.1	x	x
2.	5-day Biochemical Oxygen Demand	mg/L	50	30-50	30	50	x
3.	Acetates	mg/L	x	x	0.5	x	x
4.	Acetonitrile	mg/L	x	x	10.2	x	x
5.	Active ingredient (each)	mg/L	To be determined on a case specific basis	x	0.05	x	x
6.	Antibiotics	mg/L		x	x	x	x
7.	Adsorbable Organic Halogens	mg/L	x	1	1	0.5	x
8.	Aluminium	mg/L	x	x	x	3	x
9.	Amines (each)	mg/L	x	x	102	x	x
10.	Ammonia	mg/L	x	10	30	10, 20[1/]	x
11.	Antimony	mg/L	x	x	x	x	0.3
12.	Arsenic	mg/L	x	x	0.1	0.1	0.1
13.	Benzene	mg/L	x	x	0.02	x	x
14.	Biocides	mg/L	0.05	x	x	x	2
15.	Cadmium	mg/L	x	0.02	0.1	0.1	x
16.	Chemical Oxygen Demand	mg/L	250	160-250	150	160-250	130
17.	Chlorobenzene	mg/L	x	x	0.06	x	x
18.	Chloroform	mg/L	x	x	0.013	x	x
19.	Chloride	mg/L	x	1,000	x	x	x
20.	Chlorine (total residual)	mg/L	0.2	x	x	x	x
21.	Chromium (Hexavalent)	mg/L	x	0.1	0.1	0.1	x
22.	Chromium (total)	mg/L	x	0.5	x	0.5	x

Table 3.4-2 Effluent Guideline Values for target manufacturing in the Dawei Industrial Estate Project (Cont.)

No.	Parameters	Units	Food, Beverages, Cannery, Frozen Seafood & Agricultural Products	Garment, Textiles and Leathers	Pharmaceuticals & Biotechnology	Auto-parts, Electronics, Home Appliances & Construction Materials and Automobile Assembly	Glass & Ceramics
23.	Cobalt	mg/L	x	0.5	x	x	x
24.	Color		x	7 (436 nm, yellow)	x	x	x
			x	5 (525 nm, red)	x	x	x
			x	3 (620 nm, blue)	x	x	x
25.	Copper	mg/L	x	0.5	x	0.5	x
26.	Cyanides (free)	mg/L	x	x	x	0.1-0.2	x
27.	Cyanides (total)	mg/L	x	x	x	1	x
28.	Dimethyl sulfoxide	mg/L	x	x	37.5	x	x
29.	Fluorides	mg/L	x	x	x	5-20	5
30.	Iron	mg/L	x	x	x	3	x
31.	Isobutyraldehyde	mg/L	x	x	0.5	x	x
32.	Isopropanol	mg/L	x	x	1.6	x	x
33.	Isopropyl ether	mg/L	x	x	2.6	x	x
34.	Ketones (each)	mg/L	x	x	0.2	x	x
35.	Lead	mg/L	x	x	x	0.2	0.1
36.	Mercury	mg/L	x	x	0.01	0.01	x
37.	Methanol / Ethanol (each)	mg/L	x	x	4.1	x	x
38.	Methyl cellosolve	mg/L	x	x	40.6	x	x
39.	Methylene chloride	mg/L	x	x	0.3	x	x
40.	n-Heptane	mg/L	x	x	0.02	x	x
41.	n-Hexane	mg/L	x	x	0.02	x	x
42.	Nickel	mg/L	x	0.5	x	0.5	x
43.	o-Dichlorobenzene	mg/L	x	x	0.06	x	x

Table 3.4-2 Effluent Guideline Values for target manufacturing in the Dawei Industrial Estate Project (Cont.)

No.	Parameters	Units	Food, Beverages, Cannery, Frozen Seafood & Agricultural Products	Garment, Textiles and Leathers	Pharmaceuticals & Biotechnology	Auto-parts, Electronics, Home Appliances & Construction Materials and Automobile Assembly	Glass & Ceramics
44.	Oil and grease	mg/L	10	10	10	10	10
45.	Pesticides	mg/L	x	0.05-0.10	x	x	x
46.	pH	S.U.	6-9	6-9	6-9	6-9	6-9
47.	Selenium	mg/L	x	x	x	x	x
48.	Phenols	mg/L	x	0.5	0.5	0.5	x
49.	Silver	mg/L	x	x	x	0.1-0.2	x
50	Sulfate	mg/L	x	300	x	x	x
51	Sulfide	mg/L	x	1	x	1	x
52	Temperature increase	°C	<3	<3	x	<3	x
53	Tetrahydrofuran	mg/L	x	x	2.6	x	x
54	Toluene	mg/L	x	x	0.02	x	x
55.	Tin	mg/L	x	x	x	2	x
56.	Total coliform bacteria	100 ml	400	400	x	x	x
57.	Total nitrogen	mg/L	10	10	10	15	x
58.	Total phosporus	mg/L	2	2	2	5	x
59.	Total Suspended Solids	mg/L	50	50	10	50, 25[1/]	x
60.	Volatile Organic Halogens	mg/L	x	x	x	0.1	x
61.	Xylenes	mg/L	x	x	0.01	x	x
62.	Zinc	mg/L	x	2	x	2	x

Remarks:
X is Parameter that is not required by the guidelines
[1/] For electroplating
Source: ESIA Study Team

Table 3.4-3 Air Emission Guideline Values for target manufacturing in the Dawei Industrial Estate Project

No.	Parameters	Units	Food, Beverages, Cannery Frozen Seafood & Agriculture Products	Garment, Textiles and Leathers	Pharmaceuticals & Biotechnology	Auto-parts, Electronics, Home Appliances & Construction Materials	Glass & Ceramics
1	Acetone	mg/Nm^3 [a/]	x	x	x	150	x
2	Active ingredient (each)	mg/Nm^3 [a/]	x	x	0.15	x	x
3	Ammonia	mg/m^3	1	x	x	x	x
		mg/Sm^3 [e/]	x	x	30	x	x
		mg/Nm^3 [a/]	x	30	x	30-50	x
4	Amines and amides	mg/m^3	5	x	x	x	x
5	Arsenic	mg/Sm^3	x	x	0.05	x	1[a]
6	Arsine and arsenic compounds	mg/Nm^3	x	x	x	0.5	x
7	Benzene	mg/Nm^3	x	x	1	x	x
8	Bromides (as Hydrogen bromide)	mg/Sm^3	x	x	3	x	x
9	Cadmium	mg/Nm3[a/]	x	x	x	0.05	0.2
10	Carbon disulfide	mg/Nm^3	x	150	x	x	x
11	Chlorine	mg/Nm^3	x	5	x	x	x
12	Chlorine (as Hydrogen chloride)	mg/Sm^3	x	x	30	x	x
13	Dichloroethane	mg/Nm^3	x	x	1	x	x
14	Dioxins	mg TEQ^m/Nm^3	x	x	x	0.1	x
15	Dust	mg/Nm^3 [a/]	10	x	x	50[7/]	x
	-Dry						x
	-Wet		40	x	x	x	x
16	Ethylene oxide	mg/Sm^3	x	x	0.5	x	x
17	Fluorides	mg/Nm^3	x	x	x	x	5

Table 3.4-3 Air Emission Guideline Values for target manufacturing in the Dawei Industrial Estate Project

No.	Parameters	Units	Food, Beverages, Cannery Frozen Seafood & Agriculture Products	Garment, Textiles and Leathers	Pharmaceuticals & Biotechnology	Auto-parts, Electronics, Home Appliances & Construction Materials	Glass & Ceramics
18	Formaldehyde	mg/Nm^3	x	20	x	x	x
19	Furans	mg TEQ^m/Nm^3	x	x	x	0.1	x
20	Hazardous air pollutants	kg/year	x	x	900-1,800 [f/]	x	x
21	Hexane	mg/Nm^3	100	x	x	x	x
22	Hydrogen chloride	mg/Nm^3	x	x	x	10	30
23	Hydrogen fluoride	mg/Nm^3	x	x	x	1-5	x
24	Hydrogen sulfide	mg/Nm^3	2	5	x	x	x
25	Inorganic hazardous air pollutants[r/]	mg/Nm^3	x	x	x	0.42	x
26	Lead	mg/Nm^3	x	x	x	x	5
27	Mercaptans	mg/m^3	2	x	x	x	x
28	Mercurry	mg/Nm^3	x	x	x	0.05	x
29	Mutagenic substance	mg/Sm^3	x	x	0.05	x	x
30	Nickel	mg/Nm^3	x	x	x	x	0.1
31	Nitrogen oxides	mg/Nm^3	x	x	x	350-600	1,000
32	Non-water resistant leather	kg of hazardous air pollutant loss per 100 m^2 of leather processed	x	1.8	x	x	x
33	Odor	Odorant units	5-10	x	x	x	x

Table 3.4-3 Air Emission Guideline Values for target manufacturing in the Dawei Industrial Estate Project

No.	Parameters	Units	Food, Beverages, Cannery Frozen Seafood & Agriculture Products	Garment, Textiles and Leathers	Pharmaceuticals & Biotechnology	Auto-parts, Electronics, Home Appliances & Construction Materials	Glass & Ceramics
34	Organic hazardous air pollutant[r/]	mg/Nm^3	x	x	x	20	x
35	Other heavy metals (Total)	mg/Nm^3	x	x	x	x	5[s]
36	Paticulates[c/]	mg/Nm^3	x	50[d/]	x	x	100[t/16/],50[t/17/]
37	Phosphine	mg/Nm^3	x	x	x	0.5	x
38	PM_{10} (24-hour)	mg/Nm^3	<50	x	20	5[10/], 3[11/], 30[8], 100[9/]	x
39	- Total Class A[g/]	mg/Nm^3	x	x	20[i/]	x	x
40	- Total Class B[h/]	mg/Nm3	x	x	80[j/]	x	x
41	- Total organic carbon	mg/Nm3	x	x	50	x	x
42	PM_{10} (1-year)	mg/Nm3	20	x	x	x	x
43	Sulfides	mg/m^3	2	x	x	x	x
44	Sulfur dioxide	mg/Nm^3	x	x	x	400	700-1,500[w/]
45	Thallium	mg/Nm^3[a/]	x	x	x	0.05	x
46	Total metals [n/]	mg/Nm^3	x	x	x	0.5	x
47	Total organic carbon	mg/Nm^3	x	x	x	10-80[12/]	x
48	Upholstery leather	kg of hazardous air pollutant loss per 100 m^2 of leather processed	x	3.3	x	x	x
49	Vinyl chloride	mg/Nm^3	x	x	1	x	x
50	Volatile halogenated hydrocarbons	mg/Nm^3	x	x	x	20[10/]	x
51		mg/Nm^3	100	2[1/]	x	x	x

Table 3.4-3 Air Emission Guideline Values for target manufacturing in the Dawei Industrial Estate Project

No.	Parameters	Units	Food, Beverages, Cannery Frozen Seafood & Agriculture Products	Garment, Textiles and Leathers	Pharmaceuticals & Biotechnology	Auto-parts, Electronics, Home Appliances & Construction Materials	Glass & Ceramics
	Volatile Organic Compounds [c/ d/]		x	20[2/]	x	x	x
			x	50[3/]	x	x	x
			x	75[4/]	x	x	x
			x	100[5/]	x	x	x
			x	150[6/]	x	x	x
			x	x	x	x	x
			x	x	20-150[k/]	x	x
			x	x	50[l/]	x	x
52	Volatile Organic Compounds[13/]	mg/Nm3	x	x	x	50[o],75[p],100[p]	x
53	Volatile Organic Compounds[14/]	mg/Nm3	x	x	x	20[p]	x
54	Volatile Organic Compounds[15/]	mg/Nm3	x	x	x	20-75[q]	x
55	Volatile Organic Compounds [b]	Kg solvent loss/ feedstock	x	x	x	x	x
56	-Animal fat		1.5	x	x	x	x
57	-Castor		3	x	x	x	x
58	-Rape seed		1	x	x	x	x
59	-Sunflower seed		1	x	x	x	x
60	-Soya beans (normal crush)		0.8	x	x	x	x
61	-Soya beans (white flakes)		1.2	x	x	x	x

Table 3.4-3 Air Emission Guideline Values for target manufacturing in the Dawei Industrial Estate Project

No.	Parameters	Units	Food, Beverages, Cannery Frozen Seafood & Agriculture Products	Garment, Textiles and Leathers	Pharmaceuticals & Biotechnology	Auto-parts, Electronics, Home Appliances & Construction Materials	Glass & Ceramics
62	-Other seeds and vegetable matter (Fractionation excluding degumming)		1.5	x	x	x	x
63	-Other seeds and vegetable matter (Degumming)		4	x	x	x	x
64	Water resistant / specialty leather	kg of hazardous air pollutant loss per 100 m^2 of leather processed	x	2.7	x	x	x

Remarks:

X is Parameter that is not required by the guidelines

a/ Milligrams per normal cubic meter at specified temperature and pressure

b/ Refer to total solvent loss

c/ Calculated as Total carbon

d/ As the 30-minute mean for stack emissions

e/ Milligrams per standard cubic meter at specified temperature and pressure

f/ Process-based annual mass limit

g/ Class A compounds are those that may cause significant harm to human health and the environment

h/ Class B compounds are organic compounds of less environmental impact than Class A compounds

i/ Applicable when total Class A compounds exceed 100g/year

j/ Applicable when total Class B compounds, expressed as Toluene, exceed the lower of 5 tons/year or 2 kg/hour

k/ Facilities with solvent consumption >50 tons/year

l/ Waste gases from oxidation plants

m/ Toxicity equivalence factor

Remarks:

[n/]Total metals are Arsenic, Lead, Cobalt, Chromium, Copper, Manganese, Nickel, Vanadium, and Antimony

[o/] drying processes

[p/] up to 15 tons/year solvent consumption

[q/] 20 mg/Nm^3 for waste gases from surface cleaning using volatile organic compounds classified as carcinogenic, mutagenic or toxic to reproduction; 75 mg/Nm^3 for waste gases from other surface cleaning

[r/] Industry-specific hazardous air pollutants include: Antimony compounds, Arsine,

Carbon tetrachloride, Catechol, Chlorine, Chromium compounds, Ethyl acrilate, Ethyl benzene, Ethylene glycol, Hydrochloric acid, Hydrofluoric acid, Lead compounds, Methanol, Methyl isobutyl ketone, Methylene chloride, Nickel compounds, Perchlorothylene, Phosphine, Phosphorus, Toluene, 1,1,1-trichkoroethane, Trichloroethylene (phase-out), and Xylenes

[s/]1mg/Nm^3 for Selenium

[t/]Where toxic metals are present, not to exceed 20 mg/Nm^3; to achieve dust emissions of 50 mg/Nm^3 installation of secondary treatments (bag fillers or electrostatic precipitators) is necessary

[w/]700 mg/Nm^3 for natural gas firing, 1,500 mg/Nm^3 for oil firing

[1/]2mg/Nm^3 for volatile organic compounds classified as carcinogenic or mutagenic with mass flow greater than or equal to 10 g/hour

[2/]20mg/Nm^3 for discharges of halogenated volatile organic compounds with a mass flow equal or greater than 100 g/hour

[3/]50mg/Nm^3 for waste gases from drying of large installations (solvent consumption >15 tons/year)

[4/]75mg/Nm^3 for coating application processes for large installations (solvent consumption > 15 tons/year)

[5/]100mg/Nm^3 for small installations (solvent consumption <15 tons/year)

[6/]If solvent is recovered from emissions and reused, the guideline value is 150 mg/Nm^3

[7/]Other point sources including clinker cooling, cement grinding

[8/]Existing kilns

[9/]New kiln system

[10/]Metal surface treatment

[11/]Plastic processing

[12/]Rubber vulcanization

[13/]Metal and plastic coating

[14/]Rubber conversion

[15/]Surface cleaning

[16/]Natural gas

[17/]Other fuels

Source: ESIA Study Team

Table 3.4-4 International Ambient Environmental Quality Standards

Subjects	Parameters	Guideline Value	References
Ambient Air Quality 24-hour average	 TSP NO_2 PM_{10} SO_2 NO_2	 230 µg/m^3 150 µg/m^3 150 µg/m^3 150 µg/m^3 125 µg/m^3 200 µg/m^3	 Environmental, Health, and Safety Guidelines: Environment Air Emissions and Ambient Air Quality of International Finance Corporation, 2007.
Ambient Noise Levels Industrial and commercial area	 Leg (24 hrs) Leq (1hr) Leg (1hr) (Daytime) (Nighttime)	 70 [a/b/] dB(A) 70 [c/] dB(A) 55 [c/] dB(A 45 [c/] dB(A)	[a/] Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, U.S. EPA (U.S. Environmental Protection Agency), 1974. [b/] Notification of Guidelines for Community Noise, World Health Organization (WHO), 1999. [c/] Environmental, Health, and Safety Guidelines: General EHS GUIDELINES: ENVIRONMENTAL NOISE MANAGEMENT of International Finance
Vibration For industrial buildings and residential building	 Peak Particle Velocity	 5 mm/s	 DIN4150
Sediment Quality	 Total Chromium Total Arsenic Total Lead Total Cadmium Total Zinc Total Copper Total Mercury	Maximum limit 81 mg/kg 8.2 mg/kg 46.7 mg/kg 1.2 mg/kg 150 mg/kg 34 mg/kg 0.15 mg/kg	International association for Impact Assessment (IAIA) NOAA Screen Quick Reference Table, 2004
Groundwater Quality	pH at 25 °C Nitrate Nitrite Cadmium Lead Arsenic Cyanide Chloride	6.5-8.5 50 mg/L 3 mg/L 0.003 mg/L 0.01 mg/L 0.01 mg/L 0.17 mg/L 250 mg/L	WHO's Guidelines for Drinking Water Quality, 2011
Thermal Heat Flux	Safe level of exposure at the property line of LNG storage facility	5 k W/m^2 (1,600 Btu/hr ft^2)	NFPA 59A (Standards for the production facility)

Source: ESIA Study Team

3.5 PROJECT KEY COMMITMENTS

3.5.1 Statement of The Environmental Social And Health Policies

Myandawei Co. Ltd. is committed to develop the DSEZ Initial Industrial Estate Project in sustainable principles and manage the project in accordance with the international standard, ISO 14001 Environmental Management System (EMS). The ISO 14001 EMS will be integrated in all parts of the project and all environmental aspects to accomplish environmental and social compliance.

An environmental and social policies will be formulated in first step as guidance for management of the project, either during the construction, operation and closing phases. The policies are following:

- Develop a comprehensive Environmental, Health, and Safety (EHS) Management Plan including Environmental Management Plan (EMP);
- Implement of EMP as a part of the project and manage the operation with due diligence. Environmental auditing will have to be conducted in an appropriate interval;
- In construction phase, the nominated EPC contractors/sub-contractors are required to perform the Environmental Management Plan (EMP) in their contracts that specify EHS measures;
- In operation phase, the EHS management will be integrated as a part of the operational management;
- Establish adequate environmental and social safeguards and capabilities;
- Encourage public participation in the EHS management and related to the surrounding communities; and
- Maintain information in the EHS management and performance of the EHS reports required by the corporate management, government and the concerned authorities.

The EHS Management will be activated starting from the commencement date of the construction.

3.5.2 List Of Commitments

A consolidated summary list of environmental and social impacts and mitigation measures commitments that the Myandawei Industrial Estate Co. Ltd. is implementing in order to manage and mitigate potential impacts associated with development of the DSEZ Initial Industrial Estate project is summarized in Table 3.5-1.

Table 3.5-1 Summary of the Myandawei Industrial Estate's Key Commitments For DSEZ Initial Industrial Estate

No.	Item	Commitment
CHAPTER 2 CONTEXT OF THE PROJECT		
1.	ESIA Study	The Project commit to conduct ESIA study, as mandated by the Environmental Conservation Law (2012), in No.9/2012 Section 42 (b) and the Investment Law Section 72.
		The Project commits that the ESIA study is undergone in concordant with the Guidelines (2014) and Procedure (2015) for Environmental Impact Assessment and annexure (A).
		The Project commits to comply with the Environmental Impact Assessment Procedure (2015) and annexure (A) for all implemented activities during the project development including in EIA, IEE and EMP.
		The Project commits to implement in compliance with what all matters contained in the environmental impact assessment report to be carried out including all method to reduce environmental, social and health impacts, environmental management programmes, sub-programmes related to them, method for monitoring.
CHAPTER 3 OVERVIEW OF LAWS AND REGULATION AND INSITUTIONAL FRAMEWORK		
2.	Environmental and Social Compliance	The Project commits to prevent pollution, through the implementation of processes, practices and techniques that will minimize, avoid or reduce the pollution and comply with the enacted Myanmar Environmental Quality Standards or the International Standards, as prescribed in *The Special Economic Zone Law, Section 35.*
		The Project commits to implement and comply with the relevant laws and regulations in Table 3.1-3.
		The Project commits to comply with the undertakings contained in the Environmental and Social Impact Assessment Report. In addition, the Project commit to carry out without fail monitoring and scrutinizing environmental conservation and social impacts during pre-construction, construction, operation and closing period and reporting to relevant departments. Besides, The Project commits to carryout activities relate to environment and community and conduct public consultation and negotiation for transparency and include in the Monitoring Reports and then submit to DSEZ and MONREC.
3.	Compensation	The Project commit to pay effective compensation for loss incurred, if the Project causes damage to the natural environment and causes socio-economic losses, according to *The Investment Law 2016, Section 66.*

Table 3.5-2 Summary of the Myandawei Industrial Estate's Key Commitments for DSEZ Initial Industrial Estate (Cont.)

No.	Management	Commitments
4.	Emission Guidelines	The Project commits to comply with the standards contained in the following provisions: National Environmental Quality (Emission) Guidance, World Health Organization (WHO), U.S Environmental Protection Agency (EPA), World Bank and International Finance Corporation (IFC).
5.	Overall Project Management	The Project commits to conserve and protect natural environment, development of human resource and preservation of public property, as stated in *The Constitution of the Union of Myanmar No.1/2008 Section 45 and Section 390.*
		The Project commits to get permission for investment, as the Project is capital intensive and strategic to the region according to *The Investment Law 2016, Section 35.*
4.	ISO 14001	The Project commit to develop ISO 14001 for better compliance with environmental protection and conservation for sustainable environment.
5.	Insurance	The Project commit to effect compulsory general liability insurance with the Myanmar Insurance, if the Project may cause damage to the life and property of public or cause pollution to the environment, in accordance with *The Myanmar Insurance Law 1993, Section 16.*
CHAPTER 4 PROJECT DESCRIPTION AND ALTERNATIVES		
6.	Land clearing and Pre-Construction	The Project commits to get permission from the relevant agency before establishing any desirous activities to/in reserve forest or all type of forests that in affiliate of *The Forest Law 1992*, *Section 12 and Section 23.*
		The Project commits to get permission from the relevant agency before establishing any desirous activities to wild life/endanger species or threatening their natural habit and ecosystem as promulgated in *The Protection of Wildlife and Conservation of Natural Area 1994.*
		The Project commits to get permission from the relevant agency before relocating, modifying or excavating or extending any parts of ancient monuments in according with *The Protection and Preservation of Ancient Monuments Law 2015, Section 15.*
		The Project commit to obtain approval of Fire precaution and prevention including Emergency Responses Plan prior construction and operation as enacted in *The Fire Brigade Law 2015 Section 17 and condition of the ESIA Approval.*
7.	Overall Construction	The Project commits to inform the relevant agency that if any antique objects or ancient monuments as defined in *the Protection and Preservation of Ancient Monuments Law 2015 and The Protection and Preservation of Antique Objects 2015* are found within the Project area.

Table 3.5-2 Summary of the Myandawei Industrial Estate's Key Commitments for DSEZ Initial Industrial Estate (Cont.)

No.	Management	Commitments
		The Project commits to report immediately to the relevant agency, if natural mineral resources or antiques or treasure or mine are found above or under the land which the Project is entitled to lease or use, according to *The Special Economic Zone Law Section 80 (e)* and may continue the work on such land if the relevant agency allow. If not, the Project shall move the substituted arranged area.
		The Project commits to not make any significant alteration of topography or elevation of the land prior receiving the approval, according to *The Investment Law 2016, Section 66* and *The Special Economic Zone Law Section 80 (d).*
8.	Polder dike and Retention Ponds construction	The Project commits to not carry out any acts or channel shifting or disturbance as prescribed in *Section 12* and construction of such the structures as defined in *Section 15*, in the river-creek boundary, bank boundary and waterfront boundary without permission of the relevant agency, as prescribed in *The Conservation of Rivers, Creeks and Water Resources Law 2006, Section 8, Section 12 and Section 15.*
9.	Operation of the Industrial Estate	The Project commit to not dispose of engine oil, chemicals, materials or substances which may cause water way/course and environmental damages into the river-creek, as prescribed in *The Conservation of Rivers, Creeks and Water Resources Law 2006, Section 11 (a) and Section 19.*
		The Project commits to not dispose living aquatic creatures or any materials in marine water courses as prescribed *in Section 39 of the Myanmar Marine Fishery Law 1990.*
		The Project commits to not cause pollution or harassment of aquatic organisms in a freshwater courses as prescribed *in Section 40* or alter water quality and volume as prescribed *in Section 41* in *the Freshwater Fishery Law 1991.*
		The Project commits to operate and provide services in accordance with *The Labor Organization Law 2011, Section 41 (a) and (d), Section 43, Section 44 (a) to (d) and Section 51.* Also, The Project commits itself to aware of the formation of labor organization and its activities.
		The Project commit to settle any disputes between the project and labor organization or employee or workers in accordance with *the Settlement of Labor Dispute Law 2012 and The Special Economic Zone Law 2011, Section 76 (a) and (b).*
10.	Establishment of Factories	The Project commits to comply with almost *Sections in The Factories Act 1951.*
11	Smoke/Non-Smoking Areas	The Project commits to arrange the smoking and non-smoking area as prescribed *in Section 6 and Section 7 of The Control of Smoking and Consumption of Tobacco Product Law 2006* including carry measures and accepting the inspection in *Section 9 (c) and (d).*
12	Uses of Vehicles	The Project commits to comply *The Motor Vehicle Law 2015* in obtaining ownership of all purposes and liabilities. The Project shall educate and campaign the vehicles' drivers in such manners as prescribed by the Law.

Table 3.5-2 Summary of the Myandawei Industrial Estate's Key Commitments for DSEZ Initial Industrial Estate (Cont.)

No.	Management	Commitments
13.	Sanitation and waste management	The Project commit to manage domestic waste both and industrial waste in sustainable manners i.e. reduce, reuse and recycling (3Rs) in order to diminish quantity of waste and the spaces for disposal. The Project commit itself to manage the waste in accordance with *The Public Health Law 1972 and The National Health Policy 1993.*
14.	Storage and Transport of Petroleum	The Project commit to store and transport of Petroleum fuels in accordance with *the Petroleum Act 1934 and the Petroleum Rules 1937.*
15.	Emergency Responses Plans	The Project commits to implement the emergency response plans with regard to chemical pollution/incidents and all potential hazards such as flood, tropical storm/cyclone, fire, chemical pollution, incidents as stated Section 4.3
		The Project commits to revise the Final EIA report, depending on changing of conditions in fire hazard, safety from chemical elements, earthquake and natural disaster etc. addressed in the Emergency Response Plans and then submit to DSEZMC and MONREC.
CHAPTER 6 IMPACTS AND RISK ASSESSMENT AND MITIGATION MEASURES		
15.	Prevention and Control of Communicable Diseases	The Project commit to follow the guidance and co-operate with health officers in prevention of the outbreak and effective control of the communicable disease as prescribed *in Section 8 of The Prevention and Control of Communicable Diseases Law 1995.* The Project will report immediately to the nearest health department or hospitals if the defined epidemics *in Section 9* occur.
CHAPTER 8 ENVIROMENTAL MANAGEMENT PLANS		
17.	Green House Gases Emission	The Project commits to promote reduction of the Green House Gases by the Project activities and the establishment in accordance with the current Myanmar Green House Gases Policy.
18.	Environmental Management and Monitoring Plans	The Project commits to develop and implement all the updated EMPs and EMoPs during construction phase, operation phase and decommissioning phase. In addition, the Project commit itsef to revised as necessary at every stage of the EMPs and submitted to the DSEZMC and the MONREC.
19.	Environmental Monitoring Report	The Project commits to report the results of realizing infrastructure such as public health programme, road for the locals, electricity, water supply etc. and safety programme during the project development period covering construction, operation and decommissioning in the Monitoring Report and then submit to DSEZMC and MONREC.
		The Project commits to keep fund for monitoring programmes and sub-programs of environmental management and form the committees to implement them.

Table 3.5-2 Summary of the Myandawei Industrial Estate's Key Commitments for DSEZ Initial Industrial Estate (Cont.)

No.	Management	Commitments
		The Project commits to submit the Monitoring Reports every 6 months to MONREC for publishing for public awareness.
20.	Contractors/Sub-Contractors	The Project commits to fully implement the EMP, all undertakings, terms and condition and ensure that all developer, contract and sub-contractors fully comply with relevant laws, regulations, procedures, EMP and all terms and conditions.
CHAPTER 9 PUBLIC CONSULATION AND DISCLOSURE		
21.	Public Consultation	The Project commits to conduct public consultation and negotiate with the local community continuously for improvement of environmental and social conditions, realization and outcomes in the Monitoring Reports and then submit to the DSEZMC and the MONREC.
		The Project commits to continuously discuss with the stakeholders and incorporate their recommendations in the plan.
22.	Information Dissemination	The Project commits to publish the environmental impact assessment report.
23.	CSR Program	The Project commits to reserve and conduct Cooperate Social Responsibility (CSR) program. The project commits to contribute for education such as scholarships donation for young people who live in villages near by the Initial Industrial Estate and to support the nearby villages in Emergency such as Fire or Natural disasters.
		The Project Proponent commits to conduct the CSR activities regularly every year. The CSR spending normally depends on corporate financial readiness. In addition, the Project Proponent commits to invest in CSR, gradually increasing each year until it reaches budget of 3 million THB per year.
24.	Training Program	The Project commit to establish training program and the center for training for industries and may include the Project Impacted Persons (PIPs) from the relocation and resettlement program in accordance with *the Employment and Skill Development Law 2013 Section 16 to Section 23.*
25.	Occupational Health and Safety	The Project commit to comply the IFC EHS General guideline 2007 for workers and as stated in the Environmental Safety and Health section. The Environmental Conservation and Safety Health Section of Department of Myandawei's DSEZ Initial Industrial Estate must be established and systematically organize in manner as the role and responsibilities are prescribed.
26.	Employment and Skill Training	The Project commits to employ citizen skilled workers, technicians and staff at least 25 percent in the first two years from the commencing year of operation and at least 50 percent in the second two years and at least 75 percent in the third two years, as prescribed in *The Special Economic Zone Law, Section 75.*

Table 3.5-2 Summary of the Myandawei Industrial Estate's Key Commitments for DSEZ Initial Industrial Estate (Cont.)

No.	Management	Commitments
		The Project commits to employ, pay wages, and grant leaves and holidays in fairness and equity manners to the workers and/or employee in accordance with the stipulated laws: *The Minimum Wages Laws 2013, The Payment of Wages Act 2016, The Employment and Skill Development Law 2013*, *The Law Amending the Leave and Holidays Act 2006.*
		The Project commits to comply requirements and establish benefits for the employee and/or workers by the Project in accordance with *The Social Security Law 2012.*
CHAPTER 10		
27.	Land Acquisition	The Project commits in receivable authorization and has right to obtain a long-term lease of land in according with the relevant laws and may lease land up to an initial period of 50 years after approval of the permit, as enacted in *The Investment Law 2016*, *Section 51 (a) and (b).*
28.	Resettlement and Income Restoration	The Project commits to follow the Resettlement Action Plan and resettlement procedure in strict compliance under supervision of DSEZMC. If the Land Lease Agreement have been signed, the PAHs must be provided by the MIE, the Income Restoration Program including community's properties such schools, monasteries and cemeteries must be complete construction for public establishment.
		The Project commits to employ one (1) member of PAHs, subject to his/her capability and competency, will be employed and skill training can be provided to those who are really interesting to work with the Project.
		For the indirect affected persons/households; for example, those who do not have to relocate but whose access and use of the farmland for cultivation or/and who work for livelihood or/and natural resources are affected by the Project, the Project commits to assist them for their employment opportunities and their income will be restored in accordance with Table 10.5 1 of this Section or Table 9.4.1 in Chapter 9 of the Resettlement Action Plan (2017).
		The Project commits to bear the expenses of relocating and paying compensation in accordance with the agreements of the assets those are required to relocate and shall relocate the persons so as not to lower their original standard of living, to fulfill the fundamental needs as promulgated in *The Special Economic Zone Law 2011, Section 80.*
29.	Grievance Redress	The Project commits to establish grievance organization and implement the grievance procedures in order to receive and responses to grievances in relating feedback or concerns of the locals / PAPs as described in this Section and Chapter 13 of the Resettlement Action Plan (2017).

Source: ESIA Study Team

Table 3.5-3 Summary of legal commitments by Myandawei's Key Commitments for DSEZ Initial Industrial Estate.

No.	Laws, Regulations and Policy	Commitment Sections / Articles
1.	**Environmental Conservation Law, 2012**	Environmental Conservation Law, Section 7 (o) Environmental Conservation Law, Section 14 Environmental Conservation Law, Section 15 Environmental Conservation Law, Section 29
2.	**Environmental Impact Assessment Procedure, 2015**	Environmental Impact Assessment Procedure, Articles 102 Environmental Impact Assessment Procedure, Articles 110 Environmental Impact Assessment Procedure, Articles 113 Environmental Impact Assessment Procedure, Articles 115 Environmental Impact Assessment Procedure, Articles 117
3.	**The Investment Law,**	The Investment Law, Section 50 (a) and (d) The Investment Law, Section 51 (b), (c) and (d) The Investment Law, Section 65 (g), (i), (j), (k), (l), (m), (o), (p) and (q)
4.	**The Special Economic Zone Law, 2014**	The Special Economic Zone Law, Section 11 (f) The Special Economic Zone Law, Section 35 The Special Economic Zone Law, Section 75 The Special Economic Zone Law, Section 76 The Special Economic Zone Law, Section 77 The Special Economic Zone Law, Section 78 The Special Economic Zone Law, Section 80 (a), (b), (c), (d) and (e)
5.	**The Myanmar Insurance Law, 1993**	The Myanmar Insurance Law, Section 16

Table 3.5-1 Summary of legal commitments by the Project during Pre-Construction, Construction and Operation phases. (Cont.)

No.	Laws, Regulations and Policy	Commitment Sections / Articles
6.	**The Protection and Preservation of Ancient Monuments Law, 2015**	The Protection and Preservation of Ancient Monuments Law, Section 12
7.	**The Protection and Preservation of Antique Objects Monuments Law, 2015**	The Protection and Preservation of Antique Objects Monuments Law, Section 12
8.	**The Protection of National Race Law, 2015**	The Protection of National Race Law, Section 5
9.	**Conservation of Water Resources and River Law, 2008**	Conservation of Water Resources and River Law, Section 8 Conservation of Water Resources and River Law, Section 11 (a) Conservation of Water Resources and River Law, Section 19
10.	**Freshwater Fishery Law, 1991**	Freshwater Fishery Law, Section 40
11.	**Myanmar Marine Fishery Law, 1990**	Myanmar Marine Fishery Law, Section 39
12.	**The Myanmar Insurance Law, 1993**	The Myanmar Insurance Law, Section 16
13.	**Factories Act, 1951**	Factories Act, All Sections (Chapters)
14.	**Employment and Skill Development Law, 2013**	Employment and Skill Development Law, Section 5 Employment and Skill Development Law, Section 14 Employment and Skill Development Law, Section 30
15.	**The Minimum Wage Law, 2013**	The Minimum Wage Law, Section 12 (a), (b), (c) and (d) The Minimum Wage Law, Section 13 (a), (b), (c), (d) and (e) The Minimum Wage Law, Section 18
16.	**The Payment of Wages Act, 2006**	The Payment of Wages Act, Section 4 The Payment of Wages Act, Section 7

Table 3.5-1 Summary of legal commitments by the Project during Pre-Construction, Construction and Operation phases. (Cont.)

No.	Laws, Regulations and Policy	Commitment Sections / Articles
		The Payment of Wages Act, Section 8 The Payment of Wages Act, Section 9 The Payment of Wages Act, Section 10 The Payment of Wages Act, Section 11
17.	**The Law Amending the Leave and Holidays Act, 2006**	The Law Amending the Leave and Holidays Act, Section 3 The Law Amending the Leave and Holidays Act, Section 4 The Law Amending the Leave and Holidays Act, Section 7 The Law Amending the Leave and Holidays Act, Section 11
18.	**Labor organization Law, 2011**	Labor organization Law, Section 3 Labor organization Law, Section 4 Labor organization Law, Section 29 Labor organization Law, Section 30 Labor organization Law, Section 31 Labor organization Law, Section 38 (b) Labor organization Law, Section 41 (a), (b), (c), (d) and (e) Labor organization Law, Section 43, Labor organization Law, Section 44 (a), (b), (c) and (d).
19.	**The Settlement of Labor Dispute Law, 2012**	The Settlement of Labor Dispute Law, 3 The Settlement of Labor Dispute Law, 4 The Settlement of Labor Dispute Law, 5 The Settlement of Labor Dispute Law, 6 The Settlement of Labor Dispute Law, 7 The Settlement of Labor Dispute Law, 8

Table 3.5-1 Summary of legal commitments by the Project during Pre-Construction, Construction and Operation phases. (Cont.)

No.	Laws, Regulations and Policy	Commitment Sections / Articles
		The Settlement of Labor Dispute Law, 9 The Settlement of Labor Dispute Law, 23 The Settlement of Labor Dispute Law, 24 The Settlement of Labor Dispute Law, 25 The Settlement of Labor Dispute Law, 26 The Settlement of Labor Dispute Law, 27 The Settlement of Labor Dispute Law, 28 The Settlement of Labor Dispute Law, 29 The Settlement of Labor Dispute Law, 30 The Settlement of Labor Dispute Law, 31 The Settlement of Labor Dispute Law, 32 The Settlement of Labor Dispute Law, 33 The Settlement of Labor Dispute Law, 38 The Settlement of Labor Dispute Law, 39 The Settlement of Labor Dispute Law, 41
20.	**The Workman Compensation Act, 1951**	
21.	**Social Security Law, 2012**	Social Security Law, Section 11 (a) Social Security Law, Section 15 Social Security Law, Section 16 Social Security Law, Section 18 (a) and (b) Social Security Law, Section 48 (a) Social Security Law, Section 51 Social Security Law, Section 53

Table 3.5-1 Summary of legal commitments by the Project during Pre-Construction, Construction and Operation phases. (Cont.)

No.	Laws, Regulations and Policy	Commitment Sections / Articles
		Social Security Law, Section 54 Social Security Law, Section 75 (a) and (b) * Correction Section 75 not 74
22.	**The Prevention and Control of communicable Diseases Law, 1995**	The Prevention and Control of communicable Diseases Law, Section 5 The Prevention and Control of communicable Diseases Law, Section 8 The Prevention and Control of communicable Diseases Law, Section 9 (a) to (c)
23.	**The Control of Smoking and Consumption of Tobacco Product Law, 2006**	The Control of Smoking and Consumption of Tobacco Product Law, Section 9
24.	**The Motor Vehicles Law, 2015**	The Motor Vehicles Law, Section 4 The Motor Vehicles Law, Section 5 The Motor Vehicles Law, Section 35 The Motor Vehicles Law, Section 45 The Motor Vehicles Law, Section 46 The Motor Vehicles Law, Section 47 The Motor Vehicles Law, Section 49 The Motor Vehicles Law, Section 50 The Motor Vehicles Law, Section 51 The Motor Vehicles Law, Section 52 The Motor Vehicles Law, Section 54
25.	**The Myanmar Fire Brigade Law, 2015**	The Myanmar Fire Brigade Law, Section 25
26.	**Petroleum Act, 1934, Petroleum Rule,1937**	
27.	**The Prevention of Hazard from Chemical and related Substances Law, 2013**	The Prevention of Hazard from Chemical and related Substances Law, Section 11 The Prevention of Hazard from Chemical and related Substances Law, Section 13

Table 3.5-1 Summary of legal commitments by the Project during Pre-Construction, Construction and Operation phases. (Cont.)

No.	Laws, Regulations and Policy	Commitment Sections / Articles
		The Prevention of Hazard from Chemical and related Substances Law, Section 15 (a) and (b) The Prevention of Hazard from Chemical and related Substances Law, Section 16 (a), (b), (c), (d), (e), (f), (g), (h), (i), (j) and (k) The Prevention of Hazard from Chemical and related Substances Law, Section 17 The Prevention of Hazard from Chemical and related Substances Law, Section 18 The Prevention of Hazard from Chemical and related Substances Law, Section 20 The Prevention of Hazard from Chemical and related Substances Law, Section 22 The Prevention of Hazard from Chemical and related Substances Law, Section 27
28.	**The Private Industry Law, 1990**	The Private Industry Law, Section 11(a), (c), (d), (f) and (g) The Private Industry Law, Section 13 (d), (e), (f), (g) and (h) The Private Industry Law, Section 26

Source: ESIA Study Team

CHAPTER 4
PROJECT DESCRIPTION AND ALTERNATIVES

4.1 PRESENTATION OF THE PROJECT

4.1.1 Project Description

The Project is classified into "Infrastructure and Service Development" sector and "Industrial Zone Construction and Development" subsector according to the Environmental Impact Assessment Guidelines of The Republic of The Union of Myanmar (MONREC, 2015).

The Project will install Utilities Systems including Road works, Flood Protection and Drainage System, Power and Electricity Distribution System, Water Treatment and Distribution System, Wastewater Treatment System, Solid Waste Management System, Fire Fighting and Emergency Response System, Communication System, Security System and Green area and Recreation.

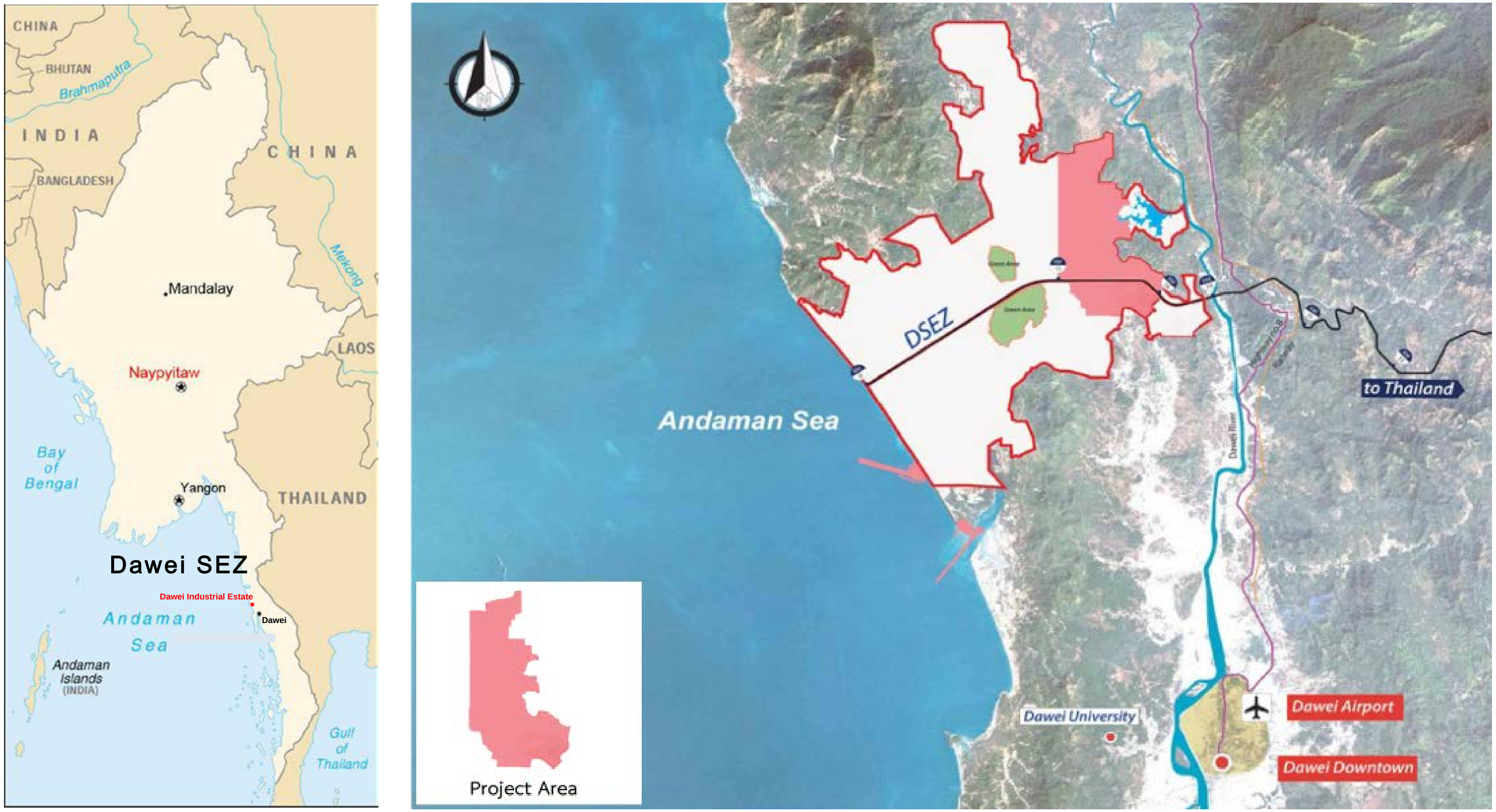
4.1.1.1 Project Size

Twenty-seven square kilometers in Dawei Special Economic Zone (DSEZ) (Figure 4.1-1) will be developed an eco-industrial estate. Land plots in the Project will be leased for medium to light industries which will be developed by phases, from phase A, phase B, phase C and to phase D. Zone A will be firstly developed for the initial phase and followed by the other zones in full phase (Figure 4.1-2). As shown in Table 4.1-1, target industries for phase A and phase B will be among the auto-parts, electronics, home appliances, garment and textiles, food and beverages, cannery and frozen seafood, agriculture and rubber products, pharmaceutical products and construction materials and for phase C and phase D will be glass products, plastics, auto-mobile and assembly manufacturing.

4.1.1.2 Project Location

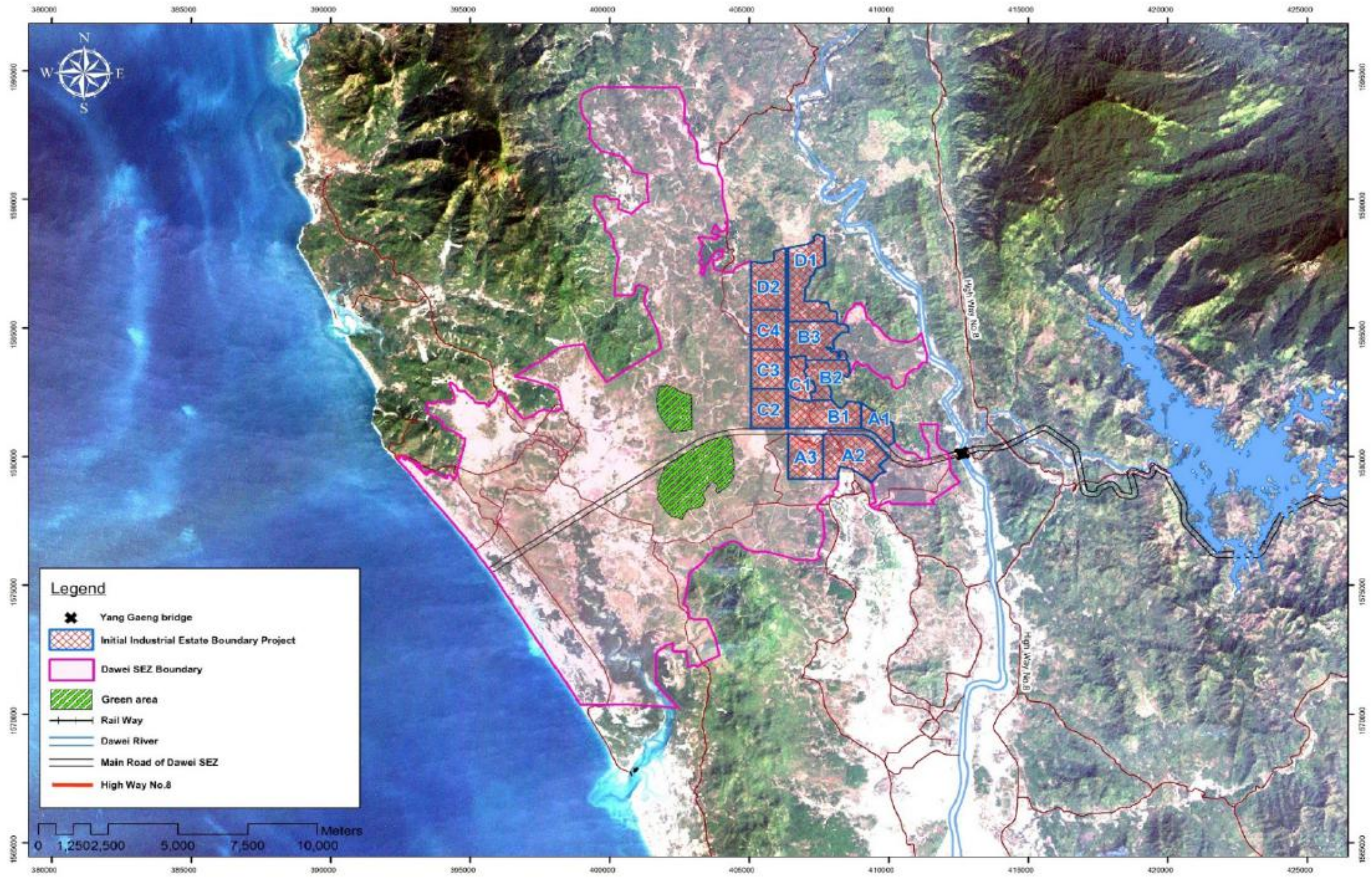
The Project is located in Dawei province (Tavoy) in the Tanintaryi region in southern Myanmar (Figure 4.1-2). The Project is situated in Dawei Special Economic Zone, which is bounded by the Andaman Sea in the west and the Dawei river in the east. The Project is approximately 30 kilometers north of the Dawei airport and the Dawei city center.

From the west, the Project can be accessed by two lanes concrete road which connects Dawei city and the Kanchanaburi province, Thailand. From the east, the Project can be accessed by the seaport and the four lane concrete road of the DSEZ. From Yangon city in the north, the Project can be accessed by the Yangon-



Source: SETEC (2012)

Figure 4.1-1 Location and accessibility of the Initial Industrial Estate in the Dawei Special Economic Zone (DSEZ).



Source: SETEC (2012)

Figure 4.1-2 Phases and zones of the Dawei SEZ Initial Industrial Estate

Table 4.1-1 Area of each zone in the Dawei SEZ Initial Industrial Estate. Estate

PHASE & ZONE	AREA (Km^2)
A	7.00
B	7.00
C	7.00
D	6.00

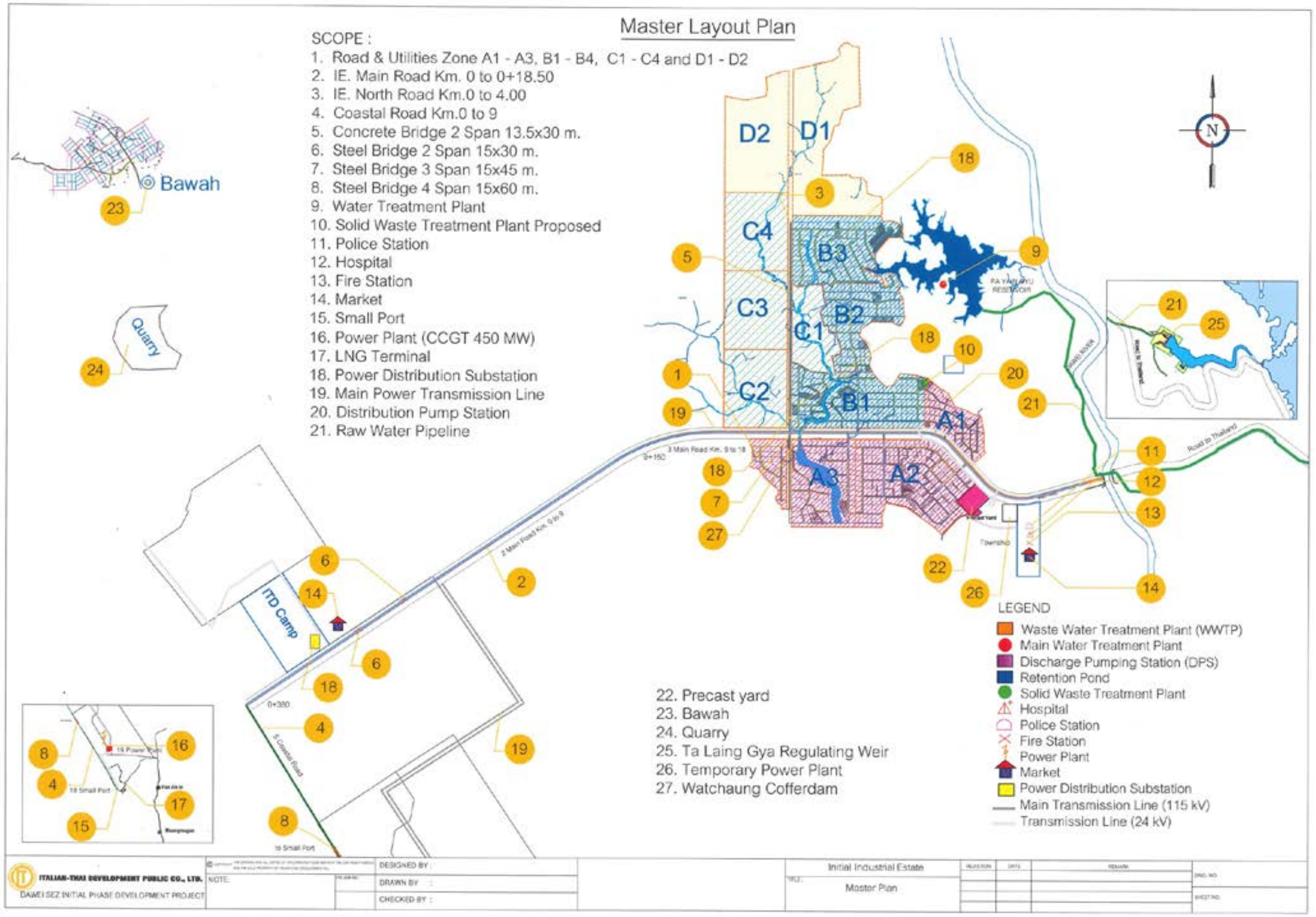
Source: ITD (2012)

Mandalay highway and the highway no. 8 and from the Dawei airport in the south, the Project can be also accessed by highway no.8.

4.1.1.3 Project Component

The Project composes of land plots for lease, infrastructure and utilities Figure 4.1-3. The infrastructure are roads and bridge. The Utilities and facilities are the Flood Protection and Drainage System, Power and Electricity Distribution System, Water Treatment and Distribution System, Wastewater Treatment System, Solid Waste Management System, Fire Fighting and Emergency Response System, Communication System, Security System and Green area and Recreation.

Outside the Project area is Township, Power Plant, Reservoir, Sea Port and areas for the future development such as Petrochemical and heavy industries.



Source: ITD (2012)

Figure 4.1-3 Layout shows components in the Dawei SEZ Initial Industrial Estate

4.1.1.4 Project Time Schedule

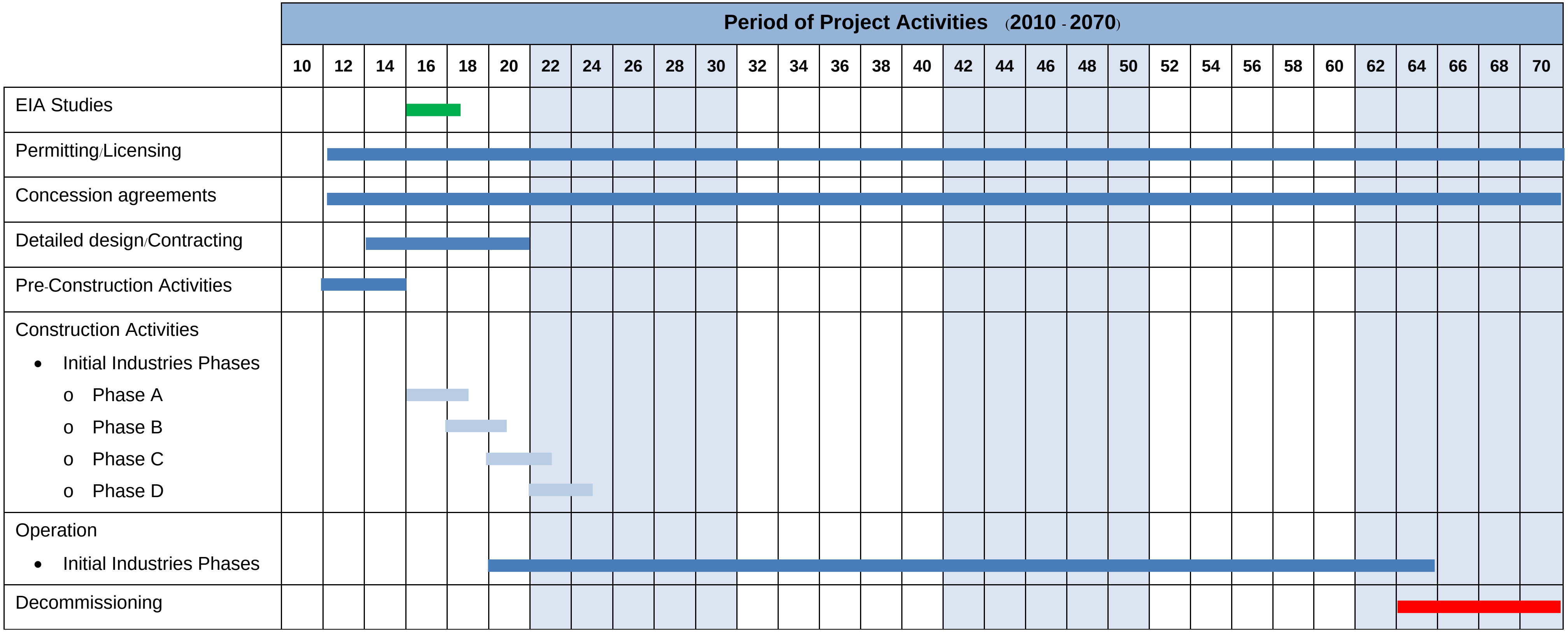
The Project schedule is shown in Table 4.1-2. To begin with period of the EIA is around 1-2 years. The Project has 50 years of the concession agreement for the entire project. Construction of Phase A will start around 2016 or as long as the EIA approval. Phase B is planning to start in 2018. Phase C is planning to start in 2020 and Phase D is planning to start in 2022. Operation of the Phase A will probably start in 2020. Decommissioning will take a few years before the concession agreement is end.

4.1.1.5 Project Organization

Myandawei Industrial Estate Company Limited (MIE) is subsidiary company limited of the Italian Thai Development (ITD) Public Company Limited. Management of organization is based on Board of directors, Audit Committee and Company Secretary (Figure 1.3-1). President/CEO administrates overall the organization including manages the four teams consisting of Land Acquisition, Design/EIA/Engineering Consultant Management, Business Development and Finance, Marketing & Sales and Supporting Unit. His/her management will be inspected by Auditing Committee.

Land Team is responsible for relocation and compensation and Cooperate Social Responsibility (CSR). Design/EIA/Engineering Consultant Management is responsible for steering and monitoring activities of consultants, construction and engineering reports, environmental report, engineering contract management, business contract management. In addition, planning and monitoring construction and reporting, supervision contract management, reporting, and project construction development. Environmental engineering is also responsible for safety, occupational health and environment (SHE) Business Development and Finance is responsible for project feasibility, loan acquisition, strategic partners and concession management. Marketing and sales is responsible for marketing and strategy, marketing activity and training and sales. Supporting Unit is responsible for accounting, logistics and coordinating (internal and external), human resources (HR), staffing and administration, legal and information technology (IT).

Table 4.1-2 Overall Schedule for Development of Dawei Industrial Estate



Remark: Modified from the Tentative Project Development Schedule dated 22 March 2013

Source: ESIA Study Team

4.1.1.6 Construction Phase

Dawei Initial Industrial Estate will be constructed by phase. Starting with phase A in 2016 and following by phase B, C and D in 2018, 2020 and 2022 respectively. Each phase will be completed with infrastructure and utilities system that are sufficient to support the expected demand of water supply, wastewater treatment, waste management and power generation. Further details on infrastructure and utilities system are described in section 4.2 The Project is planned to be complete in 2023 and land plots will be ready for lease and operation. Construction will be related to following activities

(a) Earthworks and Clearing Vegetation

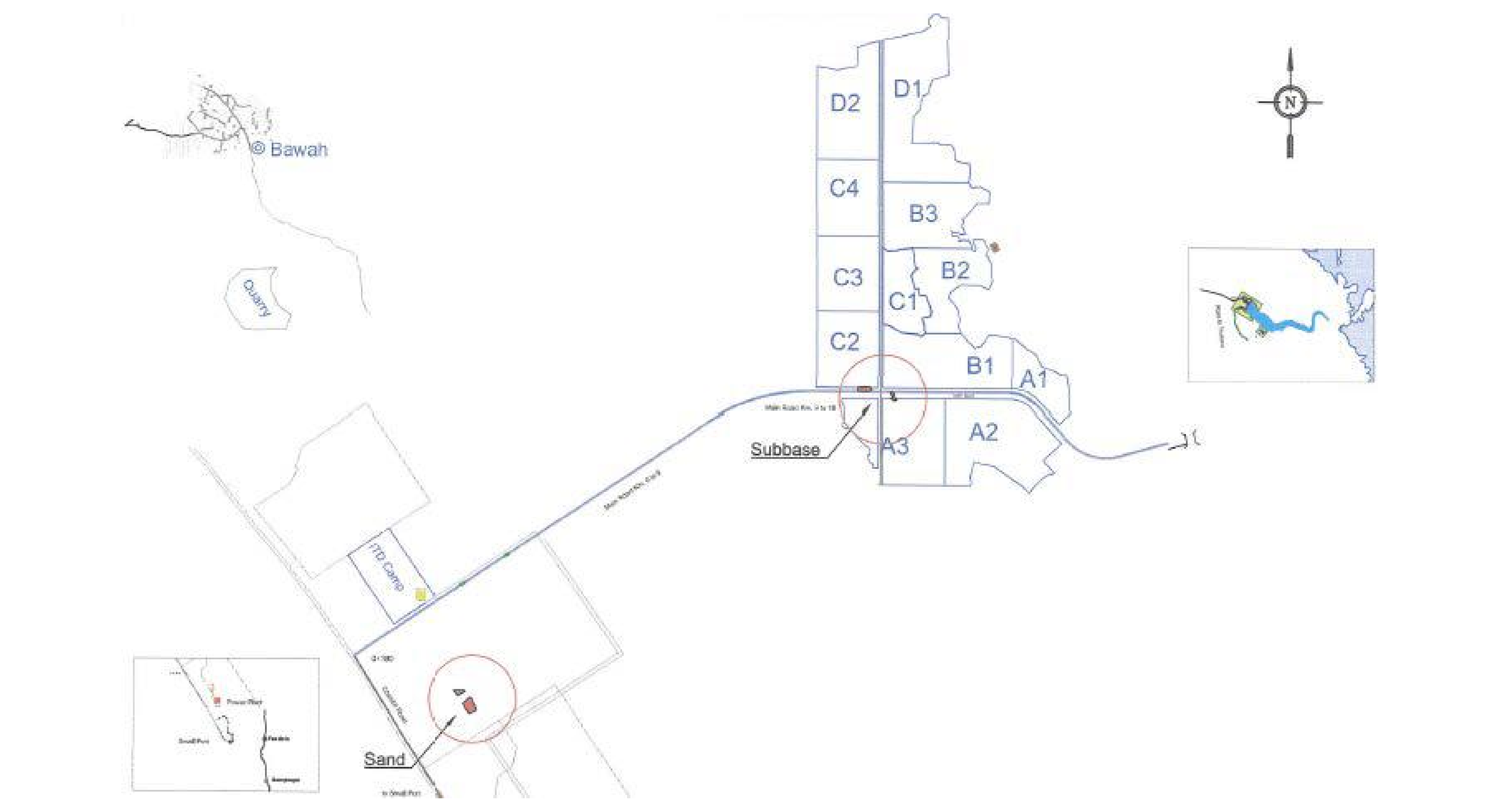
Large quantity of earth are moving and clearing of existing vegetation. All the existing vegetation in the Project area will be clear except area designed for recreation and green areas. Large quantity of earth are moving for land leveling and grading especially all low lying area in the west of the Project will be filled up to +6.0 m Chart Datum (CD), and construction of infrastructure such as road and facilities Supply of earth materials for construction are form within and outside of DSEZ.

Dry excavated quarry is located at approximately 10 kilometers northwest of the Project (Figure 4.1-4). Total area of the quarry is 540.57 Acre covering 292.13 Acre in Bawah Reserve Forest that is outside of the DSEZ and 244.48 Acre is within the DSEZ (Figure 4.1-5). The Quarry will supply 20,815,921.66 m3 of earth materials for construction. Quantity volume of quarry is shown in Table 4.1-3.

Table 4.1-3 Quantity volume of quarry supplying construction materials

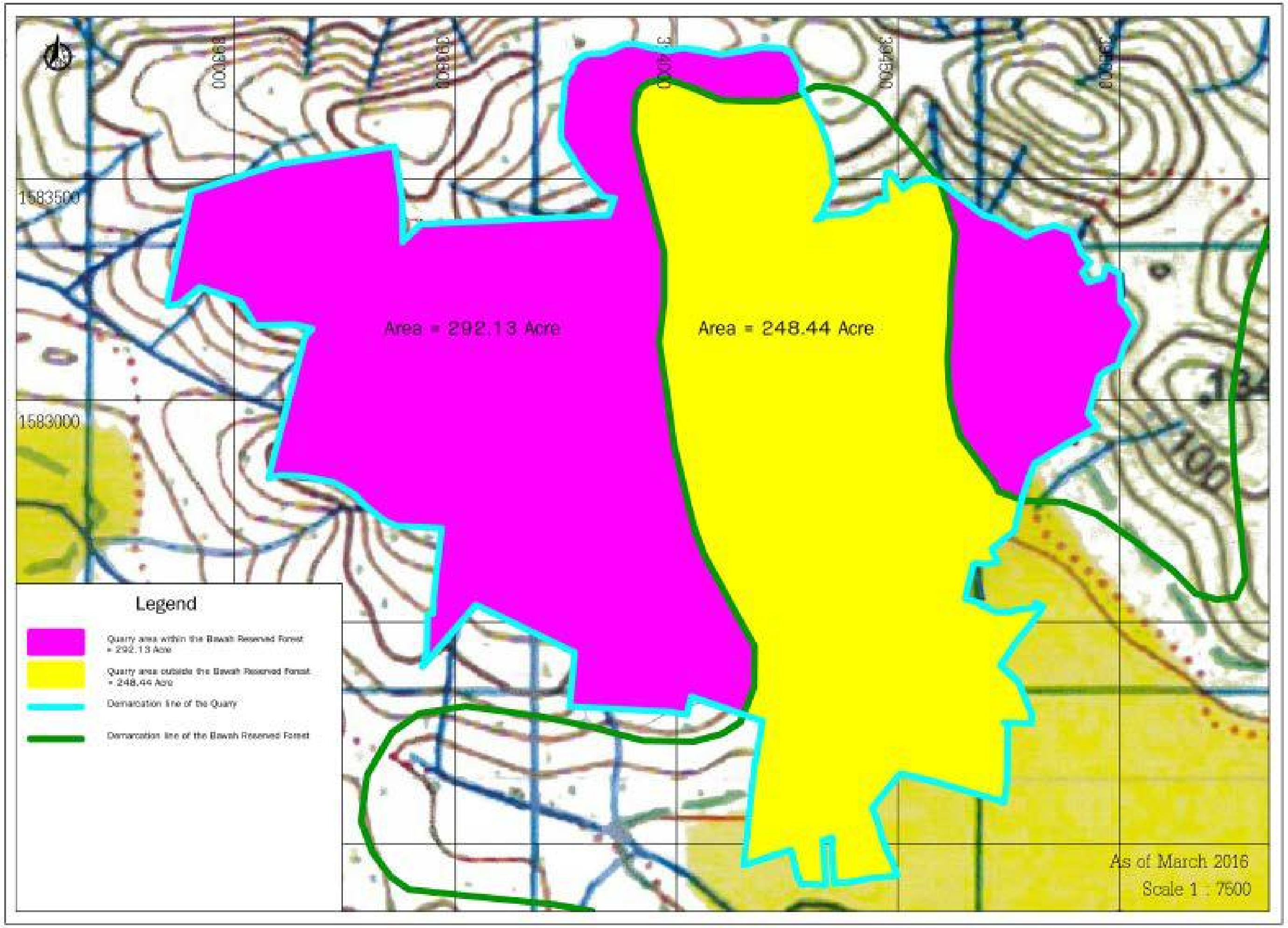
ITEM	DESCRIPTION	AREA ($m.^2$)	LENGTH (m.)	QUANTITY ($m.^3$)	ACC.QUANTITY
1	Elevation +195	79,983.689			
2	Elevation +185	109,595.214	10	947,894.51	947,894.51
3	Elevation +175	139,476.681	10	1,245,359.48	2,193,253.99
4	Elevation +165	160,236.433	10	1,498,565.57	3,691,819.56
5	Elevation +155	180,796.190	10	1,705,163.12	5,396,982.67
6	Elevation +145	198,862.200	10	1,898,291.95	7,295,274.62
7	Elevation +135	209,376.532	10	2,041,193.66	9,336,468.28
8	Elevation +125	221,629.385	10	2,155,029.58	11,491,497.86
9	Elevation +115	230,962.042	10	2,262,957.13	13,754,455.00
10	Elevation +105	244,003.663	10	2,374,828.53	16,129,283.52
11	Elevation +95	262,363.825	10	2,531,837.44	18,661,120.96
12	Elevation +70	10,518.872	15	2,046,620.23	20,707,741.19
13	Elevation +60	11,117.220	10	108,180.46	20,815,921.66
TOTAL CUT QUANTITY					**20,815,921.66**

Source: MIE (2015)



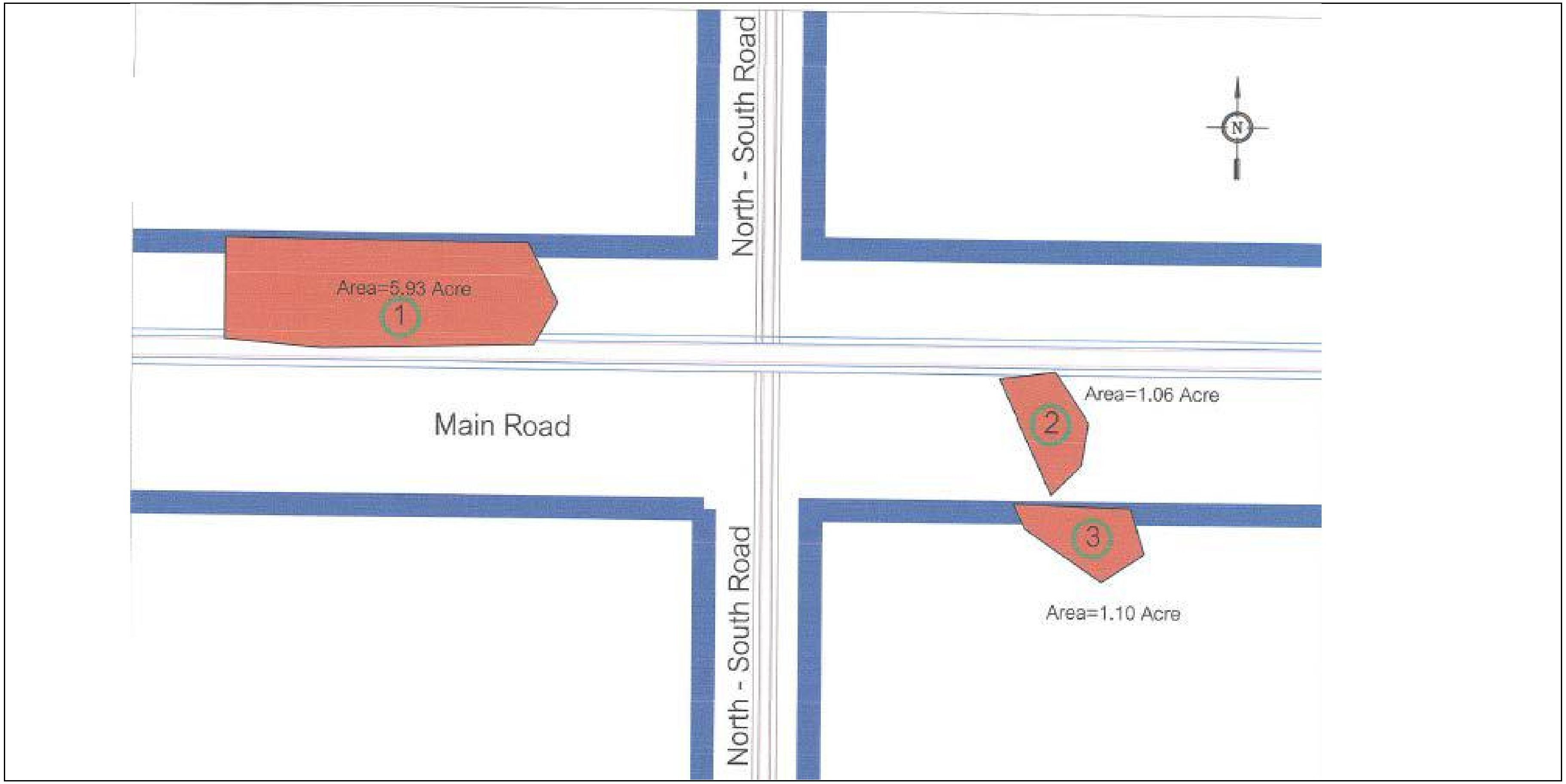
Source: MIE (2015)

Figure 4.1-4 Location of components in construction phase of Dawei Initial Industry Estate



Source: MIE (2015)

Figure 4.1-5 Areas of Quarry



Source: MIE (2015)

Figure 4.1-6 Location and Areas of Subbase Borrow Pits during Construction Phase of Dawei Industrial Estate

Subbase Borrow Pits are supplying materials for construction of road. There are three Subbase Borrow Pits and they are in the Project area near the Main Road (Figure 4.1-6) . Each of the pits has description following

Table 4.1-4 Total Quantity Volume of Subbase Borrow Pits

Subbase Borrow Pit	Elevation (m)	Area (m^2)	Quantity (m^3)
Pit 1	3.00	24,007.50	72,022.50
Pit 2	2.00	4,291.50	8,583.00
Pit 3	2.00	4458.09	8,916.18
TOTAL CUT QUANTITY			89,2521.68

Source: MIE (2015)

Sands Borrow Pits are supplying materials for construction. There are two Sands Borrow Pits and they are outside the Project area but still in the DSEZ near coastal road and ITD Campsite (Figure 4.1-4). Each of the pits has description following:

Table 4.1-5 Total Quantity Volume of Sands Borrow Pits

Sands Borrow Pit	Elevation (m)	Area (m^2)	Quantity (m^3)
Pit 1	2.80	53,262.00	149,133.60
Pit 2	2.20	13,896.00	30,571.20
TOTAL CUT QUANTITY			**179,704.80**

Source: MIE (2015)

(b) Construction Work Camp, Workshop, and Yards

Work Camp is planned to construct in order to accommodate around 500 workers during construction. The workers will be employed by Italian-Thai Development Plc. and will be a main construction subcontractor. Location of the Work Camp and Workshop is presented in Figure 4.1-4. An area of 1.64 square kilometers will be built and leveled to between Km 1+000 to 2+000 from the Main Road of the Dawei SEZ. The Accommodation area will be used for construction activities, concrete batching plants, mechanic workshop, warehouse, precast and reinforced concrete yard, and office.

Workers camp shall be constructed in accordance with Standard of the Engineering Institute of Thailand. Sanitary management for worker camp shall be in accordance with Standard and Layout for Temporary Construction Worker Camp issued by the Engineering Institute of Thailand Under H.M. the King's Patronage (Wor Sor Tor. 1010-34 Standard). Worker camp shall be constructed sufficiently for number of workers. Materials used for worker camp construction refers to Local Temporary Building Regulation, and electrical cable and device

refer to Metropolitan Electricity Authority Standard. The following obligations shall be written in the contractor contract. Construction shall be in accordance with sanitary practices as described following:

(a) ***Location***

- Worker camp shall be 100 m away from waterway to prevent sedimentation and contamination
- Worker camp shall be surrounded with 2 m high fence.

(b) ***Design***

- Room area at least 3.0 sq. meter per person. Width or length inside of each room shall not be lower than 2.4 x 2.4 m. Height from ground to lowest top-wall shall not be lower than 3.0 m. At least one set of door and window shall be equipped, including at least 1 lamp and 1 electrical plug in the room.
- Shared bathing room and washing room shall be provided by contractor in ratio of 7.0 sq. m per 20 persons. Water tank and water tap shall be sufficiently provided for bathing and washing, including sufficient light.
- Toilet shall be sufficiently provided by contractor in ratio of 1 toilet room per 20 persons. Area of toilet shall not be less than 0.90 sq. m and internal width is not less than 0.90 m. Lamp and light also shall be sufficiently provided. Toilet shall be at least 30 m away from natural waterway.
- Worker camp shall be surrounded with fence with only one gate for access control. Security guard shall be provided with guard house at gate.
- At least one set of fire extinguisher shall be provided per building or in every 45.0 m. Fire extinguishers are specific purposes as presented in Table 4.1-6.

Table 4.1-6 Type and purposes of Fire Extinguishers in Worker Camps

No.	Areas	Type	Number (Set)
1	Store	Halotron, 5kg	1
2	Welding shop	Halotron, 5kg	1
3	Laydown	Halotron, 5kg	4
4	Guard house	Dry Chemical ABC, 5 kg	1
5	Canteen	Dry Chemical ABC, 5 kg	1

Source: ESIA Study Team

- Shared cooking area shall be sufficiently provided by contractor. It should be away from worker camp or around 2-3 m to prevent firing from cooking. Area

to put on cooking stove (gas/wood), cooking space, washing sink, drainage ditch, garbage bins and lids shall be sufficiently provided.

(c) Transportation of Construction Materials and Equipment

Construction materials, machines and equipment are planned to be transported from Thailand by vessel. Marine barges will deliver the materials and machines to small port of the DSEZ. The port is about 100 acres and has two platforms berths, which are 100 and 150 meters length in size. Existing Main Roads of DSEZ connecting the Project area and the small port. The road has been improved and widened to accommodate transportation of materials and machines and equipment, dump trucks and trailers.

(d) Construction of Utilities and Facilities System

Construction of utilities will include necessary earthwork, concrete work, commissioning, and procurement of necessary equipment and machines for the following infrastructure and utility systems. Further details of infrastructure and utilities system are described in *Section 4.2*.

- Roads;
- Flood protection and drainage system;
- Water treatment and distribution system;
- Central Wastewater collection and treatment system;
- Solid waste and hazardous waste management system;
- Fire Fighting and emergency response system

4.1.1.7 Operation Phase

The integrated Dawei Initial Industrial Estate Project will comprise of four phases, A, B, C and D. Zone A1, A2 and A3 will be firstly operate in Phase A. Subsequently, zone B, C and D will be operate and developed in concurrent utilities support the industries capacity (Figure 4.1-3). Expected factories or manufacturing are different in each zone. Zone A and B are the same and targeted Auto-parts, Electronics, Home appliances, Garment and Textiles, Food and Beverages, Cannery and Frozen Seafood, Agriculture and Rubber products, Pharmaceutical products, Construction Materials industry and Factory for rent while zone C and D are targeted for Glass products, Plastics, Auto-mobile, Assembly industry and Factory for rent.

The Project focus on export-oriented light and medium industries in order to transform the Dawei Special Economic Zone (DSEZ) into one of the major exporting and logistic hub of the AEC region and employment for the local people. List of targeted industries

is summarized in Table 4.1-7; however, details of the industries planned in each zone are still at conceptual stage and limited.

(a) Electricity

Consumption of electricity is chiefly from operation of manufacturing and facilities in the Project, from operation of lights on roads, Water Treatment Plants, Central Wastewater Treatment System, Solid Waste Management System and manufacturing of target industries in each phase. Estimated electricity consumption for each phase of development are following:

Table 4.1-7 Operational Phases and Development of Dawei Initial Industrial Estate

Phase	Factory operation year	Zone	Area (Km^2)	Target Factories
A	2016 - 2017	A1 A2 A3	1.01 3.16 2.83	Auto-parts, Electronics, Home appliances, Garment and Textiles, Food and Beverages, Cannery and Frozen Seafood, Agriculture and Rubber products, Pharmaceutical products, Construction Materials industry and Factory for rent
B	2018 - 2019	B1 B2 B3	2.78 1.55 2.68	
C	2020 - 2021	C1 C2 C3 C4	1.70 1.85 1.76 1.69	Glass products, Plastics, Auto-mobile, Assembly industry and Factory for ren
D	2022 - 2023	D1 D2	3.83 2.17	

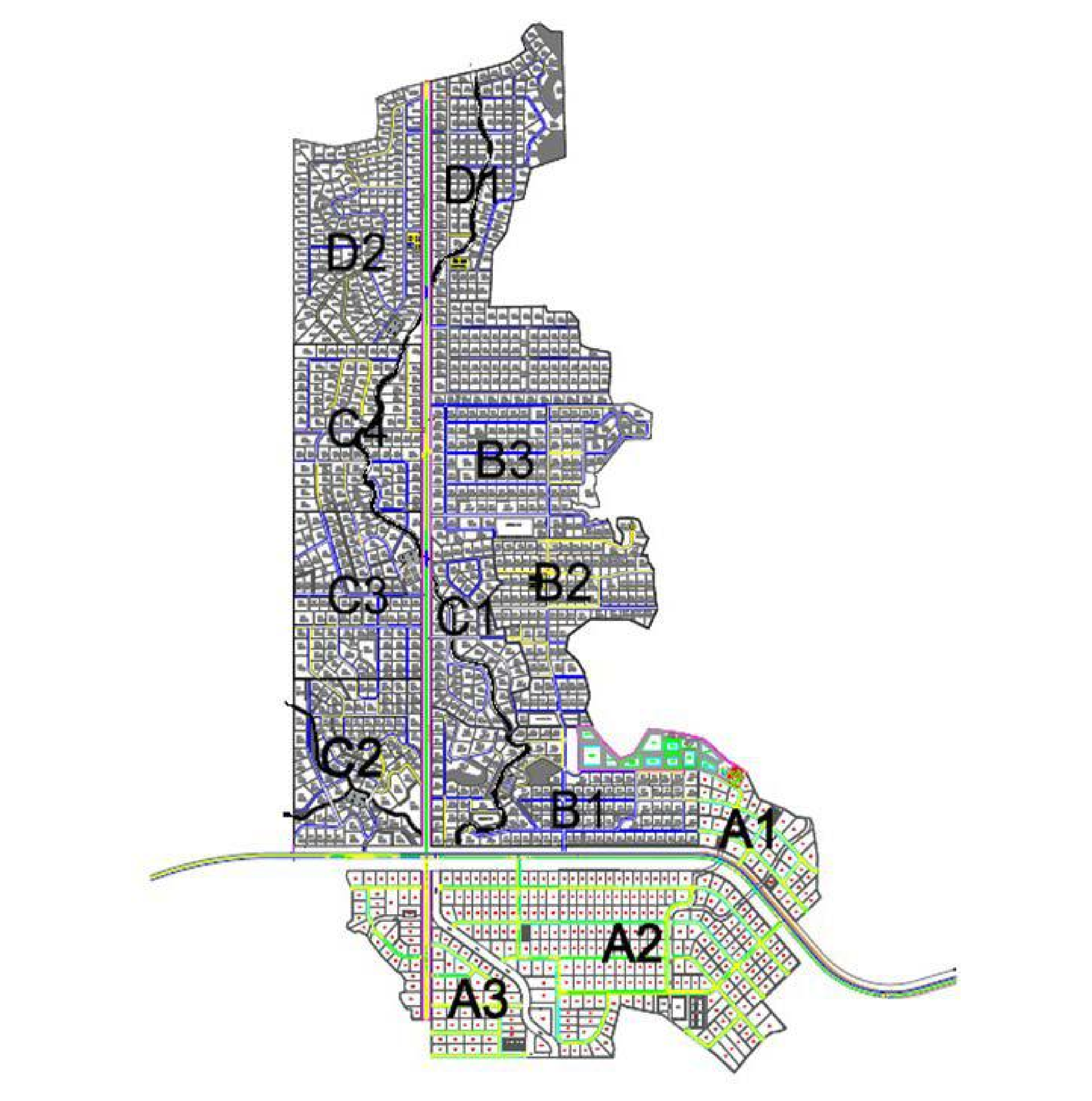
Source: ITD, 2012

Phase A demands 102.9 MW. Phase B demand 103.8 MW. Phase C demands 103.9 MW. Phase D. demands 92.8 MW. Total demand of electricity in full phase is 403.4 MW. Power will be supply by the initial power plant and distributed to the Project by Power and Distribution System as presented in *Section 4.2.3*.

(b) Water

Water Treatment System will supply 36,000 of consumable water per day in phase A. and 130,000 m^3 per day in phase B and m^3 per day in full phase. The consumable water will be distributed to Zone A1 in phase A in the distribution pumping station and then by drainage pipes in each zone in each Phase. Wastewater generated by both manufacturing and facilities will be collected and delivered to treated in the Central Wastewater Treatment Plants for each phases. Once the wastewater is treated until complying the National Environmental Quality (Emission) Guidelines for effluents as presented in the previous Chapter 3, it will be able to

discharge in the public. Almost wastewater will be discharged accordingly the phases. Wastewater from Phase A in zone A will be discharged into Kun Chung River and wastewater from Phase B, C and D will be discharged into Dawei River. The wastewater will be delivered by the gravity flow of the waste water pipeline. In case emergency, the Central wastewater treatment plant in zone A can hold 12 hours of wastewater.



Source: IEC, 2015

Figure 4.1-7 Details design of floor plan for Dawei Initial Industrial Estate Project

(c) Chemicals

Majority of chemicals used in the Project' facilities are mostly from the Water Treatment Plant, Central Wastewater Treatment system and Solid Waste Management System. Alum, Lime Chlorine and Polymer are main chemicals used in Water Treatment Plants. Some chemicals will be used in naturalizing ponds in the Central Wastewater Treatment Plants and Leachate Management System. Sludge that are solid to semi-solid waste usually generated by chemical reactions of the mentioned facilities will be disposed in the Solid Waste Management System. The other source of chemicals usage will depend on each type of manufacturing in each Phase and that the manufacturing are probably required to declare during their own EIA approvals.

(d) Road Networks

Highway no. 8 will be the main road connecting the Dawei SEZ and the rest of Myanmar. Extension of the Dawei SEZ Main Road to Ban Phu Num Ron, Kanchanaburi, Thailand will be the other route to link the Project and Thailand and the mainland of the Southeast Asia Country. Main Road of Dawei SEZ also linked the Project and the seaport on the Andaman Sea coast. The Dawei SEZ road is 4-lane. North-South Road (N-SR) will connect and link each zone of the Project together. The roads are 4-lane and 2-lane. Internal roads are linking land plots for each manufacturing with the other roads. All the roads will be lighted by the light poles and will operate once it is dawn.

After the construction phase that access road is used as a main road will connect to Dawei SEZ Main Road. The road will still operate in this phase.

(e) Flood Protection System

Precipitation or rains fall in open area of the Project will be drained into floodways and collected in the Flood Controlling System in normal situation. The retention ponds distributed over the project area (Figure 4.2-49) will not only be such a place for recreation and green area of the Initial Industrial Estate but also will retain the rainwater before it will be discharged into the existing tributaries in upstream of the Kun Chung River. In case emergency of storms or severely rainfall, each of the retention ponds can hold 6 hours of rainwater before it will be gradually drained into the River. Precipitation or rains fall in open area of manufacturing and facilities will be collected through the manufacturing and utilities themselves' drainages and required to treat until achieve the National Environmental Quality (Emission) Guidelines for effluent of each industry / manufacturing sectors in Chapter 3 (Annex3.2) or alternatively delivery to treat at the Central Wastewater Treatment Plant before discharging to public wastewater pipes and then draining to the public water.

(f) Water Treatment and Distribution System

Operation of the Water Treatment System will do by phases. There have 8 phases as presented in Table 4.2-9 Pa Yain Byu reservoir will be a major supply of raw water for the Water Treatment Plant. Raw water will be pumped into the plant at the pumping stations. Each phase required different number of pumps and volume of water per day as presented in Table 4.2-10. Flow rate of water will be adjusted and then water will be clarified before collecting in the tanks. Afterward, the water will be treated and then stored in the tank. 828 kilograms per day of sludge will be generated; however, the sludge will be dewatering and then stored in the sludge basin/tank before delivering to dispose in Solid Waste Management System. Filter need to be waste washing. The washing will take 10 minutes and will consume 50 m^3 per batch. Twice washes (2 batches) will be done. Chemicals need to be added for a consumable water in the chemical system. 276 kilogram per day of Alum will be used in phase A. 247 kilogram per day of lime will be used in phase A and 72 kilogram per day of chlorine gas will be used. Consumable water will be distributed by the GDS pumping station. Design of the station is in Annex4-1.

(g) Central Wastewater Treatment System

The Central Wastewater Treatment Plant will operate by phases. There have 4 phases of the plant. For the initial phase in Zone A. There will have 2 Wastewater Treatment Plant. Plant 1 is located in Zone A2 will receive wastewater from Zone A1 and A2. Plant 2 is located in Zone A3 will receive wastewater from Zone A3. Total volume of wastewater in phase A is 21,597 cubic meters per day. Wastewater will be treated until achieved the National Emission Guidelines of effluent discharging from Wastewater Treatment Facility. Wastewater will be coarse filtrated before chemical treatment. Then flow rate will be adjust at the Pershallfume before aerated in the lagoons and the polishing ponds. The wastewater will be sedimentation in the resting ponds and inspected for its water quality, if it can comply by the guideline for effluent. It will be rested in the resting ponds before discharging to the public wastewater pipe by gravity flow before finally into the Dawei River. In case emergency, the ponds system can hold only 24 hours of wastewater.

(h) Solid Waste Management System

Solid waste will be collected on daily basis from manufacturing area and the initial township by the facility vehicles. Some waste are expected to separate at source for non-hazardous and hazardous. Separation and processing plants will truly manage solid waste in accordance of their characteristics. Non-hazardous waste will be initially disposed in the non-hazardous waste landfill and hazardous waste will need to be stabilized or treated before dispose in hazardous waste landfill. At this stage infectious waste will have to be initially stored. Solid waste will be disposed in landfills only to until once the phases are fully developed the

incinerators will be installed in the future. Landfill leachate will operate and leachates will be treated and achieve a level of standard before delivery to the Central Wastewater Treatment Plant. Landfill gases will be collected and monitor for case of fire using passive gases collection system and active gases collection system and flaring system. Once the incinerators operate, their air emission will have to comply by the National Environmental Quality (emission) guideline for air emission. Residual from the incinerations; for example, bottom ash will be disposed in non-hazardous waste landfill and fly ash will have to be treated/stabilized before disposing in hazardous waste landfills.

(i) Fire Fighting System.

Fire Fighting station will be shared between the Initial Township and is located in the Initial Township. Initially there will have only one fire truck and one pumper truck. However, in this phase, the system will be support by Yebyu Township Fire Station resource and number trucks and the pumper trucks will be added according the development by phases of the Project.

4.2 PROJECT FACILITIES

4.2.1 Roads

Road is priority infrastructure that will be constructed. The project will construct three types of road; Main Road (MR), Secondary Road (SR) and Tertiary Roads (TR) (Figure 4.2-1). All roads in the Project will be asphalt concreted.

Pavement design is presented in Table 4.2-1 Thickness of pavement including subbase and base is determined from ESAL (Equivalent Single Axle Load) and Equivalent resilient modulus chart. ESAL is determined based on daily traffic, total truck traffic, truck factor and traffic growth factor. Details design of the Main Road of the DSEZ is in Environmental Impact Assessment of Transborder Road Link (Dawei-Phu Nam Ron) Project, in section 1(ERICU, 2013).

4.2.1.1 Main Roads (MR)

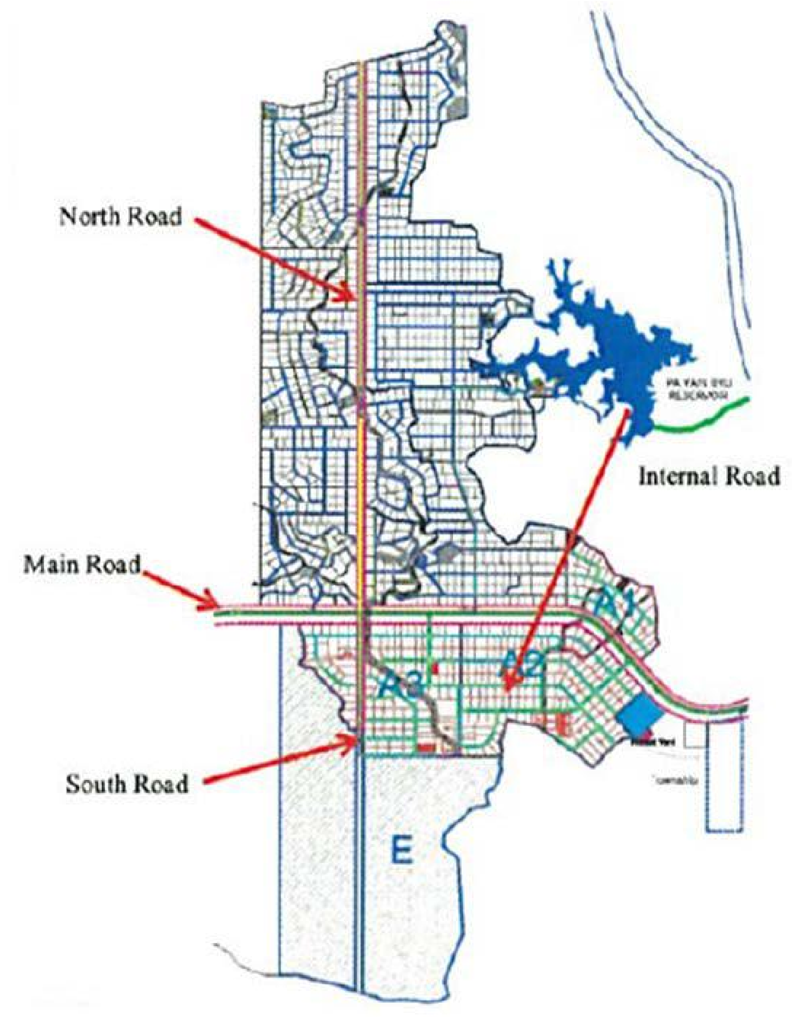
A section of Main Road is already exist in the Project. It is "Main Road of the DSEZ" that connect the Project with the others components in the DSEZ (Figure 4.1-3). The Main Road is 4 lane and broadly trending in East-West direction (Figure 4.2-1). It is linked the Transborder Road between Myanmar and Thailand. MR divided the Project into North and South sections. North section includes zone B, C, D and A3. South section includes zone A1 and A2.

Estimation of volume of vehicles on Main Road presents in Table 4.2-2. Total Daily Two-Way Vehicle Trips is calculated based on floor area of 3,396 Rai and on assumption that

there will be 40 percent of Food and Drink Industry, 20 percent of Instrument Engineering Industry and 40 percent Clothing Industry. The Total Daily Two Way Vehicles Trips is 9,057 including number of trucks which is 10 percent or 906 vehicles per day.

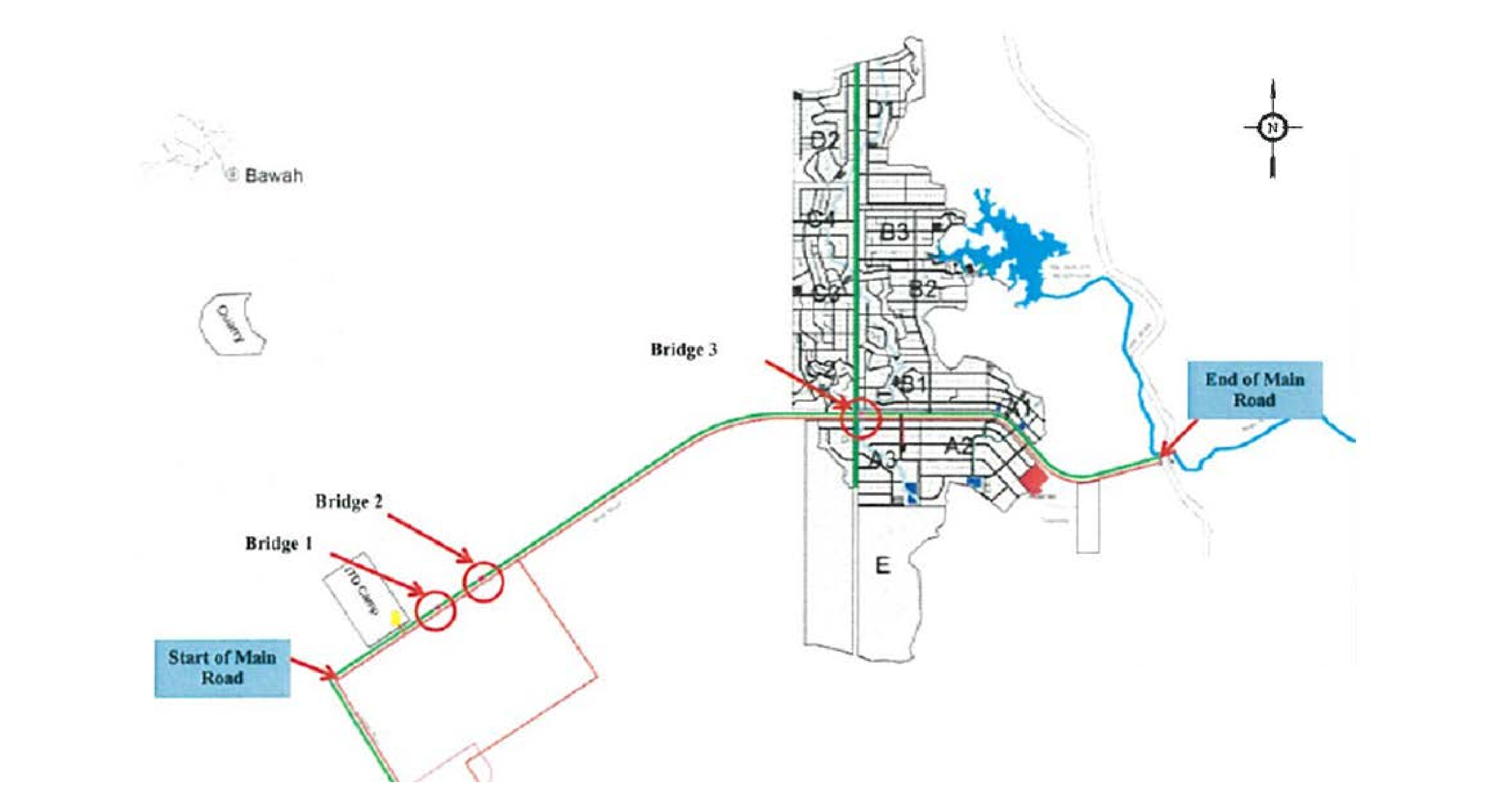
Traffic lane design is shown in Table 4.2-3

Designs of Main Roads and Bridges are presented in Figure 4.2-1 to Figure 4.2-6. On Mani Road has three bridges.



Source: IEC (2015)

Figure 4.2-1 Construction of three types of roads in Dawei Industrial Estate



Source: IEC (2015)

Figure 4.2-2 Main Road of DSEZ and connection

Table 4.2-1 Calculation On Pavement Design in Dawei Industrial Estate

Pavement Design

ESAL = ADT x DL x TF x GF x 365

ADT = First year annual average daily traffic (vehicle/day)

Where

DL = Percentage of total truck traffic on design lane

TF = Truck Factor

GF = Traffic Growth Factor

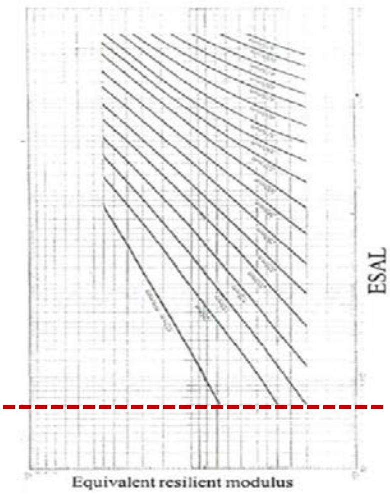


Table 4.2-2 Estimation on volume of vehicles for Main Road and North-South Road in Dawei Industrial Estate.

Main Road	INPUT			
Independent Variables				
Office Floor Area, X_1 (1000's ft^2)	3,396	**RAI**	58,489.12	(1000's ft^2)
% Site Area Built On X_2 (Percentage)	70			
Total - Office Employment, X_3 (Number)	16,980		50	Percent
Total Employees, X_4 (Number)	33,960			
Food and Drink Industry	40	Percent	36,226	Trips
Instrument Engineering Industry	20	Percent	71,667	Trips
Clothing Industry	40	Percent	7,187	Trips
Total	100	OK		
Total Weekly One-Way Vehicle Trips	31,698			
Total Weekly Two-Way Vehicle Trips	63,396			
Total Daily One-Way Vehicle Trips	4,528			
Total Daily Two-Way Vehicle Trips	**9,057**	Vehicles	ATD	
Truck Percentage	10	Percent		
Total Daily Two-Way Truck Trips	**906**	Vehicles		
Total Daily Two-Way Vehicle Trips	**8,151**	Vehicles		

Source: IEC (2015)

Table 4.2-3 Traffic Lane Design of Main road and North-South Road in the north section

Main Road

Input parameter;

ADT = 9,060 vehicles per day

K = 0.20

D = 0.60

Hourly designed volume = 1,102 vehicles per hour

Design Speed = 80 kilometer per hour

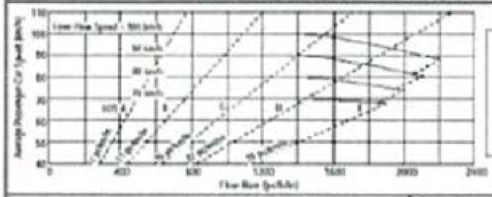
Percentage of Truck = 15%

Desired level of service : C

Output:

Number of lane (each direction) = 2

MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information		Site Information	
Analyst	Siwakorn Anutawiratkul	Highway/Direction to Travel	North-South Road
Agency or Company	IEC	From/To	
Date Performed	26/10/2558	Jurisdiction	
Analysis Time Period		Analysis Year	

Project Description

☐ Oper.(LOS) ☑ Des. (N) ☐ Plan. (v_p)

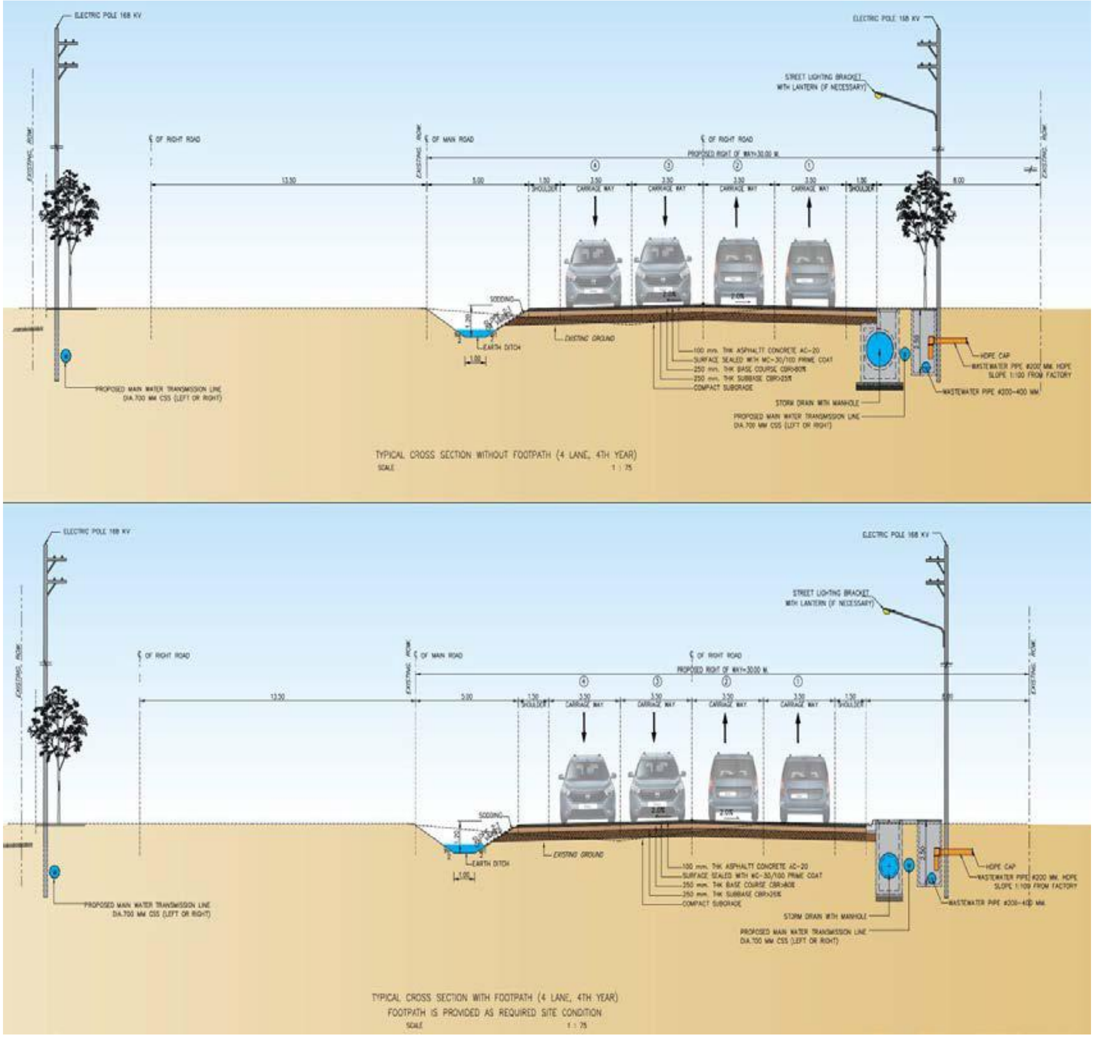
Flow Inputs			
Volume, V (veh/h)	1102	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	15
Peak-Hour Prop. of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop. D		General Terrain	Rolling
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	0.90	Up/Down %	0.00
		Number of Lanes	

Calculate Flow Adjustments			
f_p	0.90	E_R	2.0
E_T	2.5	f_{HV}	0.816

Speed Inputs		Calc Speed Adj and FFS	
Lane Width, LW (m)	3.5	f_{LW} (km/h)	1.0
Total Lateral Clearance, LC (m)	2.3	f_{LC} (km/h)	1.6
Access Points, A (A/km)	5	f_A (km/h)	3.3
Median Type, M	Divided	f_M (km/h)	0.0
FFS (measured)		FFS (km/h)	74.1
Base Free-Flow Speed, BFFS	80.0		

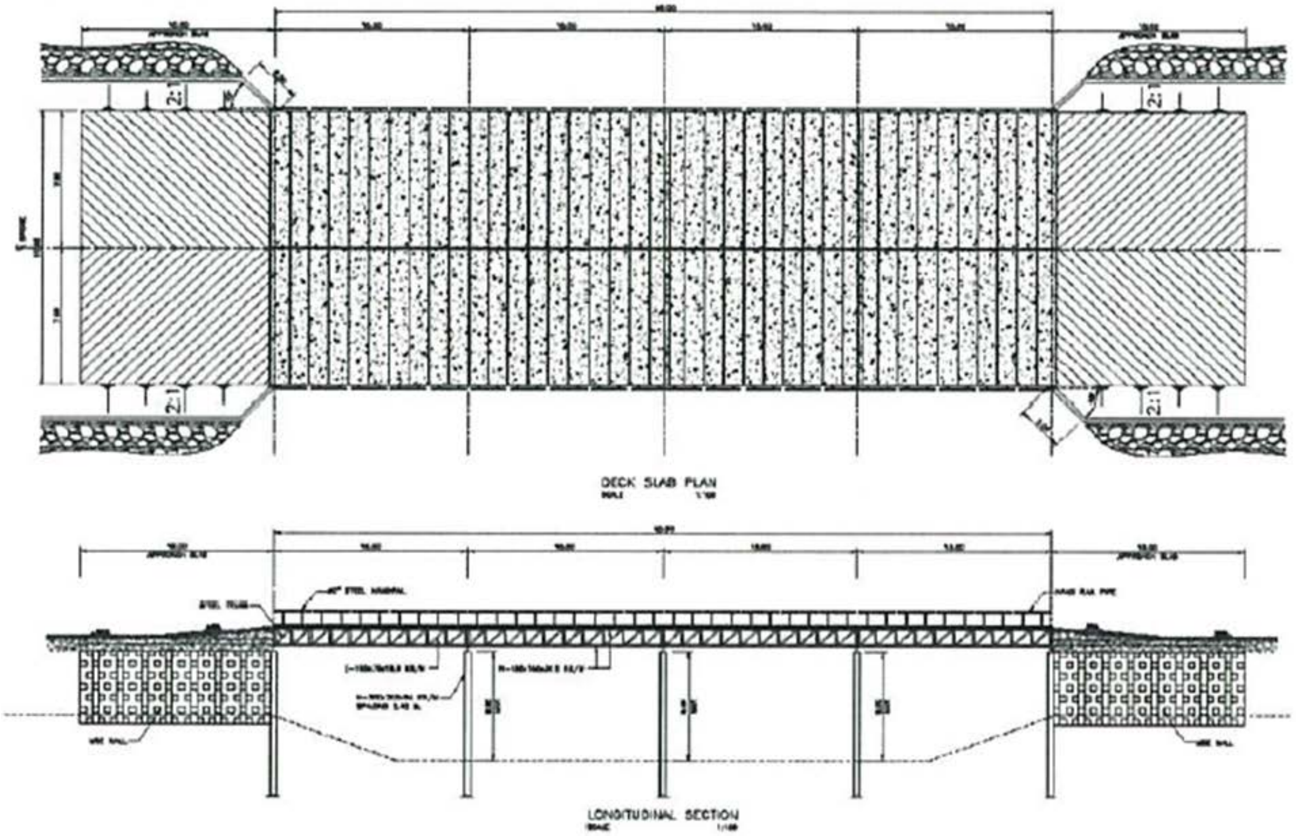
Operations		Design	
Operational (LOS)		Design (N)	
Flow Rate, v_p (pc/h/ln)		Required Number of Lanes, N	1.3
Speed, S (km/h)		Flow Rate, v_p (pc/h)	1656
D (pc/km/ln)		Max Service Flow Rate (pc/h/ln)	1136
LOS		Design LOS	C

Source: IEC (2015)



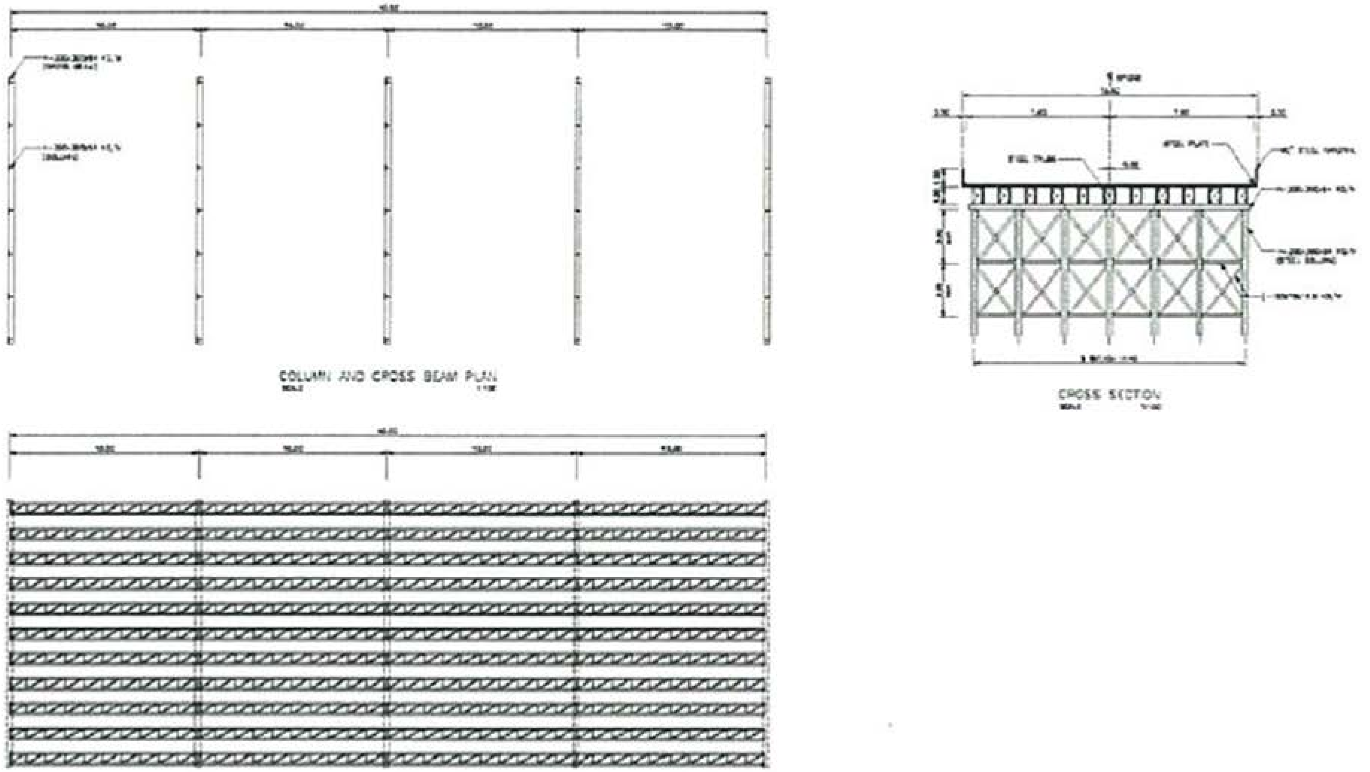
Source: IEC (2015)

Figure 4.2-3 Cross section of Main Road and Infrastructure Dawei Industrial Estate



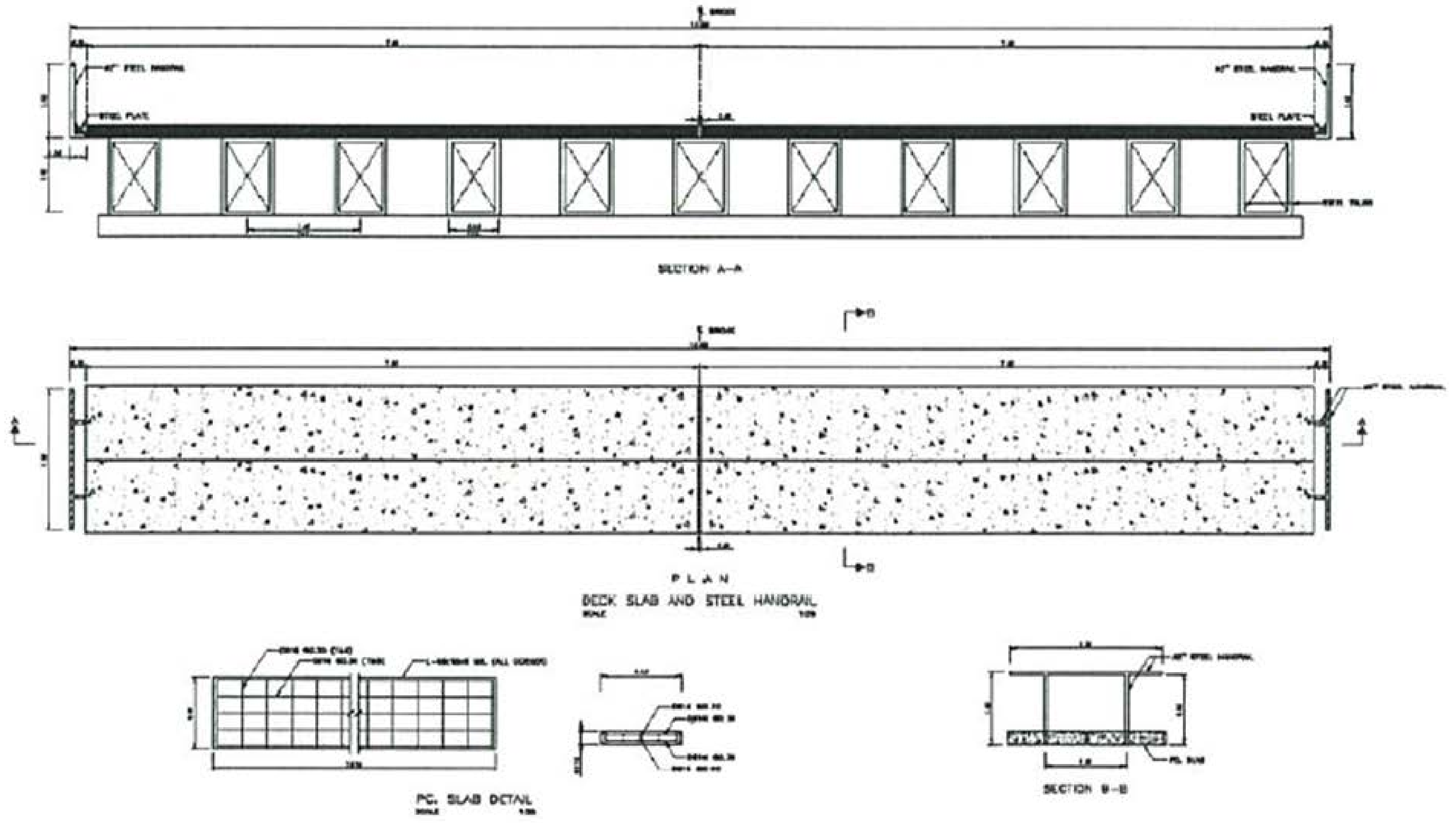
Source: IEC (2015)

Figure 4.2-4 Top view (above) and side (below) view of the bridge on Main Road in Dawei Initial Industrial Estate.



Source: IEC (2015)

Figure 4.2-5 Side view (above) and Top view (below) of the bridge on Main Road in Dawei Initial Industrial Estate.



Source: IEC (2015)

Figure 4.2-6 Side view (above) and Top view (middle) and details design of the bridge on Main Road in Dawei Initial Industrial Estate

4.2.1.2 North-South Road

The Project will construct N-S trending Road. Road in the north section will connect zone C2, C3, C4, D2 and B1, B2, B3, D1 together and this road is designed for 4 lane while road in the south section will pass through only in zone A1 and this road is designed for only 2 lane (Figure 4.2-8).

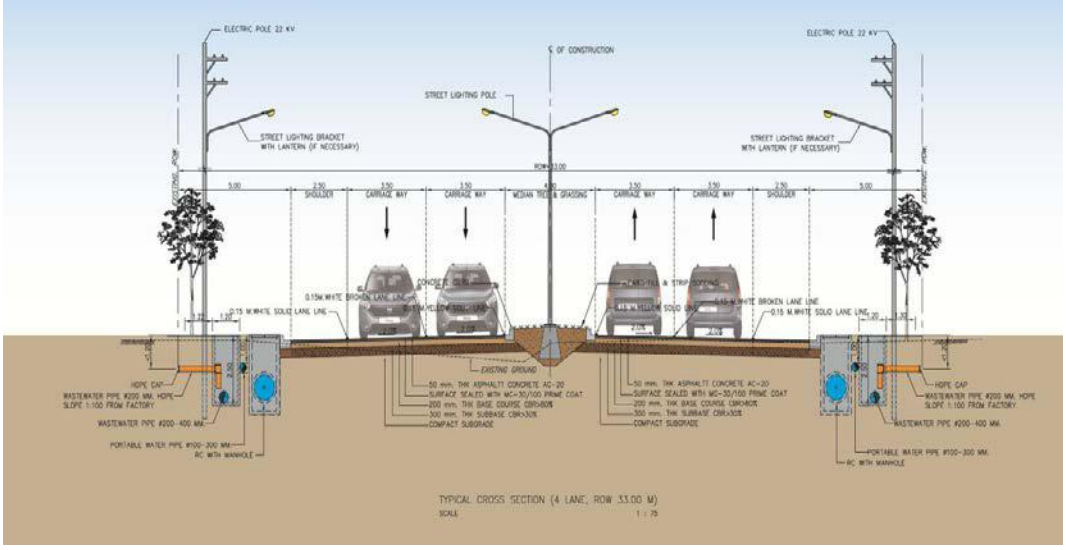
(a) Construction Phase

The Project will construct a temporary road. The road will be 2 lane in the initial phase, in zone A1, A2 and A3. Design of the temporary road present in The same design will applied both in the north and south sections.

Eventually, the temporary roads will be developed into permanent roads. Two lane road will be remained in the south section but developed into 4 lane road in the north section. Designs of 2 lane road and 4 lane road presents in Figure 4.2-10 and Figure 4.2-11 respectively. This road will have two bridges and design of the bridge is the same as in the previous section (See Figure 4.2-4 and Figure 4.2-6).

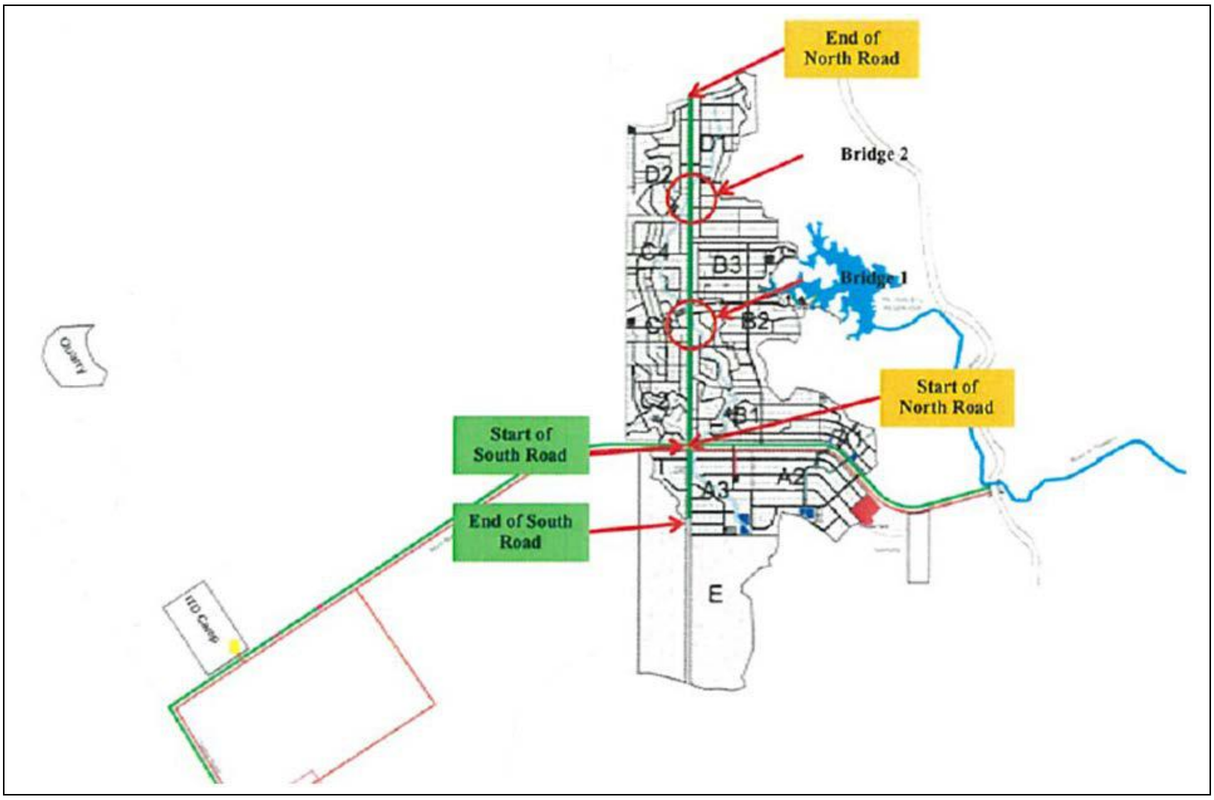
Estimated volume of vehicles on the North-South Road in the south section (in initial phase) presents in Table 4.2-4. Total Daily Two-Way Vehicle Trips is calculated and based on floor area of 3,396 Rai and on assumption that there will be 40 percent of Food and Drink Industry, 20 percent of Instrument Engineering Industry and 40 percent Clothing Industry. The Total Daily Two Way Vehicles Trips is 9,057 including number of trucks which is 10 percent or 906 vehicles per day. Traffic lane design presents in Table 4.2-5.

Estimated volume of vehicles on the North-South Road in the north section (in full phase) presents in Table 4.2-2. Total Daily Two-Way Vehicle Trips is calculated and bases on the same scenario and assumption as Main Road (4 lane) in the previous section.



Source: IEC (2015)

Figure 4.2-7 Typical Cross-section of Secondary Road



Source: IEC (2015)

Figure 4.2-8 North-South Road in Dawei Initial Estate

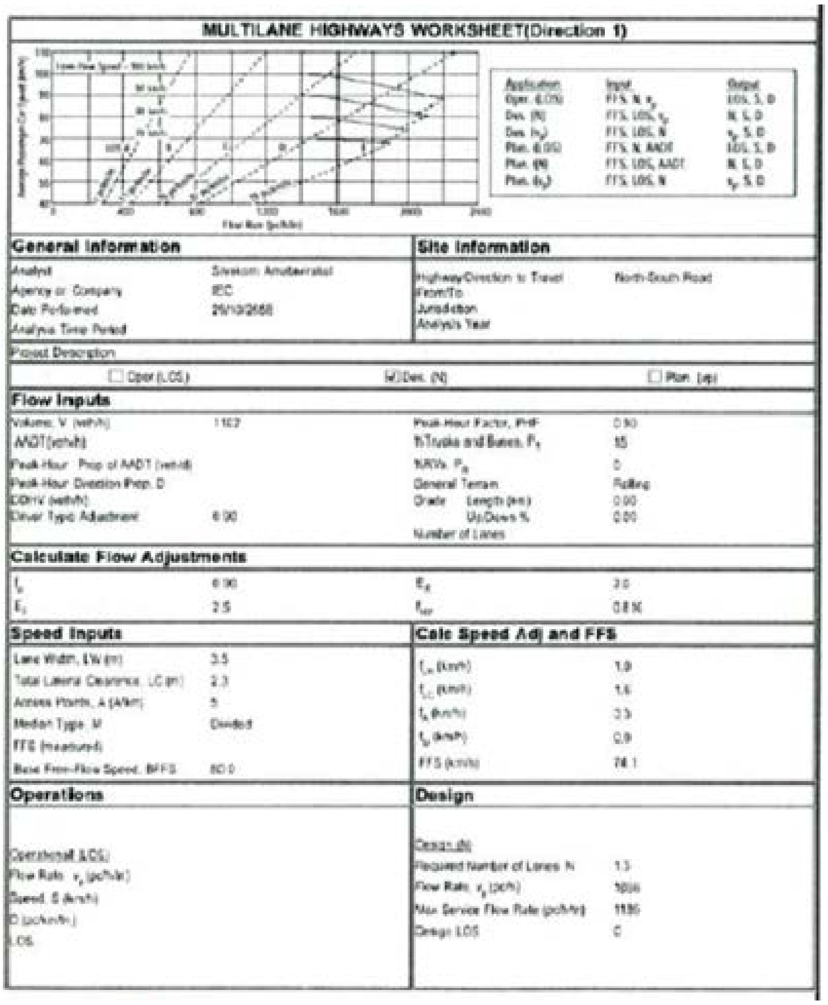
Table 4.2-4 Estimation on volume of vehicles for North-South road in South section of Dawei Industrial Estate

North-South Road	INPUT			
Independent Variables				
Office Floor Area, X_1 (1000's ft²)	3,396	**RAI**	58,489.12	(1000's ft²)
% Site Area Built On X_2 (Percentage)	70			
Total – Office Employment, X_3 (Number)	16,980		50	Percent
Total Employees, X_4 (Number)	33,960			
Food and Drink Industry	40	Percent	36,226	Trips
Instrument Engineering Industry	20	Percent	71,667	Trips
Clothing Industry	40	Percent	7,187	Trips
Total	100	OK		
Total Weekly One-Way Vehicle Trips	31,698			
Total Weekly Two-Way Vehicle Trips	63,396			
Total Daily One-Way Vehicle Trips	4,528			
Total Daily Two-Way Vehicle Trips	**9,057**	Vehicles	**ATD**	
Truck Percentage	**10**	Percent		
Total Daily Two-Way Truck Trips	**906**	Vehicles		
Total Daily Two-Way Vehicle Trips	**8,151**	Vehicles		

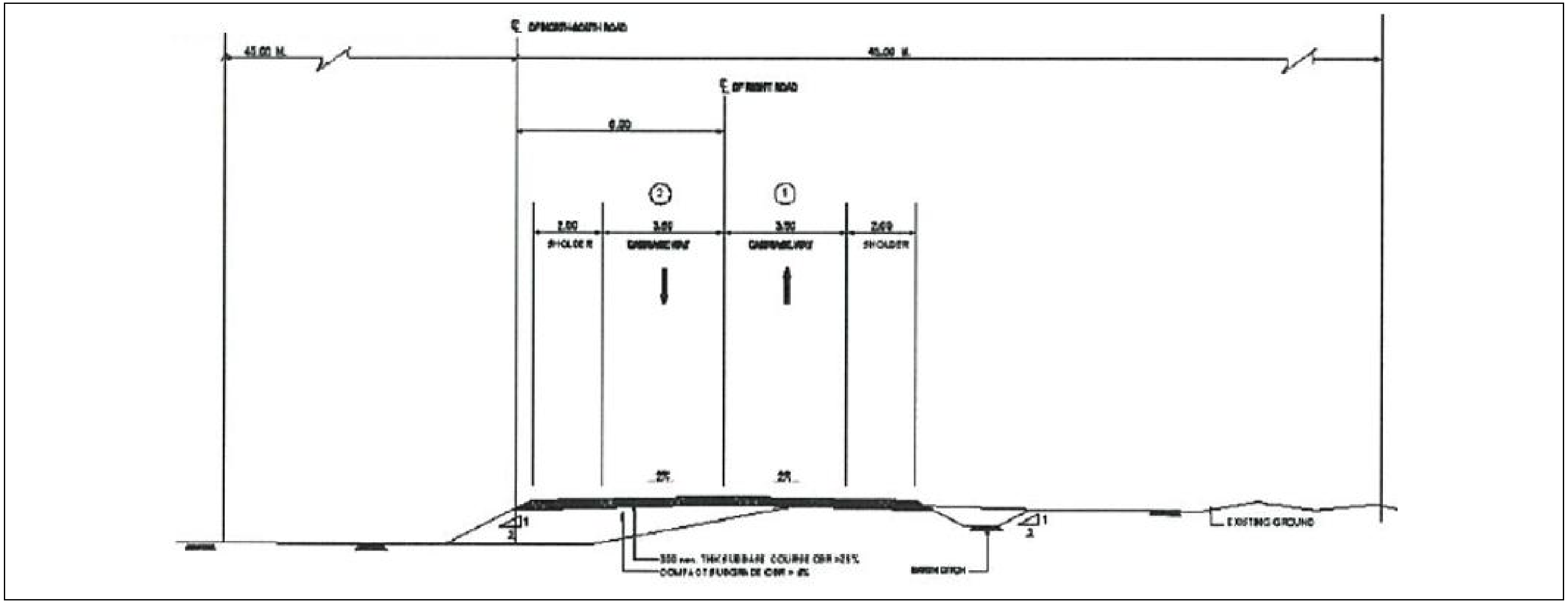
Source: IEC (2015)

Table 4.2-5 Traffic Lane Design of North-South Road in South section

North South Road
Input parameter;
ADT = 9,060 vehicles per day
K = 0.20
D = 0.60
Hourly designed volume = 1,102 vehicles per hour
Design Speed = 80 kilometer per hour
Percentage of Truck = 15%
Desired level of service : C
Output:
Number of lane (each direction) = 2

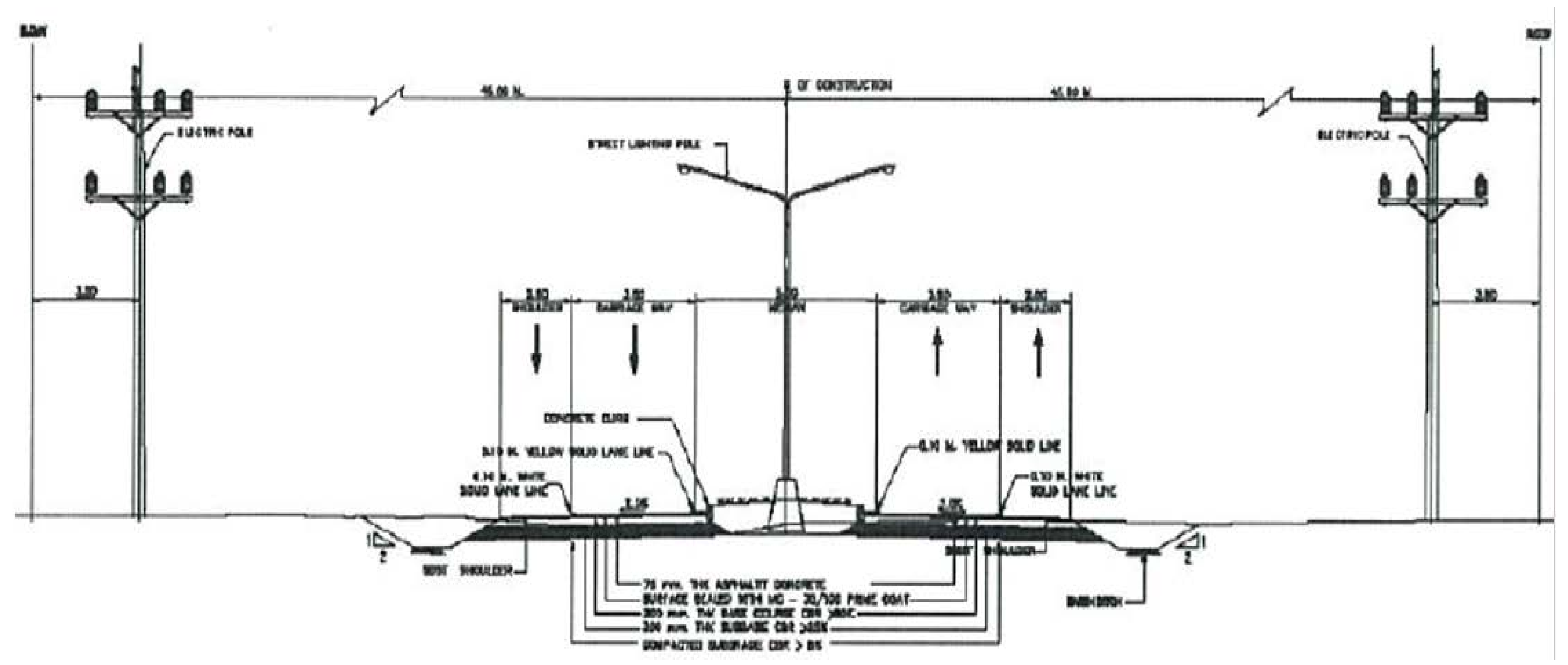


Source: IEC (2015)



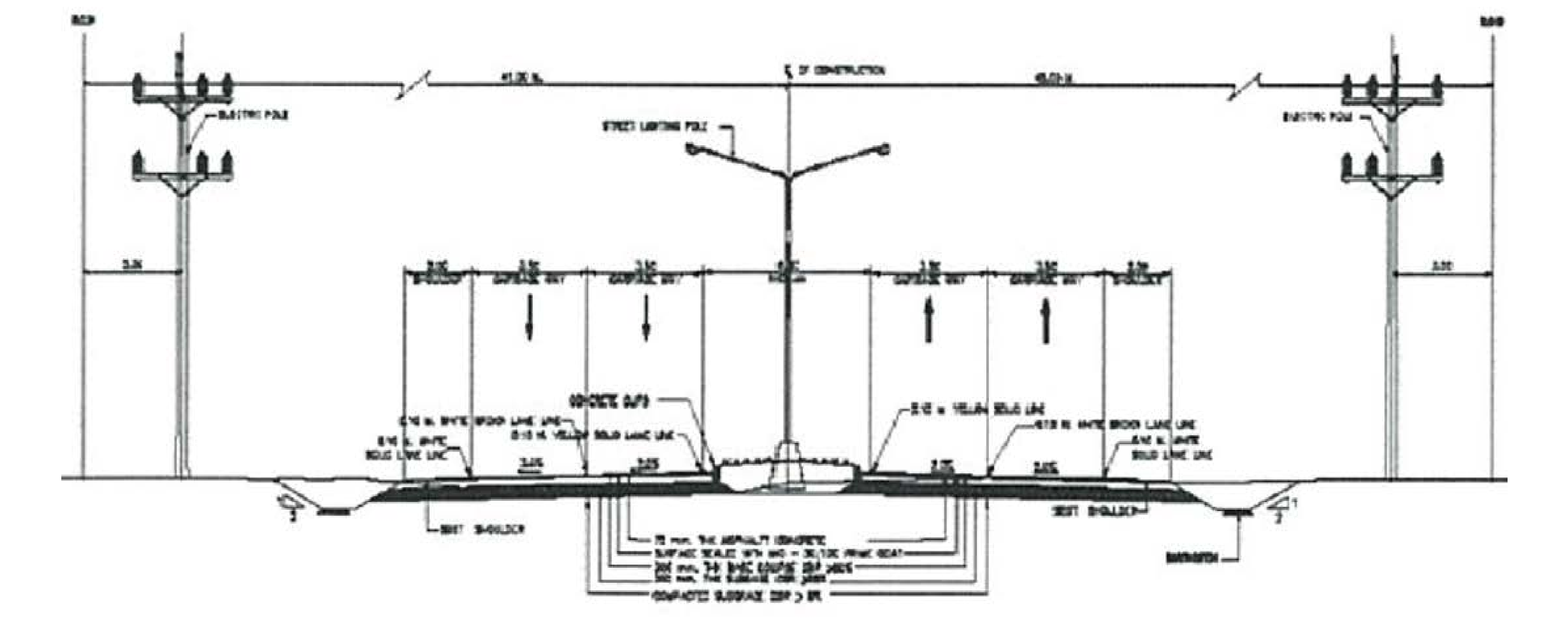
Source: IEC (2015)

Figure 4.2-9 Cross section of North-South Road in both North and South section (2-lane) in initial phase



Source: IEC (2015)

Figure 4.2-10 Cross section of North-South Road in South section (2-lane) in initial phase



Source: IEC (2015)

Figure 4.2-11 Cross section of North-South Road in North section (4-lane) in full-phase

4.2.1.3 Internal Road

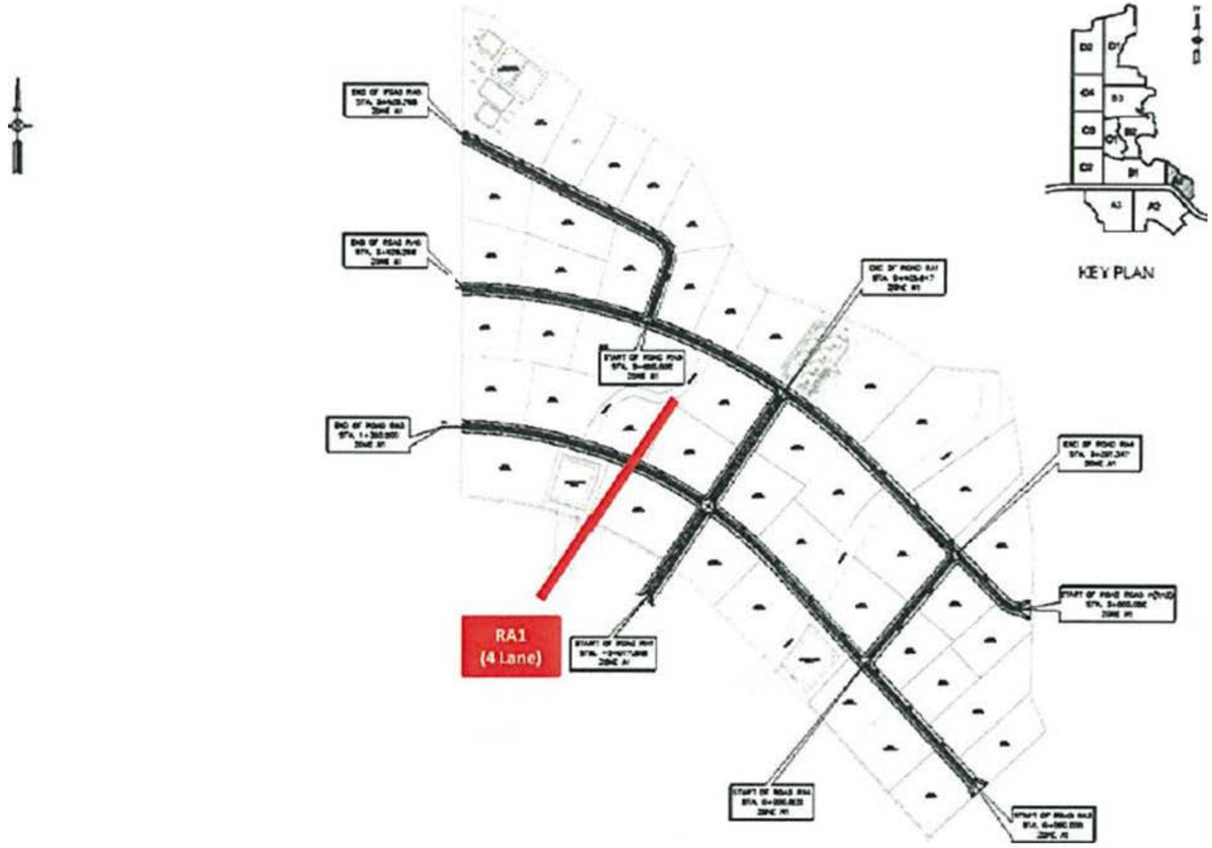
The internal roads will connect land plots within the zone together. In addition, the internal roads is tertiary road that connecting to N-S Road and Main in some locations. Design of Internal Roads base on calculation as follow.

(a) Construction Phase

The Project will develop and construct the Internal Roads for zone A1, A2 and A3 for the initial phase. The Internal Roads are 2 lane road and 4 lane road as presented in Figure 4.2-12 for Zone A1 and Figure 4.2-13 for Zone A2 and A3. The 4-Lane Roads are represented in red and yellow lines but the 2-Lane Roads are represented in black lines.

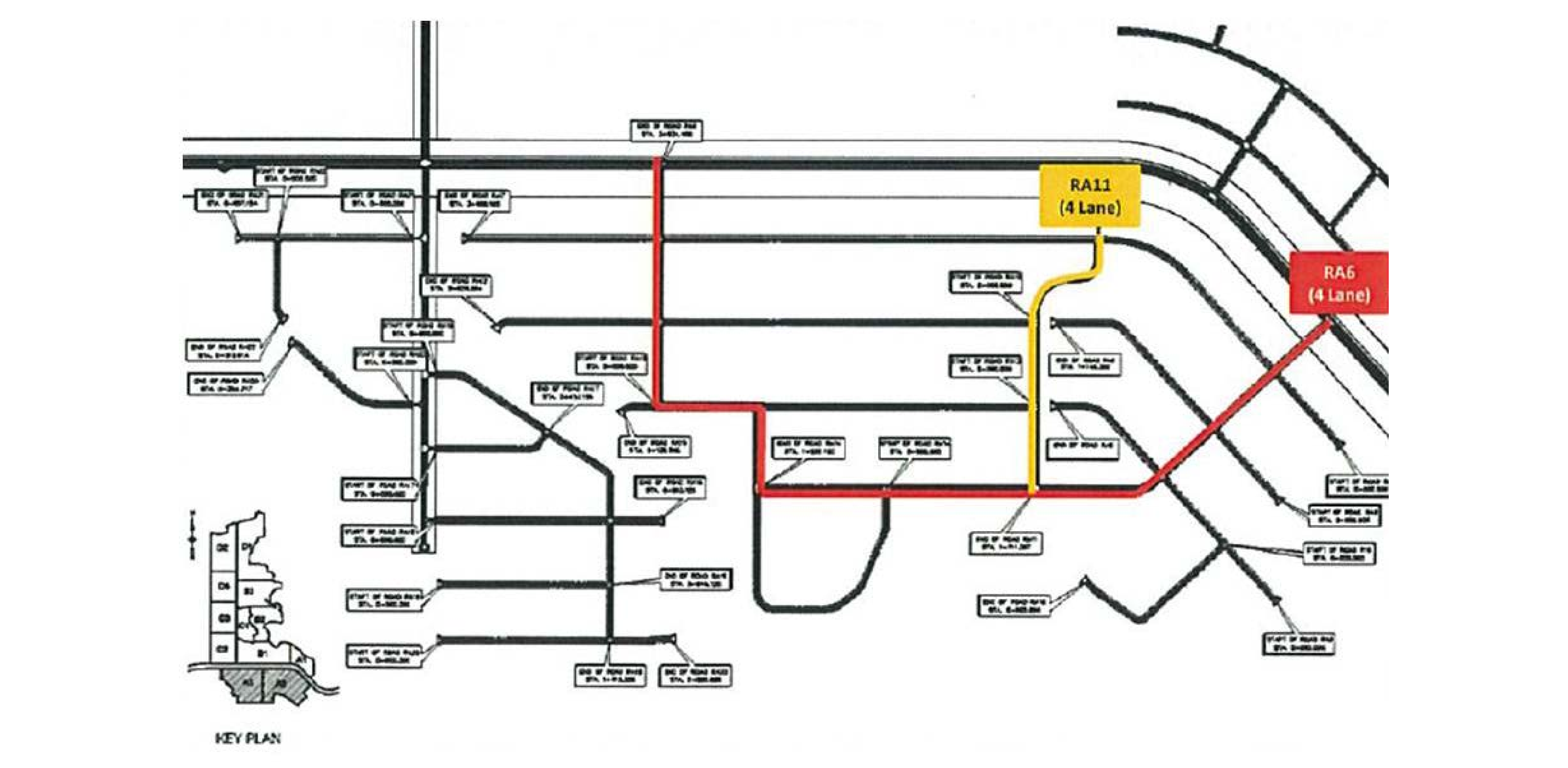
There are 2 designs for the 4-Lane Roads, single road and road alongside of channel. The single 4-lane roads with 33 meters wide and 30 meters wide will be constructed in RA 6 and RA1 as presented in Figure 4.2-14 and Figure 4.2-15, respectively. The Internal road alongside of channel will be constructed in RA11 as shown in Figure 4.2-16. The 2-lane internal road with 24 meter wide will be constructed in RA2, RA3, RA4, RA5, RA7, RA9, RA10, RA12, RA13, RA14, RA15, RA16, RA17, RA18, RA19, RA20, RA21, RA22 and RA23 as shown in Figure 4.2-17. A bridge, which is located in Zone A2 and on the single 4-lane internal road with 33 meters, will be constructed. Design of the Bridge is shown in Figure 4.2-18.

Estimated volume of vehicles on the Internal is presented in Table 4.2-6. Total Daily Two-Way Vehicle Trips is calculated and based on floor area of 2,160 Rai and on assumption that there will be 40 percent of Food and Drink Industry, 20 percent of Instrument Engineering Industry and 40 percent Clothing Industry. The Total Daily Two Way Vehicles Trips is 5,764 including number of trucks which is 10 percent or 576 vehicles per day. Traffic lanes design presents in Table 4.2-7 and Table 4.2-8.



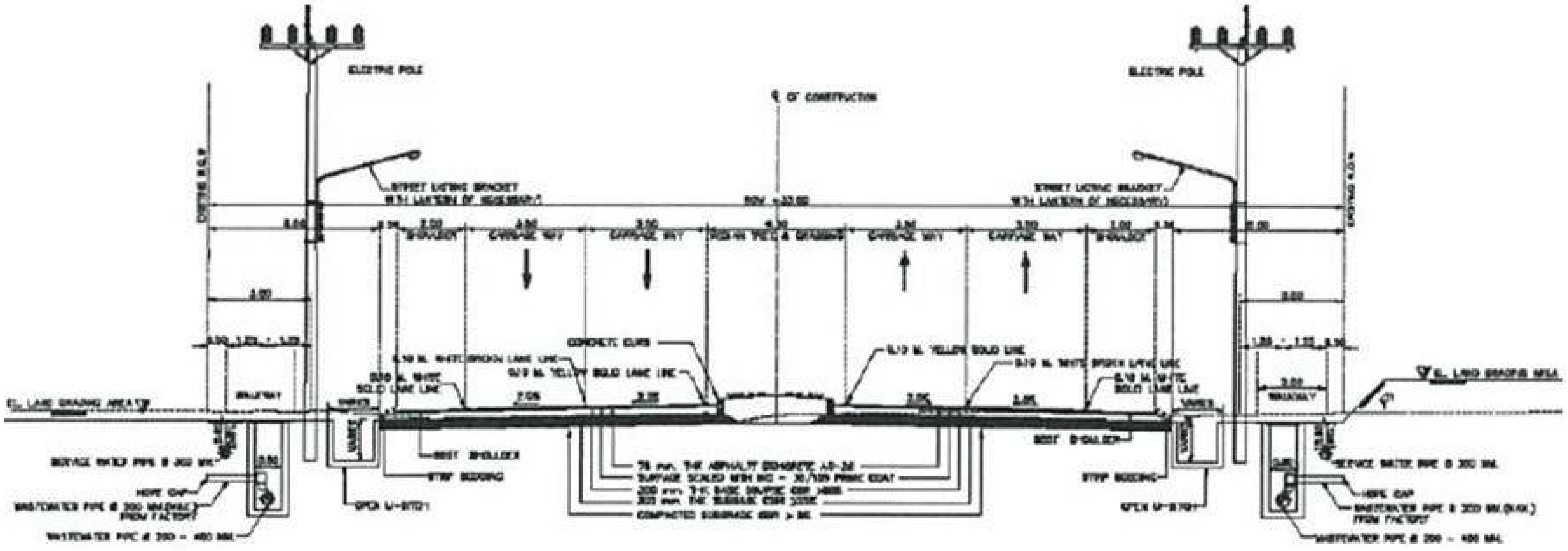
Source: IEC (2015)

Figure 4.2-12 Location of Internal Roads in Zone A1



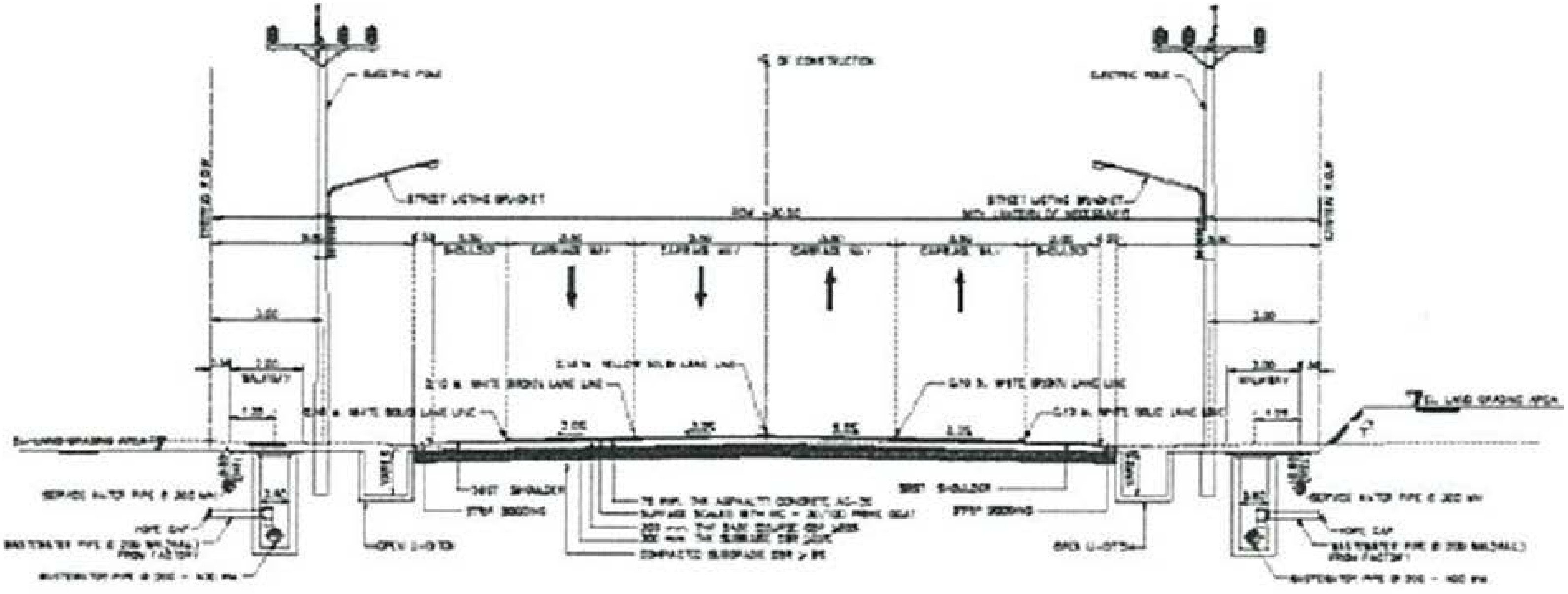
Source: IEC (2015)

Figure 4.2-13 Location of Internal Roads in Zone A2 and A3



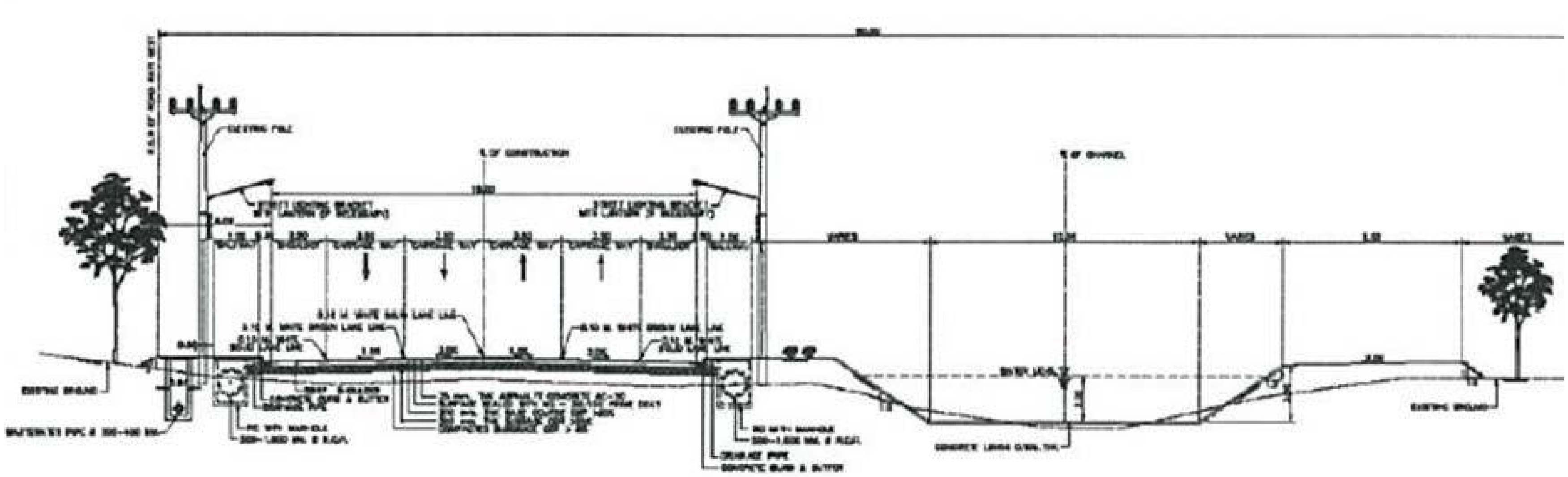
Source: IEC (2015)

Figure 4.2-14 Design of 4-Lane Internal Road with 33 meter wide in RA 6



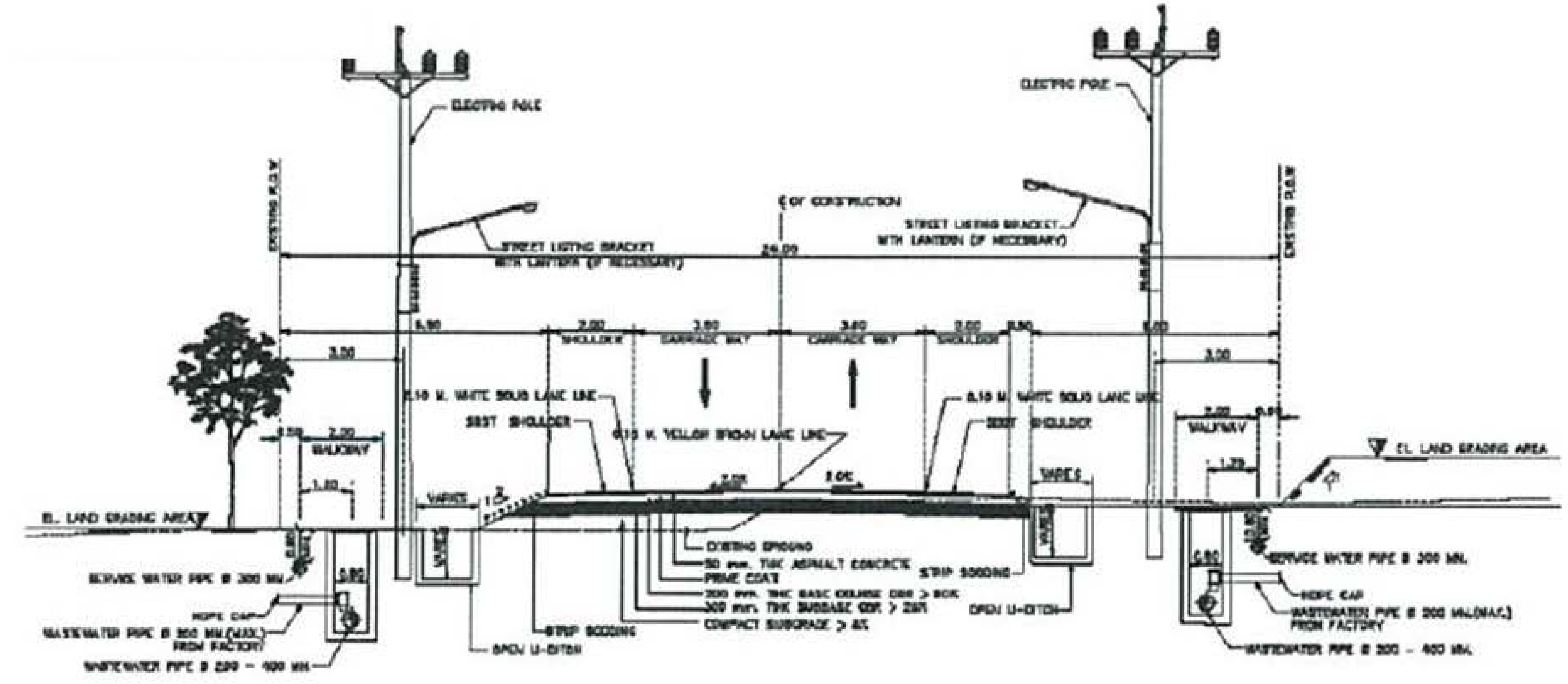
Source: IEC (2015)

Figure 4.2-15 Design of 4-Lane Internal Road with 30 meter wide in RA 6



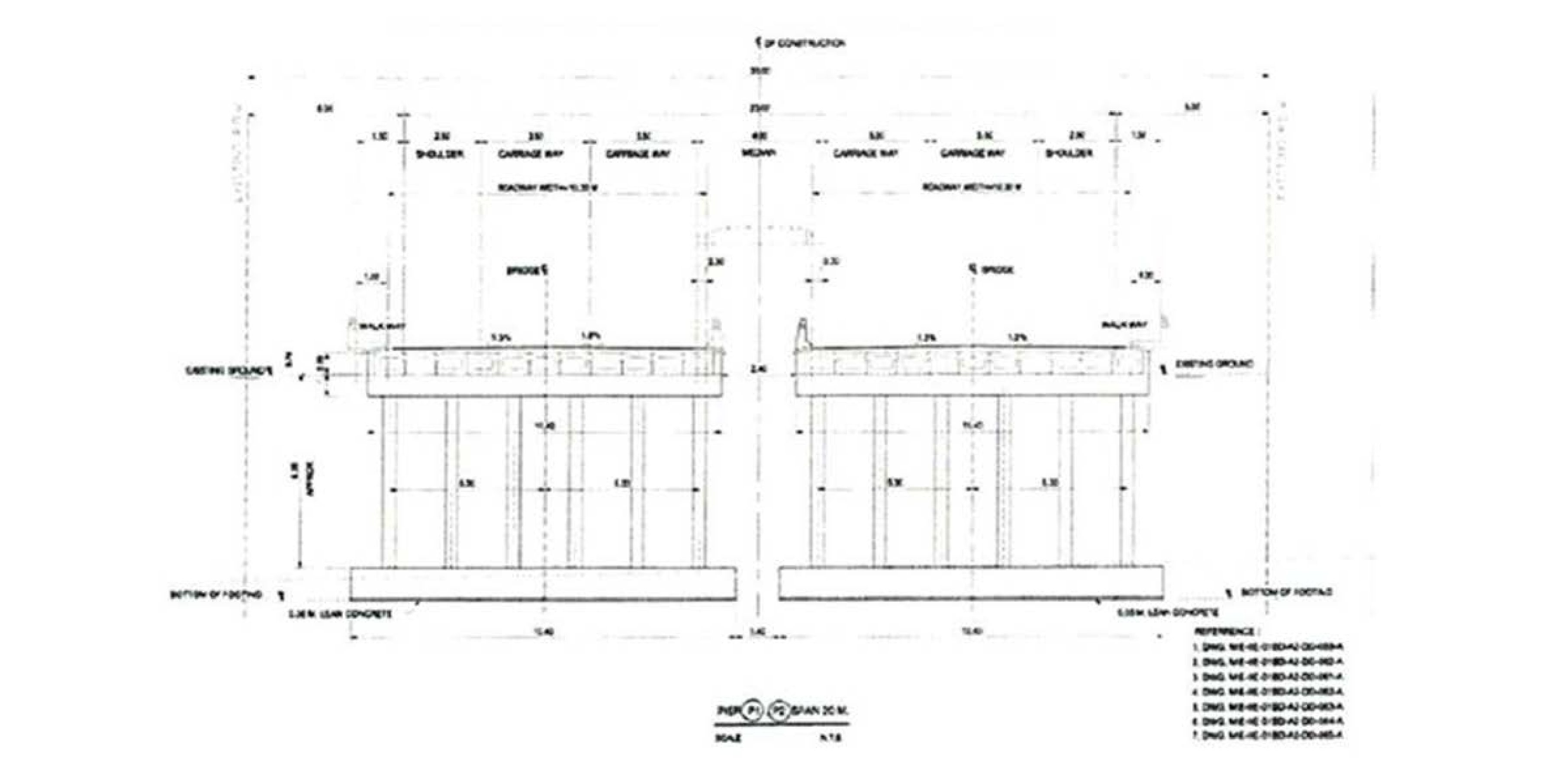
Source: IEC (2015)

Figure 4.2-16 Design of 4-Lane Internal Road along the side of channel in RA 11



Source: IEC (2015)

Figure 4.2-17 Design of 2-Lane Internal Road along the side of channel in RA 11



Source: IEC (2015)

Figure 4.2-18 Design of the bridge on 4-Lane Internal Road with 33 meter wide in RA 6

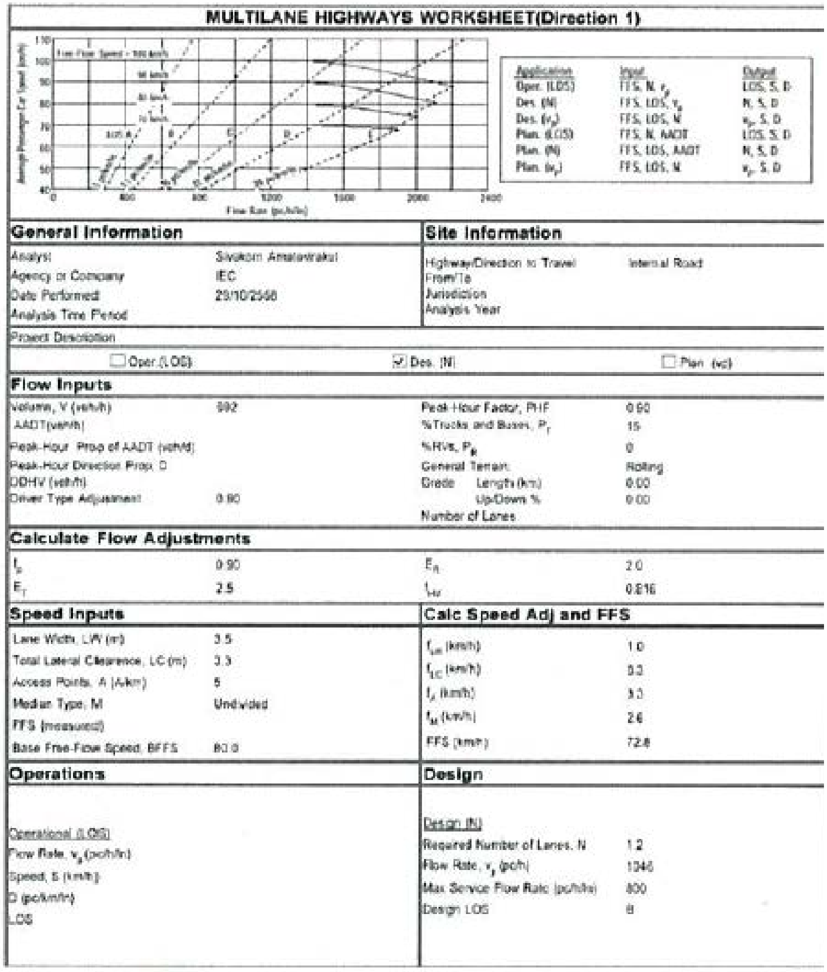
Table 4.2-6 Estimation on volume of vehicles for Internal Road in Zone A1, A2 and A3 of Dawei SEZ Initial Industrial Estate

Internal Road	INPUT			
Independent Variables				
Office Floor Area, X_1 (1000's ft^2)	2,160	**RAI**	371,995.20	(1000's ft^2)
% Site Area Built On X_2 (Percentage)	70			
Total – Office Employment, X_3 (Number)	10,800		50	Percent
Total Employees, X_4 (Number)	21,600			
Food and Drink Industry	40	Percent	23,062	Trips
Instrument Engineering Industry	20	Percent	45,587	Trips
Clothing Industry	40	Percent	4,579	Trips
Total	100	OK		
Total Weekly One-Way Vehicle Trips	20,174			
Total Weekly Two-Way Vehicle Trips	40,347			
Total Daily One-Way Vehicle Trips	2,882			
Total Daily Two-Way Vehicle Trips	**5,764**	Vehicles	**ATD**	
Truck Percentage	**10**	Percent		
Total Daily Two-Way Truck Trips	**576**	Vehicles		
Total Daily Two-Way Vehicle Trips	**5,188**	Vehicles		

Source: IEC (2015)

Table 4.2-7 Traffic Lane Design of 4-Lane Internal Road in Zone A1, A2 and A3

Internal Road
Input parameter;
ADT = 5,800 vehicles per day
K = 0.20
D = 0.60
Hourly designed volume = 692 vehicles per hour
Design Speed = 80 kilometer per hour
Percentage of Truck = 15%
Desired level of service : B
Output:
Number of lane (each direction) = 2



MULTILANE HIGHWAYS WORKSHEET(Direction 1)

Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information		Site Information	
Analyst	Sivakorn Amatavtrakul	Highway/Direction to Travel	Internal Road
Agency or Company	IEC	From/To	
Date Performed	29/10/2558	Jurisdiction	
Analysis Time Period		Analysis Year	

Project Description

☐ Oper.(LOS) ☑ Des. (N) ☐ Plan. (vc)

Flow Inputs			
Volume, V (veh/h)	692	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	15
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop. D		General Terrain	Rolling
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	0.90	Up/Down %	0.00
		Number of Lanes	

Calculate Flow Adjustments			
f_p	0.90	E_R	2.0
E_T	2.5	f_{HV}	0.816

Speed Inputs		Calc Speed Adj and FFS	
Lane Width, LW (m)	3.5	f_{LW} (km/h)	1.0
Total Lateral Clearance, LC (m)	3.3	f_{LC} (km/h)	0.3
Access Points, A (A/km)	5	f_A (km/h)	3.3
Median Type, M	Undivided	f_M (km/h)	2.6
FFS (measured)		FFS (km/h)	72.8
Base Free-Flow Speed, BFFS	80.0		

Operations		Design	
Operational (LOS)		Design (N)	
Flow Rate, v_p (pc/h/ln)		Required Number of Lanes, N	1.2
Speed, S (km/h)		Flow Rate, v_p (pc/h)	1046
D (pc/km/ln)		Max Service Flow Rate (pc/h/ln)	800
LOS		Design LOS	B

Source: IEC (2015)

Table 4.2-8 Traffic Lane Design of 2-Lane Internal Road in Zone A1, A2 and A3

Internal Road

Input parameter;

ADT = 820 vehicles per day

K = 0.60

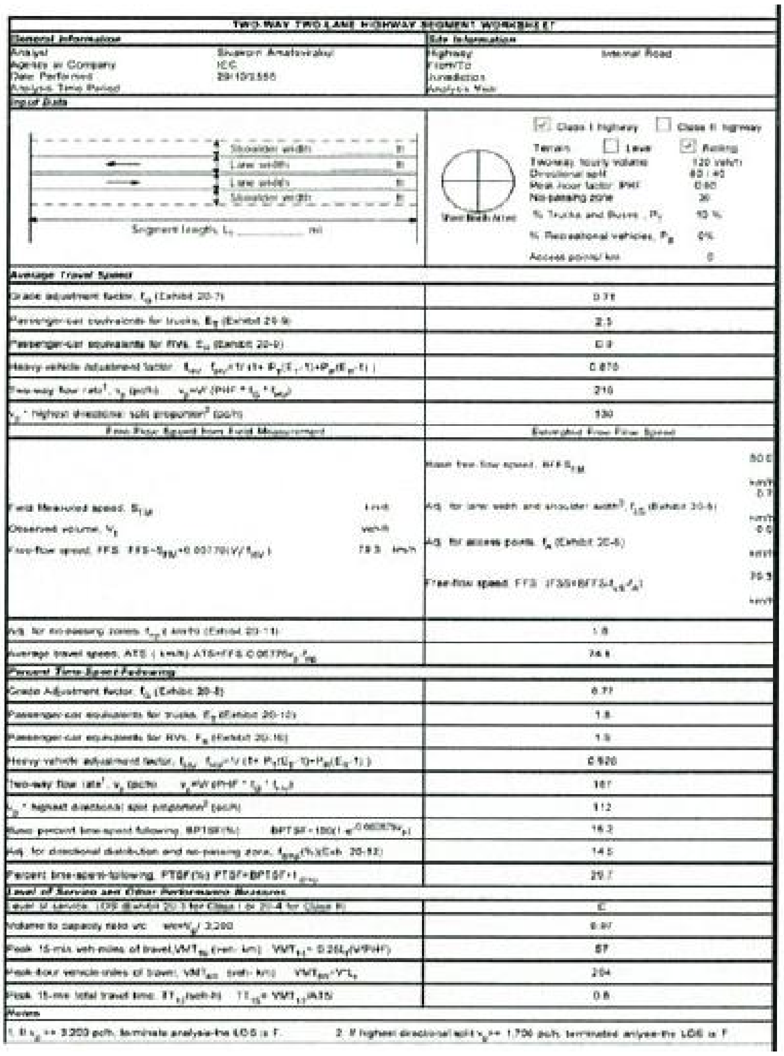
Hourly designed volume = 120 vehicles per hour

Design Speed = 80 kilometer per hour

Percentage of Truck = 10%

Output:

Level of service = C

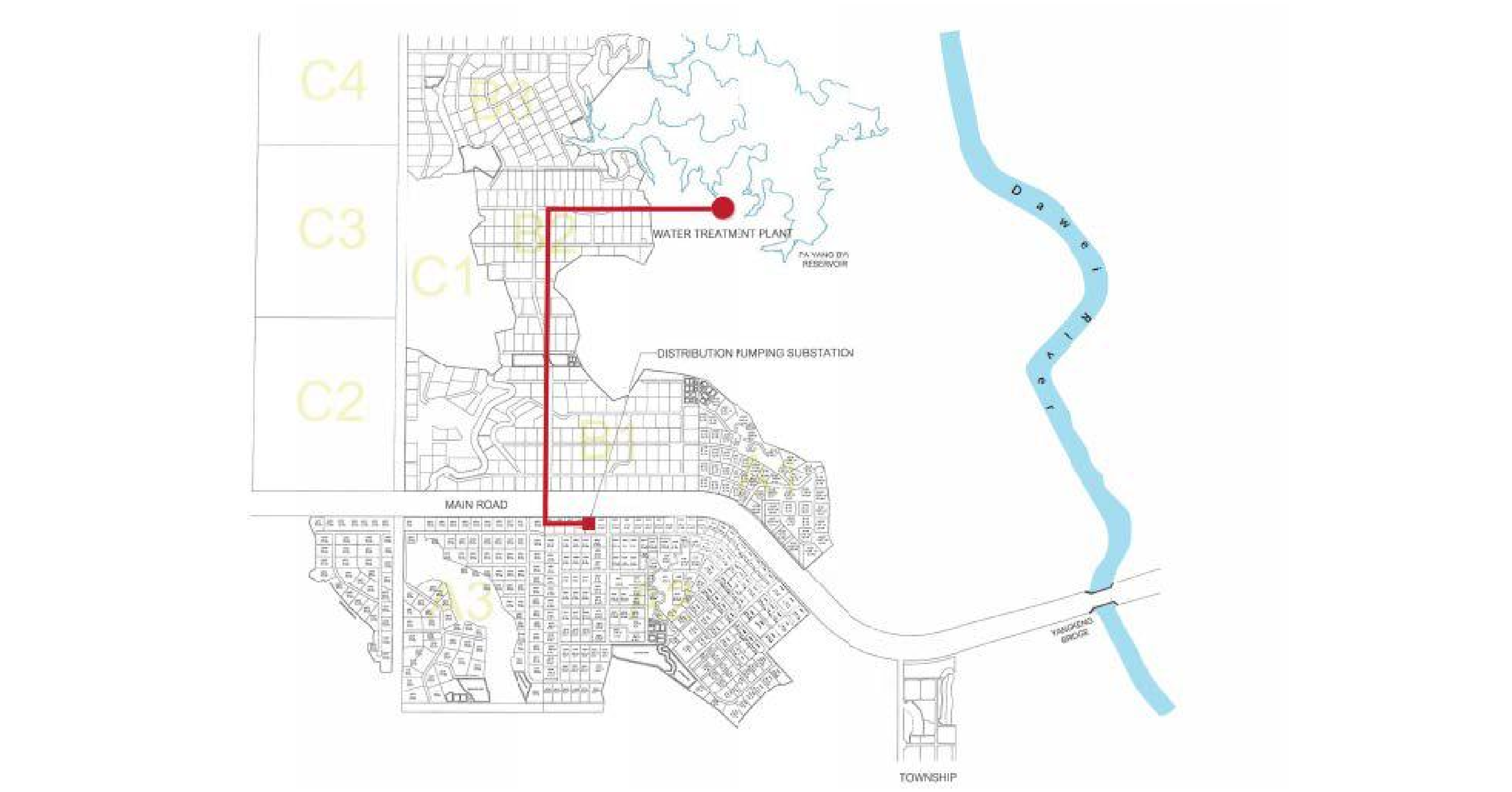


TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET	
General Information	**Site Information**
Analyst: [illegible]; Agency or Company: IEC; Date Performed: 29/10/2558; Analysis Time Period	Highway: Internal Road; From/To; Jurisdiction; Analysis Year
Input Data	
Shoulder width ft; Lane width ft; Lane width ft; Shoulder width ft; Segment length, L_t ___ mi	Class I highway ☑; Class II highway ☐; Terrain: Level ☐, Rolling ☑; Two-way hourly volume 120 veh/h; Directional split 60 / 40; Peak-hour factor, PHF 0.60; No-passing zone 30; % Trucks and Buses, P_T 10 %; % Recreational vehicles, P_R 0%; Access points/ km 0
Average Travel Speed	
Grade adjustment factor, f_G (Exhibit 20-7)	0.71
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	2.5
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	0.9
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.870
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF*f_G*f_{HV})$	210
v_p * highest directional split proportion[2] (pc/h)	130
Free-Flow Speed from Field Measurement	Estimated Free-Flow Speed
Field Measured speed, S_{FM} km/h; Observed volume, V_f veh/h; Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$ 79.3 km/h	Base free-flow speed, $BFFS_{FM}$ 80.0 km/h; Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5) 0.7 km/h; Adj. for access points, f_A (Exhibit 20-6) 0.0 km/h; Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$ 79.3 km/h
Adj. for no-passing zones, f_{np} (km/h) (Exhibit 20-11)	1.8
Average travel speed, ATS (km/h) $ATS=FFS-0.00776v_p-f_{np}$	74.6
Percent Time-Spent-Following	
Grade Adjustment factor, f_G (Exhibit 20-8)	0.77
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	1.8
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	1.0
Heavy-vehicle adjustment factor, f_{HV} $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.920
Two-way flow rate[1], v_p (pc/h) $v_p=V/(PHF*f_G*f_{HV})$	187
v_p * highest directional split proportion[2] (pc/h)	112
Base percent time-spent-following, BPTSF(%) $BPTSF=100(1-e^{-0.000879v_p})$	16.3
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%) (Exh. 20-12)	14.5
Percent time-spent-following, PTSF(%) $PTSF=BPTSF+f_{d/np}$	29.7
Level of Service and Other Performance Measures	
Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	C
Volume to capacity ratio v/c $v/c=V_p/3,200$	0.07
Peak 15-min veh-miles of travel, VMT_{15} (veh-km) $VMT_{15}=0.25L_t(V/PHF)$	87
Peak-hour vehicle-miles of travel, VMT_{60} (veh-km) $VMT_{60}=V*L_t$	204
Peak 15-min total travel time, TT_{15} (veh-h) $TT_{15}=VMT_{15}/ATS$	0.8
Notes	
1. If v_p >= 3,200 pc/h, terminate analysis-the LOS is F.	2. If highest directional split v_p >= 1,700 pc/h, terminated analysis-the LOS is F

Source: IEC (2015)

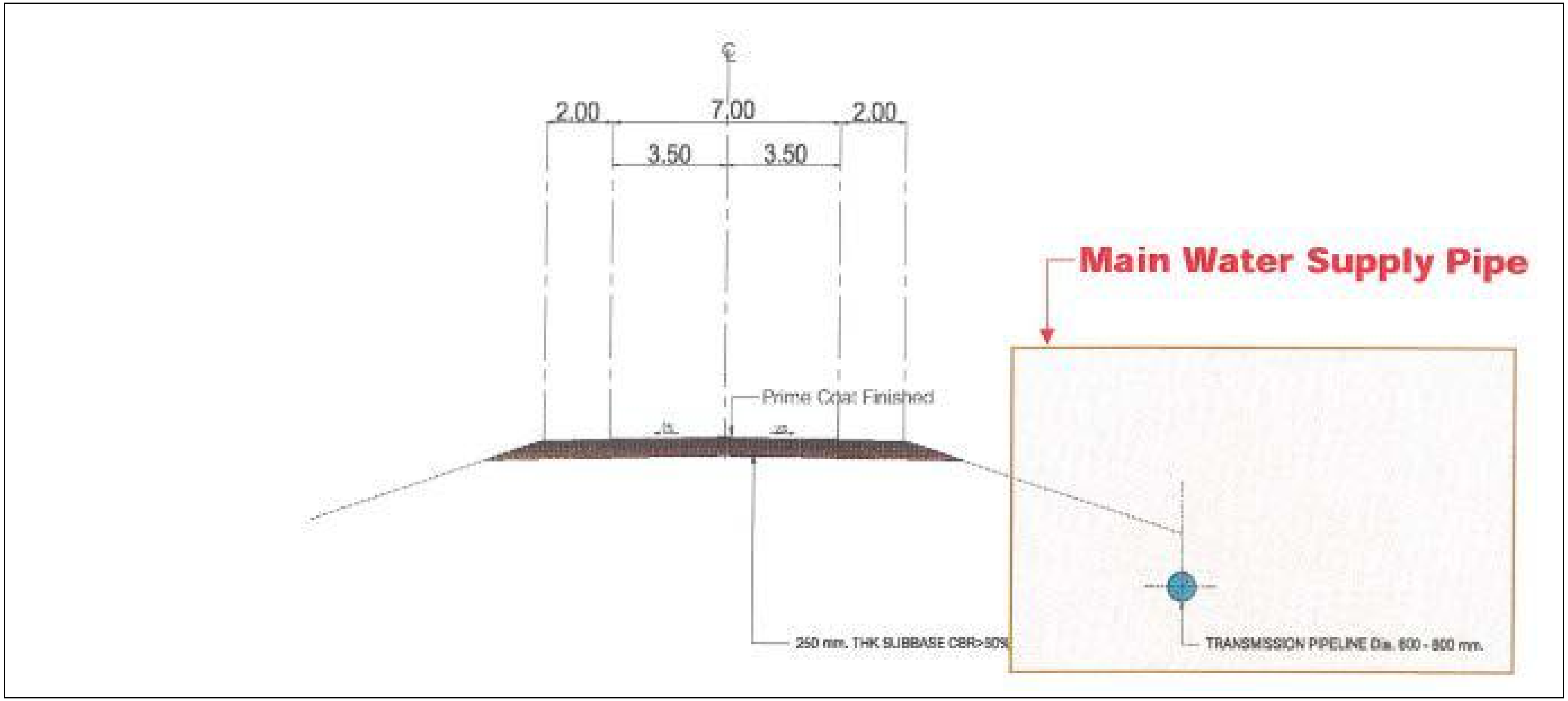
4.2.1.4 Access Road for Facility

In the initial phase, the Project will construct an access road. The road will be 2 lane starting from distribution pump station in zone A2 to the water treatment plant which is located outside of the Project are, near the reservoir (Figure 4.2-19.) Design of the road present in (Figure 4.2-20.).



Source: ESIA Study Team

Figure 4.2-19 Access road from Water Treatment Plant to Distribution Pump Station in Zone A2 of Industrial Estate



Source: IEC (2015)

Figure 4.2-20 Cross section from Water Treatment Plant to Distribution Pump Station in Zone A2 of Industrial Estate

4.2.2 Water Treatment System

Water Treatment System is a key component of DSEZ in supplying water for all activities. The Project had a feasibility study.in order to develop and design the Water Treatment System. The Water Treatment and Distribution System will be progressively developed to meet expected water demand of each phase of the industrial estate development. For the initial phase, the Water Treatment System will be able to supply 36,000 cubic meters per day and the total capacity of the Water Treatment Plant in full phase will be able to achieve 130,000 cubic meters per day (ITD, 2015).

4.2.2.1 Water Treatment Plant

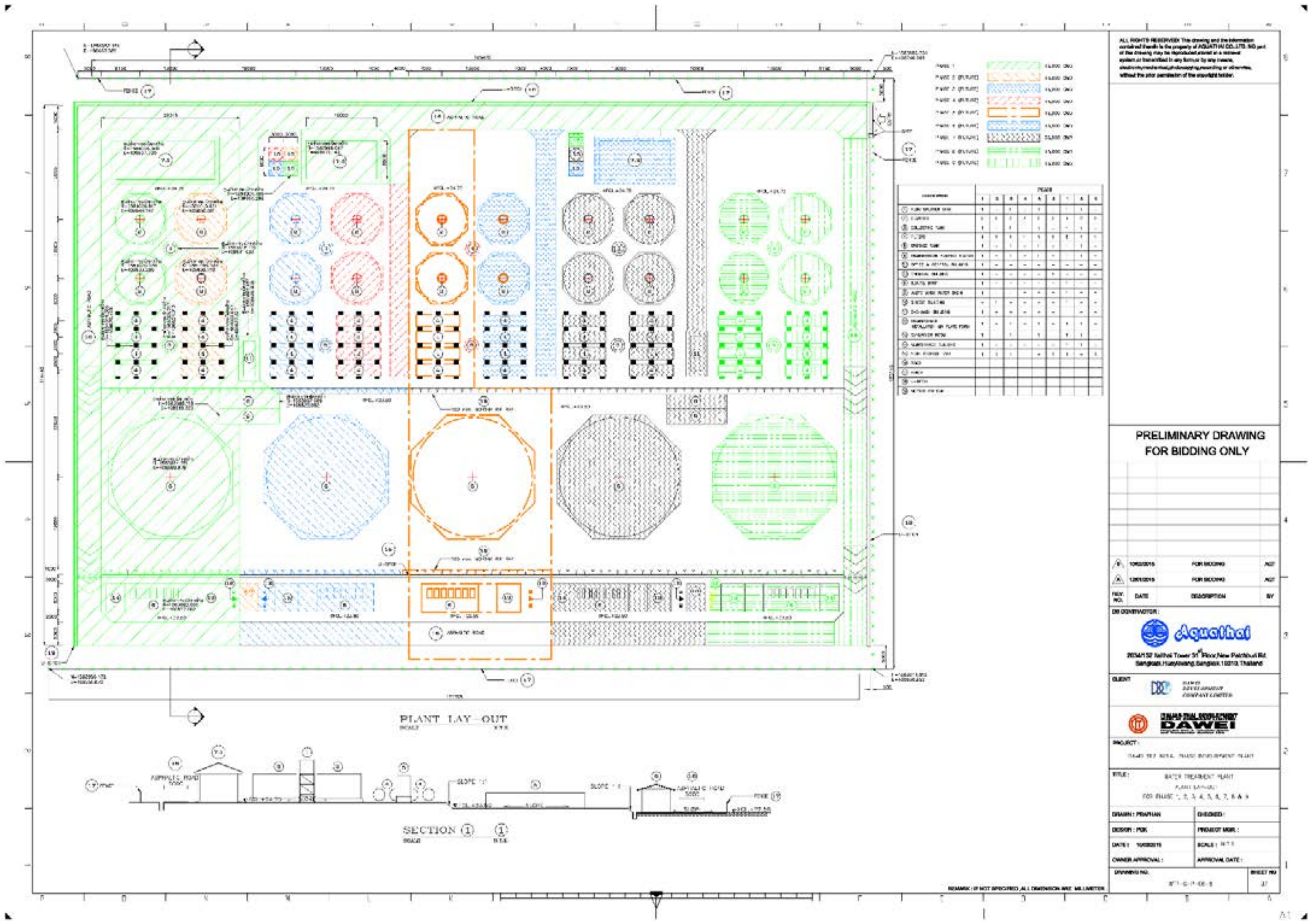
The Water Treatment Plant will be located in adjacent of the Project area, nearby Pa Yain Byu reservoir (Figure 4.2-21). The reservoir is major supply of raw water to the Water Treatment Plan for the initial phase prior the Ka Loat Htar dam is ready to supply water for entire phase of DSEZ. The Pa Yain Byu can store water around 7.7 million cubic meters and will have enough capacity to supply water for both Initial Industrial Estate and Township uses. Description and capacity of the Pa Yain Byu reservoir is in Initial Environmental Examination (see Annex4-1).

The water treatment and distribution system will be progressively developed to meet expected water demand of each phase of the industrial estate development. For the initial phase, the Water Treatment Plant will be able to supply 36,000 cubic meters per day and the total capacity of the Water Treatment Plant in full phase will achieve to approximately 130,000 cubic meters per day (ITD, 2015).

Water Treatment Plant (WTP) is consists of: Raw Water Lift Pump Station, Flow Splitter Tank, Clarifier, Collecting Tank, Sand Filter Tank, Sludge Basin & Waste Wash Water Basin, Treated Water Storage Tank, Chemical Building, Chemical Building Equipment, Office and Control Building, Transmission Pumping Station, Air Blower and Back Wash Pump Building, Alum Storage Tank, Sludge Dewatering Building. Plans and section of the Water Treatment Plant components presents in Figure 4.2-22 to Figure 4.2-34.

(a) Raw Water Pumping Station

Raw Water Pumping Station is designed based on parameters in Table 4.2-10. Capacity of the pumps is 383 cubic meter per hour for each phase.



Source: IEC (2015)

Figure 4.2-21 Layout and section of Water Treatment Plant for Dawei Industrial Estate

Table 4.2-9 Water Design Flow for WTP for Zone A-D

Parameter	Phase							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Water Demand (m^3/day)	**32,820**	65,630	---	98,430	---	126,570	---	---
Plant Max Capacity (m^3/day)	**18,000**	36,000	54,000	72,000	90,000	108,000	144,000	162,000
Plant Capacity Each phase (m^3/day)	**18,000**	18,000	18,000	18,000	18,000	18,000	36,000	18,000

Source: IEC (2015)

Table 4.2-10 Requirement of Raw Water and number of Pumps

Parameter	Phase							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Raw Water (m^3/day)	**18,367**	36,735	55,102	73,469	91,837	110,204	146,939	165,306
Raw Water in Each Phase (m^3/day)	**18,367**	18,367	18,367	18,367	18,367	18,367	36,735	18,367
Pump On Duty	**2**	2	2	2	2	2	4	2
Pump On Standby	**1**	1	1	1	1	1	2	1
Total Number of Pumps	**3**	3	3	3	3	3	6	3

Source: IEC (2015)

(b) Flow Splitting Tank

Flow Splitting Tanks are designed base on 0.5 minutes of Hydraulic Retention Time (HRT). Designed flow rate is 765 m^3 per hour with required volume 6.38 m^3 [(765 ÷ 60) x 0.5]. Choose tank diameter is 2.4 meters. Side Water Depth (SWD) is 2.9 meters. Actual volume is 13.11 m3. Actual Hydraulic Retention Time is 1.03 minutes. More than 388 cubic meter per hour of Weir/Tank Flow Rate is OK. Summarized specification of Flow Splitting Tank is in Table 4.2-11

Table 4.2-11 Design of Flow Spitting Tank System

Parameter	Phase 1-2	Phase 3-4	Phase 5-6	Phase 7	Phase 8
Tank	**1**				
Diameter (m)	**2.4**				
SWD (m)	**2.9**				
Weir/ Tank	**4**	4	4	4	2
Flow Rate/Weir (m^3/ hr)	**383**	383	383	383	191.5

Source: IEC (2015)

(c) Clarifier

Selected number of clarifier is 2 or twice of 50 percent of design flow. Flow Capacity is 765 cubic meters per hour per phase except phase 7 is 1,530 cubic meters per hour. Unit Capacity is 383 meters per hours per set. Rise rate ranges 4 to 6 cubic meter per square meter per hour or with average of 4.5 cubic meter per square meter per hour. SWD is 4.9 meter each phase and Freeboard is 0.15 meter. Therefore, cross section of required area is 85 square meter at 4.5 meter per hour (383 ÷ 4.5) each phase. Choose clarifier has 10.4 in diameter and is internal plate. Summarized specification of Clarifier is in Table 4.2-12

Table 4.2-12 Capacity and number of Clarifier

Parameter	Phase		
	1-6	**7**	**8**
Capacity (m^3/ hr)	**765**	1,530	765
Clarifier	**2**	4	2

Source: IEC (2015)

(d) Collecting Tank

Collecting Tanks are designed base on 0.5 minutes. Designed flow rate is 750 m^3 per hour with required volume 6.25 m^3 [(750 ÷ 60) x 0.5]. Choose tank diameter is 2.4 meters. SWD is 3.4 meters. Actual volume is 13.11 m^3. Actual Hydraulic Retention Time is 1.05 minutes. Flow rate of weir is 375 cubic meter per hour and more than 388 cubic meter per hour calculated flow rate of weir is ok. Length and head on weird crest is 0.5 and 0.151 meter, respectively.

Phase 1 to 2, Phase 3 to 4, and phase 5 to 6, phase 7 and phase 8 require one each of the collecting tanks.

Table 4.2-13 Design of Collecting Tank

Parameter	Phase 1-2	Phase 3-4	Phase 5-6	Phase 7	Phase 8
Tank	**1**				
Diameter (m)	2.4				
SWD (m)	3.4				

(e) Filter

Selected number of filter is 4 or four times of 25 percent of design flow. Flow Capacity is 750 cubic meters per hour per phase. Unit Capacity is 188 meters per hours per set. Filtration rate is 15 cubic meter per square meter per hour and has maximum rate during one backwash. Required Filter area is 16.7 m2 {[750 ÷ (4-1)] ÷ 5}. Therefore, choose filter is 20 square meter per set. Check filtration rate is 9.4 cubic meter per square meter per hour at normal and Check filtration rate is 12.5 cubic meter per square meter per hour at oe backwash, Ok less than fifteen. Summarized specification of Filter is in Table 4.2-14.

Table 4.2-14 Design of Filter

Parameter	Phase							
	1	2	3	4	5	6	7	8
Capacity Each Phase (m^3/hr)	750	750	750	750	750	750	1,500	750
Number of Filter	4	4	4	4	4	4	8	4
Normal Capacity (m^3/hr/set)	188	188	188	188	188	188	188	188
Selected Filter	2.5-9.3							
Effective Filter Area (m^2/set)	20	20	20	20	20	20	20	20
Normal Filtration Rate (m^3/m^2/hr)	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
During Backwashing (m^3/m^2/hr)	12.8	10.9	12.8	10.9	12.8	10.9	10.9	12.8
Backwash System	Automatic with Air and Water by Timer							

Table 4.2-14 Design of Filter

Parameter	Phase							
	1	2	3	4	5	6	7	8
Air Scouring Rate ($m^3/m^2/hr$)	45							
Wash Water Rate ($m^3/m^2/hr$)	15							

Table 4.2-14 Design of Filter (Cont.)

Parameter	Phase							
	1	2	3	4	5	6	7	8
Water Inlet Valve (mm)	200							
Water Outlet Valve (mm)	200							
Backwash Water Inlet valve (mm)	250							
Backwash Water Outlet valve (mm)	250							
Air Scouring Valve (mm)	150							
Air Vent	50							
Water Inlet Valve (mm)	200							
Effective Size (mm)	0.95 - 1.2							
U.C.	1.5							
Depth (m)	0.95							
Effective Size (mm)	3-5							
Depth (m)	0.05-0.1							
Nozzle D-25 for Metal Floor	55 sets / m^2							

Source: IEC (2015)

(f) Treated Water Storage Tank

Treat Water Storage Tanks are designed base on 1.25 hour of Hydraulic Retention Time (HRT). Designed flow rate is 1500 m3 per hour with required volume 1,875 m3 [(1500 x 1.25]. Choose tank diameter is 29.65 meters. Side Water Depth (SWD) is 3.0 meters. Actual

volume is 2,070 m3. Actual Hydraulic Retention Time is 1.38 hour which is more than 1.25 hour, OK. Summarized specification of Treated Water Storage Tank is in Table 4.2-15

Table 4.2-15 Design of Treat Water Storage Tank

Parameter	Phase 1-7	Phase 8
Tank (each phase)	**1**	**1**
Diameter (m)	29.65	22.0
Actual volume (m^3)	2,070	1,140

Source: IEC (2015)

(g) Sludge

Sludge is solids precipitation in water. Majority of sludge in the water treatment processes are from Alum and Lime dosing and raw water. Calculation of sludge quantity and it design is summarized in Table 4.2-16

Table 4.2-16 Sludge quantity and design of Sludge Dewatering Belt

A. Sludge from Solids			
Capacity of water treatment plant	=	750	m^3 / hr
Total flowrate of water	=	18,000	m^3 / day
Estimated sludge weight and flowrate			
Alum & lime dosing rate	=	65.0	g / m^3
Assume			
Ratio of suspended solid generate per alum & lime dosing	=	0.5	
• Suspended solid from alum & lime dosing	=	33	g/m^3
Turbidity of raw water for calculation	=	35	NTU/SS (mg/l)
• Suspended solid from raw water	=	13	g/m^3
Total Suspended Solid	=	46	g / m^3
	=	0.046	kg / m^3
	=	34.5	kg / hr
Total Suspended Solid Load (each phase)	=	**828**	**kg / day**
Assume			
Sludge concentration	=	0.5%	of total

	=	5	kg / m^3
	=	165	m^3 / day

B. Sludge from Clarifier

Assume			
Sludge drain from Clarifier	=	1%	
Volume of Water in Clarifier	=	766	m^3 / hr
	=	18,367	m^3 / day
Total volume of sludge drain from the clarifier	=	7.7	m^3 / hr
	=	184	m^3 / day
Total Suspended Solid Load	=	**39**	**kg / hr**

C. Design of Sludge Dewatering Belt

Assume			
Dewatering rate of GBT Belt	=	120	kg / hr / m of belt width
Operating time	=	22	hr / day (incl. idle)
Belt width (available in)	=	1.2	m
Estimate			
Maximum Total Suspended Solid Sludge in 6th phase	=	4,950	kg / day
	=	225	kg / hr
Require 2 Belts	=	2.4	m
Actual Dewatering rate	=	94	kg / hr / m of belt width
OK	<	120	kg / hr / m of belt width

Source: IEC (2015)

Sludge instantly derives from the Alum and Lime dosing and raw water. Only sometimes, sludge will derive from the Clarifier. Estimated total load of solid sludge for each phase is 828 kilograms per day or 165 cubic meter per day. As the result, in 6th phase of the Project's development, the totally daily load of solid sludge will be around 4,950 kilograms per day [□828 X 6] or 225 kilograms per hour (base on 22 working hours) and actual belt width is 1.87 meters. If the Project designs 2 belts with total 2.4 meters in width of the press loading

belt, the belt press loading rate will be 94 kilograms per hour per meter. Therefore, the designed rate of the Dewatering Belt at 120 kilogram per hour per meter is applicable, OK.

Although, the calculated Sludge Basin is 82.5 cubic meter per phases, choose Sludge Basin is 100 cubic meter (per phases as shown in Table 4.2-17) and with 12 hours of Hydraulic Retention Time. There will have 2 Sludge pumps in phase 1 to phase 6 and the other 2 Sludge pumps will be added for phase 7 to phase 8. Capacity of the Sludge pumps are the same type for each phase. They are 3 bar and 4 kilowatts and can pump at 15 cubic meter of sludge per hour. They will work 100 percent of their efficiency. Belt of the Sludge Dewatering is the Gravity Belt Thickener (GBT) with 1.2 meter of belt width each.

Table 4.2-17 Sludge Basins and Sludge Dewatering in each phase

Items	Phase 1 - 4	Phase 5 - 6	Phase 7 - 8
Sludge Basin (per entire phases)	1		1
Sludge pump	2		2
Sludge Dewatering	1	1	1

Source: IEC (2015)

(h) Waste Wash Water

The Water Treatment Water Filter and Basin requires a wash. Rate of Backwash system is 15.00 per cubic meter per square meter per hour. Filter area is 20 square meter and it will take 10 minutes in each washing. Volume of water consuming in Backwash is 50 cubic meter per batch. For standard twice washes (2 batches), will consume 100 cubic meter and will generate 100 cubic meter of Waste Wash Water (WWW) per time of washing.

Thus, selected Tank size for WWW basin is 2.65 meter in width, 11.95 meter in length and Side Water Depth is 3.20 meters with actual volume of the tank is 101.3 cubic meter. There will have 3 Recycle pumps in phase 1 to phase 6 and the other 3 Recycle pumps will be added in phase 7 to phase 8 (Table 4.2-18). Capacity of the Recycle pumps are the same type for each phase. They are 3 bar and 4 kilowatts and can pump at 18 cubic meter of WWW per hour and at 36 cubic meter of WWW per hour, respectively. They will work only 50 percent of their efficiency.

Table 4.2-18 Waste Wash Water Basins for each phase

Parameters	Phase 1 -6	Phase 7-8
WWW Basin (per entire phases)	1	1
Recycle pump	3	3

Source: IEC (2015)

(i) Chemical System

Four main chemicals; Alum, Lime, Polymer and Chlorine will be used in the Water Treatment Plant. Details are below

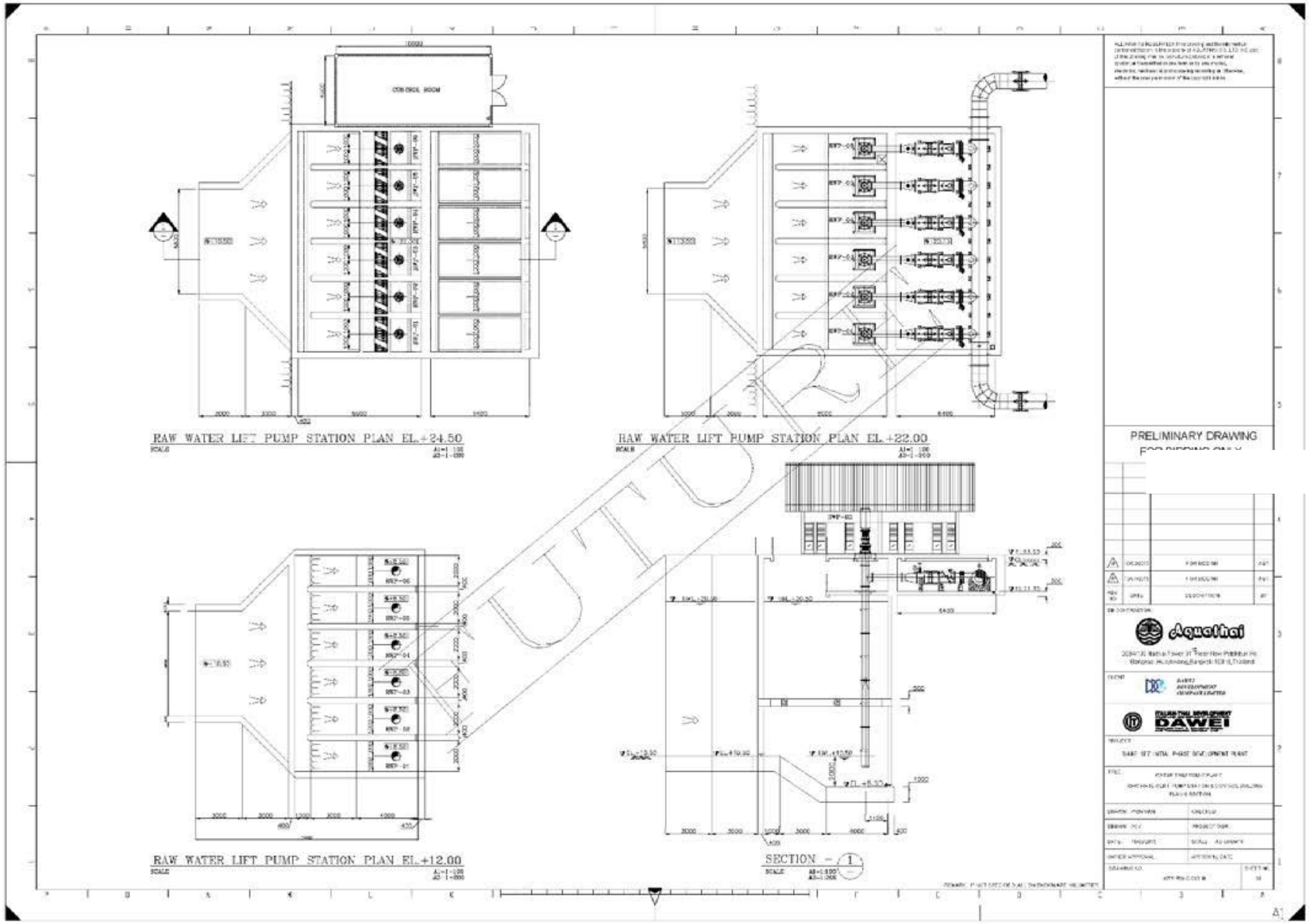
- Alum

  Total storage volume requires for the Tank is 6.14 cubic meter. Each phase require 1 tank. Actual storage tank is 15 cubic meter and Selected storage tank is 15 cubic meter.

Table 4.2-19 Alum Tank Capacity

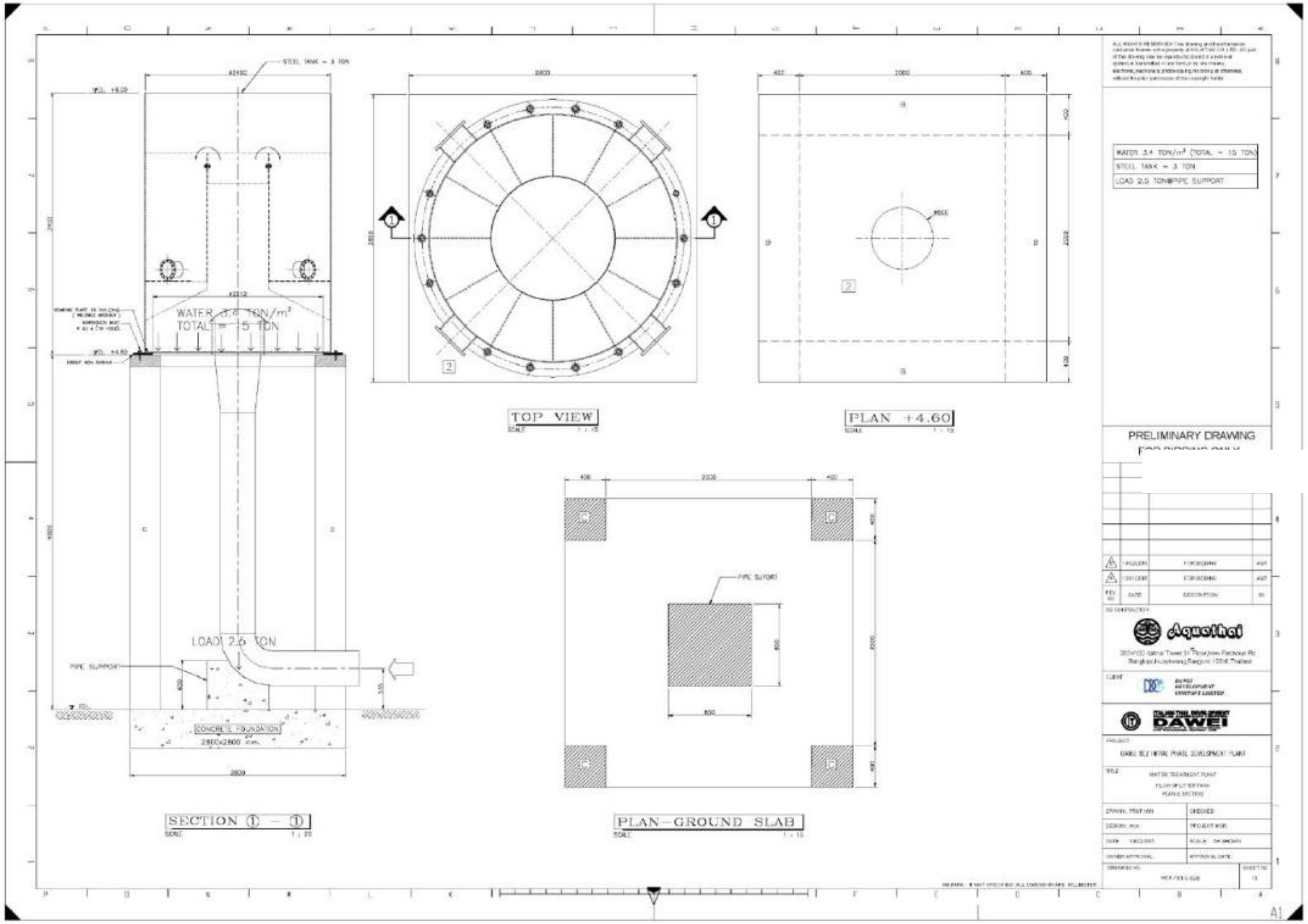
Description		Capacity	Unit
Capacity of water treatment plant	=	750	m^3 / hr
Total flowrate of water	=	18,000	m^3 / day
Aluminium sulphate	=	30	g / m^3
Use liquid Alum (8% Al_2O_3) or			
645 g / l of conventional solid commercial $Al_2(SO_4)_3.14H_2O$			
Maximum dosing rate			
Average dosing rat	=	15	g / m^3
Liquid alum solution, specific gravity	=	1.32	
Alum consumption	=	11.25	kg / hr
	=	270	kg / day
Chemical Storage Tank Required	=	0.20	m^3 / day
Storage tank duration	=	30	day

Source: IEC (2015)



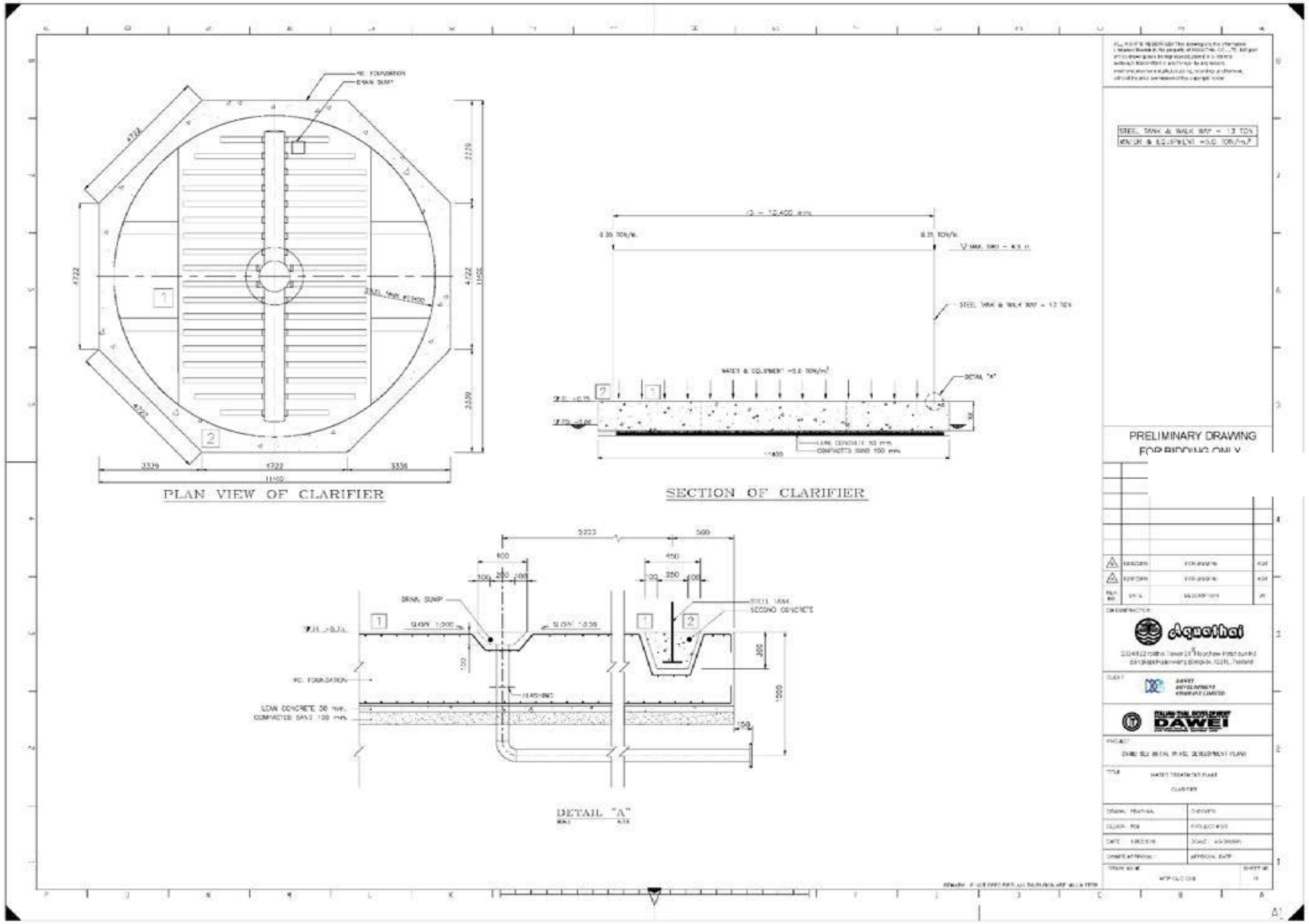
Source: IEC (2015)

Figure 4.2-22 Plan and section of Raw Water Lift Pump Station and Control Building



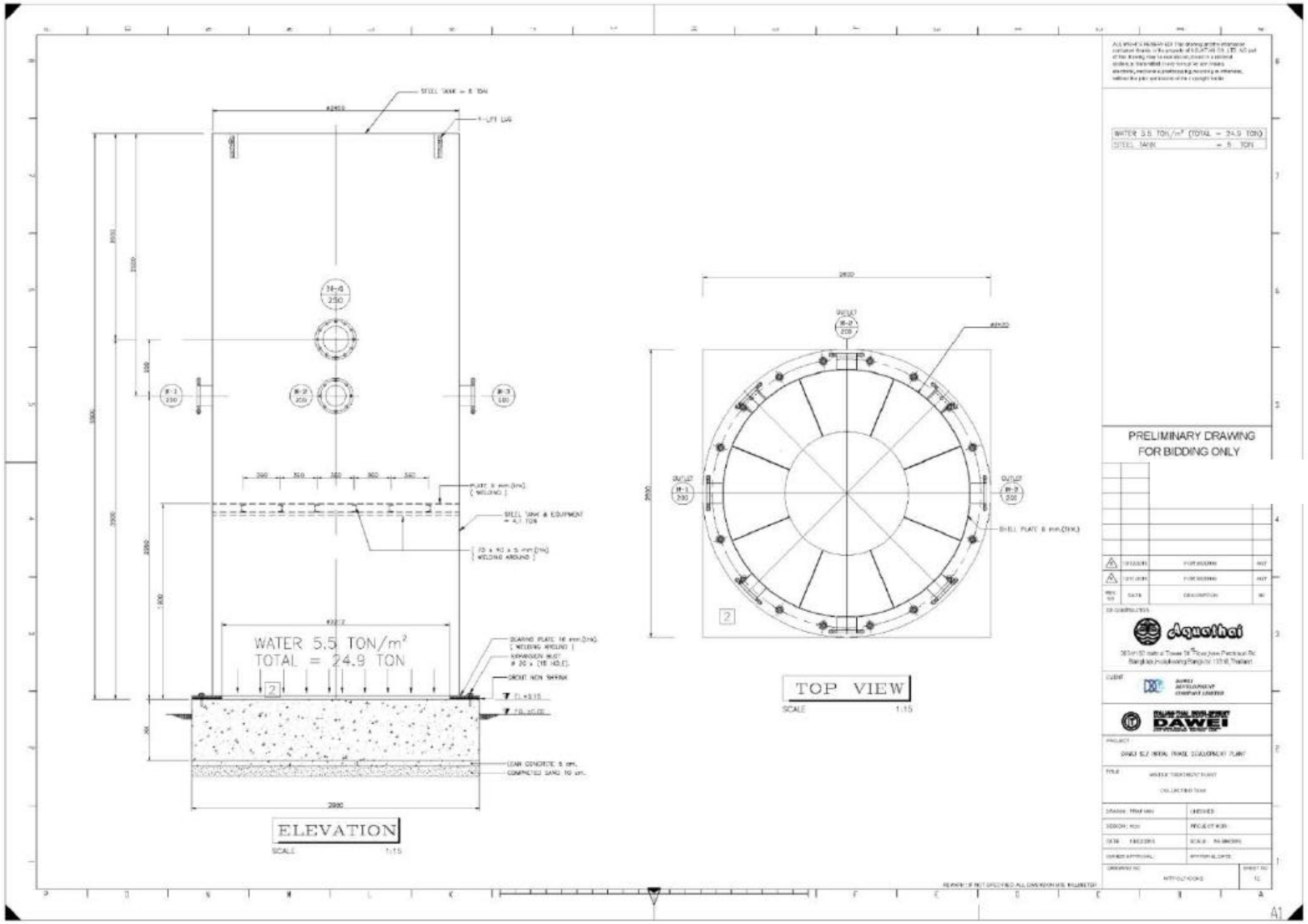
Source: IEC (2015)

Figure 4.2-23 Plan and Section of Flow Spliter Tank for rapid mixing



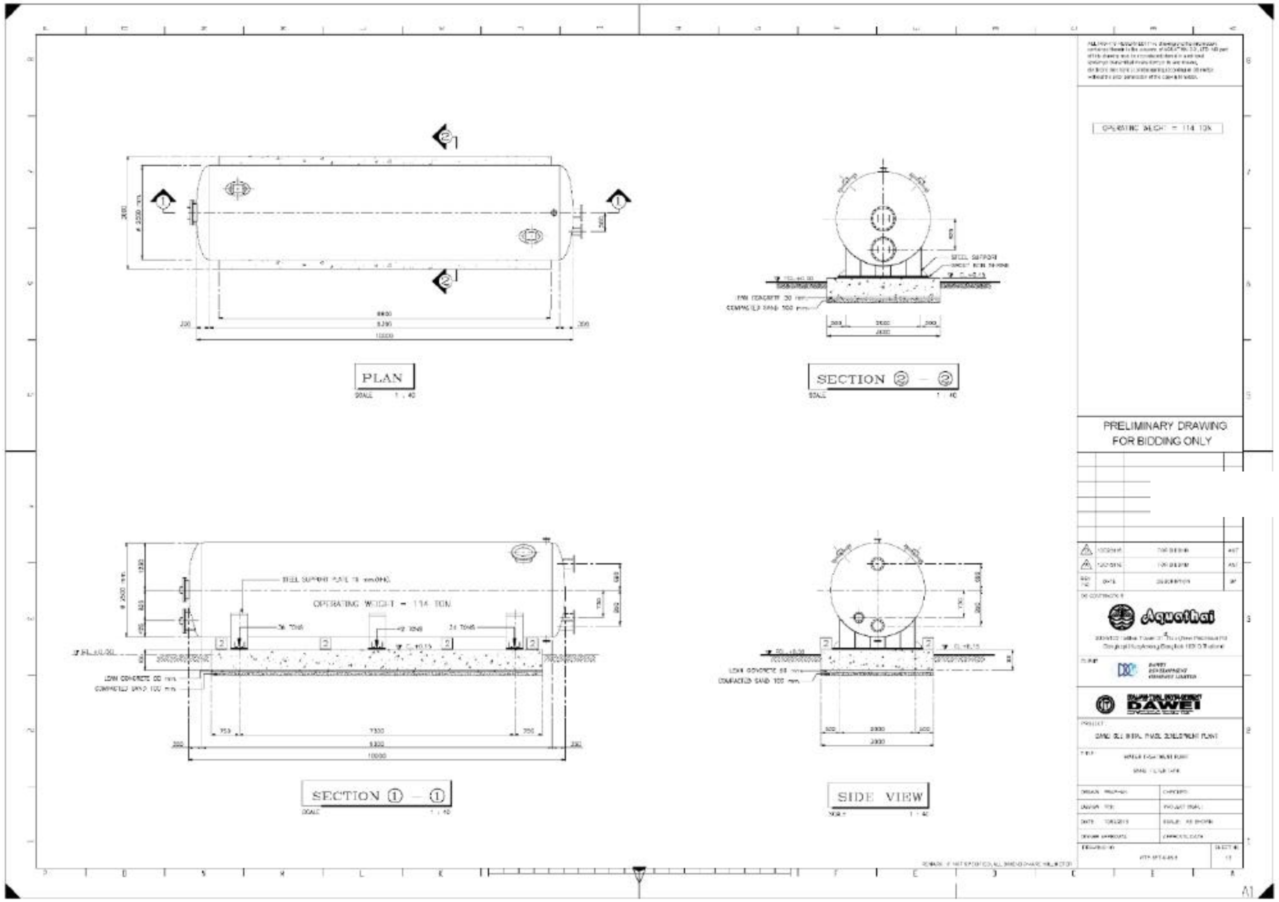
Source: IEC (2015)

Figure 4.2-24 Plan and section of Clarifier for flocculation



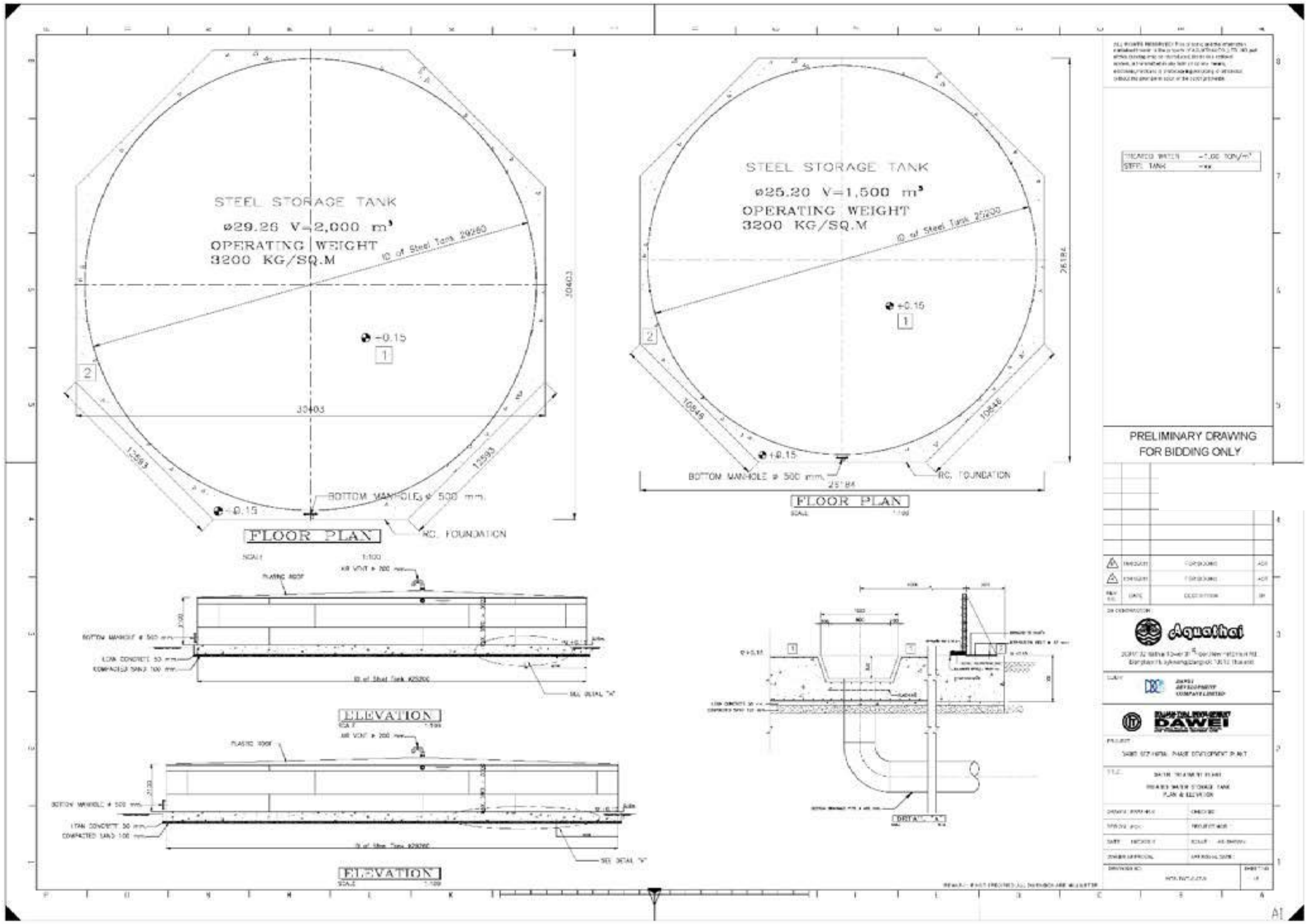
Source: IEC (2015)

Figure 4.2-25 Plant and section of Collecting Tank for sedimentation



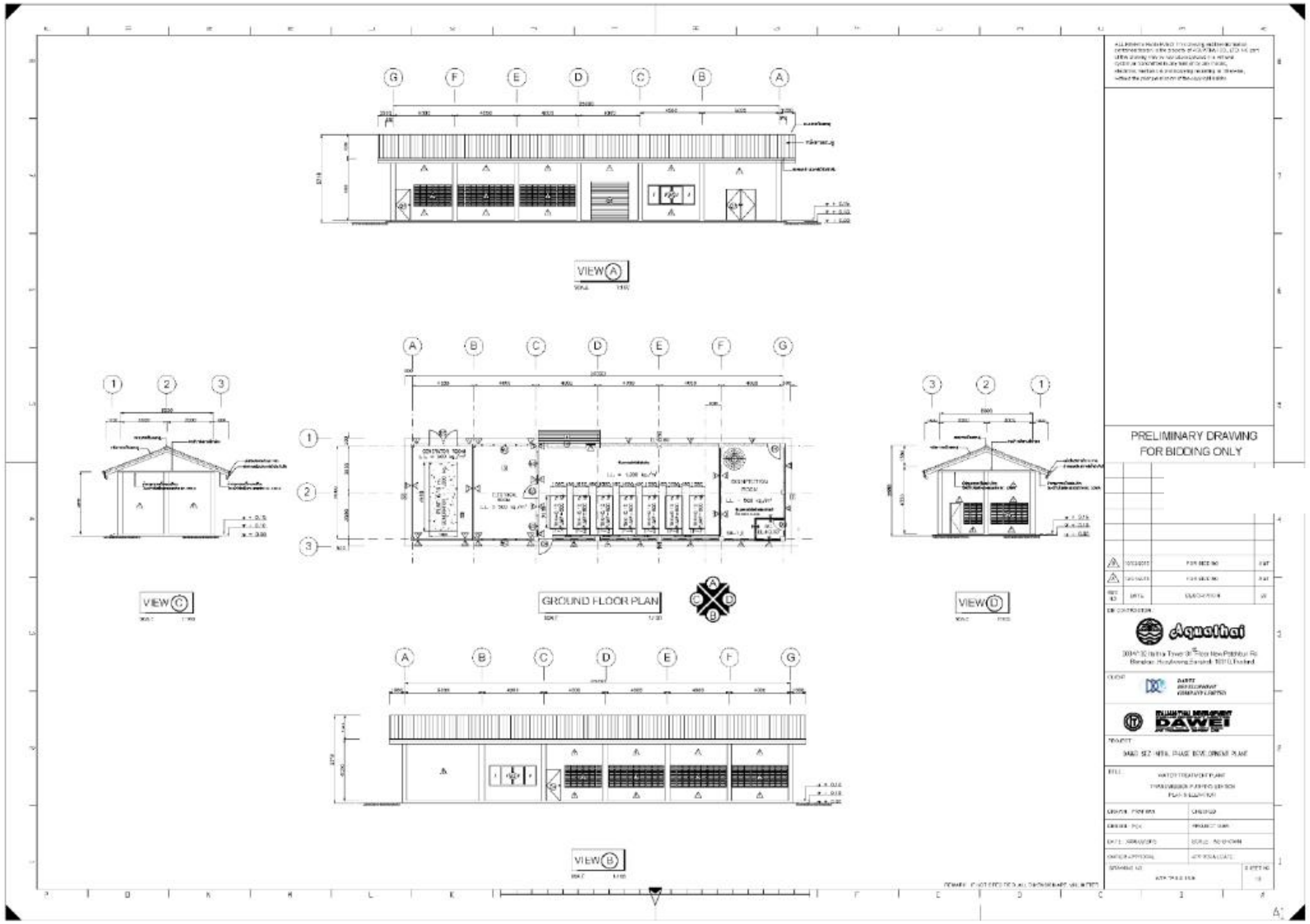
Source: IEC (2015)

Figure 4.2-26 Plant and section of Sand Filter Tank for filtration



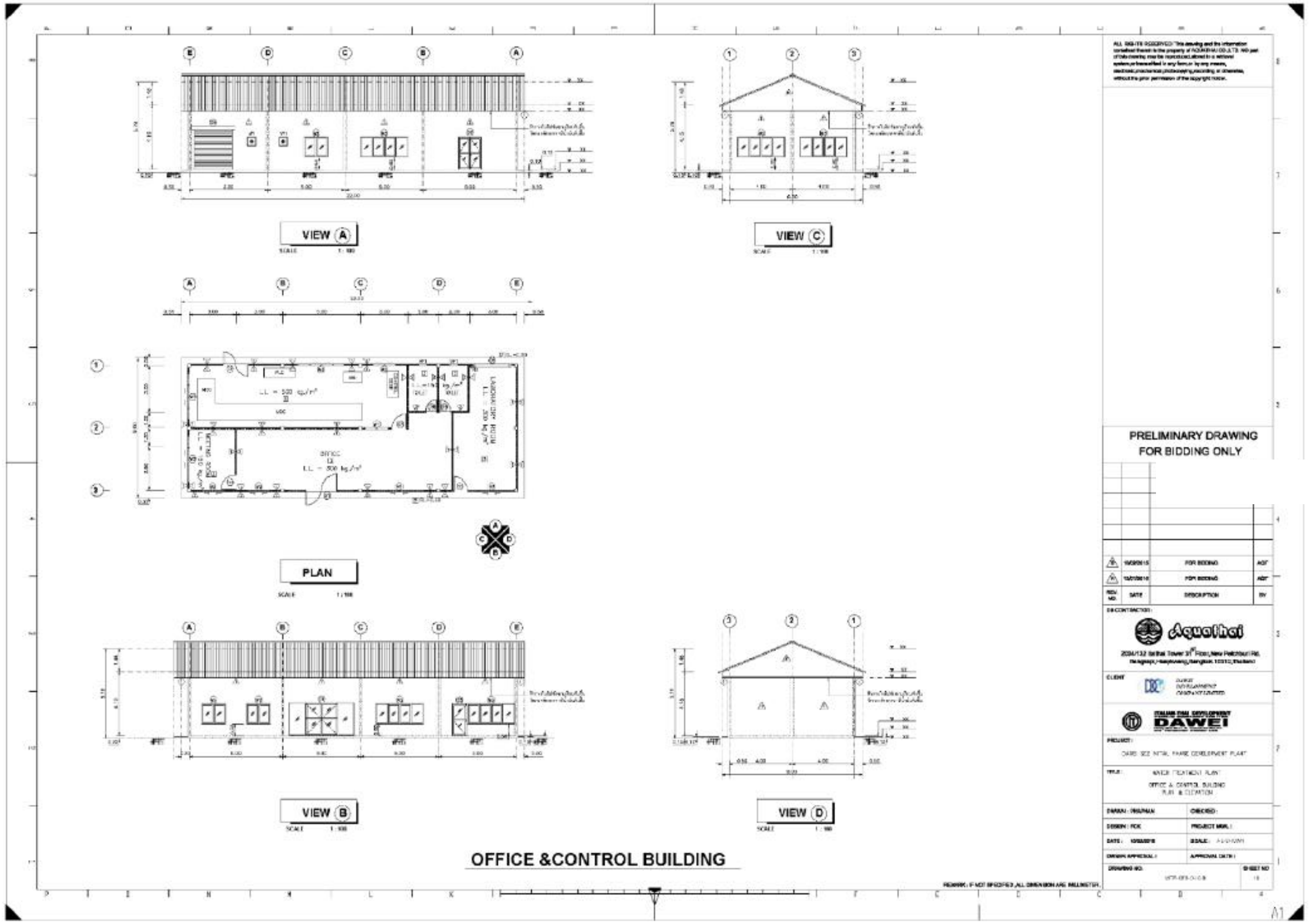
Source: IEC (2015)

Figure 4.2-27 Plan and Section of Treated Water Storage Tank for chemical feed system



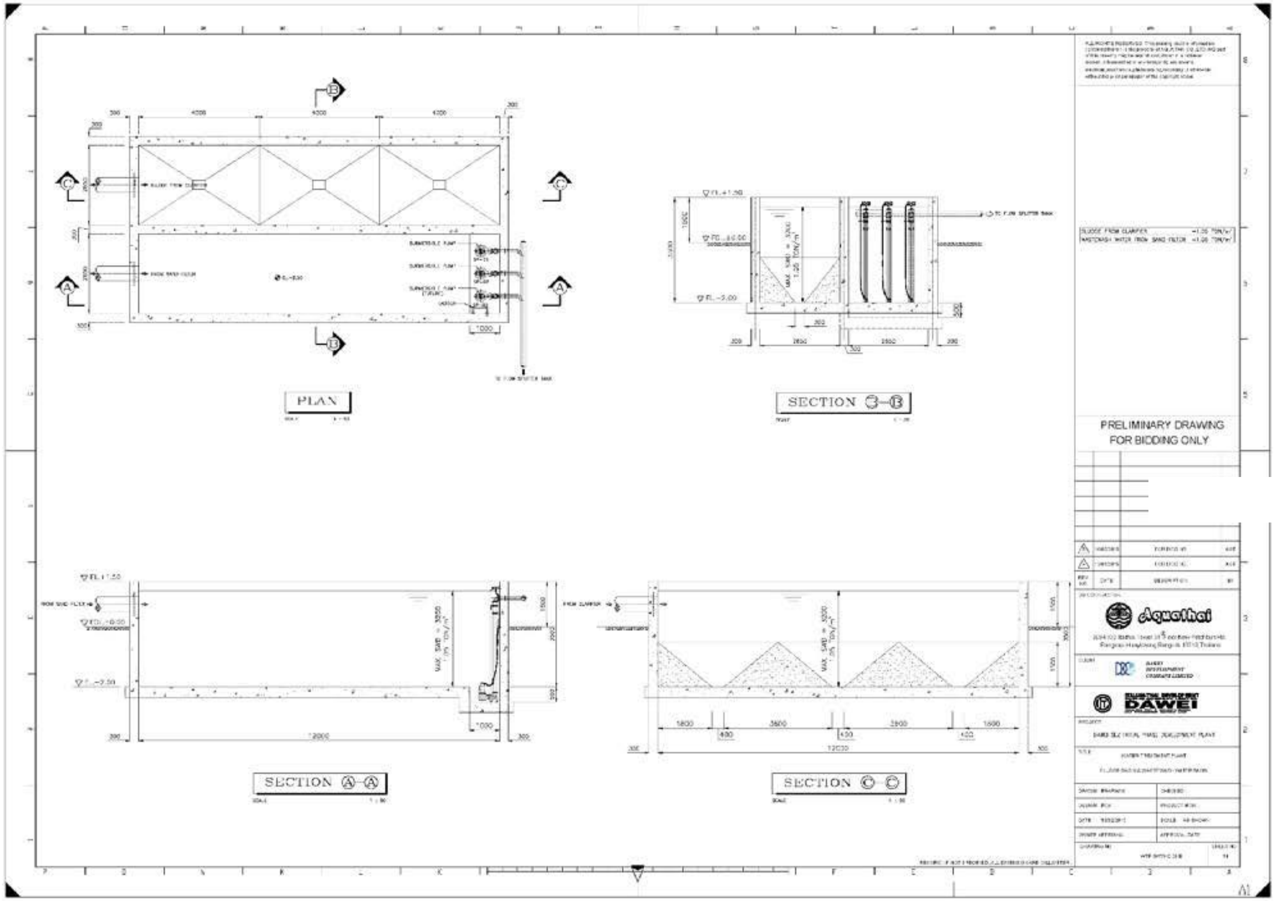
Source: IEC (2015)

Figure 4.2-28 Plan and elevation of Transmission pumping station



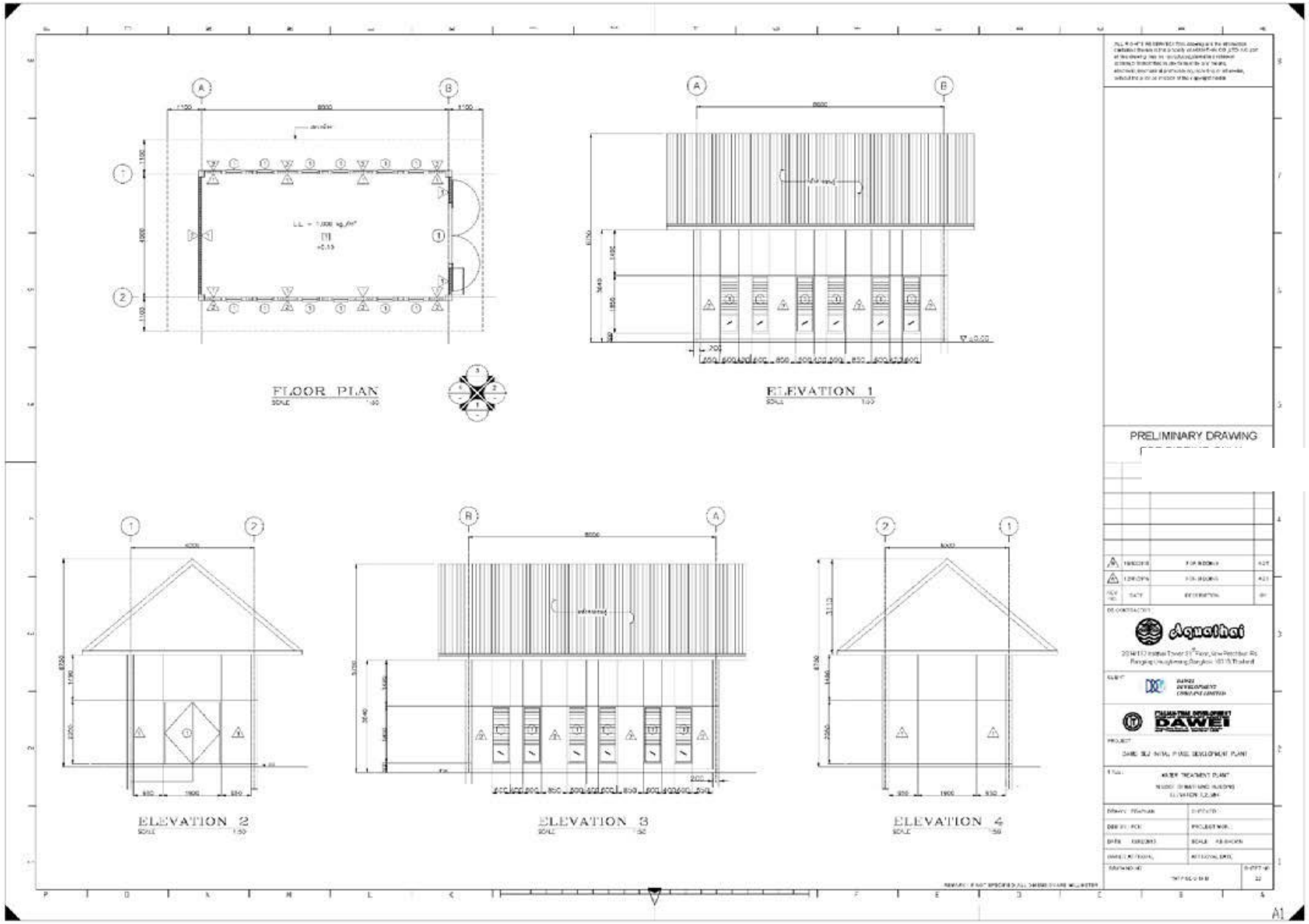
Source: IEC (2015)

Figure 4.2-29 Plan and elevation of Office and Control Building for Dawei Water Treatment Plant



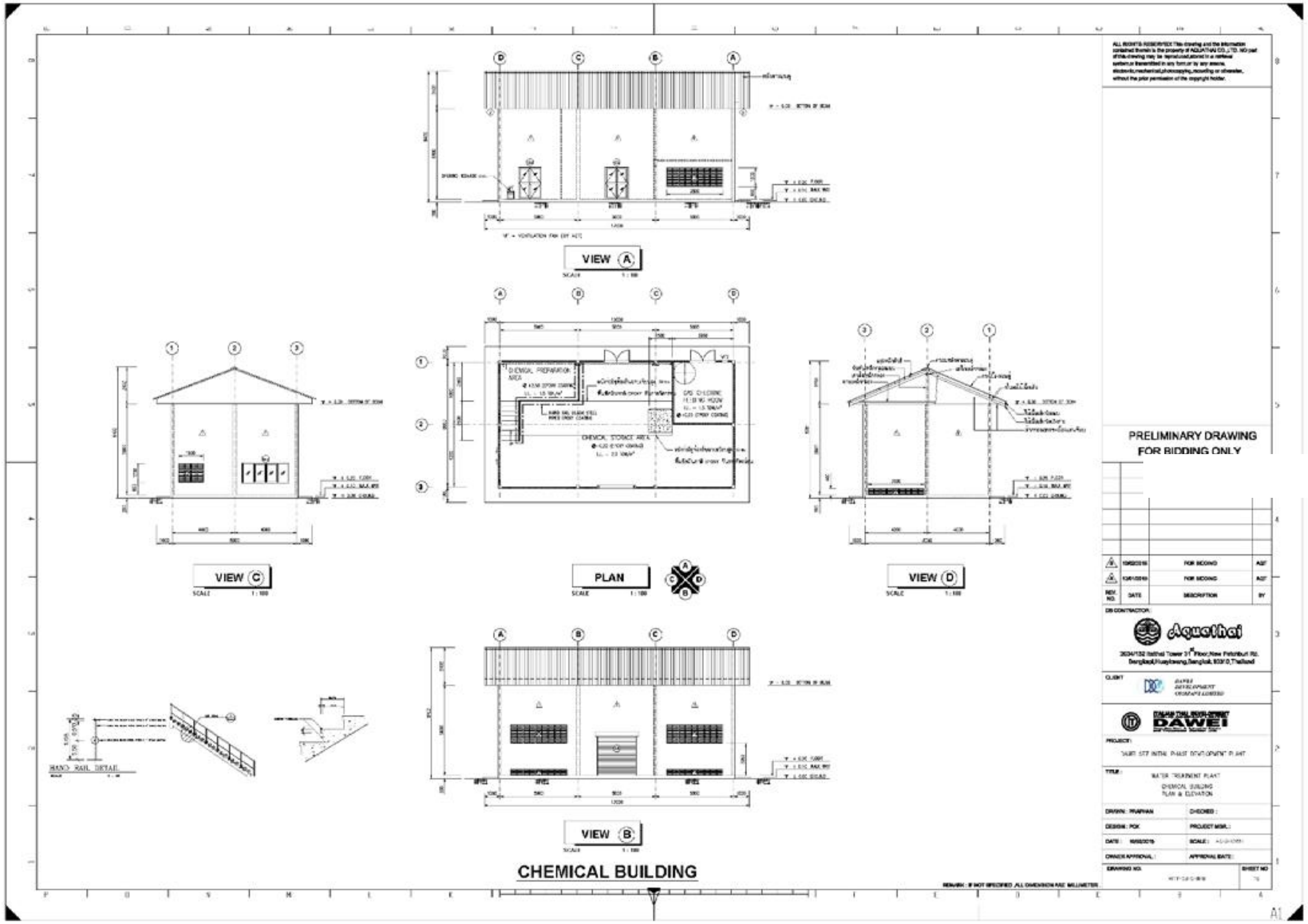
Source: IEC (2015)

Figure 4.2-30 Plan and section of Sludge Basin and Waste Washed Water Basin for Dawei Water Treatment Plant



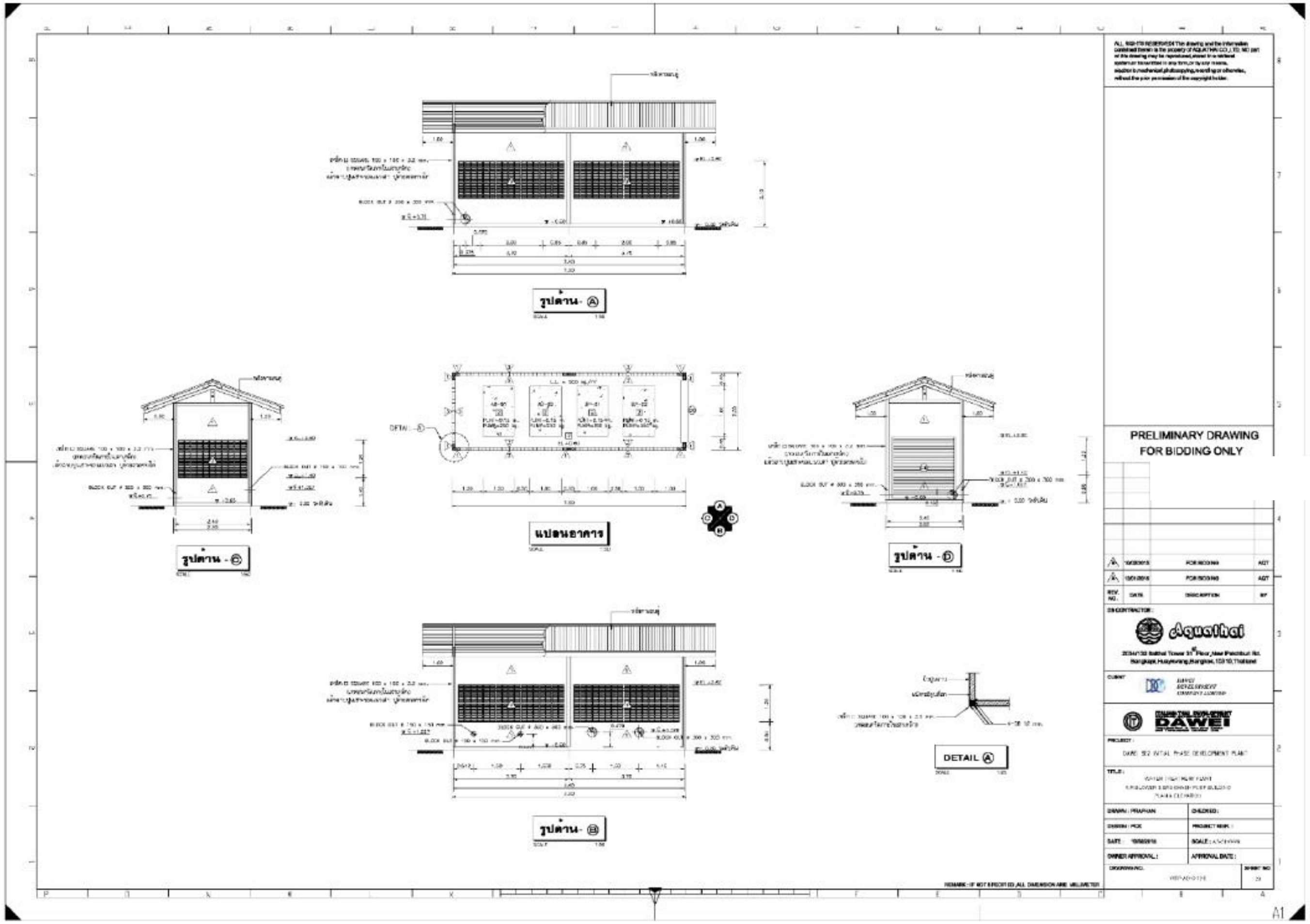
Source: IEC (2015)

Figure 4.2-31 Plan and elevation of Sludge Dewatering Building for Dawei Water Treatment Plant



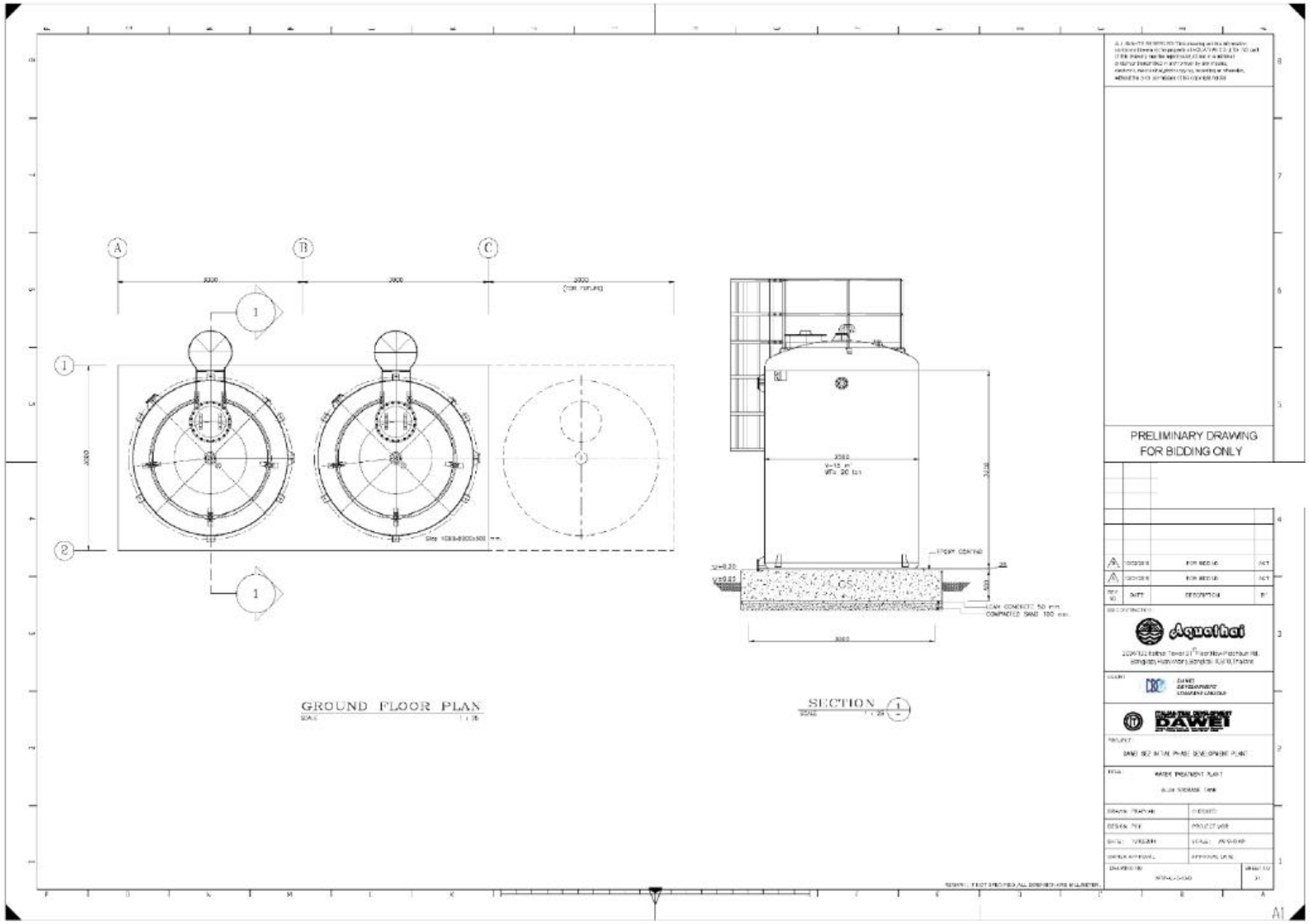
Source: IEC (2015)

Figure 4.2-32 Plan and elevation of Chemical Building for Dawei Water Treatment Plant



Source: IEC (2015)

Figure 4.2-33 Plan and elevation of Air Blower and Backwash Pump Building

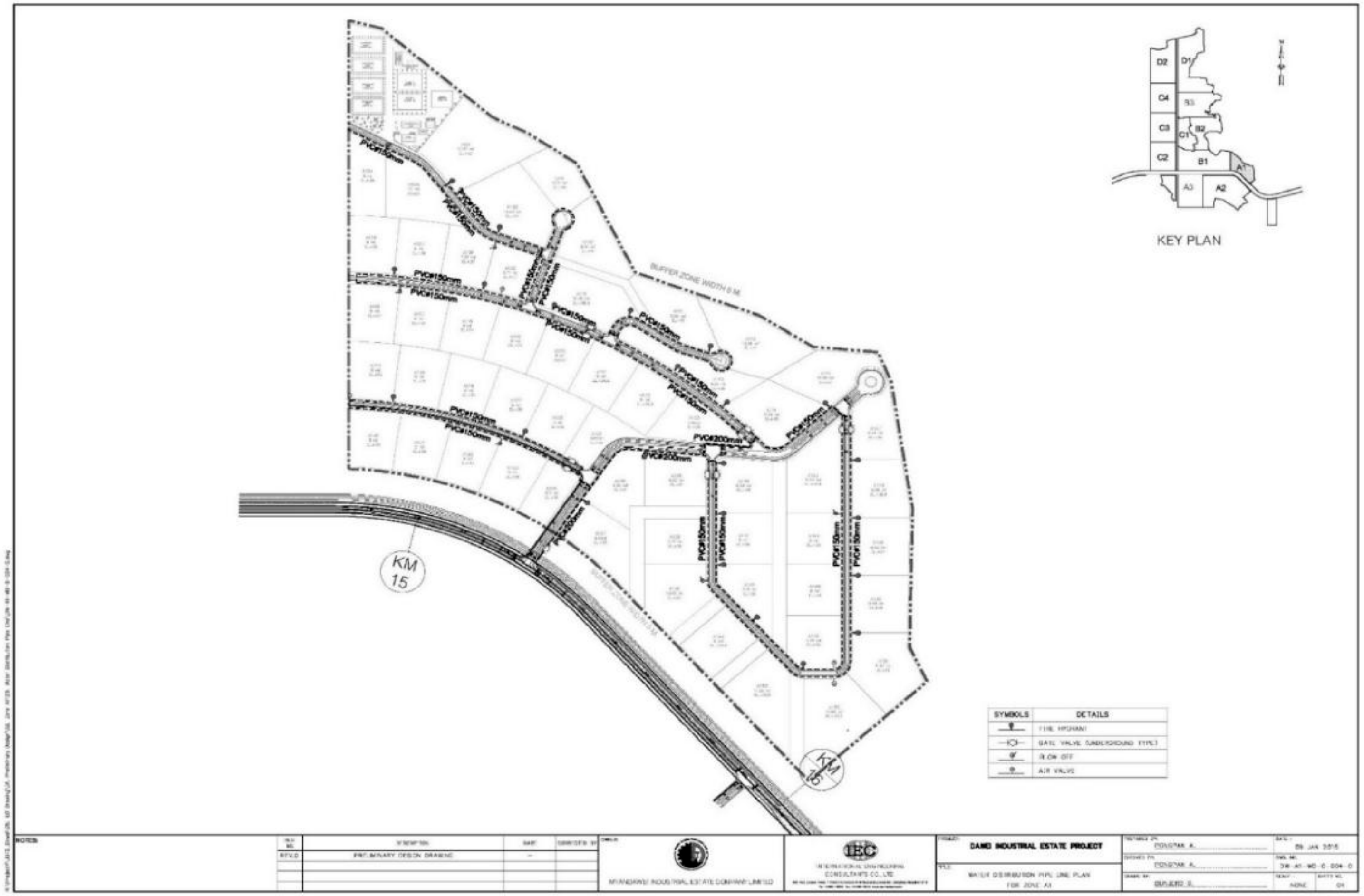


Source: IEC (2015)

Figure 4.2-34 Plan and section of Alum Storage Tank

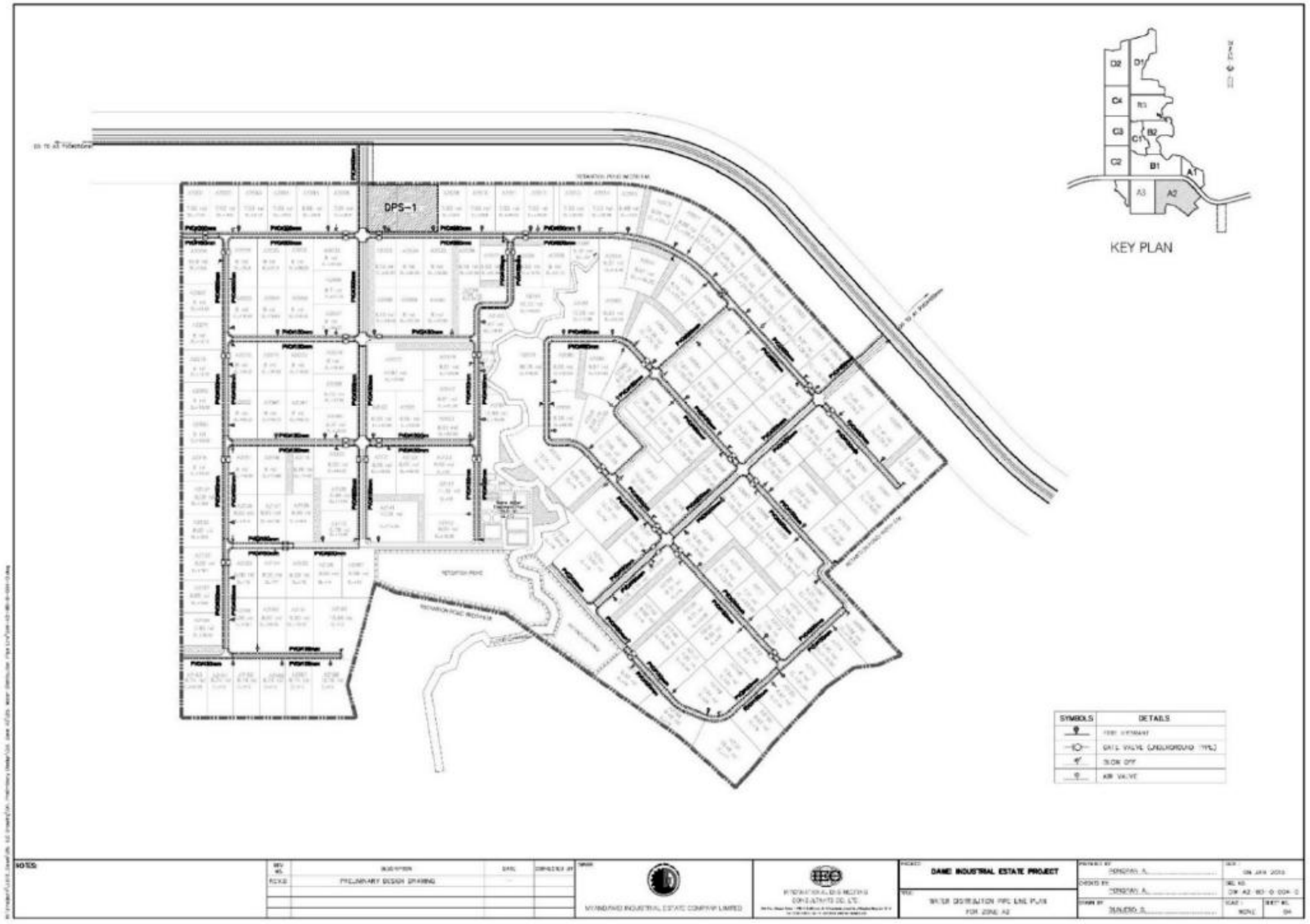
4.2.2.2 Water Distribution Pipe

Treated water will be distributed from Water Treatment Plant to zone A2 Distributed Pumping Substation by a steel pipe in initial phase. The pipe which has 600-800 millimeters of diameter and is 5.010 kilometers in length will be installed underneath the Access Road to Water Treatment Plant. Lay out of Water Distribution Pipe in each zone of Dawei Initial Industrial Estate are presented in (Figure 4.2-35) to (Figure 4.2-46)



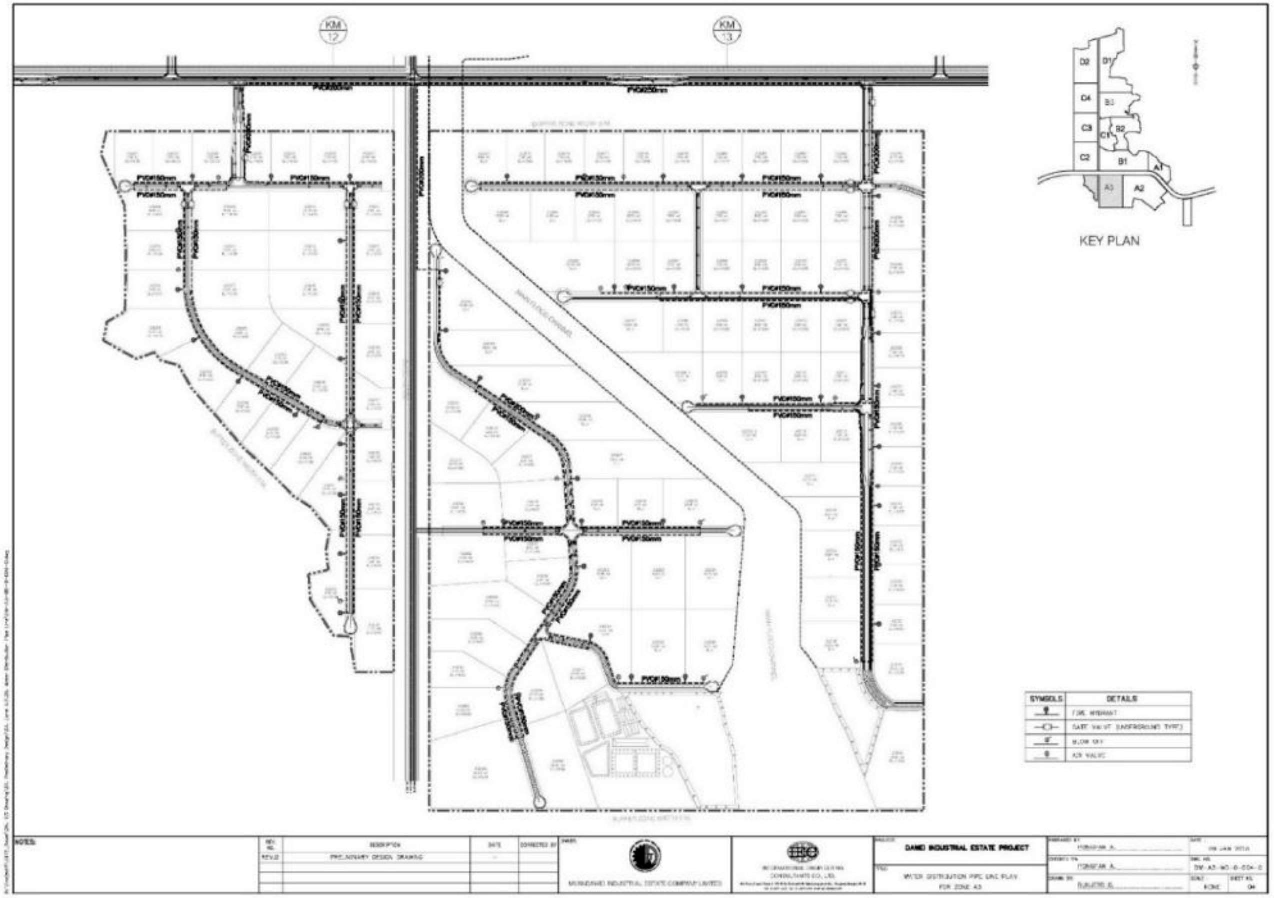
Source: IEC (2015)

Figure 4.2-35 Water Distribution Pipe for Zone A1 of Dawei Industrial Estate



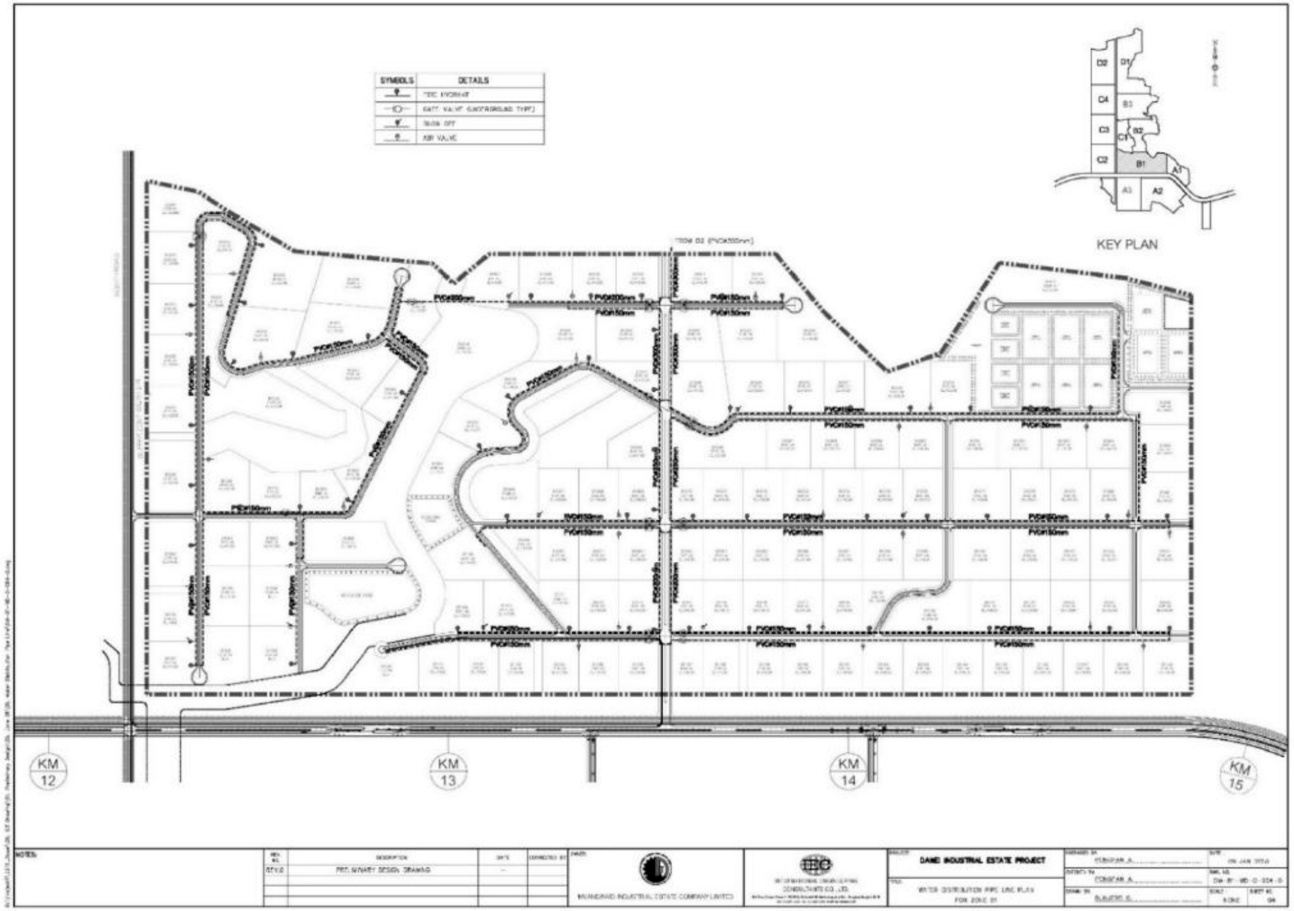
Source: IEC (2015)

Figure 4.2-36 Water Distribution Pipe for Zone A2 of Dawei Industrial Estate



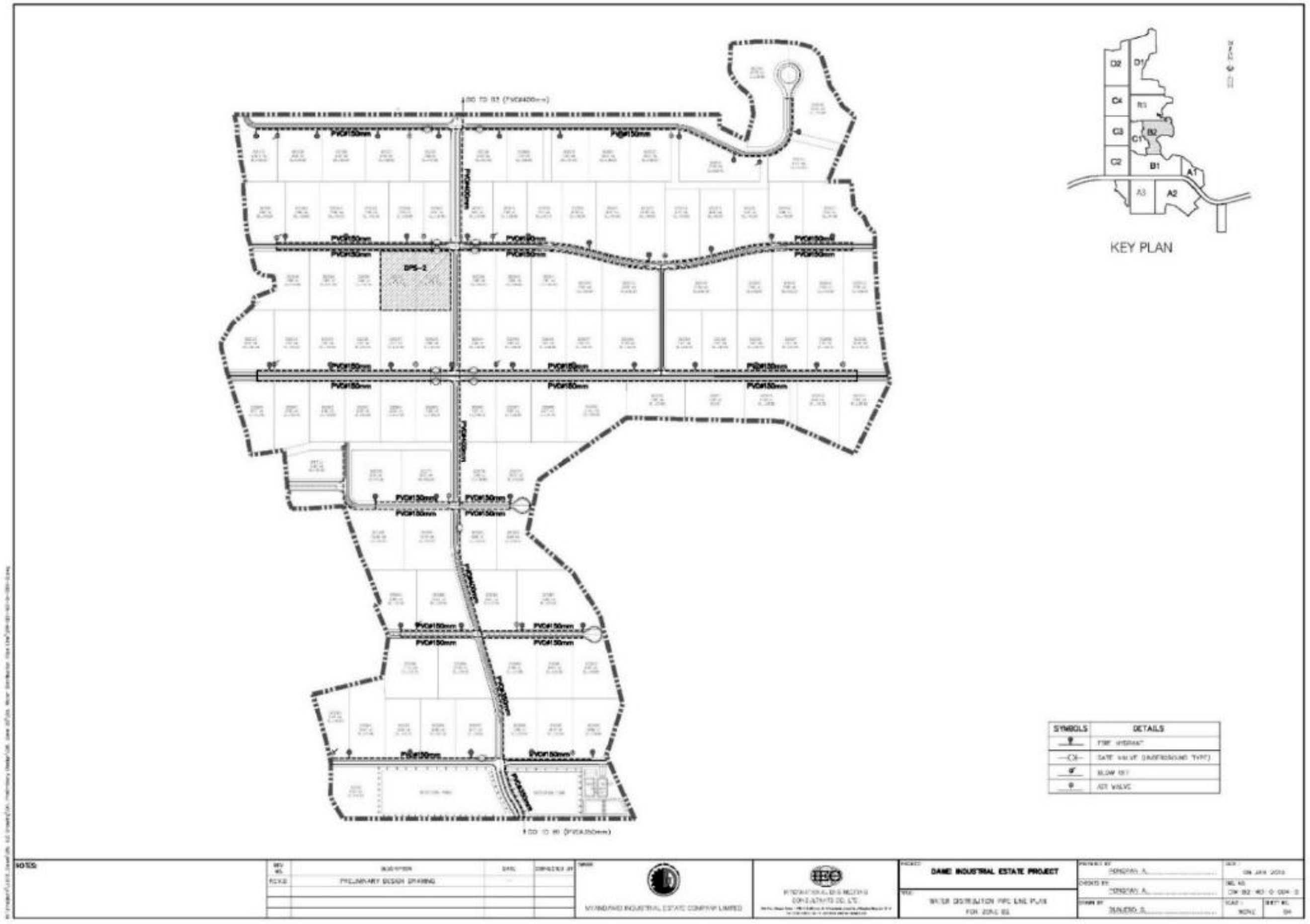
Source: IEC (2015)

Figure 4.2-37 Water Distribution Pipe for Zone A3 of Dawei Industrial Estate



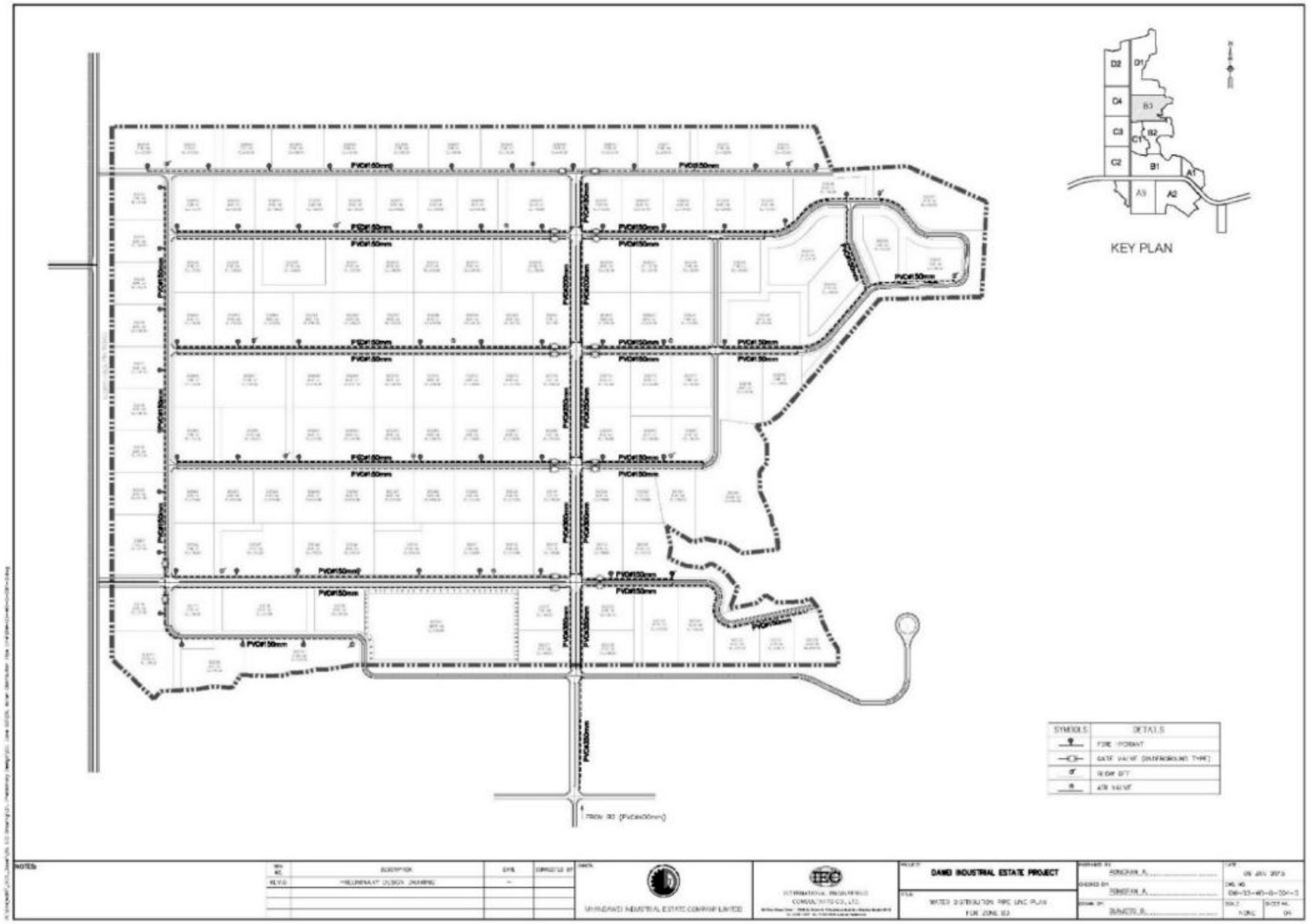
Source: IEC (2015)

Figure 4.2-38 Water Distribution Pipe for Zone B1 of Dawei Industrial Estate



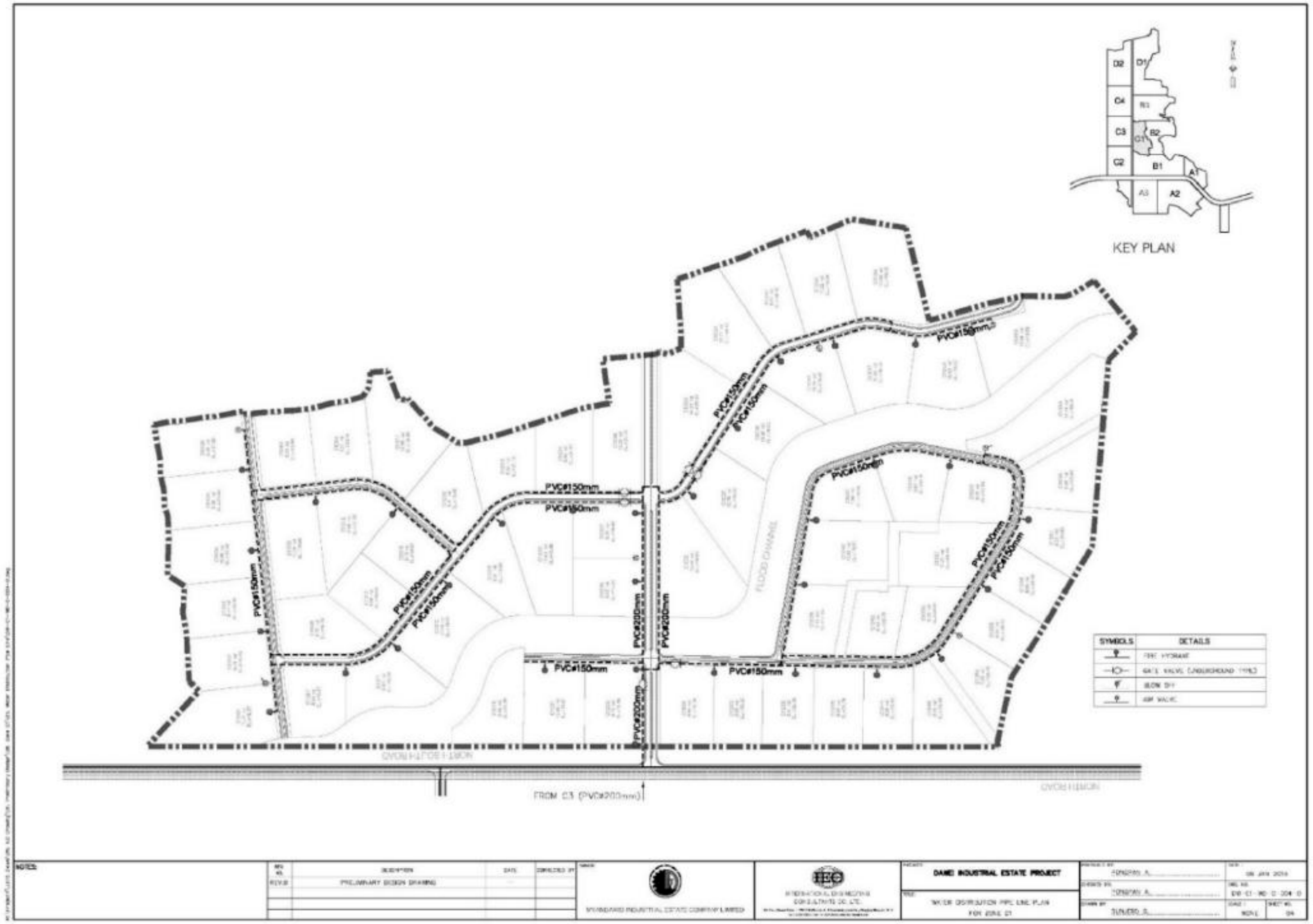
Source: IEC (2015)

Figure 4.2-39 Water Distribution Pipe for Zone B2 of Dawei Industrial Estate



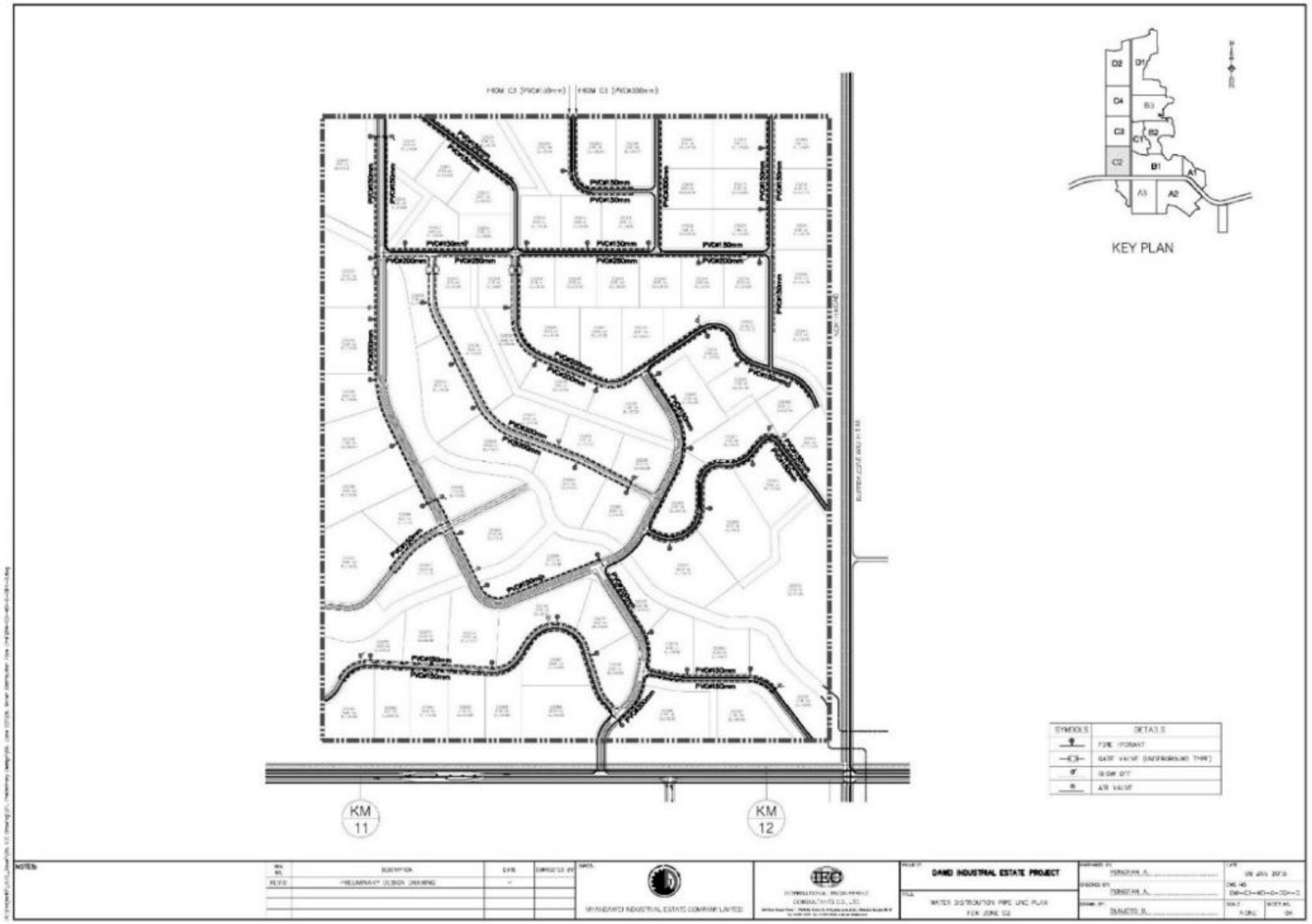
Source: IEC (2015)

Figure 4.2-40 Water Distribution Pipe for Zone B3 of Dawei Industrial Estate



Source: IEC (2015)

Figure 4.2-41 Water Distribution Pipe for Zone C1 of Dawei Industrial Estate

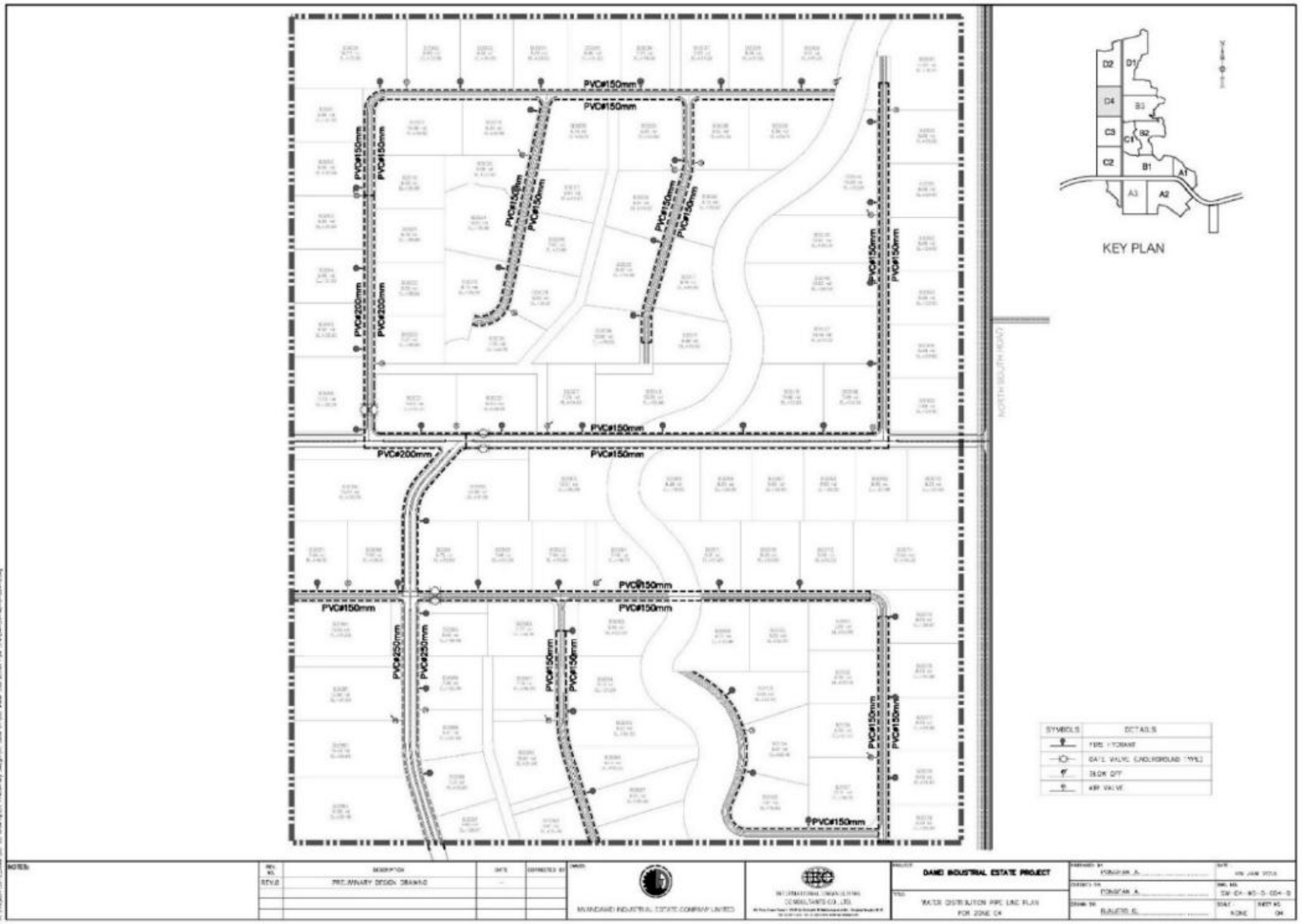


Source: IEC (2015)

Figure 4.2-42 Water Distribution Pipe for Zone C2 of Dawei Industrial Estate

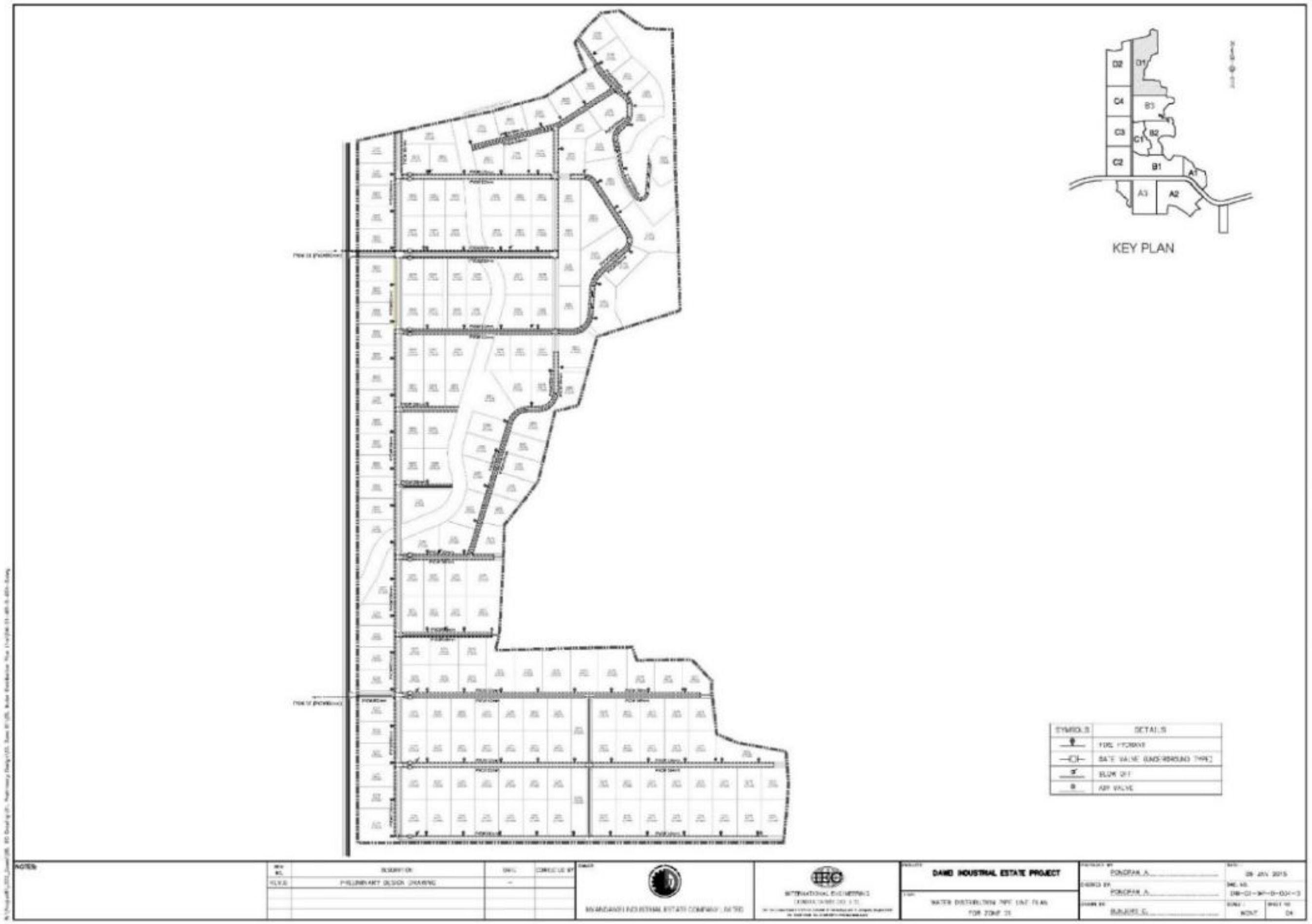
Source: IEC (2015))

Figure 4.2-43 Water Distribution Pipe for Zone C3 of Dawei Industrial Estate



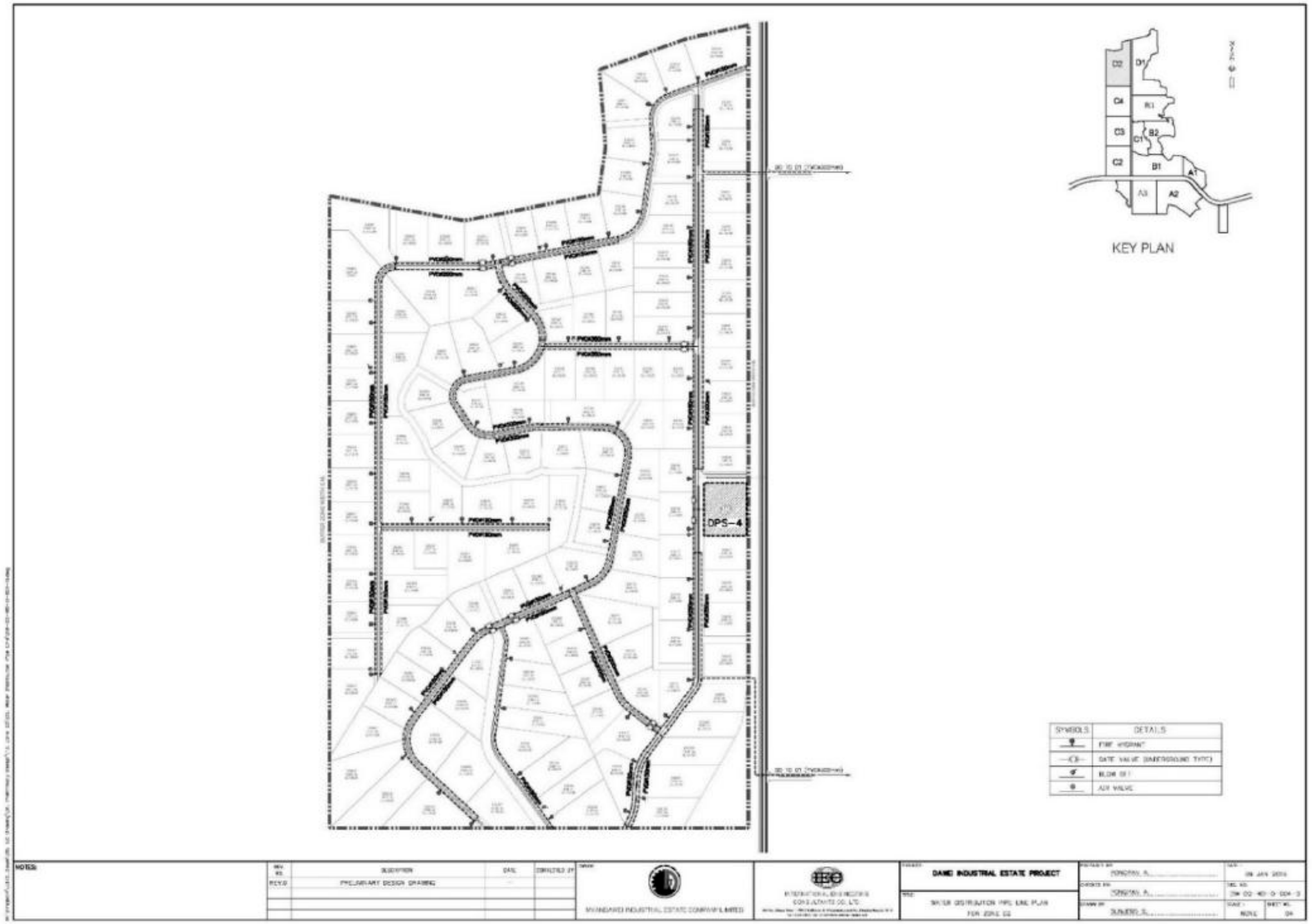
Source: IEC (2015)

Figure 4.2-44 Water Distribution Pipe for Zone C4 of Dawei Industrial Estate



Source: IEC (2015)

Figure 4.2-45 Water Distribution Pipe for Zone D1 of Dawei Industrial Estate



Source: IEC (2015)

Figure 4.2-46 Water Distribution Pipe for Zone D2 of Dawei Industrial Estate

4.2.3 Power and Lighting

4.2.3.1 Power Distribution System

When fully developed, approximately 450 MW of electricity was estimated to be generated from the central GT/CCGT power plant to serve the demand of the industrial estate. 115 kV / 24 kV Power Transmission Line, High voltage power from the power plant are installed along the road network with a number of substations constructed in selected places within the industrial estate areas.

Power Distribution System comprises of 3 major components which are 115kV Main Transmission Line System, 115kB/24kV High Voltage Substation and 24 kV Distribution System.

(a) 115 kV Main Transmission Line System

The Main Transmission Line System is 115 kV power line from the Initial Phase Power Plant or other power sources. The connection point will be constructed by concrete pole 22 m. height above ground in accordance with the typical standard and prudent practice of Provincial Electricity Authority of Thailand. The main line may have several types subject to designation and current carrying capacity. The branch line is normally using 240 sq.mm. or 400 sq.mm. Aluminum conductor, and 3 phases on the tower. Overhead ground wire will be on top of the tower for lightning protection. The surge arrester will be installed for some certain distance to protect the voltage surge from lightning strike and consequent damage to the power line and all connected system.

(b) 115 kV / 24 kV High Voltage Substation

The High Voltage Substation is a power receiving station and step down voltage system from high voltage 115 kV to medium voltage 24 kV prior to distribute to the 24 kV distributed grids. The substation in the Dawei SEZ has two categories which are

The Center Substation is designed for grouping all distributed substations in many zones of the Industrial Estate. The station is designed in ring loop for high reliability network configuration. Such kind of substation is introducing to the Initial Industrial Estate grid before zone B is developing.

The Distributed Substation is designed for each zone which is 3,000 Rai and achieving peak demand of 123 Mega-volt amperes ("MVA") will require a 195 MVA distributed substation. The Distributed Substation System will comprise of Power Transformers, Medium Voltage Switchgear, High Voltage and Medium Voltage Protection and Control System, Energy Metering System, Communication System, Computerized Aid System for Dispatching, Alternate Current ("AC") and Direct Current ("DC") power Supply System, Auxiliary Power

Supply System and other necessary equipment for support operation of power distribution. Designation of the Distributed Substation is redundancy and it is possible to maintenance the major equipment on annual program without shutdown the system.

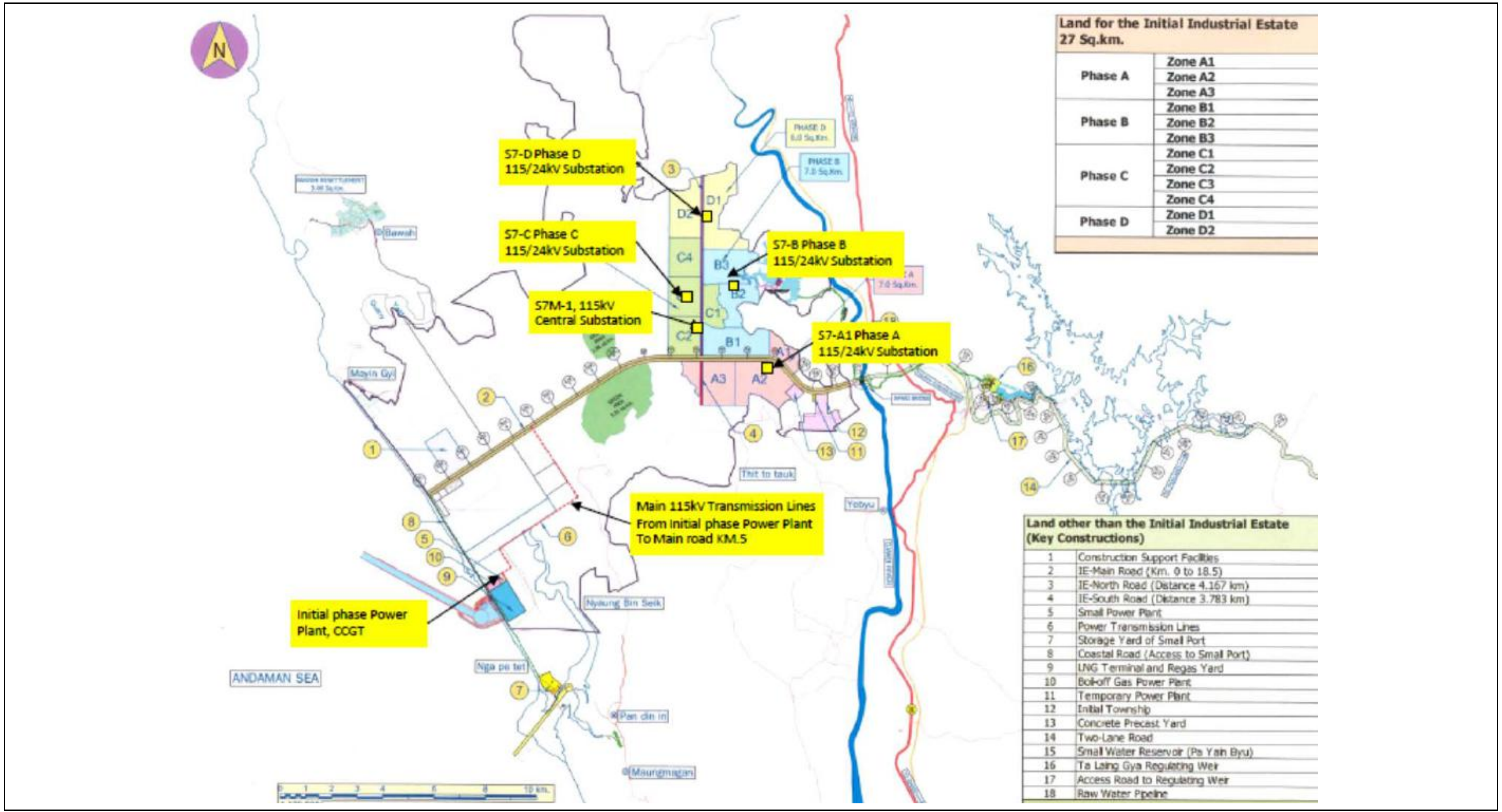
(c) 24 kV Distribution System

The Distribution System is electricity network that connects between the Distributed Substations to customer's system and revenue metering. The system consists of 24 kV distribution line on 12-14 m. height concrete pole with aluminum conductor cable. The system will be designed for capacity per line around 12 MVA and will have redundancy system by circuit allocation from upstream transformers to each zone of the Industrial Estate. The system will have load break switch installation to be able to switch over and maintenance the line without interruption to customer.

Typical design and installation of the overall transmission line and distribution system will comply to the at least one standard and the prudent practice code on 115 kV power line and 24 kV distribution line design and construction of The Provincial Electricity Authority of Thailand.

4.2.3.2 Lighting

The Project will install 3 types of a concrete light poles; 14.4 M concrete light pole, 12.2 M concrete light pole and 9M concrete light poles. Total concrete light poles calculated from 16,887.00 Rai of Dawei Initial Industrial Estate is 7,756 concrete light poles. Number of concrete light poles for each zone presents in Table 4.2-21. Initially, development in the initial phase of the Project (Zone I) that will be some parts of zone A2 and A3 will require 63 of 14.4 M concrete light poles, 191 of 12.2 M concrete light poles and 46 of 9 M concrete light poles.



Source: IEC (2015)

Figure 4.2-47 Power distribution development for Dawei Industrial Estate

Table 4.2-20 Description of Power Distribution System

Phase	Sellable Area (Rai)	Item	Description	Qty	Unit
1	3,281	1.1	Distribution substation S7A1 195MVA 115kV at Phase A area	1.0	Lot
A1, A2, A3		1.2	115kV transmission line double circuits AAC 400 sq.mm. From power plant to Sub S7A1. ROW 30.5m approx. 18km-circuit	1.0	Lot
		1.3	115kV transmission line single circuit AAC 400 sq.mm. From Center sub STM1to Sub S7A1 approx. 8 km-circuit	1.0	Lot
		1.4	24kV distribution grid on tertiary road ROW including feeders to township approx. 20 km-circuit	1.0	Lot
		1.5	Distribution substation S7A2 115//24kV 6.0MVA power supply to small port with direct buried XLPE cable, 4 km.	1.0	Lot
2	3,281	1.1	Distribution substation S7B 195MVA 115kv//24kV at Phase B area	1.0	Lot
B1, B2, B3		1.2	115kV transmission line double circuits AAC 400 sq.mm. From power plant to sub S7A1. ROW 30.5m. Approx.18km-circuit	1.0	Lot
		1.3	115kV transmission line single circuits AAC 400 sq.mm. From center sub S7B. approx. 6km-circuit	1.0	Lot
		1.4	115kV transmission line double circuits AAC 400 sq.mm. From center sub S7M1 to sub S7B. approx. 5m-circuit	1.0	Lot
		1.5	115kV transmission line single circuits AAC 400 sq.mm. From center sub STM1 to S7AB. Approx. 2km-circuit	1.0	Lot
		1.6	24kV distribution grid for initial industrial factory one entire tertiary road ROW. Approx. 20 km-circuit	1.0	Lot
		1.7	Main center substation S7M1 115kV substation at Km.12/115kV Breaker and a half type, 6 bays	1.0	Lot
3	3,281	1.1	Distribution substation S7C 195 MVA 115kV//24kV at Phase C area	1.0	Lot
C1,C2,C3,C4		1.2	115kV transmission line single circuit AAC 400 sq.mm. From center sub S7M1 to Sub S7C. Approx. 7km-circuit	1.0	Lot
		1.3	24kV Distribution grid for initial industrial factory on entire tertiary road ROW. Approx. 20km-circuit	1.0	Lot
4	2,812	1.1	Distribution substation S7D 130MVA115kV//24kV at phase D area	1.0	Lot
D1,D2		1.2	115kV transmission line single circuit AAC 2x400sq.mm. From center sub S7M1 to sub S7D. Approx. 6km-circuit	1.0	Lot
		1.3	115kv transmission line double circuits AAC 400 sq.mm. From center sub S7M1 to sub S7D. Approx. 5km-circuit	1.0	Lot
		1.4	24kV distribution grid for initial industrial factory on entire tertiary road ROW approx. 20km-circuit	1.0	Lot

Source: IEC (2015)

Table 4.2-21 Number of Light poles in Dawei Industrial Estate

Zone I	654.77	Rai
14.4 M. CONCRETE POLE	63.00	Nos.
12.2 M. CONCRETE POLE	191.00	Nos.
9 M. CONCRETE POLE	46.00	Nos.
Zone A1 ใหม่	630.00	Rai
14.4 M. CONCRETE POLE	61.00	Nos.
12.2 M. CONCRETE POLE	184.00	Nos.
9 M. CONCRETE POLE	45.00	Nos.
Zone A2 ใหม่	2,011.00	Rai
14.4 M. CONCRETE POLE	194.00	Nos.
12.2 M. CONCRETE POLE	587.00	Nos.
9 M. CONCRETE POLE	142.00	Nos.
Zone A3 ใหม่	1,744.00	Rai
14.4 M. CONCRETE POLE	168.00	Nos.
12.2 M. CONCRETE POLE	509.00	Nos.
9 M. CONCRETE POLE	123.00	Nos.
Zone B1 ใหม่	1,738.00	Rai
14.4 M. CONCRETE POLE	168.00	Nos.
12.2 M. CONCRETE POLE	507.00	Nos.
9 M. CONCRETE POLE	123.00	Nos.
Zone B2 ใหม่	1,143.00	Rai
14.4 M. CONCRETE POLE	110.00	Nos.
12.2 M. CONCRETE POLE	334.00	Nos.
9 M. CONCRETE POLE	81.00	Nos.
Zone B3 ใหม่	1,495.00	Rai
14.4 M. CONCRETE POLE	144.00	Nos.
12.2 M. CONCRETE POLE	437.00	Nos.
9 M. CONCRETE POLE	106.00	Nos.
Zone C1 ใหม่	773.00	Rai
14.4 M. CONCRETE POLE	75.00	Nos.
12.2 M. CONCRETE POLE	226.00	Nos.
9 M. CONCRETE POLE	55.00	Nos.
Zone C2 ใหม่	1,201.00	Rai
14.4 M. CONCRETE POLE	116.00	Nos.
12.2 M. CONCRETE POLE	351.00	Nos.
9 M. CONCRETE POLE	85.00	Nos.
Zone C3 ใหม่	1,201.00	Rai
14.4 M. CONCRETE POLE	116.00	Nos.
12.2 M. CONCRETE POLE	351.00	Nos.
9 M. CONCRETE POLE	85.00	Nos.
Zone C4 ใหม่	1,201.00	Rai
14.4 M. CONCRETE POLE	116.00	Nos.
12.2 M. CONCRETE POLE	351.00	Nos.
9 M. CONCRETE POLE	85.00	Nos.
Zone D1 ใหม่	2,173.00	Rai
14.4 M. CONCRETE POLE	210.00	Nos.
12.2 M. CONCRETE POLE	634.00	Nos.
9 M. CONCRETE POLE	153.00	Nos.
Zone D2 ใหม่	1,577.00	Rai
14.4 M. CONCRETE POLE	152.00	Nos.
12.2 M. CONCRETE POLE	461.00	Nos.
9 M. CONCRETE POLE	111.00	Nos.
สรุป Zone A - D	**16,887.00**	**Rai**
14.4 M. CONCRETE POLE	**1,630.00**	**Nos.**
12.2 M. CONCRETE POLE	**4,932.00**	**Nos.**
9 M. CONCRETE POLE	**1,194.00**	**Nos.**
Total	**7,756.00**	**Nos.**

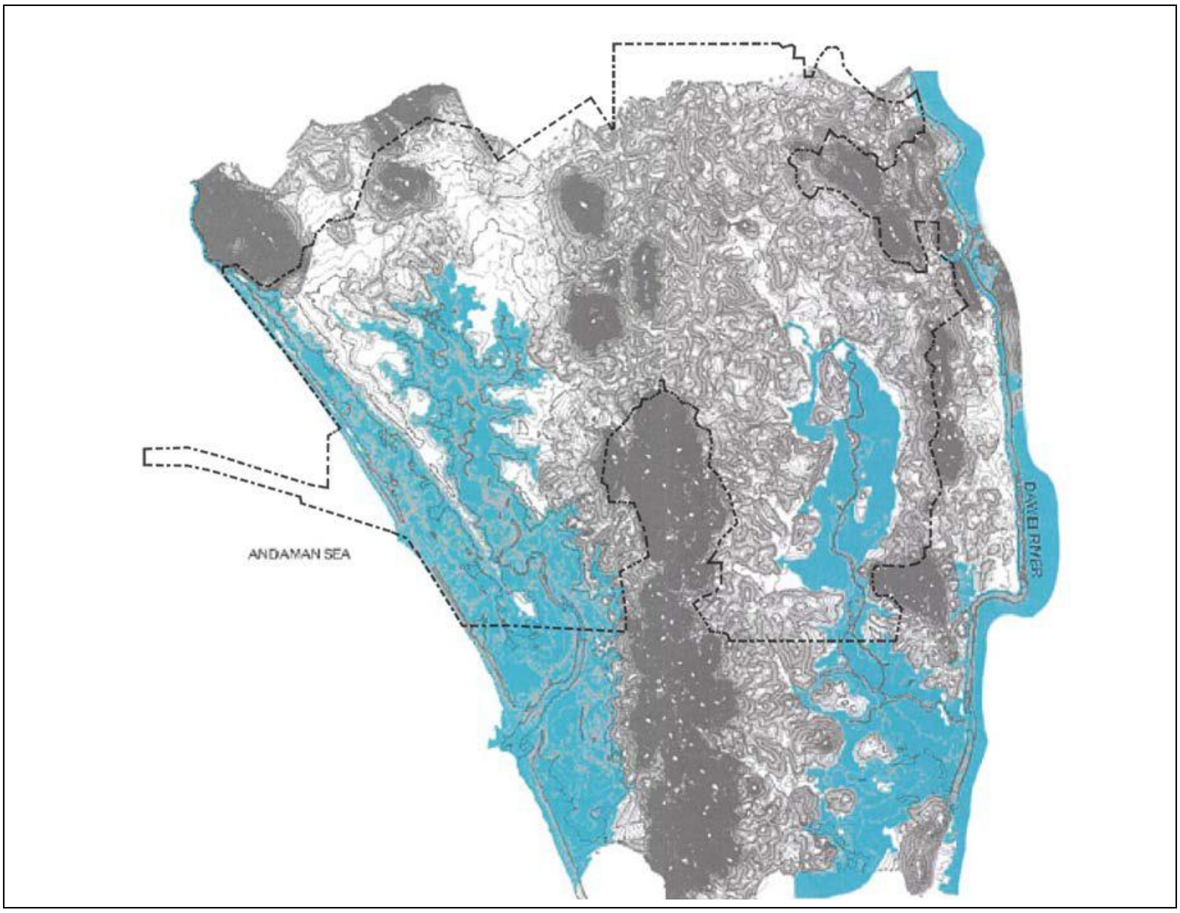
Source: IEC (2015)

4.2.4 Flood Controlling System

Flood Controlling and Drainage System are key facility in protecting the Project from severely run off and regional periodically flooding. Basin Analysis and Flooding history reveals that the Initial Industrial Estate is located in the western sub basin of the Dawei River Basin and in the upstream area of Kun Chuang River (Figure 4.2-48). Flooding is likely reoccurring in downstream area of the Kun Chuang River, further the Project area. Flood marks from recent field revealed that flood level was up to 13 meters above the Chart Datum (CD).

Nevertheless, the location is not an area of regular flooding, flood plain in the Project site which is located on both sides along the upstream of the Kun Chung River can be flooded by storms and extreme rainfalls.

Design of Flood Controlling System based on the return periods of flood within 100 years of cycle as presented in Table 4.2-22. The Flood Controlling and Drainage System consists of three major structures; Polder Dikes, Floodways and Retention Ponds.



Source: SEATEC (2012)

Figure 4.2-48 Flood Map in 2006

Table 4.2-22 Return Period of Flood Controlling System Structures

Drainage Structure	Return Period in Years	References
1. Polder Dike	100 years	AASHTO Drainage Manual
2. Floodway	100 years	AASHTO Drainage Manual
3. Box Culvert	50 years	AASHTO Drainage Manual
4. Retention Pond	50 years	AASHTO Drainage Manual

Source: IEC (2015)

Location of Floodway, Polder Dike and Retention Pond are presented in Figure 4.2-49. Floodways are broadly in north-south trending and in coherent direction of the existing upstream of the Kun Chuang River. Three Polder Dikes are in western boundary of the Project. Retention Ponds are in certain interval along the Floodways.

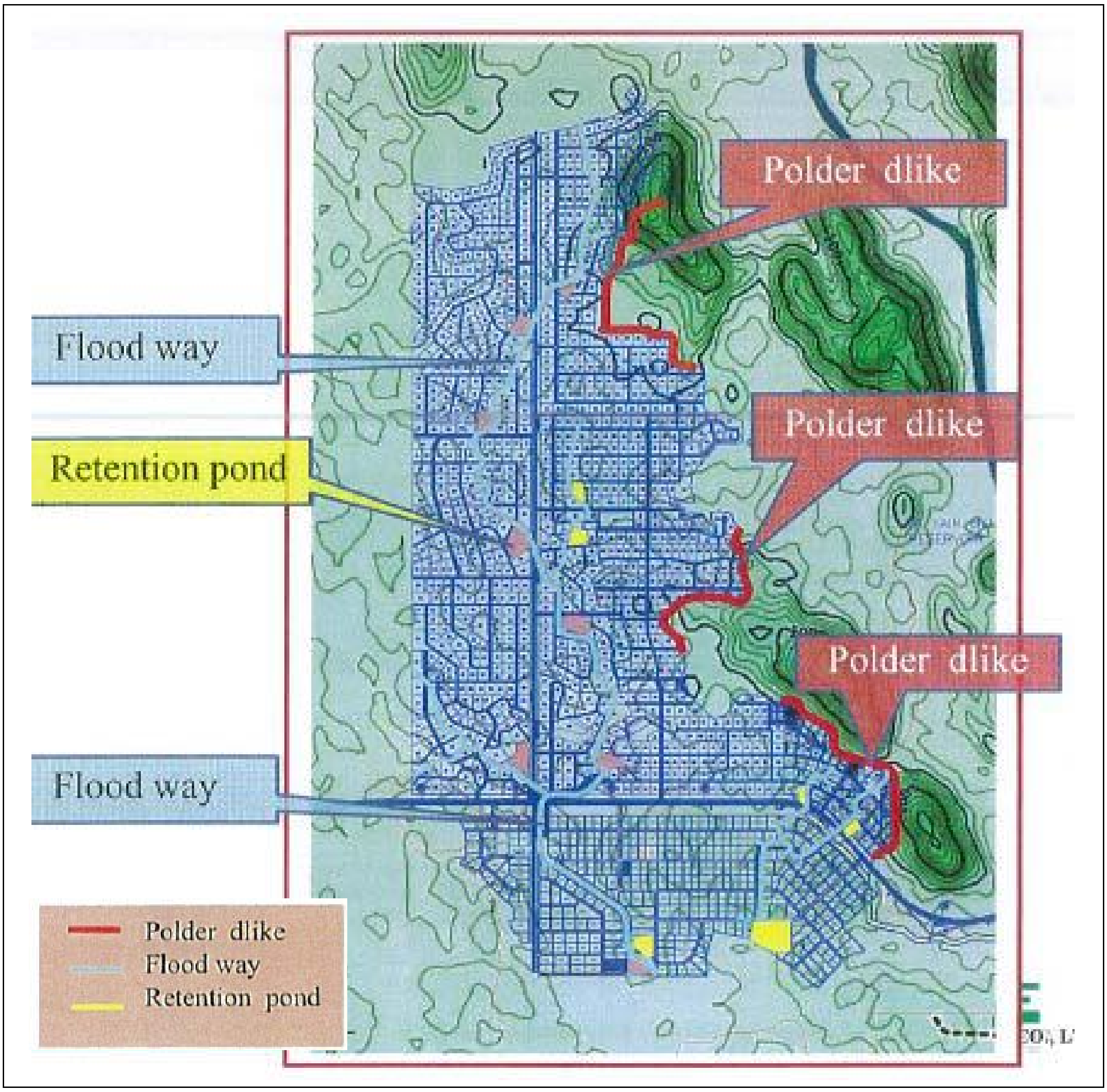
4.2.4.1 Polder Dike

Polder Dikes are Gravel Compaction type (Earth Dike) with Trapezoidal Channel. The Polder Dikes are designed base on 100 years of flood return period. They are designed with at least 50 centimeters of free board height from the maximum flood level. The Dikes have a service road on, with minimum width is 2.50 meters and 20 centimeter of laetrile surface. The service roads are connected to the access road every 800 meters.

Both side ditch and side slope of the Trapezoidal Earth Dikes are 10 V 1.5 H. Manning's Roughness of the dikes are 0.024. The hydraulic gradient shall always be below the ground level and is taken the same as the road gradient with minimum slope 1:2,000. Minimum velocity through drainage is not less than 0.60 meter per sec in order to avoid sedimentation and keep consistent gradient. Maximum velocity is limited to 1.5 meter per sec in order to prevent the drains from scouring.

4.2.4.2 Floodway

Floodway with Trapezoidal channel is concrete. The Floodways are designed base on 100 years of flood returning period. They are modified and improved from existing drainage of the Kun Chuang River. Additional work such as dredging and slope protection are required for some sections.

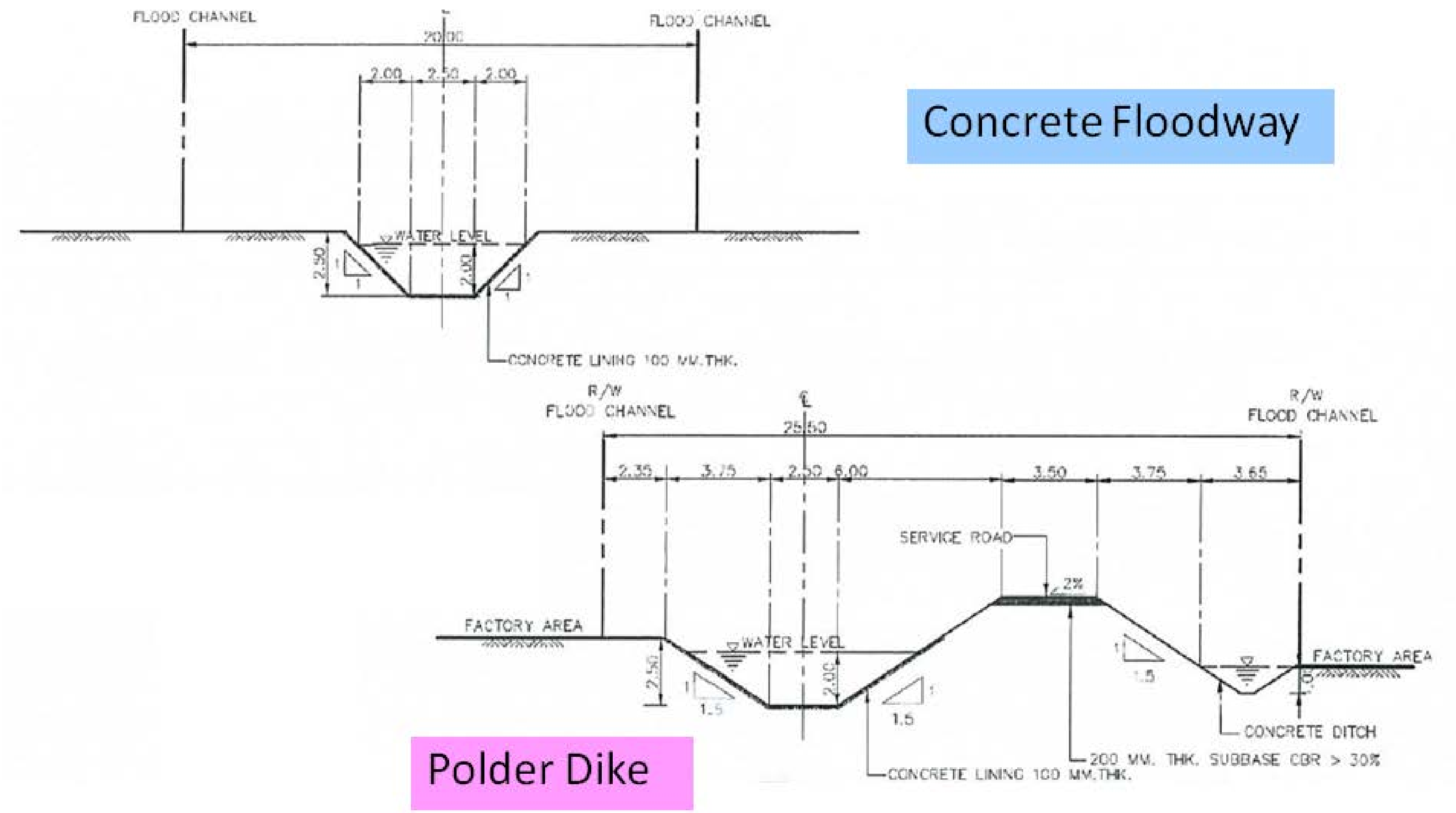


Source: IEC (2015)

Figure 4.2-49 Components of Flood and Drainage Controlling System

Both side ditch and side slope of the Trapezoidal channel are 10 V 1.5 H. Manning's Roughness are 0.014. To avoid sedimentation and keep consistent gradient, minimum velocity through drainage is not less than 0.60 meter per sec. Maximum velocity is limited to 2.0 meter per sec in order to prevent the drains from scouring.

Table 4.2-23 to Table 4.2-25 are summary of Polder Dike and Floodway Design in Zone A1 to A3 of the Dawei Industrial Estate.



Source: IEC (2015)

Figure 4.2-50 Cross section and design of Polder dike (Type 1) and concrete Floodway (Type 2)

Table 4.2-23 Variables and calculation of Polder Dike and Floodway in Zone A1

Area NO.	Area (m2) C=0.95 n=0.025	ΣCA (km2)	L (km)	H (m)	Time of Concentration T_c (min)	Rainfall Intensity I (mm./hr)	Design Runoff (m^3/s)	Drainage Structures Require: Bottom Width (m)	Drainage Structures Require: Side Slope 1:	Drainage Structures Require: Depth of Water (m)	Drainage Structures Design: Bottom Width (m)	Drainage Structures Design: Side Slope 1:	Drainage Structures Design: Depth of Water (m)	Slope of Ditch	Flow Velocity (m/s)
Poder Dike Zone A1-1	967260.313	0.9188973	4.394	157.0000	44.869	120.00	30.654	5.00	1.50	1.885	5.00	1.50	2.000	1 : 500	2.077
Poder Dike Zone A1-2	229441.994	0.2179699	1.243	135.0000	15.000	146.43	8.873	2.00	1.50	1.648	2.00	1.50	2.000	1 : 1000	1.204
Floodway A1-Right	1196702.307	1.1368672	5.678	157.0000	60.331	107.08	33.843	6.00	1.50	2.214	6.00	1.50	2.500	1 : 1000	1.640
Floodway A1-Left(Part1)	105976.768	0.1006779	0.600	11.0000	15.000	146.43	4.098	2.50	1.00	1.119	2.50	1.00	1.500	1 : 1000	1.011
Floodway A1-Left(Part2)	202027.479	0.1919261	0.750	14.0000	15.000	146.43	7.813	2.50	1.50	1.446	2.50	1.50	2.000	1 : 1000	1.157

Source: IEC (2015)

Table 4.2-24 Variables and calculation of Polder Dike and Floodway in Zone A2

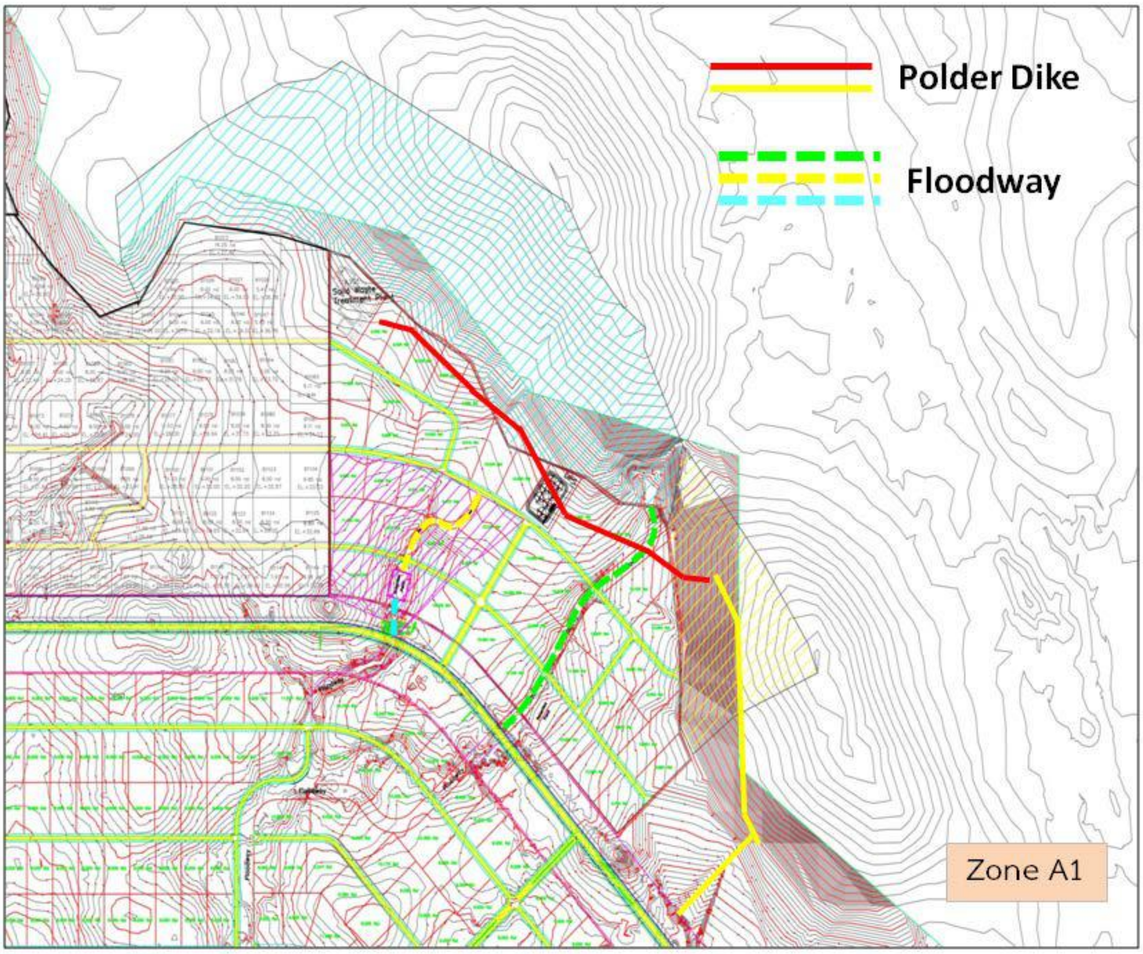
Area NO.	Area (m2) C=0.95 n=0.015	ΣCA (km2)	L (km)	H (m)	Time of Concentration T_c (min)	Rainfall Intensity I (mm./hr)	Design Runoff (m^3/s)	Drainage Structures Require: Bottom Width (m)	Drainage Structures Require: Side Slope 1:	Drainage Structures Require: Depth of Water (m)	Drainage Structures Design: Bottom Width (m)	Drainage Structures Design: Side Slope 1:	Drainage Structures Design: Depth of Water (m)	Slope of Ditch	Flow Velocity (m/s)
Floodway A2-Left	202027.479	0.1919261	0.750	14.0000	15.000	120.00	6.403	2.50	1.50	1.003	2.50	1.50	2.000	1 : 1000	1.593
Floodway A2-Right	1196702.307	1.1368672	5.678	157.0000	60.331	146.43	46.279	6.00	1.50	1.992	6.00	1.50	2.000	1 : 1000	2.585
Floodway A2	1398729.786	1.3287933	1.320	2.0000	60.011	146.43	54.092	12.00	1.50	1.540	12.00	1.50	2.000	1 : 1000	2.454

Source: IEC (2015)

Table 4.2-25 Variables and calculation of Polder Dike and Floodway in Zone A3

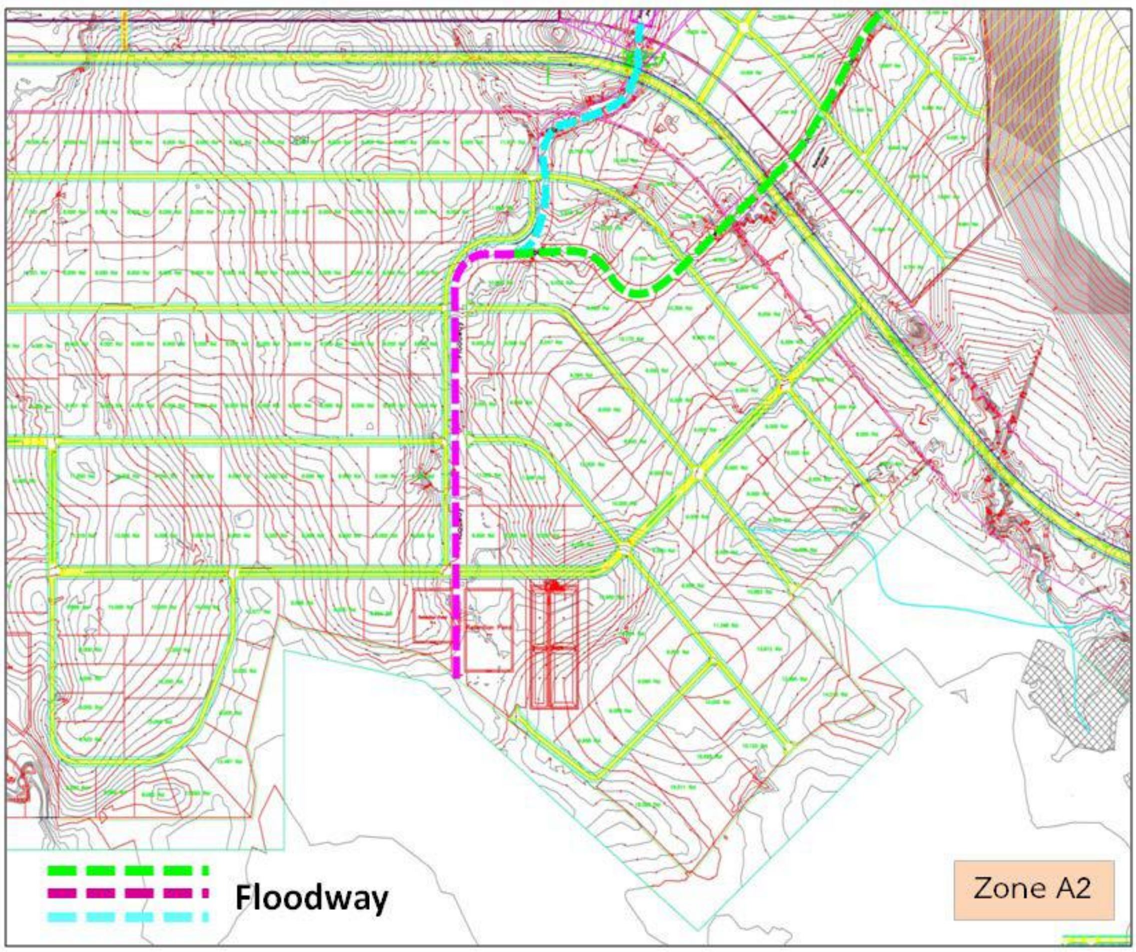
Area NO.	Area (m2) C=0.95 n=0.015	ΣCA (km2)	L (km)	H (m)	Time of Concentration T_c (min)	Rainfall Intensity I (mm/hr)	Design Runoff (m^3/s)	Drainage Structures Require			Drainage Structures Design			Slope of Ditch	Flow Velocity (m/s)
								Bottom Width (m)	Side Slope 1:	Depth of Water (m)	Bottom Width (m)	Side Slope 1:	Depth of Water (m)		
Zone A3-Left (1:1000)	456,798.76	0.4339588	0.92	15.0000	18.253	143.60	17.324	6.00	1.50	1.157	20.00	1.50	2.000	1 : 1000	1.936
Zone A3 (1:1000)	47,499,474.62	45.1245009	14.13	190.0000	160.677	21.23	266.322	40.00	1.50	1.982	40.00	1.50	2.500	1 : 1000	3.127

Source: IEC (2015)



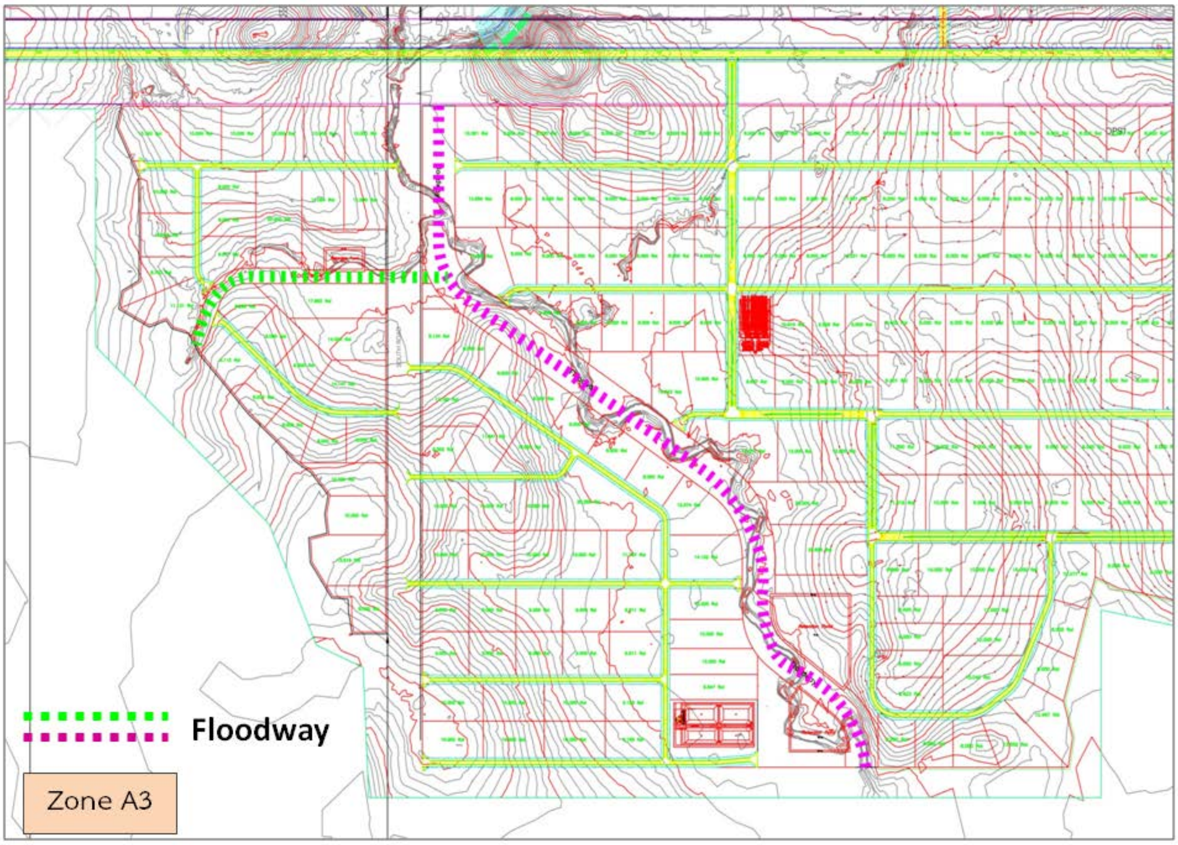
Source: IEC (2015)

Figure 4.2-51 Schematic diagram of Polder Dikes and Floodways in Zone A1



Source: IEC (2015)

Figure 4.2-52 Schematic diagram of Floodways in Zone A2



Source: IEC (2015)

Figure 4.2-53 Schematic diagram of Floodways in Zone A3

4.2.4.3 Retention Ponds and Pumping Stations

Retention Pond is designed for retaining rainwater and preventing run off flood the Project area. Rainfall Intensity (I) can be demined from IDF curve of the Project area and returning period (a period of the repeated event) is determined from time of concentration Table 4.2-23 to Table 4.2-25. Capacity and characteristic of the retention ponds for the initial phase of Dawei Industrial Estate (in Zone A) are presented in Table 4.2-26. The Retention Ponds can hold rainwater for maximum 4 hours. Layout of the Retention Ponds in Zone A are presented in Figure 4.2-54 to Figure 4.2-57.

Table 4.2-26 Capacity and characteristic of Retention Ponds for Initial Phase

Zone	Number of Retention Pond	Retained Volume (m^3)	Area (m^2)	Depth (m)	Sizing (Width x Length)
A1	2	15,831	3,957	4	80 x 100
		18,729	4,682	4.5	90 x 100
A2	2	32,889	8,222	3	150 x 150
		67,854	16,963	4	150 x 220
A3	3	43,278	14,426	4	14,426
		113,191	28,297	3	31,408
		15,737	3,934	4	60 x 120

Source: IEC (2015)

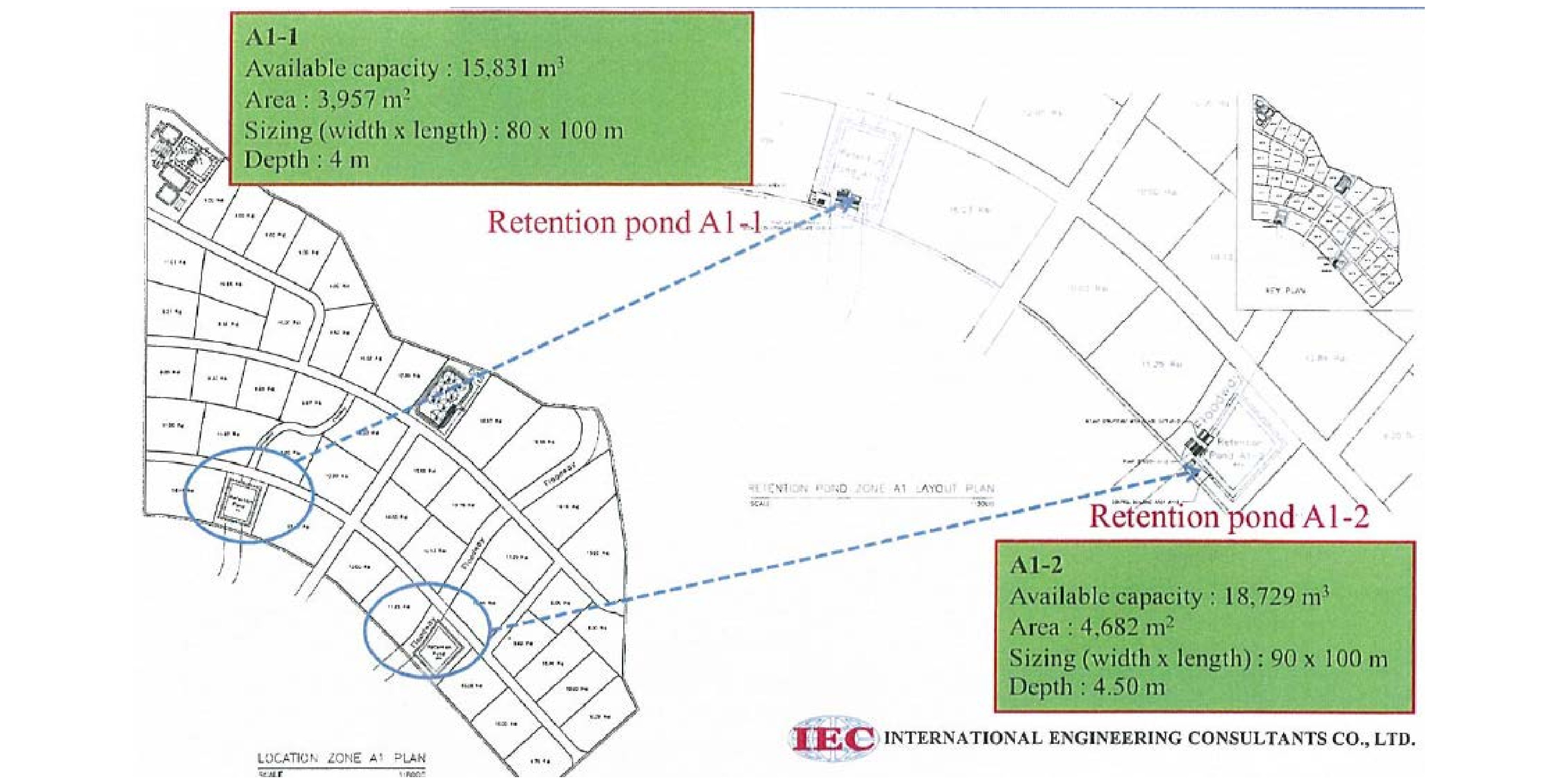
In case of heavy rainfall, the retained water will be continuously drained out of the ponds by pumps. Number and specification of pumps are presented in Table 4.2-27. In addition, to prevent rapid flooding downstream of the Project area that retained water will have to be drained, gradually.

Table 4.2-27 Pump in each retention pond of Zone A

Zone	Retention Pond	On Duty Pump	Stand By Pump
A1	A1-1	1	1
	A1-2	1	
A2	A2-1	1	1
	A2-2	1	
A3	A3-1	1	1
	A3-2	1	
	A3-3	1	

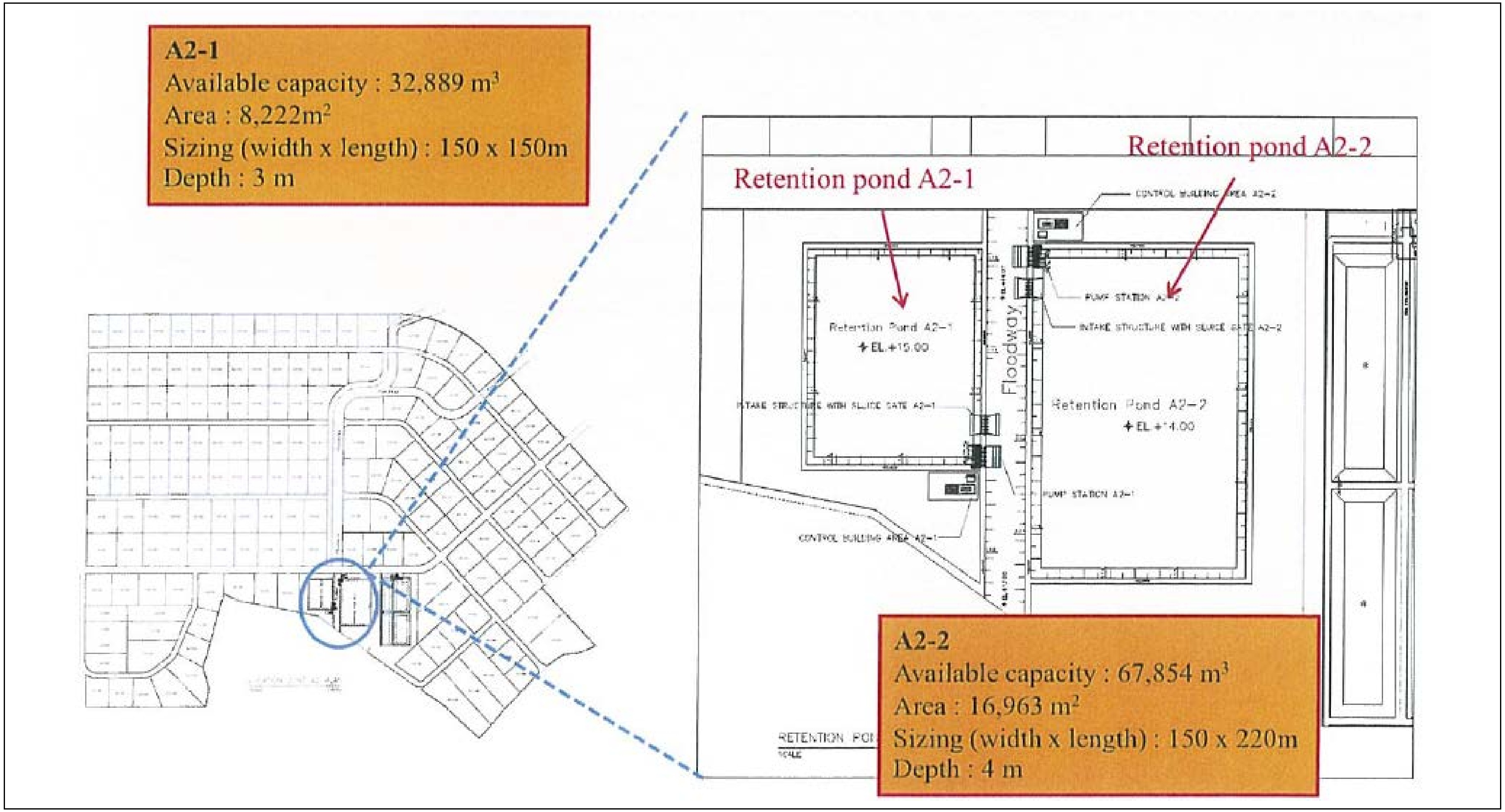
Source: IEC (2015)

Design and construction of the Retention Ponds are derived from field tests of Soil Profile and properties and simulation of Slope Stability test following.



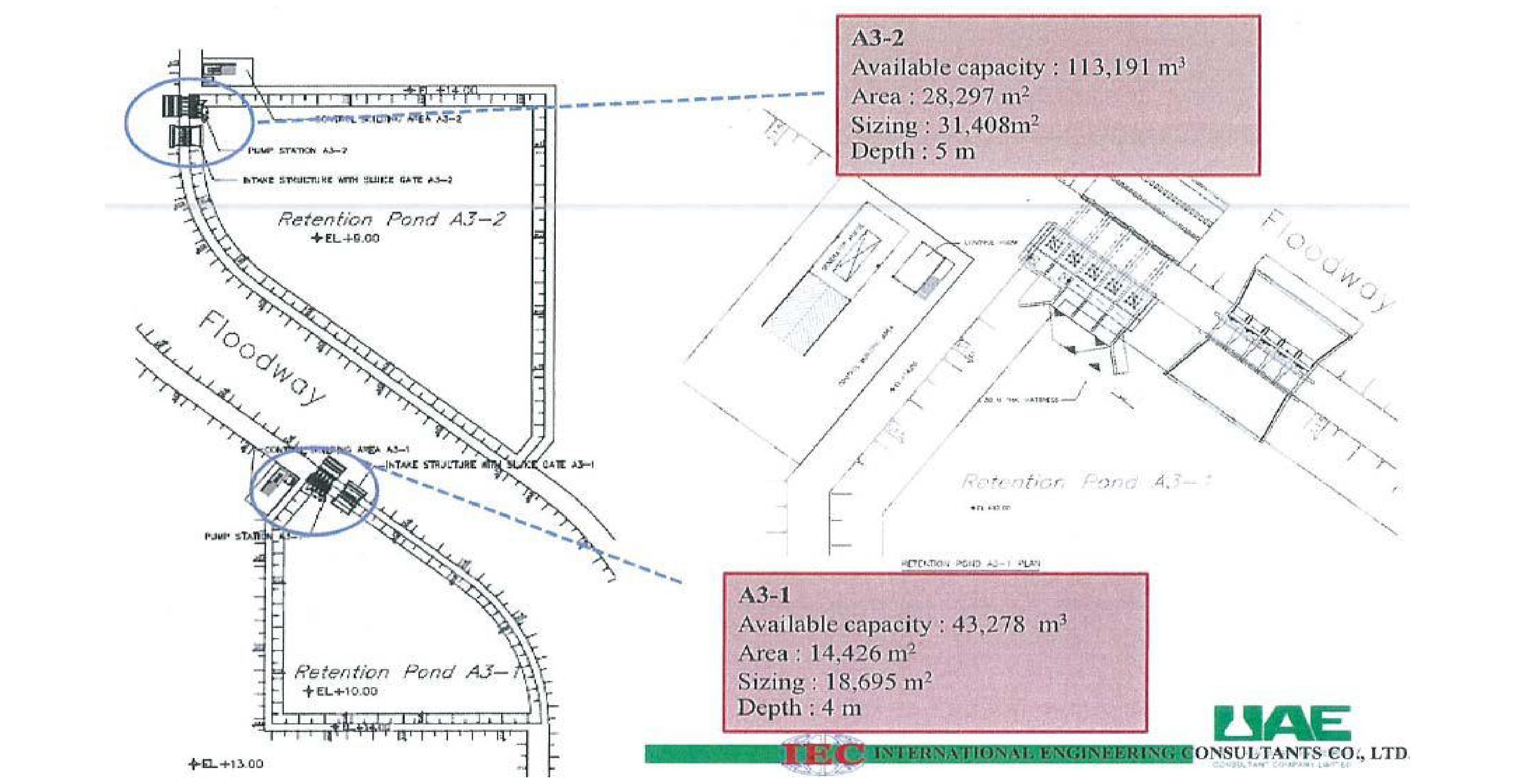
Source: IEC (2015)

Figure 4.2-54 Location and layout of the Retention Ponds in Zone A1



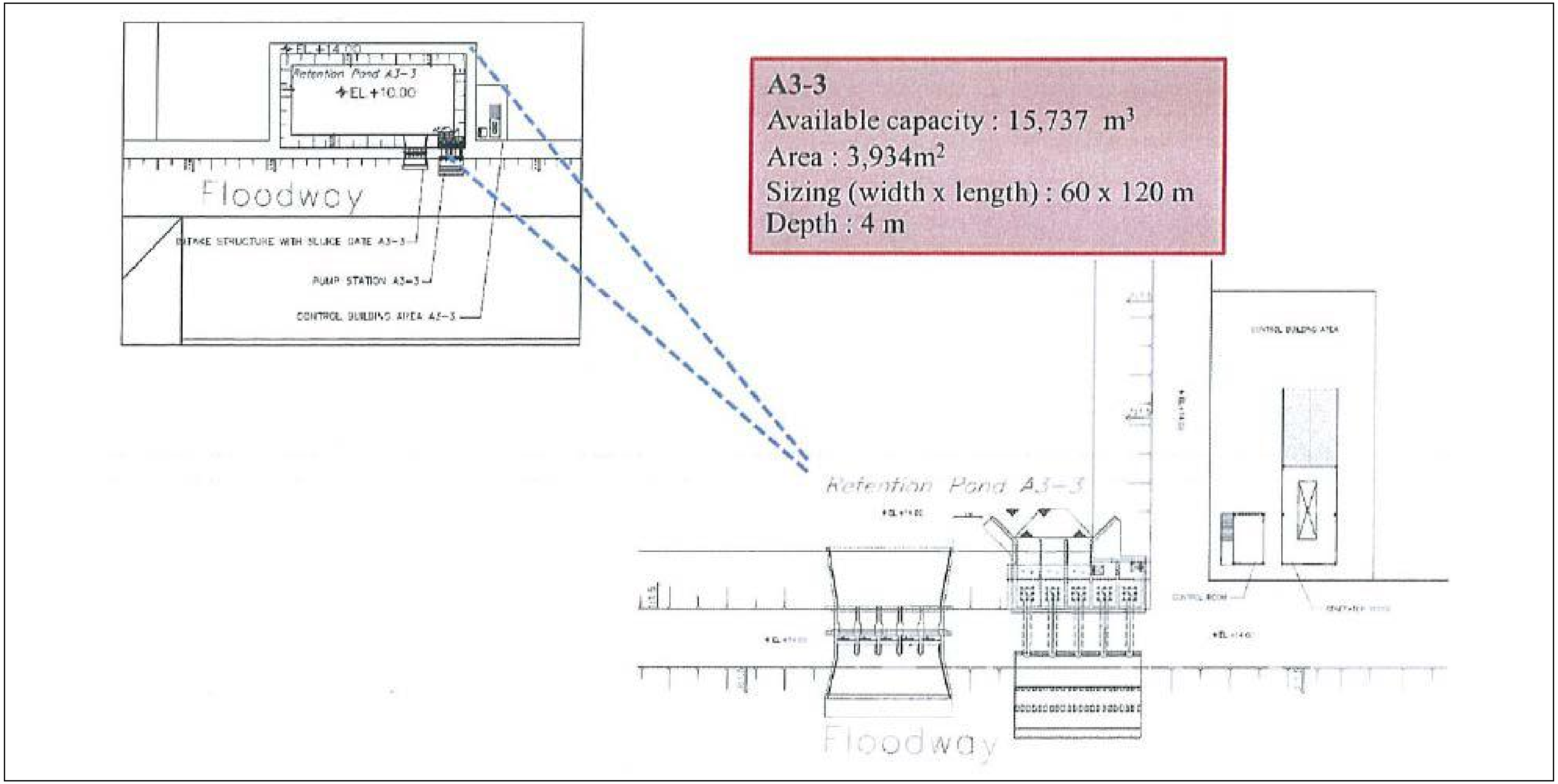
Source: IEC (2015)

Figure 4.2-55 Location and layout of the Retention Ponds in Zone A2



Source: IEC (2015)

Figure 4.2-56 Layout of the Retention Ponds in Zone A3

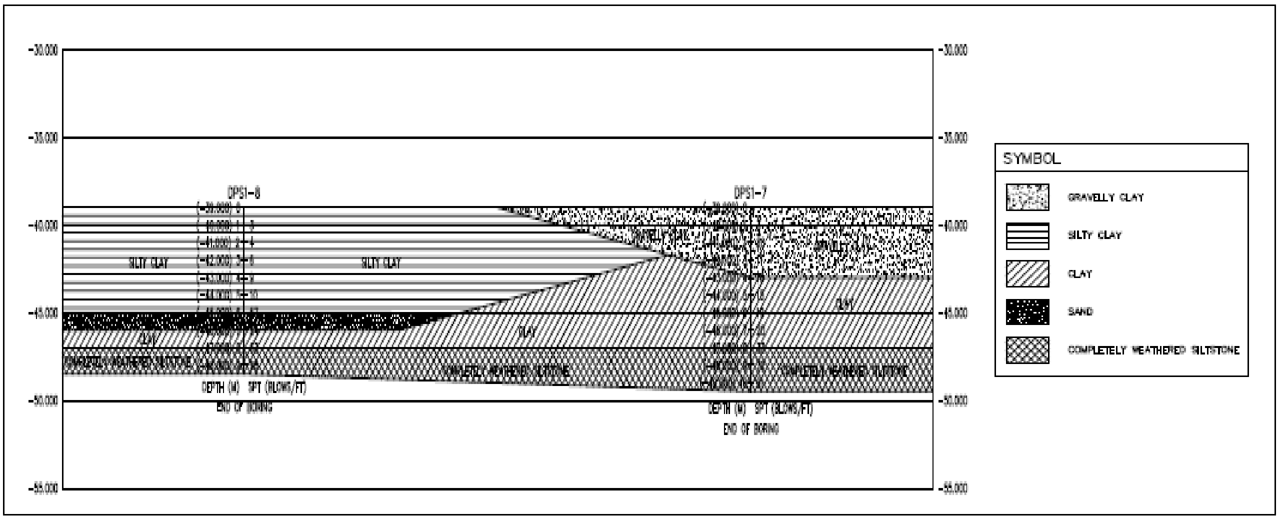


Source: IEC (2015)

Figure 4.2-57 Layout of the Retention Ponds in Zone A3

(a) Soil Profile and Design of Pile Capacity

Soil profile of zone A1 is presented in Figure 4.2-58. The soil profile tested from 2 DPS boring and logging. Data from 2 bores are correlated by geotechnical software (GeoStudio). Bores location are selected in distance of the retention ponds. Referring from the Soil Profile test, soil properties can be predicted as presented in Table 4.2-28. These properties can be applied in engineering design such as cohesion, friction angle and unit weight.



Source: IEC (2015)

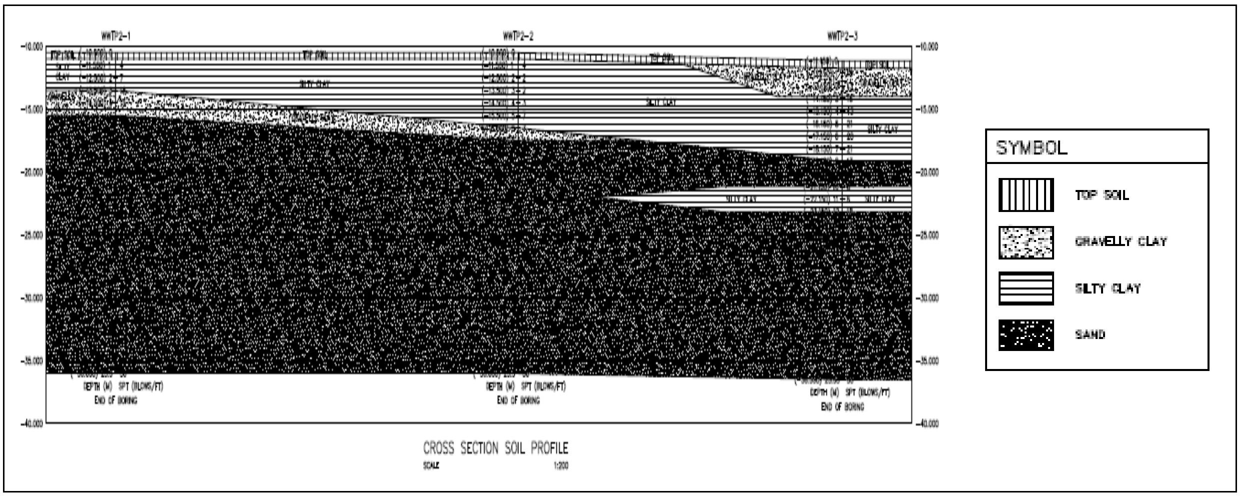
Figure 4.2-58 Tested Soil Profile of Zone A1

Table 4.2-28 Predicted Soil Properties in Zone A1

Soil properties	**Cohesion (kPa)**	**Friction angle (°)**	**Unit Weight (kN/m3)**
GC	0	30	17
CL	35	0	18
Weathered siltstone	50	38	21
Fill material	10	34	20

Source: IEC (2015)

Soil Profile of zone A3 is presented in Figure 4.2-59. The soil profile is logged and tested from 2 DPS boring in zone A3 near Wastewater Treatment Plant (WWTP). The soil properties in zone A3 are presented in Table 4.2-28.



Source: IEC (2015)

Figure 4.2-59 Tested Soil Profile of Zone A3 near the WWTP

Table 4.2-29 Soil properties of WWTP zone

Soil properties	Cohesion (kPa)	Friction angle (°)	Unit weight (kN/m³)
GC	0	33	17
CL	32	0	18
SP	0	30	18
Fill material	10	34	20

Source: IEC (2015)

According to Soil Profile Test and Soil property in zone A1 and A3, the foundations built in zone A (1-3) of the Dawei Industrial Estate are recommended in Table 4.2-30 with Safety Factor is 2.50.

(b) Slope Stability Analysis

Stability of slope is analyzed by using Slope/W, a member of Geo Studio software for calculating Factor of Safety (FS) at any circumstances. All stability designs of slope in this report are followed only Morgenstern-Price method. The Morgenstern-Price method is explained by Equation 4.2-1

$$FS = \frac{\sum_{i=1}^{n-1}\left(R_i \prod_{j=i}^{n-1} \Psi_j\right) + R_n}{\sum_{i=1}^{n-1}\left(T_i \prod_{j=i}^{n-1} \Psi_j\right) + T_n}$$

Where

R_i = The sum of the shear resistance contributed by all the forces acting on the slice except normal shear inter-slice forces.

Table 4.2-30 Allowable load pile capacity of 0.40 x 0.40 square single driven pile

Zone	Pile tip depth (m)	Allowable single pile capacity (kN)
A1	4.0 5.5 7.0 8.0 9.5	53 80 21 337 540
A2	4.5 6.0 7.5 9.0 10.0 11.5 13.0 14.5 16.0 17.5 19.0	64 91 119 172 218 284 332 383 439 497 559
A3	4.5 6.0 7.5 9.0 10.0 11.5 13.0 14.5 16.0 17.5 19.0	64 91 119 172 218 284 332 383 439 497 559

Remarks: Factor of safety = 2.50

T_i = The sum of the components of forces tending to cause instability of slope

Ψ_i = $[(\sin\alpha_{i+1} - \lambda.f_i.\cos\alpha_{i+1}).\tan\square + (\cos\alpha_{i+1} + \lambda.f_i.\sin\alpha_{i+1}).FS]/\phi_i$

ϕ_i = $(\sin\alpha_i - \lambda.f_i.\cos\alpha_i).\tan\varphi + (\cos\alpha_i + \lambda.f_i.\sin\alpha_i).FS$

Source: IEC (2015)

Two main scenario are considered in this report, normal and rapid drawdown. normal condition refers to a situation under normal rains. The retention pond will be filled and steadily drained out; whereas, rapid drown condition will occasionally occur; for example, by severely raining or storming situation. The retention pond will be rapidly filled by heavy rain and that rain water need to be drained out, shortly. Pumps will be used for draining out the retain water from the retention pond, to the floodways. Minimum Safety Factor for normal condition must not be less than 1.50 and 1.30 for rapid drawdown condition, respectively.

alculation of Slope / W is derived from 3 chief parameters such as cohesion (kPa), friction angle (phi), and unit weight (kN/m^3).

- **Slope stability of retention ponds**

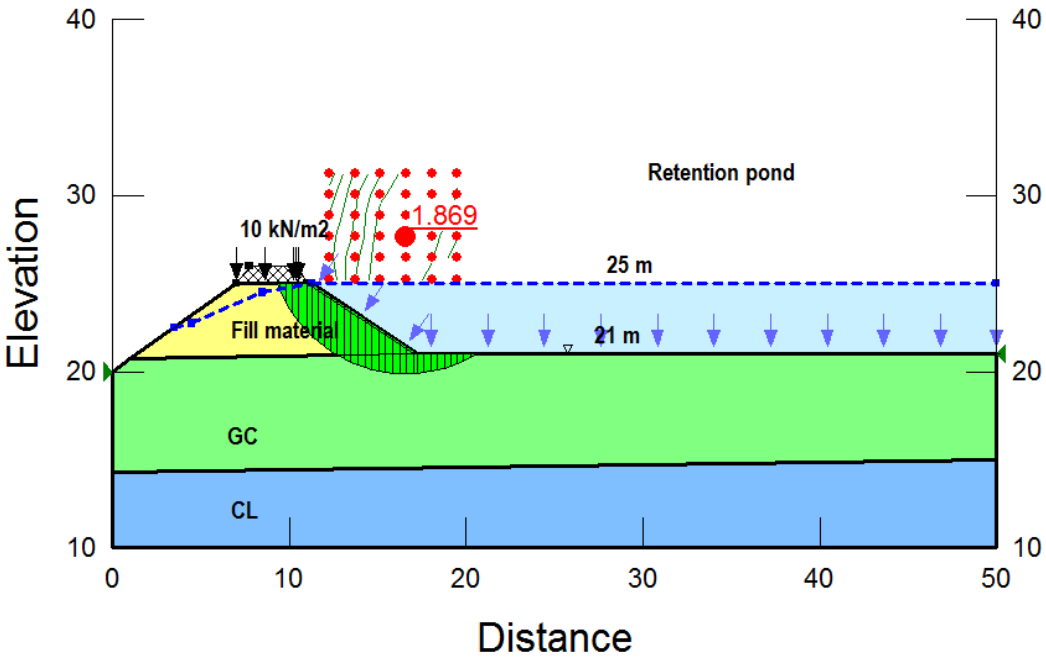
Safety Factor is computed according to the referred equation and the model is also run base on two scenario that mentioned previously. In case of rapid drawdown, slope stability analysis is simulated from condition that the water level will be decreased for 2 meters in 4 hours. Safety Factor of each the retention ponds is presented in Table 4.2-31. Simulated model of each pond under normal condition is presented in Figure 4.2-60 to Figure 4.2-66.

Table 4.2-31 Safety Factor of the Retention Ponds in different condition

Zone	Factor of safety	Condition
A1-1	1.869 1.572	Normal condition Rapid drawdown
A1-2	2.491 1.809	General condition Rapid drawdown
A2-1	2.771 2.323	General condition Rapid drawdown
A2-2	2.937 2.180	General condition Rapid drawdown
A3-1	2.058 1.662	General condition Rapid drawdown
A3-2	1.993 1.680	General condition Rapid drawdown
A3-3	2.055 1.640	General condition Rapid drawdown

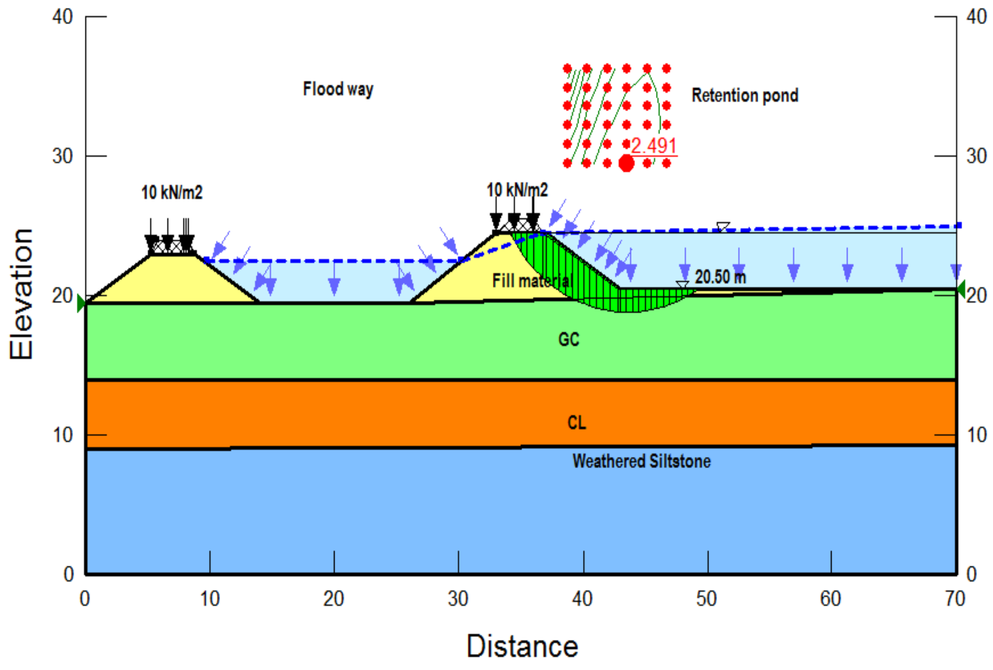
Source: IEC (2015)

In conclusion, slope of the retention ponds shall be 1V:1.5H and that leads Safety Factor to more than 1.50.



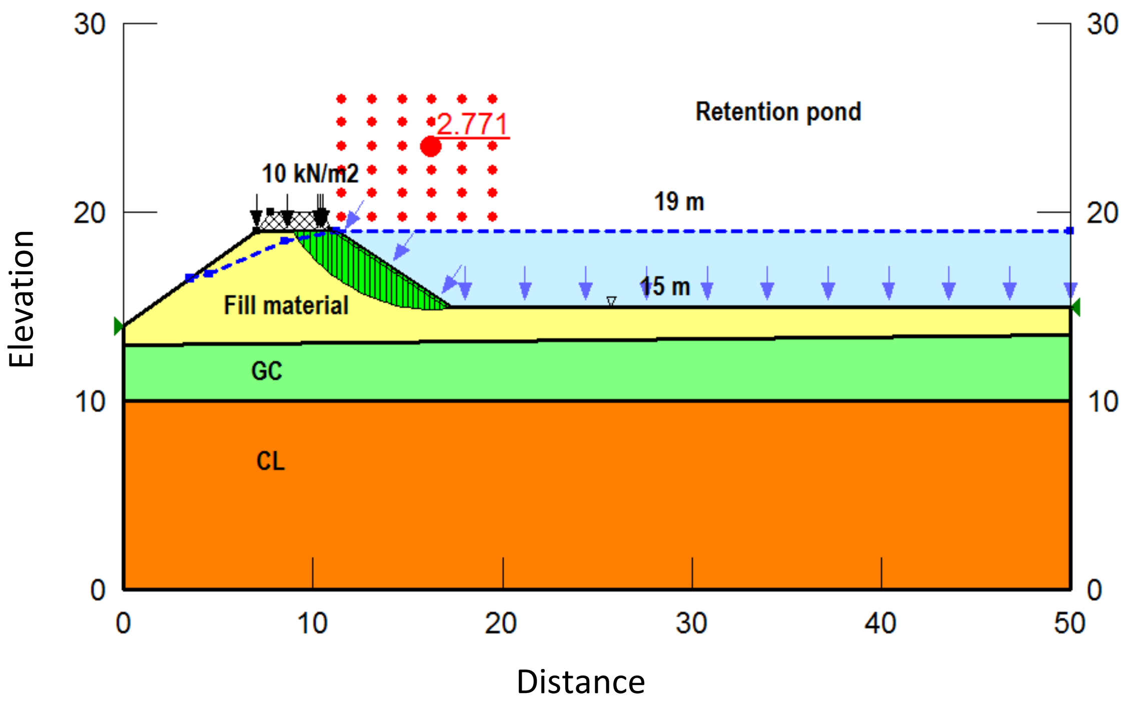
Source: IEC (2015)

Figure 4.2-60 Stability simulation of Retention Pond A1-1



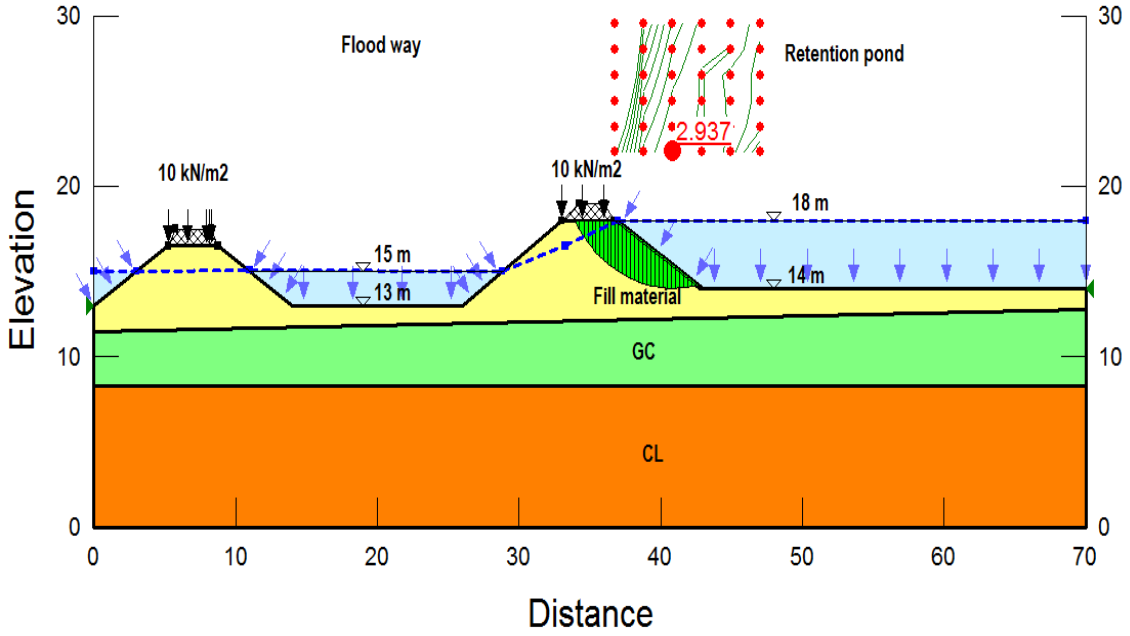
Source: IEC (2015)

Figure 4.2-61 Stability simulation Retention Pond A1-2



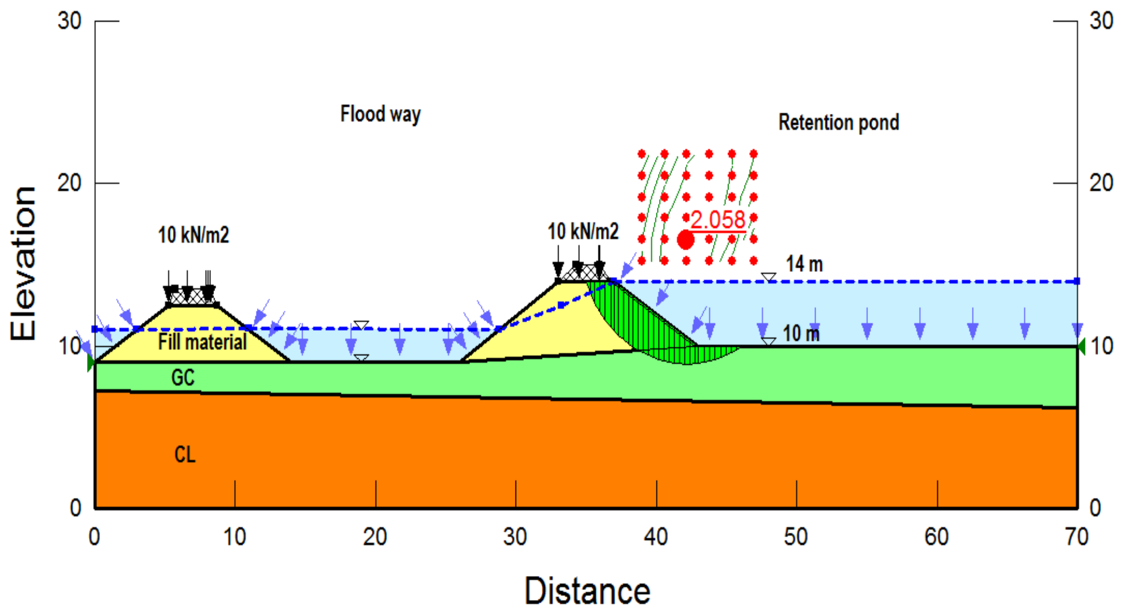
Source: IEC (2015)

Figure 4.2-62 Stability simulation of Retention Pond A2-1



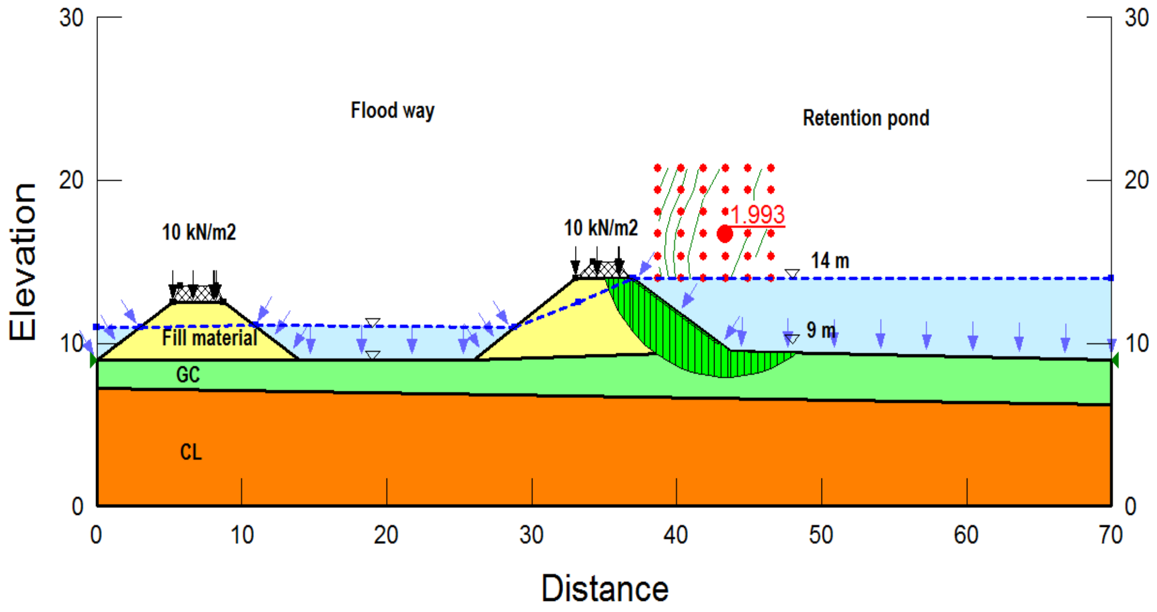
Source: IEC (2015)

Figure 4.2-63 Stability simulation of Retention Pond A2-2



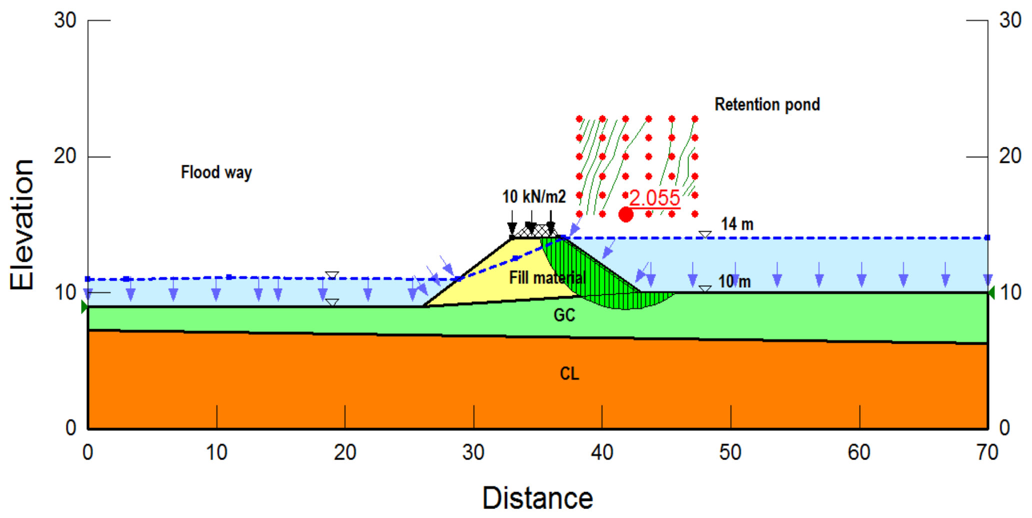
Source: IEC (2015)

Figure 4.2-64 Stability simulation of Retention Pond A3-1



Source: IEC (2015)

Figure 4.2-65 Stability simulation of Retention Pond A3-2



Source: IEC (2015)

Figure 4.2-66 Stability simulation of Retention Pond A3-3

- **Stability of pumping station**

The pumping stations will be installed on the embankment of the Retention Ponds. Weight of the pumping station on the embankment of the Retention Ponds may be effected and stability analysis shall be done.

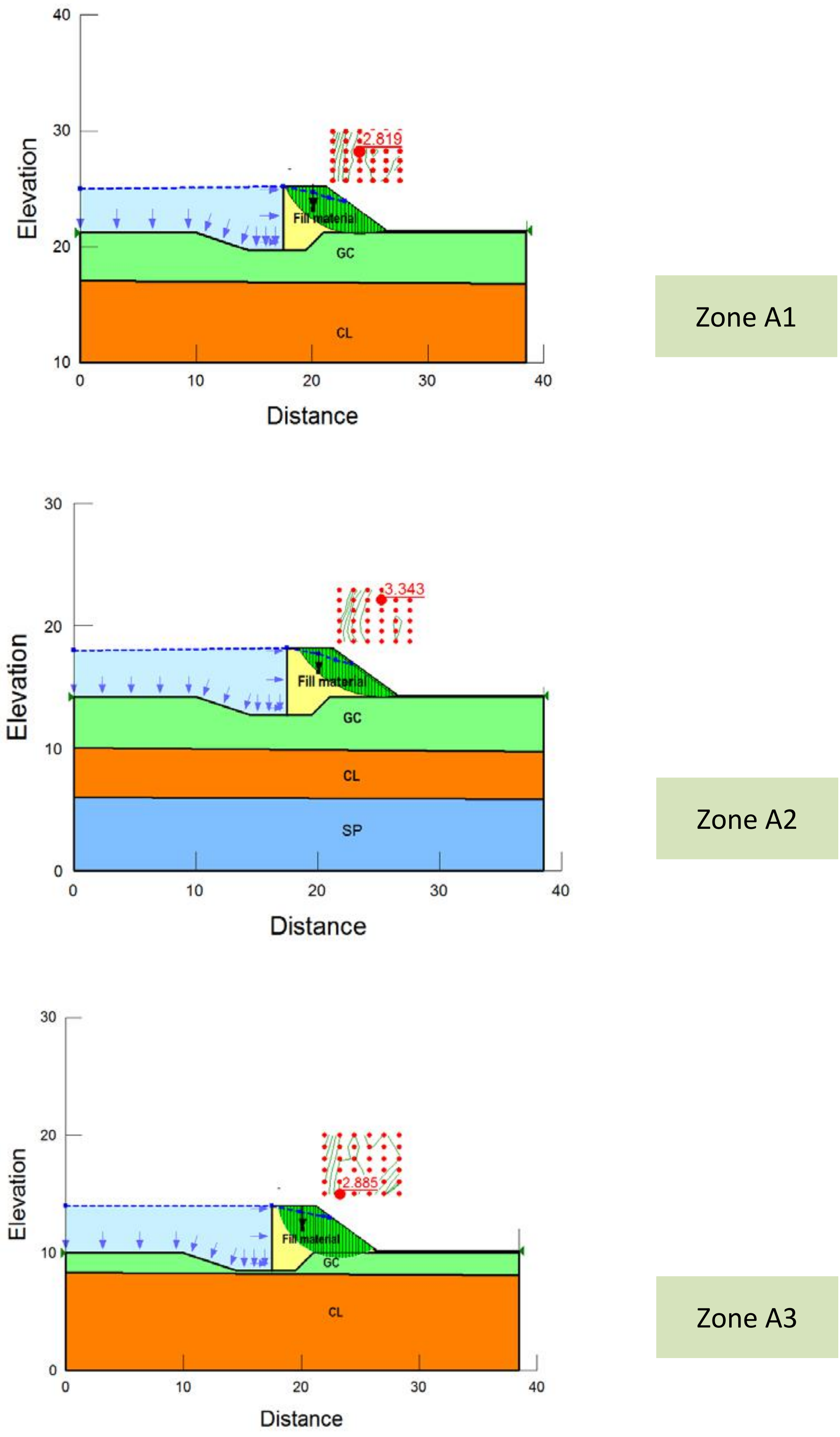
Safety factor is computed according to the referred equation and the model is run base on two scenario that also mentioned above. In case of rapid drawdown, slope stability analysis is simulated from condition that the water level will be decreased immediately. Safety factor of each the retention ponds is presented in Table 4.2-32 and simulated model of each pond under normal condition is presented in Figure 4.2-67.

Table 4.2-32 Factor of Safety of the embankment for constructing the pumping stations

Zone	Factor of safety	Condition
A1	2.819 2.518	Normal condition Rapid drawdown
A2	3.343 2.965	Normal condition Rapid drawdown
A3	2.885 2.656	Normal condition Rapid drawdown

Source: IEC (2015)

Although, there have loads of pumping stations on the embankment, design of slope shall be 1V:1.5H that will lead to suitable and safety condition.



Source: IEC (2015)

Figure 4.2-67 Stability simulation of Pumping Stations in zone A

4.2.5 Wastewater Treatment System

Wastewater Treatment Plants (WWTP) and Wastewater Collection Pipe are designed and constructed to serve wastewater discharged from the factories in the Dawei Industrial Estate. In full phase, the total seven WWTP (Figure 4.2-68) can achieve 92,425 cubic meters per day of treatment load. These WWTP are planned to construct and operate by phase in concurrent with expansion of the industrial estate.

Starting from the initial phase, phase 1 in zone A (between 2016 and 2017) and will follow by phase 2, phase 3 and phase 4 in zone B, C and D (between 2018 and 2023), respectively. (See Table 4.2-33). Due to uncertainty of the future development, the design is started for zone A or Phase 1 only. In this phase there will be two WWTPs, WWTP 1A and WWTP 2A located in zone A2 and A3, respectively (as shown Figure 4.2-69). Capacity of the WWTP 1A is 11,424 m^3/day and WWTP 2A is 10,173 m^3/day.

Table 4.2-33 Development of WWTP in Dawei SEZ

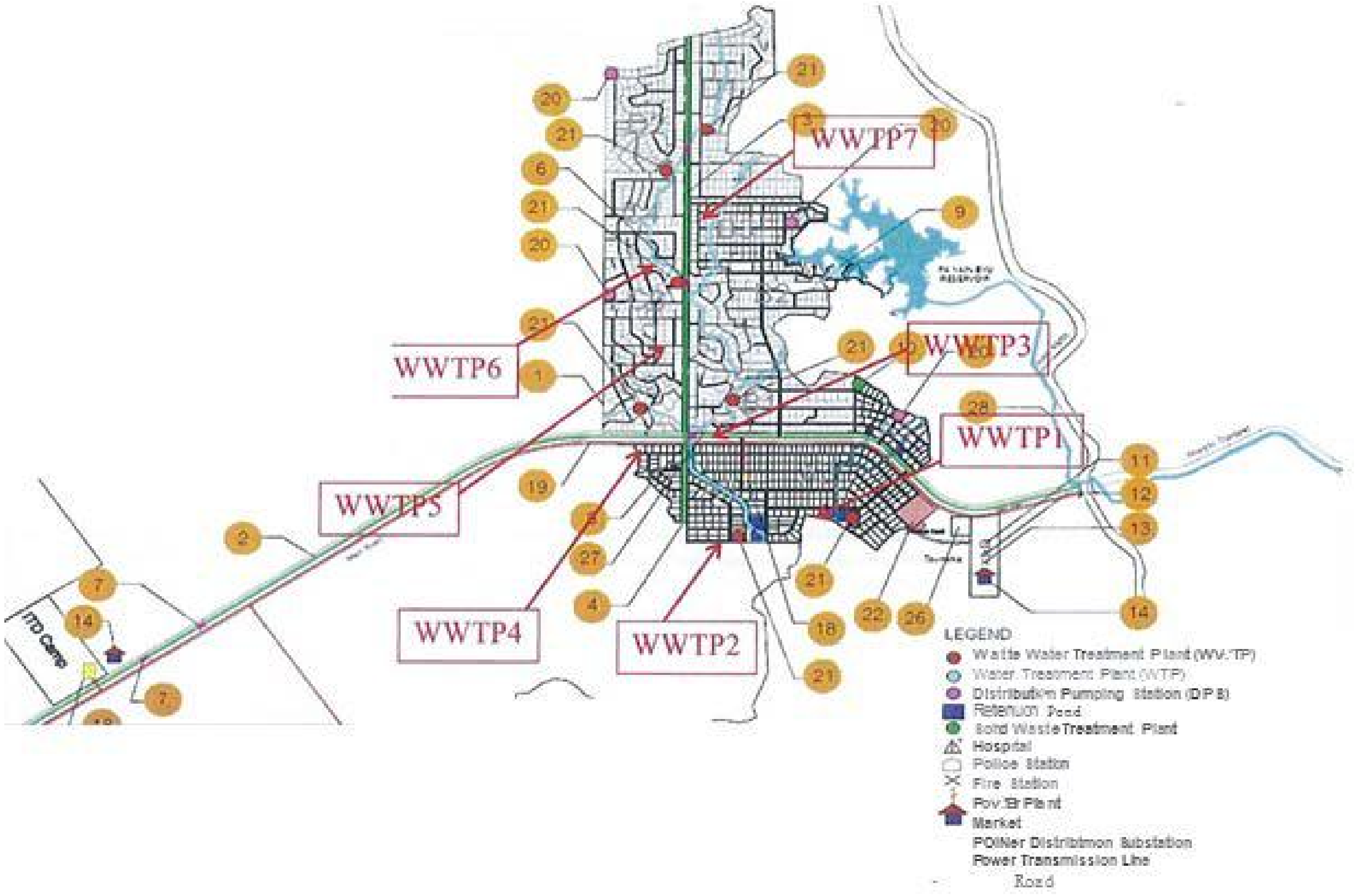
WWTP	Location	Received Wastewater	Capacity of Plant (m^3/d)	WWTP Phase	Developing Year
Plant 1	A 1	A2	11,424	1	2016-2017
Plant 2	A 2	A3	10,173		
Plant 3	B 1	B 1, B 2, B 3	26,061	2	2018-2019
Plant 4	C 2	C 1, C 2	13,250	3	2020-2021
Plant 5	C 4	C 3, C 4	12,828		
Plant 6	D 1	D 1	14,490	4	2022-2023
Plant 7	D 2	D 2	8,199		
TOTAL			**96,425**		

Source: IEC (2015)

4.2.5.1 Management of Wastewater

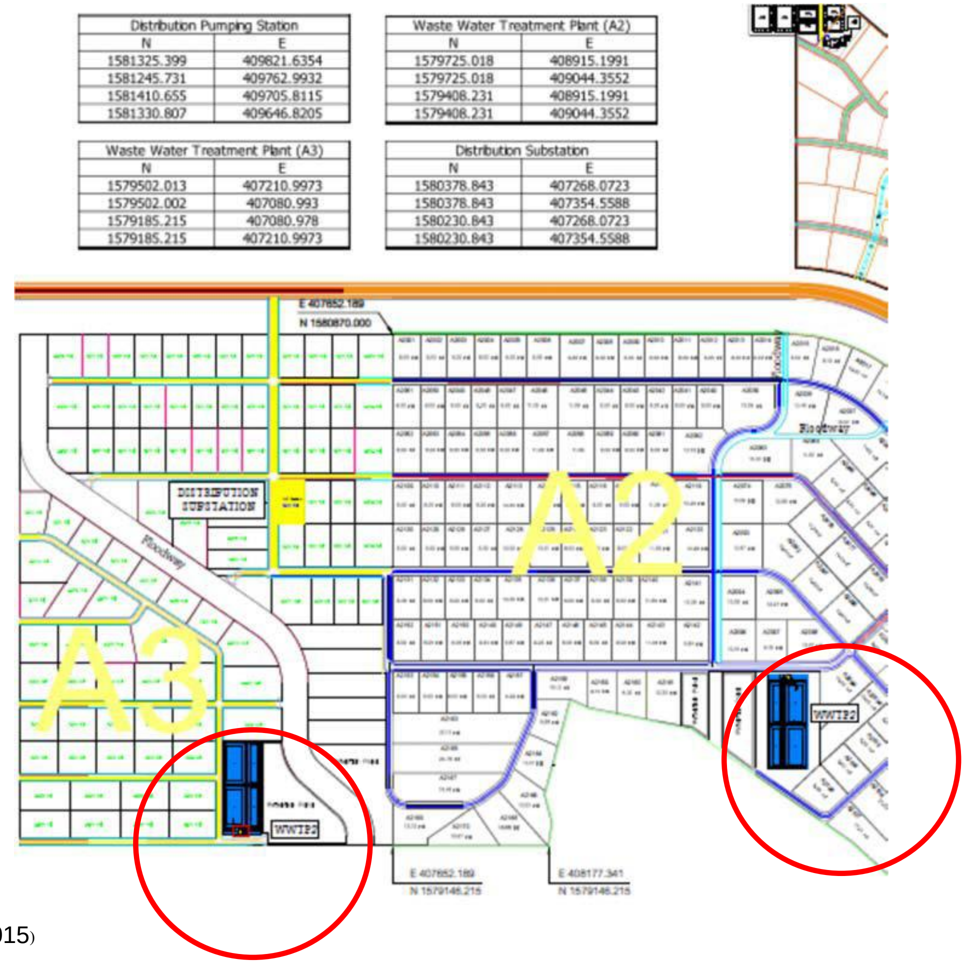
The WWTP are designed to reduce BOD and other pollutants in effluents of the factories in the Project. Certain criteria in receiving discharged effluents from each type of factories is presented Figure 4.2-68 and broadly guided in The National Emission Guidelines (2015) that its summary is presented in Chapter 3 in Table 3.6-3.

Received wastewater from the factories will be tested accordingly the mentioned criteria, before entering to the WWTP. Acceptable wastewater will be delivered to the treatment processes by pipe but unacceptable wastewater will have to be treated until achieve acceptable quality at outsource (Figure 4.2-69). Treated wastewater will be inspected before discharging to environment or public sewage or water bodies. Quality of effluent is strictly and must comply by local laws and regulation as presenting in Table 4.2-35



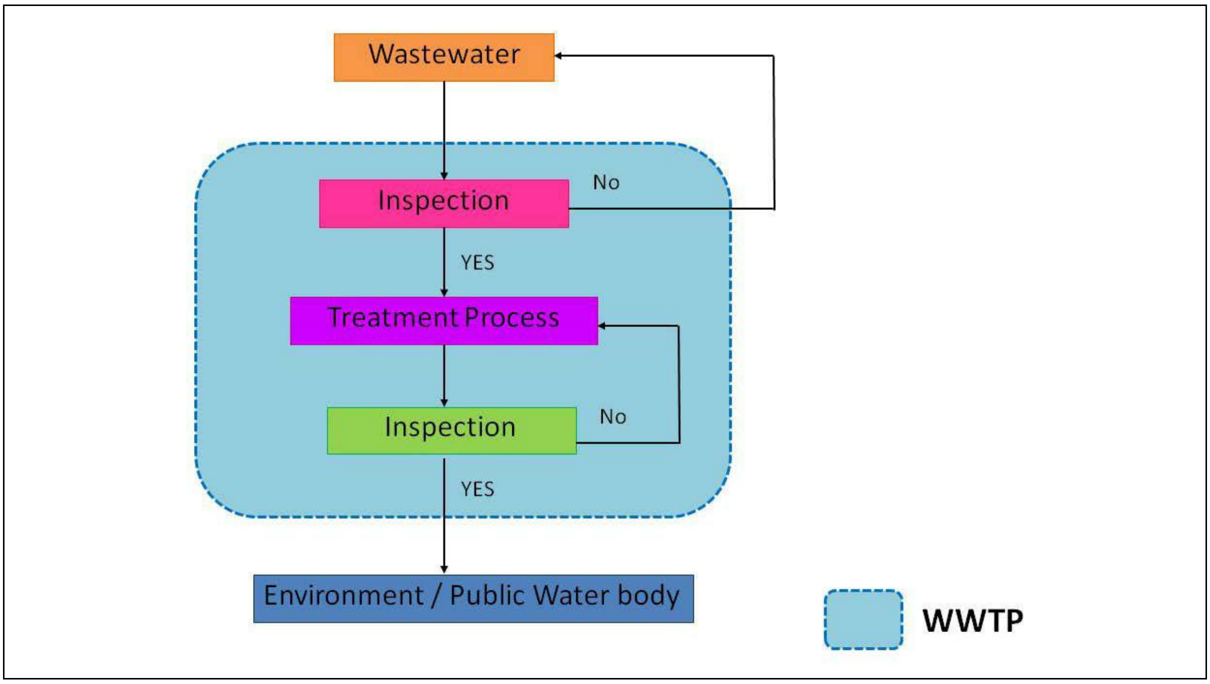
Source: IEC (2015)

Figure 4.2-68 Location of Seven Wastewater Treatment Plants in Dawei Industrial Estate



Source: IEC (2015)

Figure 4.2-69 Location of the two Wastewater Treatment Plants for Zone A in Phase I



Source: IEC (2015)

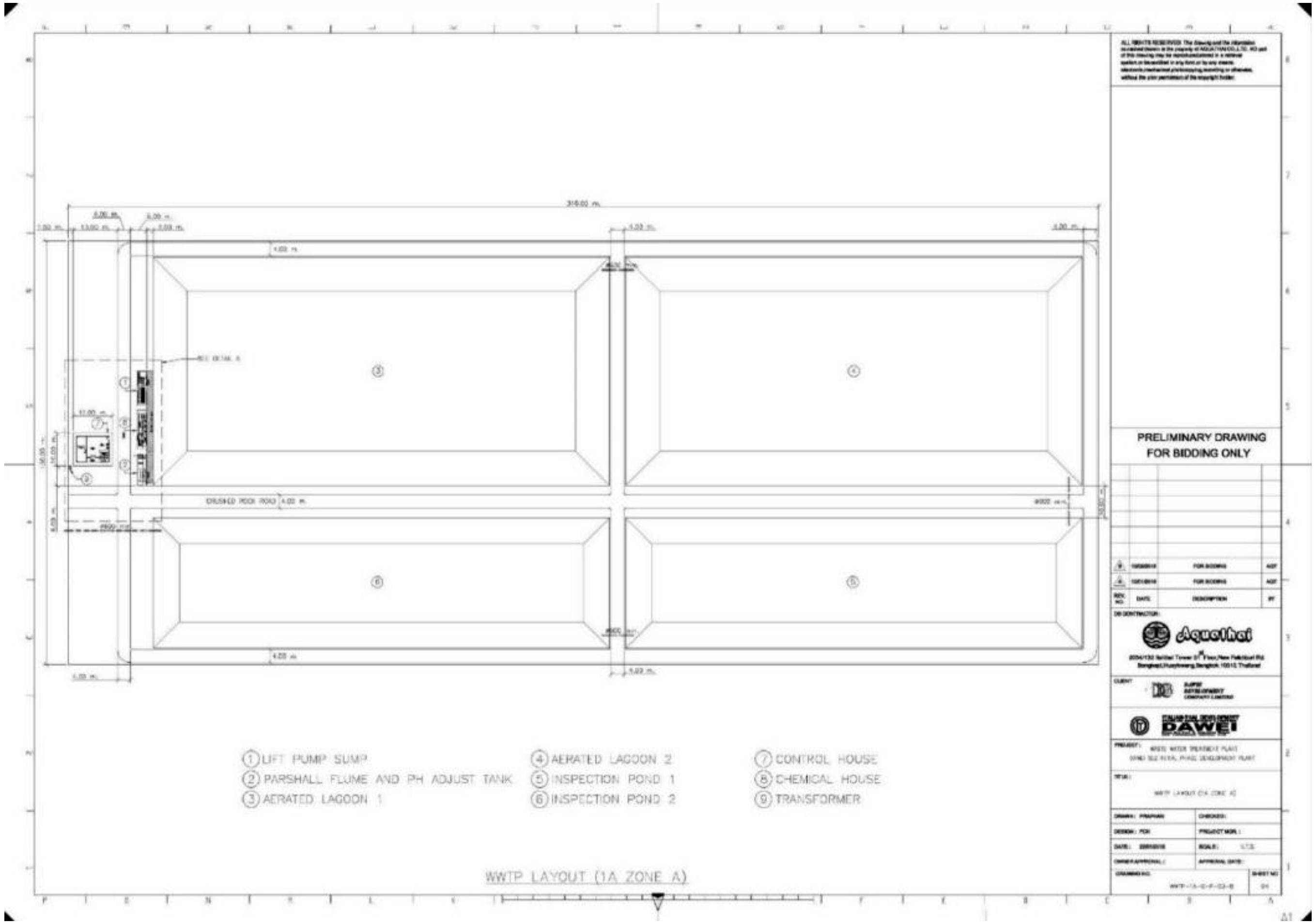
Figure 4.2-70 Management of wastewater for the Dawei WWTP

4.2.5.2 Wastewater Treatment Plant Facility

Wastewater from the factories will be collected by pipes located in each zone of the project area and conducted to each WWTP by subsurface gradient of gravity. Area of WWTP are restricted within WWTP boundary (Figure 4.2-71), from terminal end of influent pipeline (TP-01) at the lift pump station and terminal end of treated effluent pipeline (TP-02) at drainage at the perimeter fence (Figure 4.2-72)

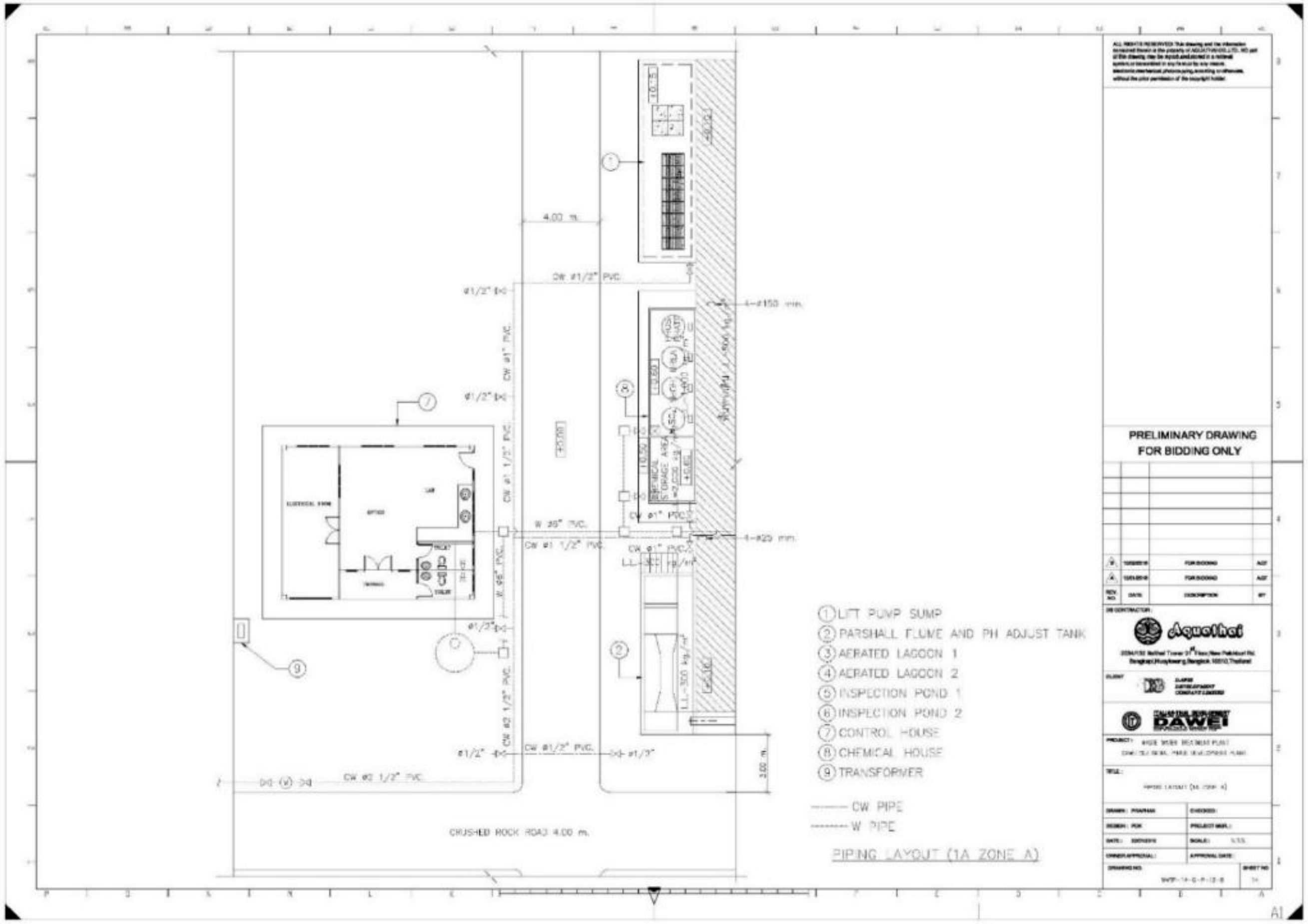
Biological treatment scheme is routine and consistence for seven WWTPs; however, the initial designs presented in this EIA report is specific for zone A. The WWTPs consists of

- Lift pumping;
- Chemical feed system;
- Flow measurement and pH adjustment;
- Polishing pond and aerated lagoon (Alternative);
- Inspecting pond;
- Resting pond;
- Emergency pond.



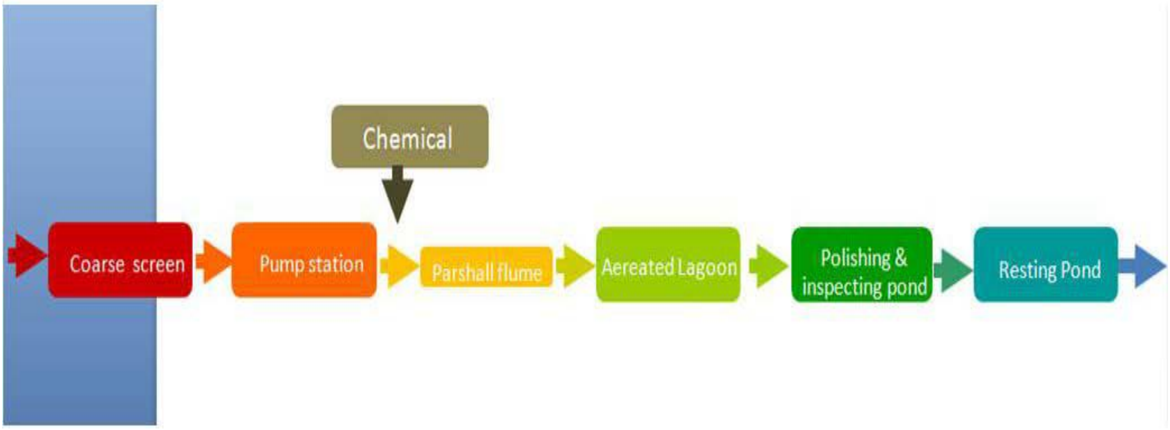
Source: IEC (2015)

Figure 4.2-71 Layout of WWTP 1A



Source: IEC (2015)

Figure 4.2-72 Layout of pipelines in WWTP 1A



Source: ESIA Study Team

Figure 4.2-73 Basic Flow Chart of WWTP

The received wastewater will be sieved by coarse screen before introduced to the process by Lift Pumping. Afterwards, rate of flow is adjusted and chemicals such as lime or are added, treated wastewater will be passed through the Aerated Lagoon (Polishing Ponds, July 2016) for biological treatment. Treated wastewater will be rested for 12 hours and sedimentation in the resting pond before discharging to the environment or public water body. Flow diagram is presented in Figure 4.2-74. Quality of effluent will be tested for parameters in Table 4.2-35 In case emergency such as failure of pumps or performance or in case of maintenance, the wastewater will be hold in emergency pond for 24 hours.

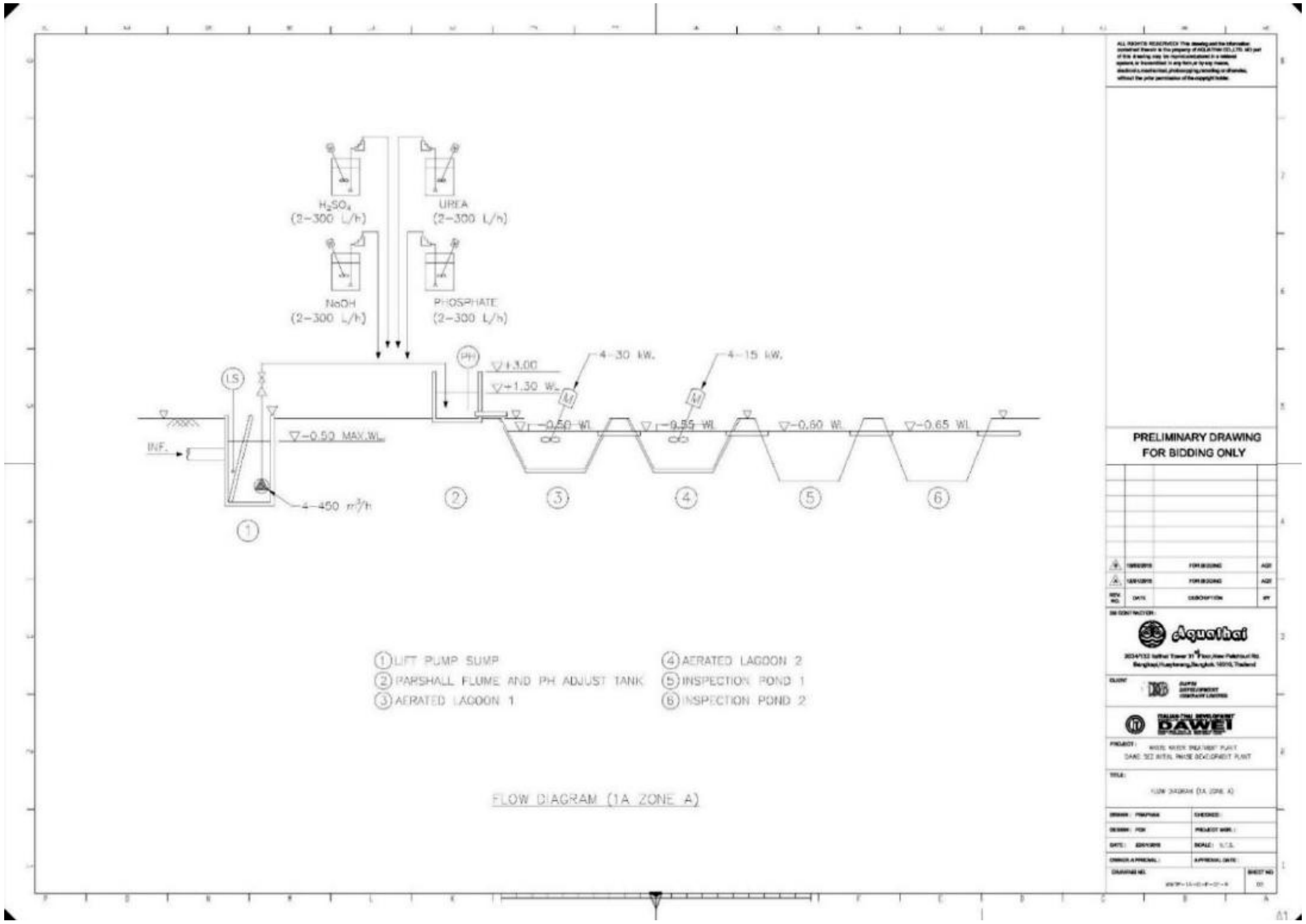
(a) Flow Rate

Flow rate is designed base on average dry weather flow and depends on situation, development of the Industrial Estate. WWTP 1A will receive wastewater from zone A1 and some part of zone A2 and WWTP 2A will received wastewater from some part of zone A2 and zone A3. Assumed rate of water consumption in each zone are the same at 4.375 cubic meter per day per one thousand square meters and rate of wastewater generation is 0.8 of consumed water. Total capacity of WWTP 1A is 11,424 cubic meters per day and total capacity of WWTP 2A is 10,173 cubic meter per day. Calculation of flow rate are presented in Table 4.2-34.

Table 4.2-34 Flow Rate of WWTP 1A and WWTP 2A

	Sellable Area (m^2)	Consumed Rate (m^3/day)	Wastewater Generation (m^3/day)
WWTP 1A	3,264,000	14,280	11,424
WWTP 2A	2,906,571	12,716	10,173

Source: IEC (2015)



Source: IEC (2015)

Figure 4.2-74 Flow Diagram of WWTP 1A

Table 4.2-35 Quality of discharging effluents from WWTP [a]

Discharged Water Parameters	
Construction Phase	
Biological Oxygen Demand (BOD)	30 mg/L
Chemical Oxygen Demand (COD)	125 mg/L
Operation Phase	
5-day Biochemical Oxygen Demand	50 mg/L
Chemical Oxygen Demand	250 mg/L
Ammonia	10 mg/L
Arsenic	0.1 mg/L
Barium[d]	1 mg/L
Cadmium	0.1 mg/L
Chlorine (Total residual)	0.2 mg/L
Chloride as Cl_2	1,000 mg/L
Chromium (Trivalent)[d]	0.75 mg/L
Chromium (Hexavalent)	0.1 mg/L
Chromium (Total)	0.5 mg/L
Copper	0.5 mg/L
Cyanide (Free)	0.1 mg/L
Cyanide (Total)	1 mg/L
Formaldehyde	1mg/L
Fluoride	20 mg/L
Heavy metals (Total)	10 mg/L
Iron	3.5 mg/L
Lead	0.1 mg/L
Manganese[d]	5 mg/L
Mercury	0.01 mg/L
Nickel	10 mg/L
Oil and grease	10 mg/L
pH	6-9
Pesticide	0.10 mg/L
Phenols	0.5 mg/L
Radioactive	Not Allowed
Selenium	0.1 mg/L
Silver	0.5 mg/L

Table 4.2-35 Quality of discharging effluents from WWTP to Environment or Public Sewage or Water [a] (Cont.)

Discharged Water Parameters	
Sulfide	1 mg/L
Surfactant (Synthesis)[d]	30
Temperature increase [b]	< 3 °C
Total Coliform Bacteria	400/100mL
Total Dissolve Solid (TDS)[d]	3,000 mg/L
Total phosphorus	2 mg/L
Total Suspended Solids (TSS)	50 mg/L
Zinc	2 mg/L
Odor Level [c]	2-10 Odor unit

Remarks:

a/ National Pollution prevention and abatement handbook. 1998. Toward cleaner production. World Bank Group in collaboration with United Nations Environment Programme and the United Nations Industrial Development Organization.

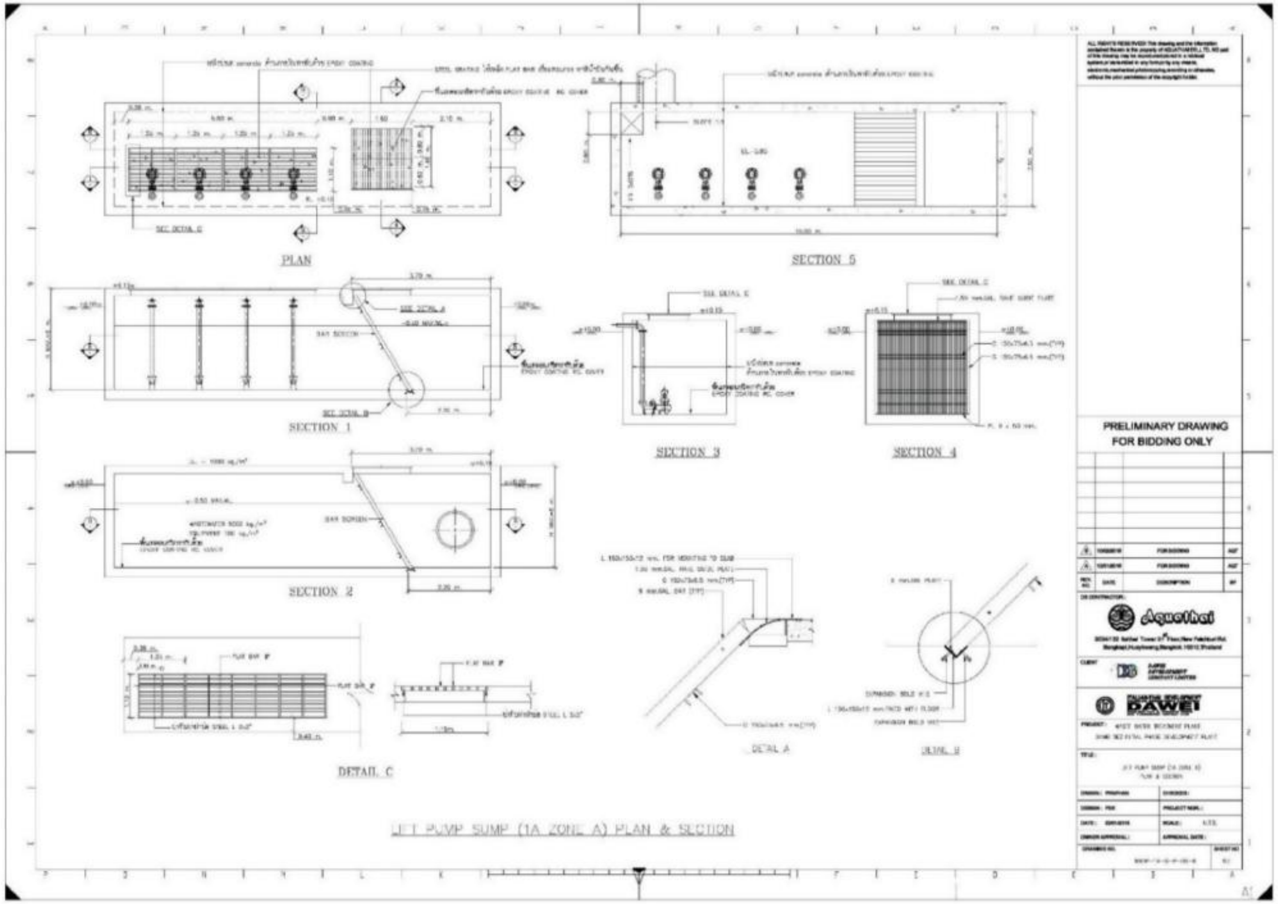
b/ At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity when the zone is not defined, use 100 meters from the point of discharge.

C/ Industrial odor control. 2002. Environmental guideline No.9, Danish Environmental Protection Agency, Ministry of Environment.

Source: The Myanmar National Environmental Quality Emission Guidelines, 2015.

(b) Lift Pumping Station

Lift pump sump will receive wastewater from the collection pipe system. The received wastewater will be filtrated by coarse bar screen. Some pollutants such a gross particles i.e. sticks, floating and general debris will be removed from the influent prior pumped to the subsequent treatment processes. There will be 4 pumps on duty and 1 stand by on the self for each WWTP. The pumps will operate according to level of water in the pump sump. Pumps are 15 KW submersible and non-clog type with rate of 360 m^3/hour. RC Tank is 2.5 meters of width, 10 meters of length and 7 meters of height and with 6 meters of SWD.



Source: IEC (2015)

Figure 4.2-75 Plan and section of Lift Pump Sump in WWTP 1A

Peak hourly flow of pump at WWTP 1A is 1,428 m3/hour while peak hourly flow of pump a WWTP 2A is 1,272 m3/hour. Design of the pumps are summarized in Table 4.2-36.

Table 4.2-36 Capacity of components in Lift Pumping Station

	RC Tank (m^3)	Pump (m^3/hour)	Peak Hourly Flow (m^3/hour)
WWTP 1A	150	360	1,428
WWTP 2A			1,272

Source: IEC, 2015

(c) Parshall flume and pH Adjustment and nutrients addition

Rate of influent flow will be measured by Parshall flume with totalizer. Afterward, wastewater will be firstly treated in the neutralizing tank. pH will be adjusted by additives. In reducing pH in WWTP 1A, sulfuric acid (H_2SO_4) will be fed by dosing pumps at 95 lph with air mixing and in raising of pH, sodium hydroxide (NaOH) will be added by dosing pumps at 95 lph with air mixing. The same method is also applied for WWTP 2A but with different rate of dosing pumps at 85 lph. Phosphate and urea will be fed into water after neutralization. Phosphate will be fed by dosing pumps at 10 lph with 0.5 kW mixer and urea will be fed by dosing pumps at 30 lph with 0.5 kW mixer. For each chemicals, one dosing pump is on duty and one dosing pump is stand by. a Size of pH adjusting tanks are the same for both WWTPs, 2.5 meters of width, 8 meters of length and 3 meters of height and with 1.5 meters of SWD.

Table 4.2-37 Chemicals substance for treated in the neutralizing tank

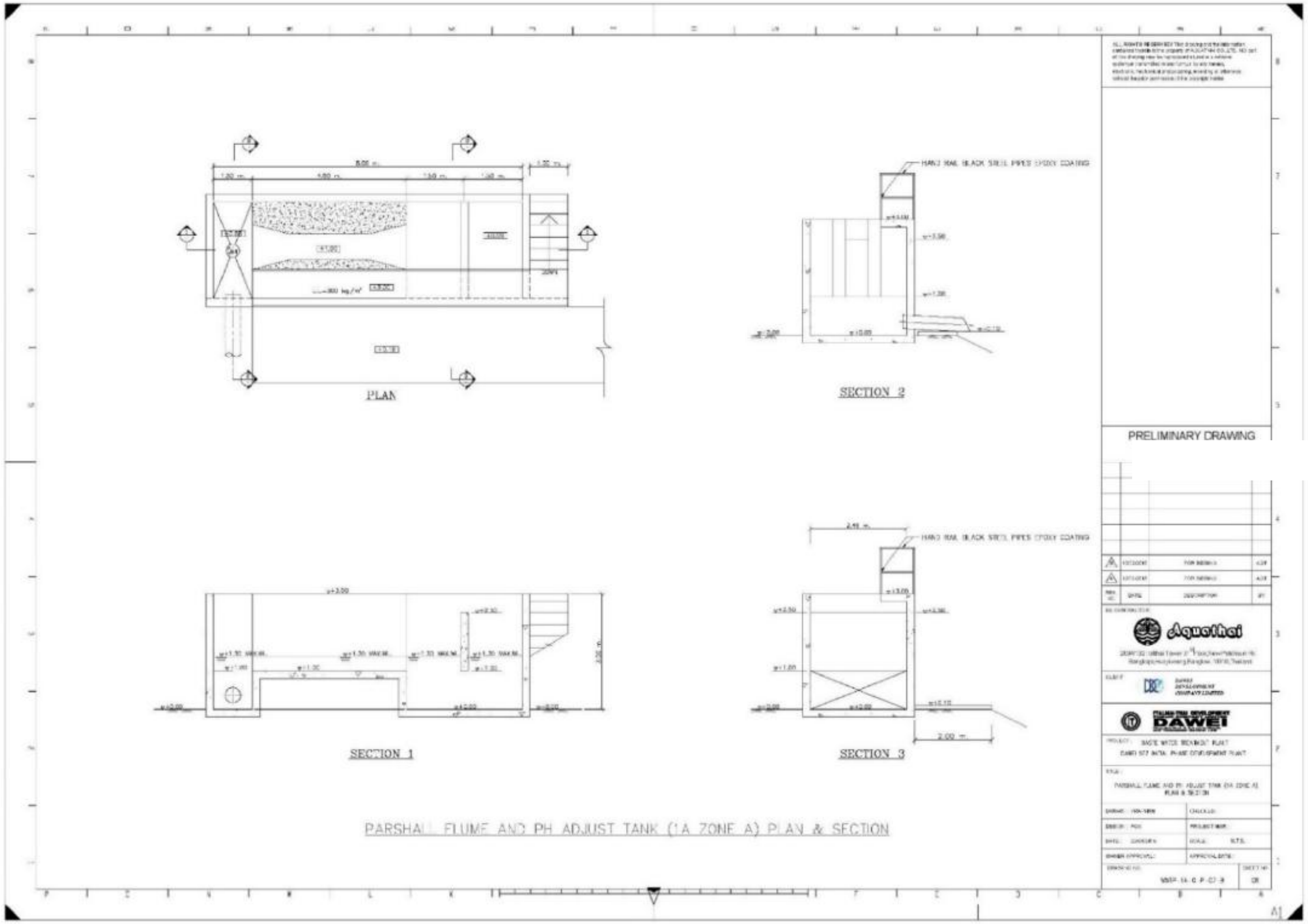
Chemicals	Day Tank Mixer (L)	Air MixingTank (m^3)	Feeding Rate (L/hour)	Pumping Rate (lph)
Sulfuric acid	2, 034.60	2.5	84.77	95[a] / 85[b]
Sodium hydroxide				
Urea	1,017.30	0.2	42.39	30[a] / 25[b]
Phosphate	203.46		8.48	10

Remarks: a/ For WWTP 1A , b/ For WWTP 2A
Source: IEC (2015)

Table 4.2-38 Dosing Pumps in the pH Adjusting Tank of WWTP

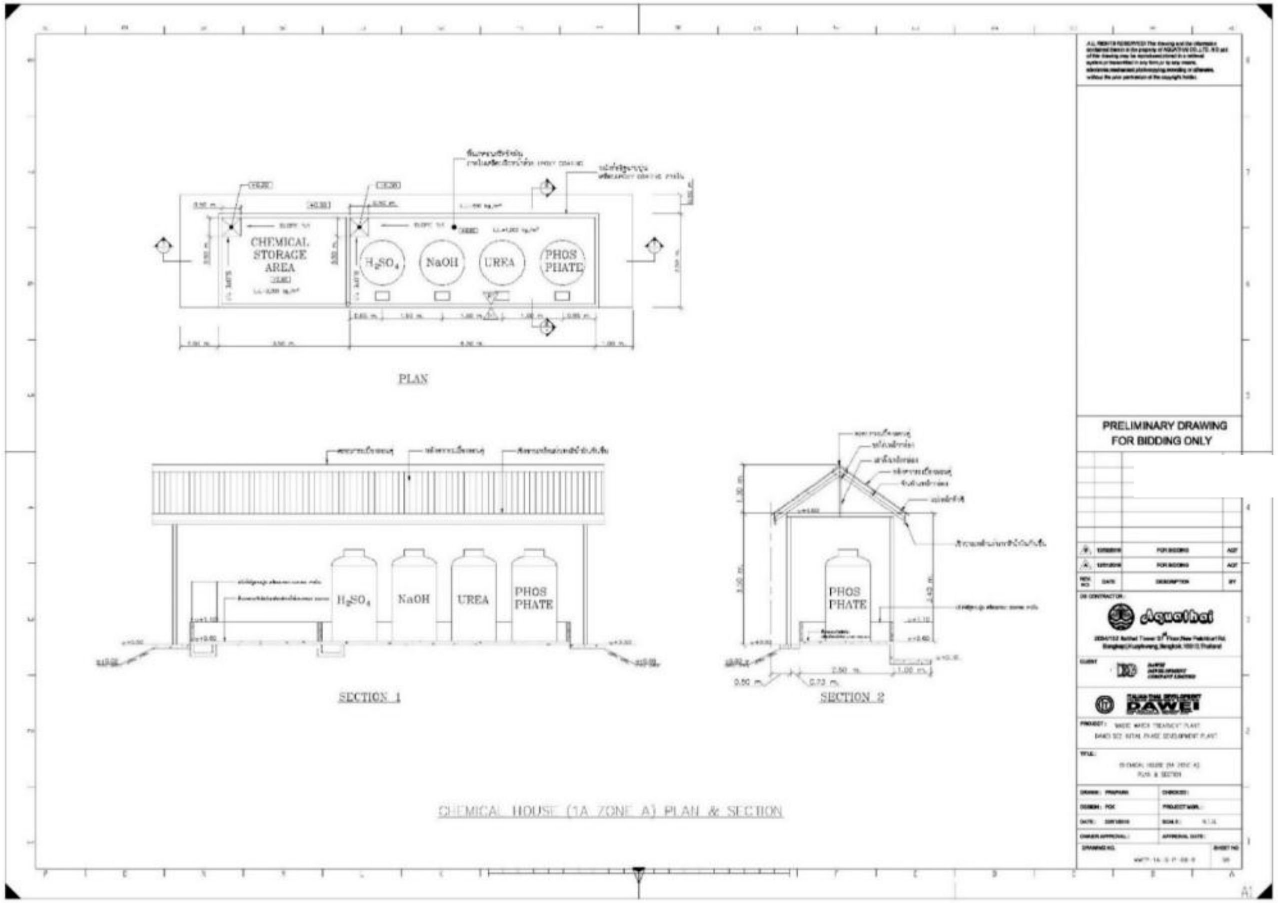
	pH Adjusting Tank	Dosing Pumps		PE / FRP Day Tank	Air Mixer Tank
		On Duty	Stand By		
WWTP 1A	1	4	4	4	4
WWTP 2A	1	4	4	4	4

Source: IEC, 2015



Source: IEC (2015)

Figure 4.2-76 Plan and section of Pershall Flume and pH Adjust Tank of WWTP 1A



Source: IEC (2015)

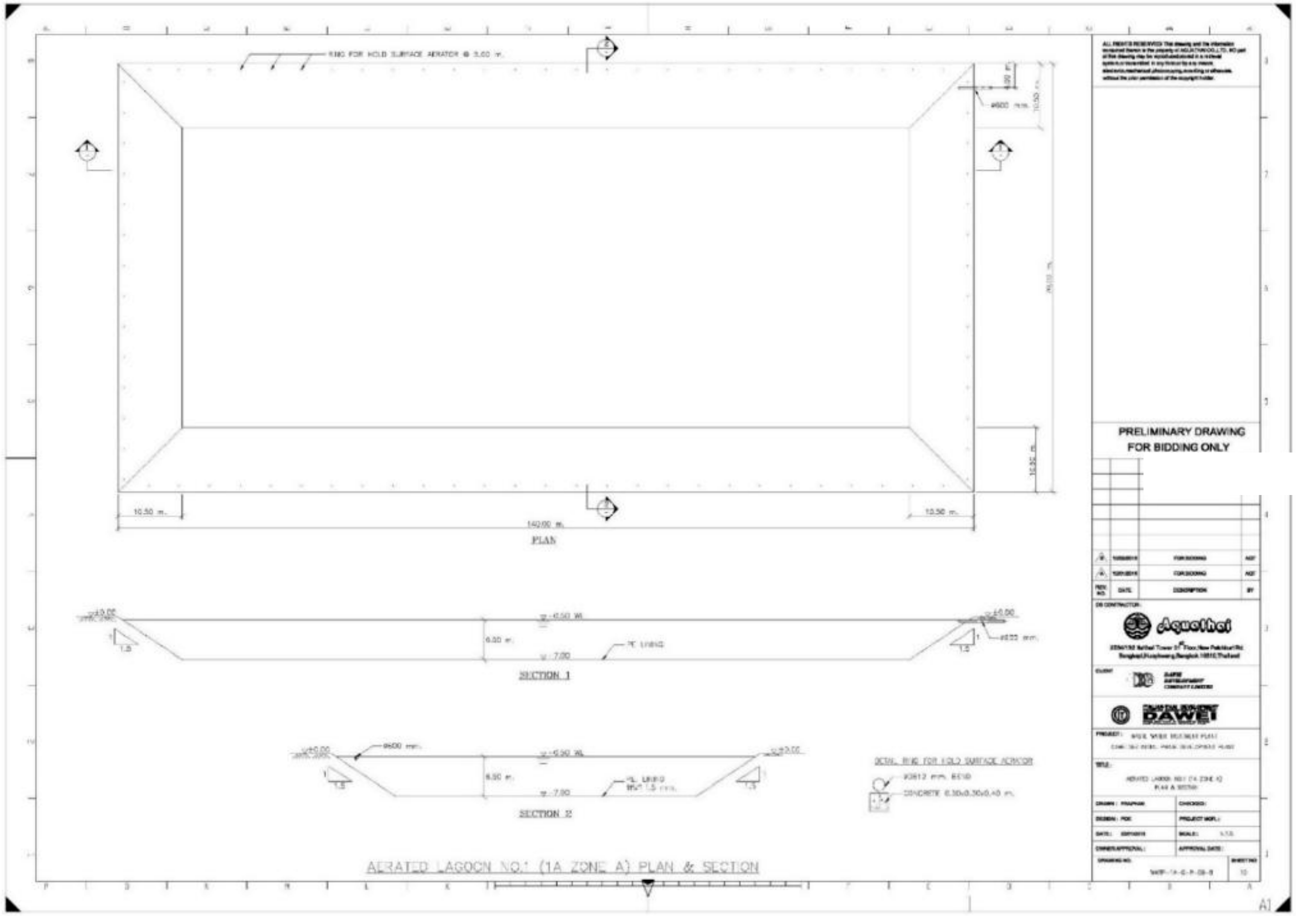
Figure 4.2-77 Layout and section of Chemical house of WWTP 1A

(d) Aerated Lagoon / Polishing Pond

Two lagoons will be constructed in series. Each lagoons is less than 5 meters depth. 0.7-1.0 kilogram of oxygen BOD will be removed. HRT for all lagoons are more than 5 days. Mixing power is 1.5-3.0 KW per 1,000 cubic meter.

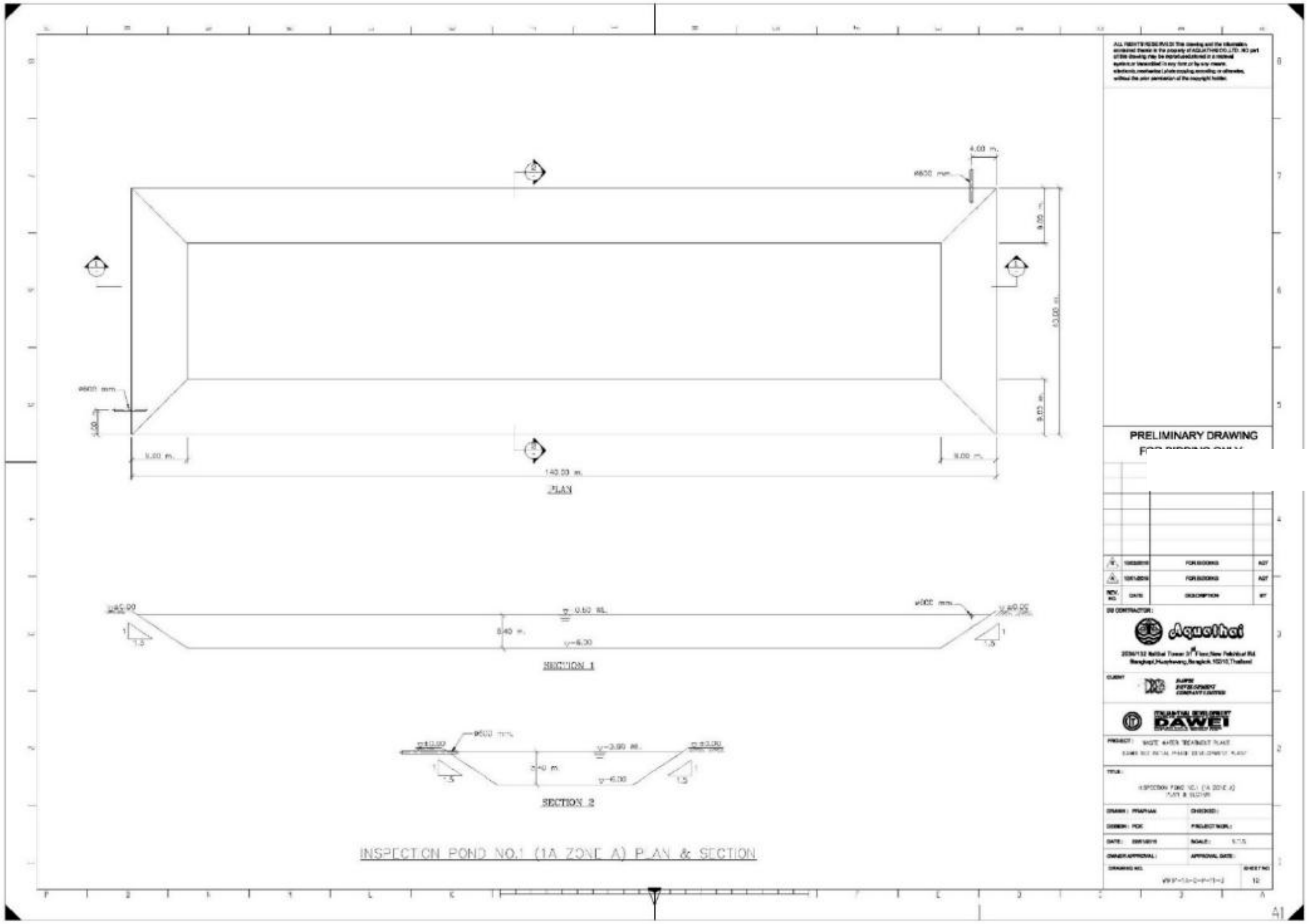
(e) Inspection Pond

Is final check point and polishing. One (1) No. operated in series. The pond will have less than 4 meter depth. HRT for all ponds more than one day.



Source: IEC (2015)

Figure 4.2-78 Layout of Aerated Lagoon / Polishing Pond number one



Source: IEC (2015)

Figure 4.2-79 Layout of Aerated Lagoon / Polishing Pond number two

4.2.6 Solid Waste Management System

Solid Waste Management System is essentially designed to serve industries in the Dawei Industrial Estate and the Township. The Waste Management Facility is located in zone A1 (Figure 4.2-80). Area of the facilities covers square kilometers. The system is a complete module (cradle to yard) of waste management starting from collection, transportation and transfer, separation, transformation and treatment, waste landfills, leachate and landfill gases management system and incinerators. Solid Waste Management consists of facility following

Facilities	Item
Sorting and Recycling Plant	1
Non-Hazardous Waste Landfills	9
Hazardous Waste Landfills	2
Leachate Management System	1
Gases Management System	1
Non-Hazardous Waste Incinerator	2
Hazardous Waste Incinerator	1

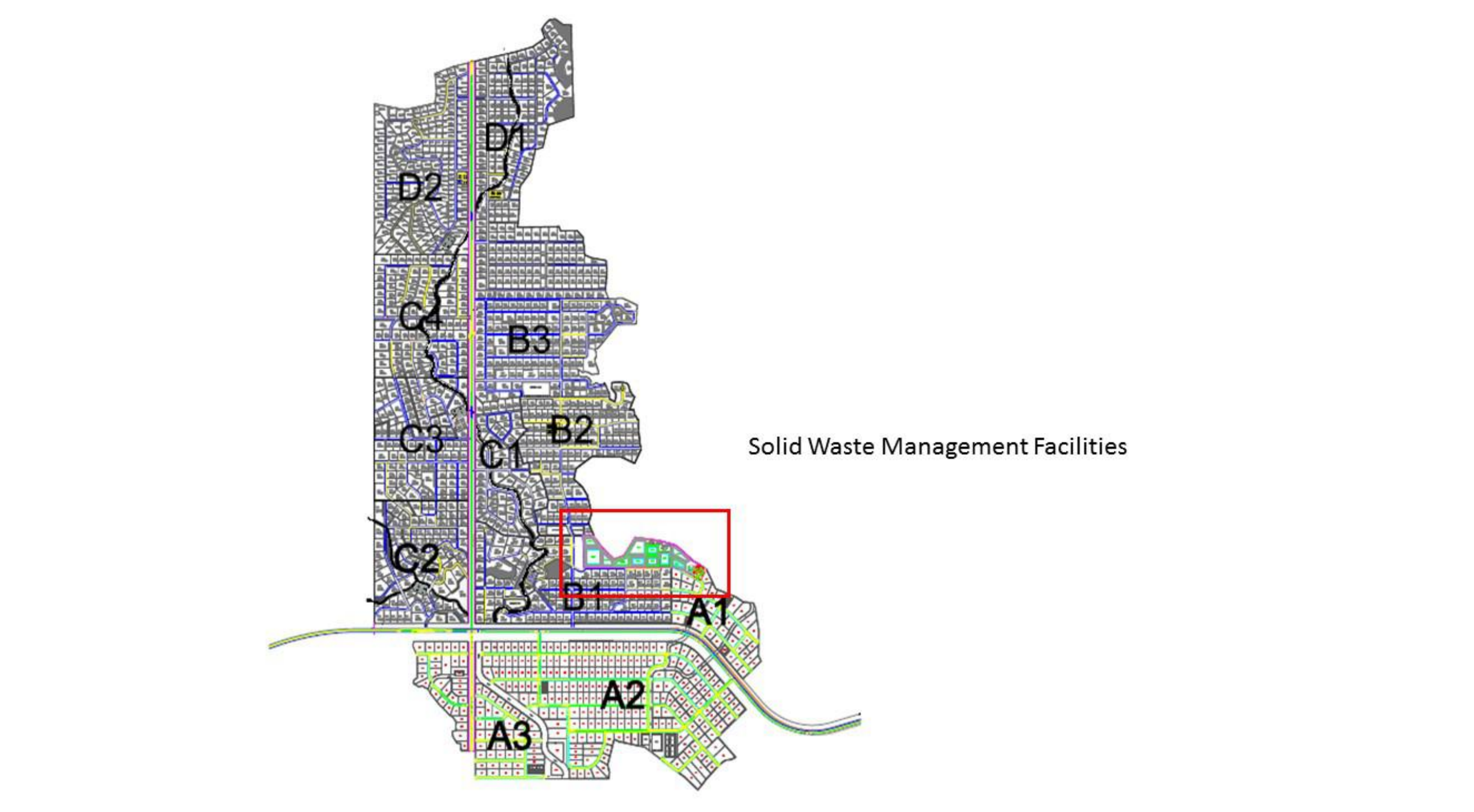
Source: IEC (2015)

Location of these facilities are presented in Figure 4.2-81.

4.2.6.1 Type of Waste

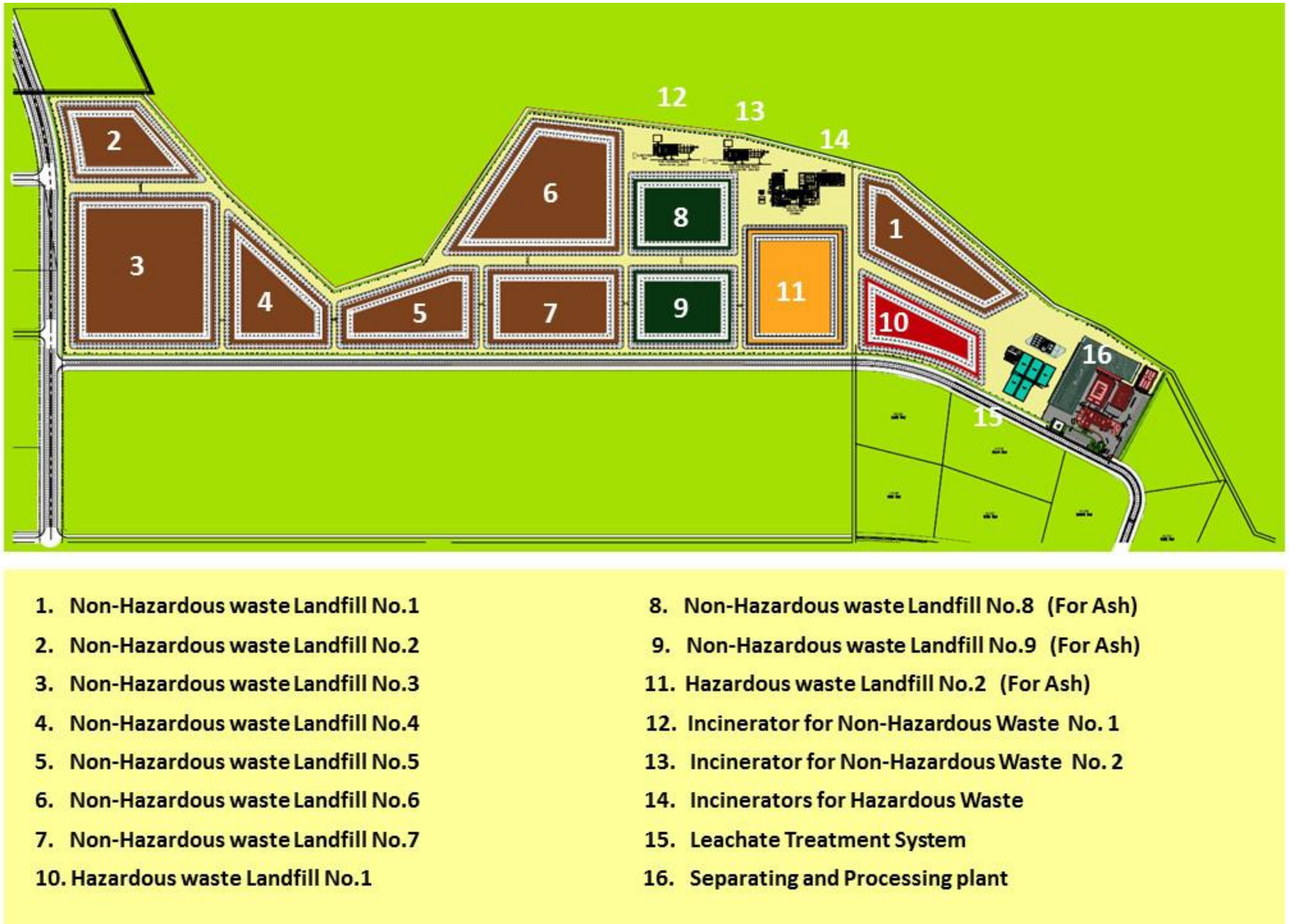
In this EIA report, solid waste generating from the industries activities or manufacturing are defined as "Industrial waste". For example, sludge, scarp metals, scarp textiles, electronic chips, rubber, animal tissues, slags, bricks, concrete or chemicals. Garbage or rubbish are generally collected from Township and offices will be classified as "*Municipal waste*". Both Industrial waste and Municipal waste which contains none hazardous substances or are not hazardous will be defined as "*Non-Hazardous waste*".

Hazardous waste is referred to a waste that is or contains the following characteristics, flammable, toxicity, corrosive, reactive, infectious and radioactive. Ignitable waste is flammable and can be flame itself below the ignition point at 60 °C (in optimize condition). They are such as used engine oil, grease or solvents. Corrosive waste is corroding. They are such as oxidizing agents (strong acid or alkaline) that are regularly used in the industries such as etching or carving metals. Reactive waste is a waste that is stable under normal condition but if the waste is activated, it is active and can pose a harm when accumulating in environment. The reactive waste is usually in special forms such as lithium sulfate or metallic compounds in dry cells or batteries. Toxic waste is a dangerous and fatal waste. They are such as radioactive materials; for example, uranium compounds or cobalt 60.



Source: IEC (2015)

Figure 4.2-80 Location of Solid Waste Management System



Source: IEC (2015)

Figure 4.2-81 Layout of facilities in Solid Waste Management System

Recycling waste is recyclable. The waste can be converted or processed to reused materials in order to achieving their most potentials and in reducing uses of raw materials. The waste are such as glass, metals, textiles, paper or plastics. Alternatively, the recycling waste that is non-metallic and combustible (high calorific value) can be transformed to Refused Derived Fuels (RDF). The RDF can be burned for power generation.

Infectious waste is waste that contaminated with blood and other bodily fluids, cultures or stocks of infectious agents, discarded diagnostic samples, waste from autopsies, infected animals from laboratories, waste from patients in isolation wards and equipment e.g. swabs, bandages or disposable medical devices, human tissues, organs or fluids, body parts of human or animals.

4.2.6.2 Generation Rates and Volume

Both Municipal waste and Industrial waste are encouraged to separate at sources for non-hazardous and hazardous waste. Municipal waste can be routinely sorted at source by separating bins for reuse, recycle and hazardous waste. Either, Industrial waste shall be stored or characterized and broadly segregated as much as possible at the manufacturing factories.

Expected characteristics of Industrial waste are assumed from percentage of the expected industries. Assumed that there have 40 percent of Food Processing Industries, 20 percent of Textiles and 40 percent of Appliance and Electronics. Expected characteristics of the Industrial waste can be as presented in Table 4.2-39.

Table 4.2-39 Characteristics of Target Industrial Waste

Industries	Waste
Food Processing	Animals and Plants Tissues
Textiles	Fabric scraps, off-spec fabric, cloth scraps, packaging, fiber lint, yarn, yarn and sweepings, fiber, trimmings, dye containers, salvage trims, flock, wool, vegetable matter, waxes, seams, paper, cartons, cardboards plastic sheets, rope, chemical containers, sheets, woven, knitted, fly fibre and threads
Appliance and Electronics	Scarp metals, circuit boards and chips, rubber, plastic,

Source: ESIA Study Team

Characteristics and features of waste generating from the initial phase of Dawei Industrial Estate (zone A) is presented in Table 4.2-39. Volume of waste generation are calculated from developed area of the Dawei Industrial Estate in each phase. Rate of Non-Hazardous waste and Hazardous Waste generation are following. Bulk Density of industrial waste is 0.15 Tons / m3 and Bulk Density of office waste is 0.30 Tons / m3 Volume of Non-Hazardous waste generating for 20 years of the Project's life operation is shown in Table 4.2-41. Total volume of Non-Hazardous waste are generating for 20 years of Project's life operation is shown in Table 4.2-42.

Ashes, residual particles and mix compounds, is by product of waste combustion in incinerators. Volume of ash is estimated, around 10 percent of total waste input in the incinerator. Bottom ash is accounting for 80 percent of total ash (approximately 30.56 tons per day) and fly ash is accounting for 20 percent (approximately 7.64 tons per day). The Fly ash is hazardous waste that will have to be stabilized and solidified before disposing in the Hazardous Waste Landfill (Secure Landfill).

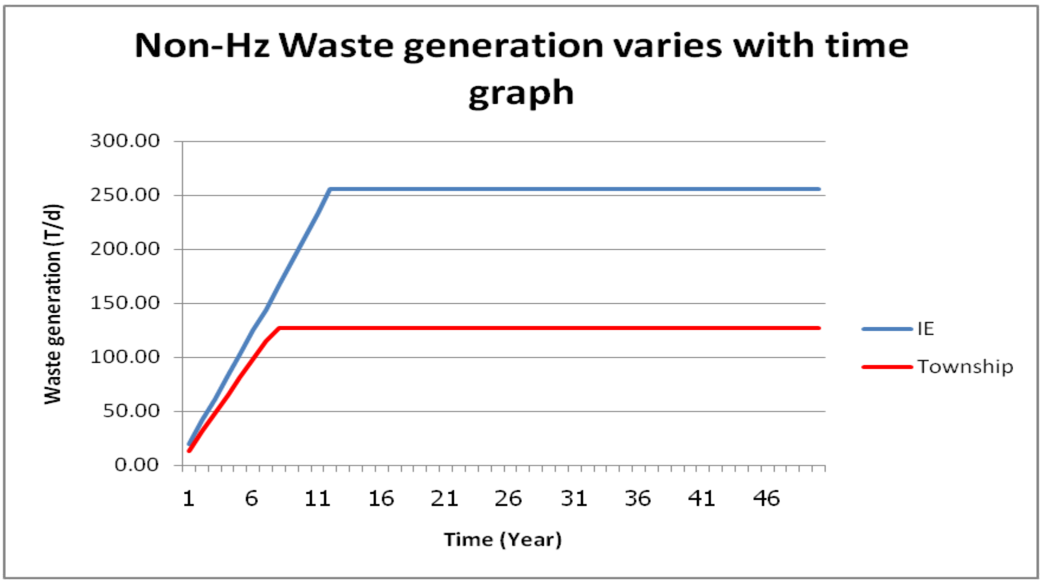
Disposal of by landfills will generate two major waste products, leachate and gases.

Landfill leachate is liquid waste originated from landfill disposal The leachate generated by Non-Hazardous waste Landfills are initially considered "Non-Hazardous". The leachates will be collected by Leachate Management System (LMS) and then they will be treated within the facility, at Leachate Treatment Plant (Figure 4.2-97).

Landfill gases are produced by landfills from decomposition and degradation of the waste. The gases from both Non-Hazardous and Hazardous waste Landfills can be utilized as fuel and they are planned to use in the Waste Management Facility for boilers in the Sorting and Recycling Plant and in the incinerators that will start in 16th Year.

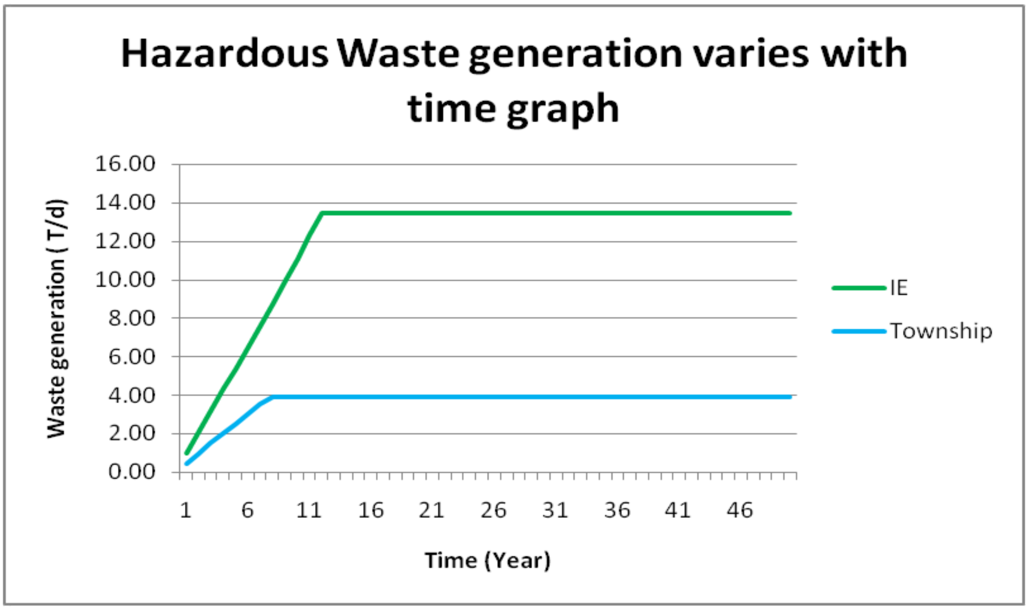
Ashes, residual particles and mix compounds, is by product of waste combustion in incinerators. Volume of ash is e.

Estimated 3.92 tons per day of household Hazardous waste will be generated from the Township and estimated 13.44 tons per day of Hazardous waste will be generated from the Industrial Estate.



Source: IEC (2015)

Figure 4.2-82 Trend of non-Hazardous waste generation over time



Source: IEC (2015)

Figure 4.2-83 Trend of Hazardous waste generation over time

Table 4.2-40 Rate of Waste generation

	Non-Hazardous Waste	Hazardous Waste
Waste Proportion		
Industrial Waste	95%	5%
Municipal Waste (Township)	97%	3%
Incinerator ash	10% of waste	N/A
Bottom ash	80 %	N/A
Fly ash	20 %	N/A
Waste Generation Rate		
Industrial Waste	18 kg / 1,600m^2 / day 32 Tons / day	1.46 Tons / day
Office Waste	3 kg / 1,600m^2 / day 256 Tons / day	11.76 Tons / day
Municipal Waste (Township)	1kg / person / day	
Sludge from WTP	0.054 kg / m^3 / 5 years	

Source: Industrial Estate Authority of Thailand, 2004

Pollution Prevention Department of Thailand, 2012

* Depend on data collection after operating.

** Receiving from WTP every 5 years

Table 4.2-41 Estimated volume of Non-Hazardous waste generating for over 50 years of operation of the Dawei Industrial Estate

Year	Development Zone				Area (m^2)	Non-Hazardous Waste			Operation (day)	Total Industrial Waste (T/A)	Ash 10% by weight (waste)		Cumulative Waste (T)
	A	B	C	D		Industrial Waste (T/d) 95% by Weight	Office Waste (T/d) 95% by Weight	Total Non-Hazardous Waste (T/d)			Bottom ash 80% by weight (T/A)	Fly ash 20% by weight (T/A)	
1	30%				1,535,880.00	16.41	2.74	19.15	365	6,989.93			6,989.93
2	65%				3,327,740.00	35.57	5.93	41.49	365	15,144.86			22,134.79
3	65%	30%			4,863,620.00	51.98	8.66	60.64	365	22,134.79			44,269.58
4	65%	65%			6,655,480.00	71.13	11.86	82.99	365	30,289.71			74,559.29
5	65%	65%	30%		8,191,360.00	87.55	14.59	102.14	365	37,279.65			111,838.94
6	65%	65%	65%		9,983,220.00	106.70	17.78	124.48	365	45,434.57			157,273.51
7	65%	65%	65%	30%	11,519,100.00	123.11	20.52	143.63	365	52,424.50			209,698.02
8	65%	65%	65%	65%	13,310,960.00	142.26	23.71	165.97	365	60,579.43			270,277.44
9	100%	65%	65%	65%	15,102,820.00	161.41	26.90	188.31	365	68,734.35			339,011.79
10	100%	100%	65%	65%	16,894,680.00	180.56	30.09	210.66	365	76,889.27			415,901.07
11	100%	100%	100%	65%	18,686,540.00	199.71	33.29	233.00	365	85,044.20			500,945.26
12	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365	93,199.12			594,144.38
13	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365	93,199.12			687,343.50
14	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365	93,199.12			780,542.62
15	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365	93,199.12			873,741.73
16	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	883,061.65
17	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	892,381.56
18	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	901,701.47
19	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	911,021.38
20	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	920,341.29
21	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	929,661.20
22	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	938,981.12
23	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	948,301.03
24	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	957,620.94
25	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	966,940.85
26	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	976,260.76
27	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	985,580.68
28	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	994,900.59
29	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,004,220.50
30	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,013,540.41
31	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,022,860.32
32	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,032,180.23
33	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,041,500.15
34	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,050,820.06
35	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,060,139.97
36	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,069,459.88
37	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,078,779.79
38	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,088,099.71

Table 4.2-41 Estimated volume of Non-Hazardous waste generating for over 50 years of operation of the Dawei Industrial Estate (Cont.)

Year	Development Zone				Area (m²)	Non-Hazardous Waste			Operation (day)	Total Industrial Waste (T/A)	Ash 10% by weight (waste)		Cumulative Waste (T)
	A	B	C	D		Industrial Waste (T/d) 95% by Weight	Office Waste (T/d) 95% by Weight	Total Non-Hazardous Waste (T/d)			Bottom ash 80% by weight (T/A)	Fly ash 20% by weight (T/A)	
39	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,097,419.62
40	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,106,739.53
41	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,116,059.44
42	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,125,379.35
43	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,134,699.26
44	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,144,019.18
45	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,153,339.09
46	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,162,659.00
47	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,171,978.91
48	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,181,298.82
49	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,190,618.74
50	100%	100%	100%	100%	20,478,400.00	218.86	36.48	255.34	365		7,455.93	1,863.98	1,199,938.65

Source: IEC, 2015

Table 4.2-42 Estimated volume of Municipal waste generating from the Township for over 50 years of dwelling

Year	Population (Person)	Waste Generate (1kg/person/d)	Waste		Non-Hz 97% By Weight (T/d)	Operation (day)	Total Industrial Waste (T/A)	Ash 10% by weight (waste)		Cumulative Non-Hz Waste (T)
			(kg/day)	(T/d)				Bottom ash 80% by weight (T/A)	Fly ash 20% by weight (T/A)	
1	13,550	1.00	13,550	13.55	13.14	365	4,797.38			4,797.38
2	32,730	1.00	32,730	32.73	31.75	365	11,588.06			16,385.43
3	49,780	1.00	49,780	49.78	48.29	365	17,624.61			34,010.04
4	66,830	1.00	66,830	66.83	64.83	365	23,661.16			57,671.20
5	83,880	1.00	83,880	83.88	81.36	365	29,697.71			87,368.92
6	100,930	1.00	100,930	100.93	97.90	365	35,734.27			123,103.19
7	117,860	1.00	117,860	117.86	114.32	365	41,728.33			164,831.52
8	130,590	1.00	130,590	130.59	126.67	365	46,235.39			211,066.91
9	130,590	1.00	130,590	130.59	126.67	365	46,235.39			257,302.30
10	130,590	1.00	130,590	130.59	126.67	365	46,235.39			303,537.69
11	130,590	1.00	130,590	130.59	126.67	365	46,235.39			349,773.08
12	130,590	1.00	130,590	130.59	126.67	365	46,235.39			396,008.47
13	130,590	1.00	130,590	130.59	126.67	365	46,235.39			442,243.86
14	130,590	1.00	130,590	130.59	126.67	365	46,235.39			488,479.24
15	130,590	1.00	130,590	130.59	126.67	365	46,235.39			534,714.63
16	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	580,950.02
17	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	627,185.41
18	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	673,420.80

Table 4.2-42 Estimated volume of Municipal waste generating from the Township for over 50 years of dwelling (Cont.)

Year	Population (Person)	Waste Generate (1kg/person/d)	Waste (kg/day)	Waste (T/d)	Non-Hz 97% By Weight (T/d)	Operation (day)	Total Industrial Waste (T/A)	Ash 10% by weight (waste): Bottom ash 80% by weight (T/A)	Ash 10% by weight (waste): Fly ash 20% by weight (T/A)	Cumulative Non-Hz Waste (T)
19	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	719,656.19
20	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	765,891.58
21	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	812,126.97
22	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	858,362.36
23	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	904,597.75
24	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	950,833.14
25	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	997,068.53
26	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,043,303.92
27	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,089,539.31
28	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,135,774.70
29	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,182,010.09
30	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,228,245.48
31	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,274,480.87
32	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,320,716.26
33	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,366,951.65
34	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,413,187.03
35	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,459,422.42
36	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,505,657.81
37	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,551,893.20
38	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,598,128.59
39	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,644,363.98
40	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,690,599.37
41	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,736,834.76
42	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,783,070.15
43	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,829,305.54
44	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,875,540.93
45	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,921,776.32
46	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	1,968,011.71
47	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	2,014,247.10
48	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	2,060,482.49
49	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	2,106,717.88
50	130,590	1.00	130,590	130.59	126.67	365		3,698.83	924.71	2,152,953.27

Source: IEC (2015)

Table 4.2-43 Estimated volume of Hazardous waste generating for over 50 years of operation of the Dawei Industrial Estate

Year	Development Zone				Area (m^2)	Hazardous Waste			Operation (day)	Total Industrial Waste (T/A)	Ash 10% by weight (waste)		Cumulative Waste (T)
	A	B	C	D		Industrial Waste (T/d) 5% by Weight	Office Waste (T/d) 5% by Weight	Total Industrial Waste (T/d)			Bottom ash 80% by weight (T/A)	Fly ash 20% by weight (T/A)	
1	30%				1,535,880.00	0.86	0.14	1.01	365	367.89			367.89
2	65%				3,327,740.00	1.87	0.31	2.18	365	797.10			1,164.99
3	65%	30%			4,863,620.00	2.74	0.46	3.19	365	1,164.99			2,329.98
4	65%	65%			6,655,480.00	3.74	0.62	4.37	365	1,594.20			3,924.17
5	65%	65%	30%		8,191,360.00	4.61	0.77	5.38	365	1,962.09			5,886.26
6	65%	65%	65%		9,983,220.00	5.62	0.94	6.55	365	2,391.29			8,277.55
7	65%	65%	65%	30.00%	11,519,100.00	6.48	1.08	7.56	365	2,759.18			11,036.74
8	65%	65%	65%	65.00%	13,310,960.00	7.49	1.25	8.74	365	3,188.39			14,225.13
9	100%	65%	65%	65.00%	15,102,820.00	8.50	1.42	9.91	365	3,617.60			17,842.73
10	100%	100%	65%	65.00%	16,894,680.00	9.50	1.58	11.09	365	4,046.80			21,889.53
11	100%	100%	100%	65.00%	18,686,540.00	10.51	1.75	12.26	365	4,476.01			26,365.54
12	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365	4,905.22			31,270.76
13	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365	4,905.22			36,175.97
14	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365	4,905.22			41,081.19
15	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365	4,905.22			45,986.41
16	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	50,891.62
17	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	55,796.84
18	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	60,702.06
19	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	65,607.27
20	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	70,512.49
21	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	75,417.71
22	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	80,322.92
23	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	85,228.14
24	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	90,133.36
25	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	95,038.57
26	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	99,943.79
27	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	104,849.01
28	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	109,754.22
29	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	114,659.44
30	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	119,564.66
31	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	124,469.88
32	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	129,375.09
33	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	134,280.31
34	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	139,185.53
35	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	144,090.74
36	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	148,995.96
37	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	153,901.18
38	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	158,806.39

Table 4.2-43 Estimated volume of Hazardous waste generating for over 50 years of operation of the Dawei Industrial Estate (Cont.)

Year	Development Zone				Area (m²)	Hazardous Waste			Operation (day)	Total Industrial Waste (T/A)	Ash 10% by weight (waste)		Cumulative Waste (T)
	A	B	C	D		Industrial Waste (T/d) 5% by Weight	Office Waste (T/d) 5% by Weight	Total Industrial Waste (T/d)			Bottom ash 80% by weight (T/A)	Fly ash 20% by weight (T/A)	
39	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	163,711.61
40	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	168,616.83
41	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	173,522.04
42	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	178,427.26
43	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	183,332.48
44	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	188,237.69
45	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	193,142.91
46	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	198,048.13
47	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	202,953.34
48	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	207,858.56
49	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	212,763.78
50	100%	100%	100%	100.00%	20,478,400.00	11.52	1.92	13.44	365		392.42	98.10	217,668.99

Source: IEC (2015)

Table 4.2-44 Estimated volume of Hazardous waste generating for over 50 years of operation of the Dawei Industrial Estate

Year	Area (m²)	Waste Generate (1Kg/person/d)	Waste		Hazardous Waste 3% By Weight (T/d)	Operation (day)	Total Industrial Waste (T/A)	Ash 10% by weight (waste)		Cumulative Non-Hz Waste (T)
			(Kg/day)	(T/d)				Bottom ash 80% by weight (T/A)	Fly ash 20% by weight (T/A)	
1	13,550	1.00	13,550	13.55	0.41	365	148.37			148.37
2	32,730	1.00	32,730	32.73	0.98	365	358.39			506.77
3	49,780	1.00	49,780	49.78	1.49	365	545.09			1,051.86
4	66,830	1.00	66,830	66.83	2.00	365	731.79			1,783.65
5	83,880	1.00	83,880	83.88	2.52	365	918.49			2,702.13
6	100,930	1.00	100,930	100.93	3.03	365	1,105.18			3,807.32
7	117,860	1.00	117,860	117.86	3.54	365	1,290.57			5,097.88
8	130,590	1.00	130,590	130.59	3.92	365	1,429.96			6,527.84
9	130,590	1.00	130,590	130.59	3.92	365	1,429.96			7,957.80
10	130,590	1.00	130,590	130.59	3.92	365	1,429.96			9,387.76
11	130,590	1.00	130,590	130.59	3.92	365	1,429.96			10,817.72
12	130,590	1.00	130,590	130.59	3.92	365	1,429.96			12,247.68
13	130,590	1.00	130,590	130.59	3.92	365	1,429.96			13,677.65
14	130,590	1.00	130,590	130.59	3.92	365	1,429.96			15,107.61
15	130,590	1.00	130,590	130.59	3.92	365	1,429.96			16,537.57
16	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	17,967.53
17	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	19,397.49
18	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	20,827.45
19	**130,590**	**1.00**	**130,590**	**130.59**	**3.92**	**365**		**114.40**	**28.60**	**22,257.41**
20	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	23,687.37
21	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	25,117.33
22	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	26,547.29
23	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	27,977.25
24	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	29,407.21
25	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	30,837.17
26	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	32,267.13
27	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	33,697.09
28	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	35,127.05
29	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	36,557.01
30	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	37,986.97
31	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	39,416.93
32	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	40,846.89
33	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	42,276.86
34	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	43,706.82
35	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	45,136.78
36	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	46,566.74
37	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	47,996.70
38	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	49,426.66

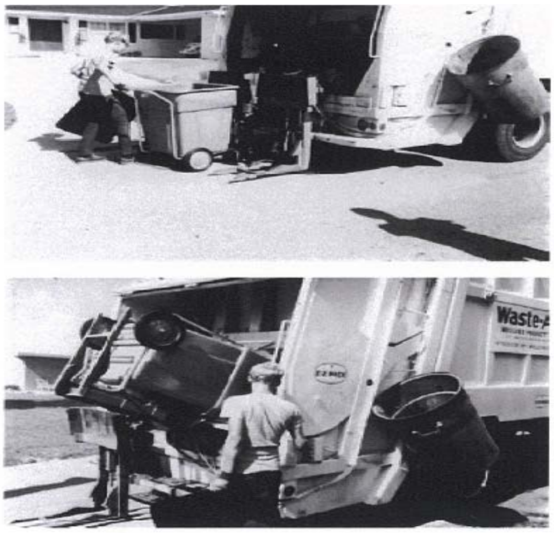
Table 4.2-44 Estimated volume of Hazardous waste generating for over 50 years of operation of the Dawei Industrial Estate

Year	Area (m^2)	Waste Generate (1Kg/person/d)	Waste		Hazardous Waste 3% By Weight (T/d)	Operation (day)	Total Industrial Waste (T/A)	Ash 10% by weight (waste)		Cumulative Non-Hz Waste (T)
			(Kg/day)	(T/d)				Bottom ash 80% by weight (T/A)	Fly ash 20% by weight (T/A)	
39	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	50,856.62
40	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	52,286.58
41	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	53,716.54
42	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	55,146.50
43	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	56,576.46
44	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	58,006.42
45	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	59,436.38
46	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	60,866.34
47	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	62,296.30
48	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	63,726.26
49	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	65,156.22
50	130,590	1.00	130,590	130.59	3.92	365		114.40	28.60	66,586.18

Source: IEC (2015)

4.2.6.3 Collection and Transportation

Waste are collected on daily basis. Collection of waste and transportation depends on volume of waste. Small quantity of municipal and industrial waste will be collected by rare loaded and compacted trucks, which can carry around 20 cubic meters of waste per trip. Large volume of industrial waste will be collected by hoist trucks or trash-trailer, which can carry 30 cubic meters of waste per trip. Transportation of Hazardous waste require manifest.



Left : Rear loaded and compacted Trucks

Above: Container from Hoist Truck

Source: IEC (2015)

Figure 4.2-84 Type Vehicles for Solid Waste Collection

4.2.6.4 Disposal and Treatment Management

Solid waste will be managed according to processes as presented in Figure 4.2-85. Solid waste both from the Industrial Estate and the Township are broadly identified as Non-Hazardous or Hazardous waste, before undergoing through the next steps. Estimated 255.34 tons per day of the Industrial Estate Waste and 126.67 tons per day of the Township Waste will be delivered to sorting and recycling plant.

(a) Non-Hazardous Waste

Non Hazardous waste will be weighted at checking point before undergone through the Sorting and Recycling Plant. For the initial phase, a period before installation of the incinerators, combustible waste may be sorted out and/or transformed for Refused Derived Fuels (RDF). Noncombustible and recyclable waste such as metals and glass will be sorted and segregated. At this stage, both of these types of waste are delivering away from the facility

or stored for the future purposes. Residual waste, which cannot be recycled or has low economic value, will be disposed in the Non-Hazardous waste Landfills.

- Landfill leachates generated by Non-Hazardous waste Landfills are initially considered "Non-Hazardous" waste; however, depending on their characteristics. If they reached the hazardous characteristics, they would be dispose in line of the Hazardous waste Management. Landfill leachates will be collected by Leachate Management System (LMS) and the Non-Hazardous leachates will be treated within the facility, at Leachate Treatment Plant (Figure 4.2-97). Treated water will be delivered to WWTP, if it comply by the Guideline of Effluent for the Landfill facility.

- Landfill gases are produced by all types of landfills from decomposition and degradation of the waste. The gases from both Non-Hazardous and Hazardous waste Landfills can be utilized as fuel and they are planned to use in the Waste Management Facility for boilers in the Sorting and Recycling Plant and in the incinerators that will start in 16th Year.

- Bottom ash from the Non-Hazardous waste incinerators are disposed in the Ash Landfill, Non-Hazardous waste Landfill number 9.

There will be a period of 15 years since the residual waste will have been disposing in the Non-Hazardous waste Landfills. Starting in 16th year, all the Non-Hazardous waste that are remained from the Sorting and Recycling Plant will be disposed in the Non-Hazardous waste Incinerators.

(b) Hazardous waste

Management of Hazardous waste requires license including transportation of Hazardous waste, they requires the manifests. Hazardous waste will be sorted and characterized at the Sorting and Recycling Plant Figure 4.2-85. Approximately 17.36 tons per day of Hazardous waste will be delivered to the Sorting and Recycling Plant before undergoing through the Treatment and Disposal processes. Specific treatments are required for hazardous waste as presented in Figure 4.2-86.

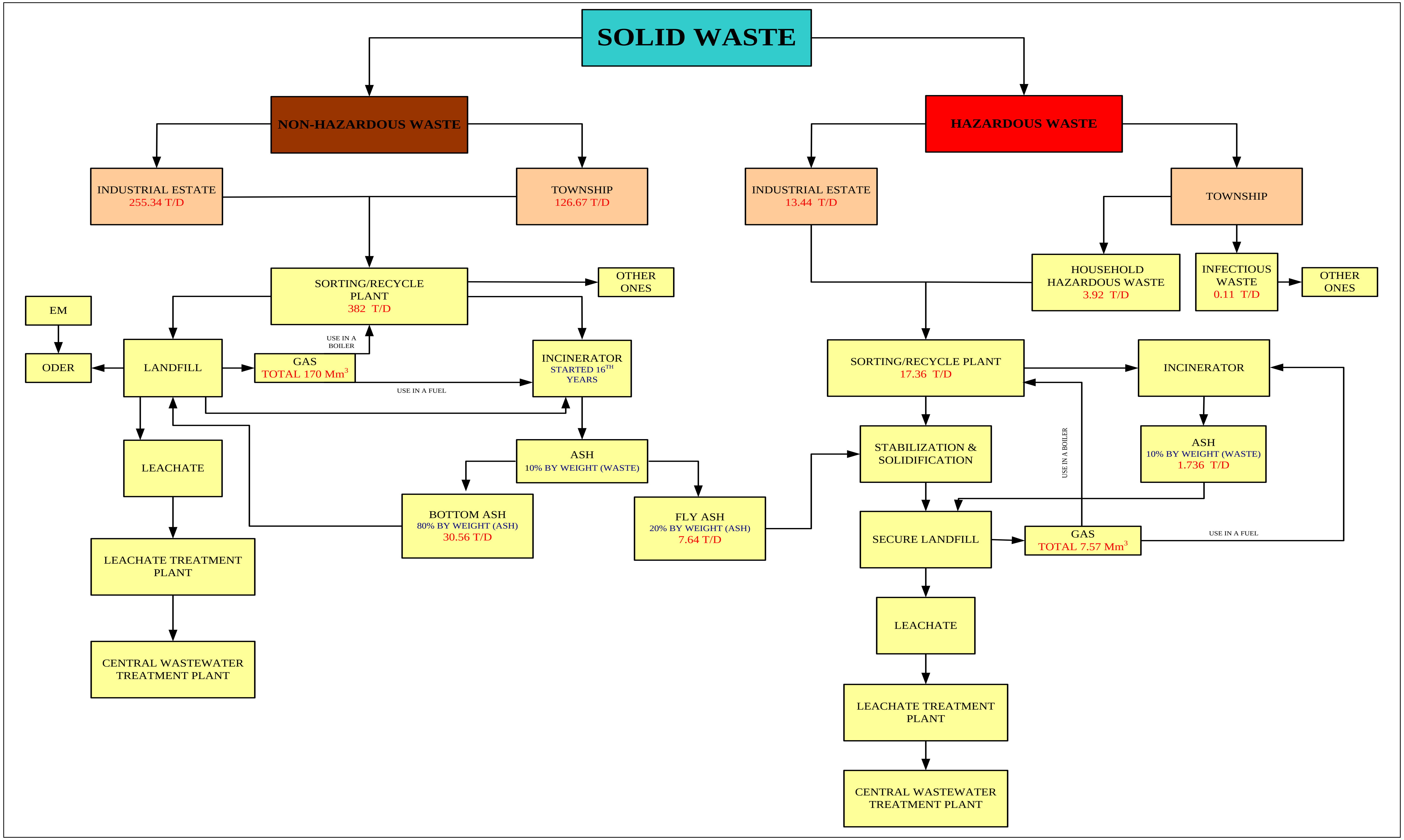
- Solid hazardous waste will be shredded for size reduction before undergoing through Filling and Mixing Drum. Afterward, the waste will be stabilized and solidified. Hazardous sludge received from the Industrial Estate will be treated as the same as solid waste except shredded and filling and mixing drum.
- Liquid hazardous waste (Hazardous wastewater) will be neutralized (oxidized or reduced) before precipitation. Hazardous sludge from the precipitation will be

treated as the same as solid hazardous waste; whereas, wastewater will be delivered to WWTP for treatment.

Once the waste is treated, it will be inspected while they are storing or curing. If the treated waste is qualified, the waste will be able to dispose in the Secure Landfills but if the treated waste is unqualified, the waste will have to be returned to the treatment processes

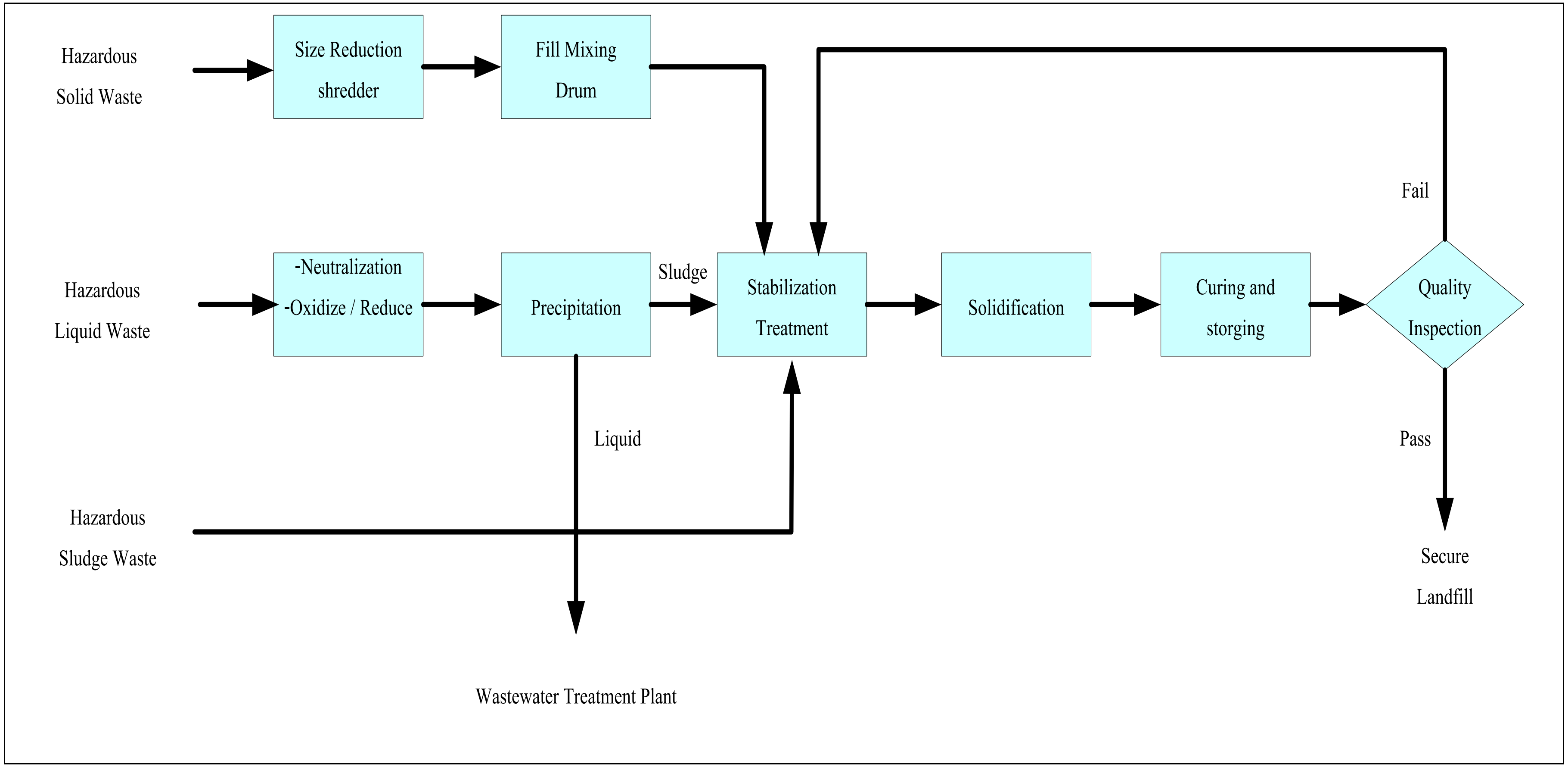
- Hazardous waste that are not needed to be stabilized or solidified, they will be eliminated in the Hazardous waste incinerator straightforward. For example, ignitable waste can be eliminated incineration at approximately 1200-1600 °C; whereas, corrosive will take higher temperature at 1600-1900 °C. Estimated 10 percent of hazardous waste input in the hazardous waste incinerator and approximately 1.736 tons/day of ashes are produced. Generally, bottom ash is not hazardous waste, it will be disposed in the ash landfill, number 9; however, depending on the ash characteristics. Whereas, the fly ash often has hazardous characteristics. They will be disposed in the Secure Landfill.
- Leachate generating from the Secure Landfill, are initially considered "Hazardous" waste; however, depending on their characteristics. Landfill leachates will be collected by Leachate Management System (LMS) and the hazardous leachates are needed to be treated within line of Hazardous waste management. Treated water will be delivered to WWTP, if it does not comply by the Guideline of Effluent for the Landfill.
- Fly ash is hazardous waste. They have to be stabilized and solidified before disposing in the Hazardous Waste Landfill (Secure Landfill).
- For the Infectious waste, the Waste Management Facility is not receiving and disposing. The Infectious waste will be directly managed at the Township Waste Management Facility by incineration, which is specifically for infectious waste.
- Ashes from the Township incinerator will be managed and disposed in lines of both Non-Hazardous waste and Hazardous waste, if required.

Nevertheless, radioactive waste or Hazardous waste that the Waste Management System has none facility to treat or dispose. The manufacture must be carried out for their own elimination.



Source: IEC (2015)

Figure 4.2-85 Conceptual of disposal processes



Source: IEC (2015)

Figure 4.2-86 Hazardous waste Disposal Process

4.2.6.5 Disposal and Treatment Facilities

Solid Waste Management facility consists of Sorting and Recycling plant, 9 Non-Hazardous Waste landfills, 2 Hazardous Waste Landfills (Secure landfill), 2 Non-Hazardous Waste Incinerator, 1 Hazardous Waste Incinerator (Figure 4.2-81) and the others system such as Leachate Treatment System and Landfill Gases Management System.

There are two types of Landfills; Non-Hazardous Waste Landfills and Hazardous Waste Landfills (Secure Landfill).

(a) Landfills for Non-Hazardous waste

The Project has 9 Non-Hazardous Waste Landfills. Their locations are presented in Figure 4.2-81. The Non-Hazardous Waste Landfill no.1 will be firstly developed for the initial phase of The Project and the others will be developed in the later phases.

Volumes and capacity of the Non-Hazardous Waste Landfills are presented in Table 4.2-45.

Table 4.2-45 Volume of Non-Hazardous Waste Landfills

Description	Deep (m)	Slop (x/y)	Surface Area (m^2)	Bottom Area (m^2)	Volume (m^3)
Non-Hazardous Waste Landfill No.1					
Bottom Layer1	6	2	21,477.29	13,886.45	105,267
Bottom Layer2	3	2	11,073.94	7,970.94	28,440
Layer 1	2	3	21,477.29	17,533.50	38,944
Layer 2	3	3	14,473.69	9,485.35	35,676
Layer 3	3	3	7,002.55	3,084.42	14,734
				Total	**223,062**
Non-Hazardous Waste Landfill No.2					
Bottom Layer1	6	2	30,355.06	22,463.94	157,864
Bottom Layer2	3	2	19,492.87	16,173.64	53,422
Layer 1	2	3	30,355.06	26,275.29	56,581
Layer 2	3	3	23,080.53	17,799.70	61,149
Layer 3	3	3	15,126.87	10,785.53	38,685
Layer 4	3	3	8,634.64	5,232.79	20,589
				Total	**388,292**

Table 4.2-45 Volume of Non-Hazardous Waste Landfills

Description	Deep (m)	Slop (x/y)	Surface Area (m^2)	Bottom Area (m^2)	Volume (m^3)
Non-Hazardous Waste Landfill No.3					
Bottom Layer1	6	2	16,800.00	10,719.21	81,877
Bottom Layer2	3	2	8,587.74	6,340.97	22,308
Layer 1	2	3	16,800.08	13,558.92	30,301

Table 4.2-45 Volume of Non-Hazardous Waste Landfills (Cont.)

Description	Deep (m)	Slop (x/y)	Surface Area (m^2)	Bottom Area (m^2)	Volume (m^3)
Layer 2	3	3	11,173.83	7,422.01	27,703
Layer 3	3	3	5,667.26	3,099.62	12,958
				Total	**175,147**
Non-Hazardous Waste Landfill No.4					
Bottom Layer1	6	2	47,047.82	37,242.06	252,297
Bottom Layer2	3	2	33,481.95	29,230.59	93,997
Layer 1	2	3	47,047.82	42,007.11	89,007
Layer 2	3	3	38,017.09	31,320.27	103,844
Layer 3	3	3	27,877.47	22,184.43	74,930
Layer 4	3	3	19,301.64	14,616.60	50,715
				Total	**664,791**
Non-Hazardous Waste Landfill No.5					
Bottom Layer1	6	2	18,990.01	12,383.69	93,418
Bottom Layer2	3	2	10,034.95	7,530.07	26,258
Layer 1	2	3	18,990.01	15,515.79	34,447
Layer 2	3	3	12,881.95	8,739.75	32,232
Layer 3	3	3	6,771.14	3,826.36	15,688
				Total	**202,043**
Non-Hazardous Waste Landfill No.6					
Bottom Layer1	6	2	15,796.50	10,110.47	77,089
Layer 1	2	3	8,113.26	6,005.43	21,099
Layer 2	3	3	15,796.50	12,795.94	28,540

Table 4.2-45 Volume of Non-Hazardous Waste Landfills (Cont.)

Description	Deep (m)	Slop (x/y)	Surface Area (m^2)	Bottom Area (m^2)	Volume (m^3)
Layer 3	3	3	10,536.17	7,019.96	26,156
			5,372.84	2,959.41	12,320
				Total	**165,204**
Non-Hazardous Waste Landfill No.7					
Bottom Layer1	6	2	13,110.00	8,190.00	63,324
Bottom Layer2	3	2	6,480.00	4,692.00	16,686
Layer 1	2	3	13,110.00	10,506.00	23,568
Layer 2	3	3	8,556.00	5,550.00	20,997
Layer 3	3	3	4,160.00	2,162.00	9,321
				Total	**133,896**
Non-Hazardous Waste Landfill No.8					
Bottom Layer1	6	2	26,450.00	18,746.00	134,927
Bottom Layer2	3	2	15,876.00	12,696.00	42,769
Layer 1	2	3	26,450.00	22,454.00	48,849
Layer 2	3	3	19,344.00	14,250.00	50,197
Layer 3	3	3	11,700.00	7,614.00	28,752
Layer 4	3	3	5,624.00	2,546.00	11,954
				Total	**317,448**
Non-Hazardous Waste Landfill No.9					
Bottom Layer1	6	2	26,450.00	18,746.00	134,927
Bottom Layer2	3	2	15,876.00	12,696.00	42,769
Layer 1	2	3	26,450.00	22,454.00	48,849
Layer 2	3	3	19,344.00	14,250.00	50,197
Layer 3	3	3	11,700.00	7,614.00	28,752
Layer 4	3	3	5,624.00	2,546.00	11,954
				Total	**317,448**
Cumulative Volume (m^3)					**2,550,745**

Source: IEC (2015)

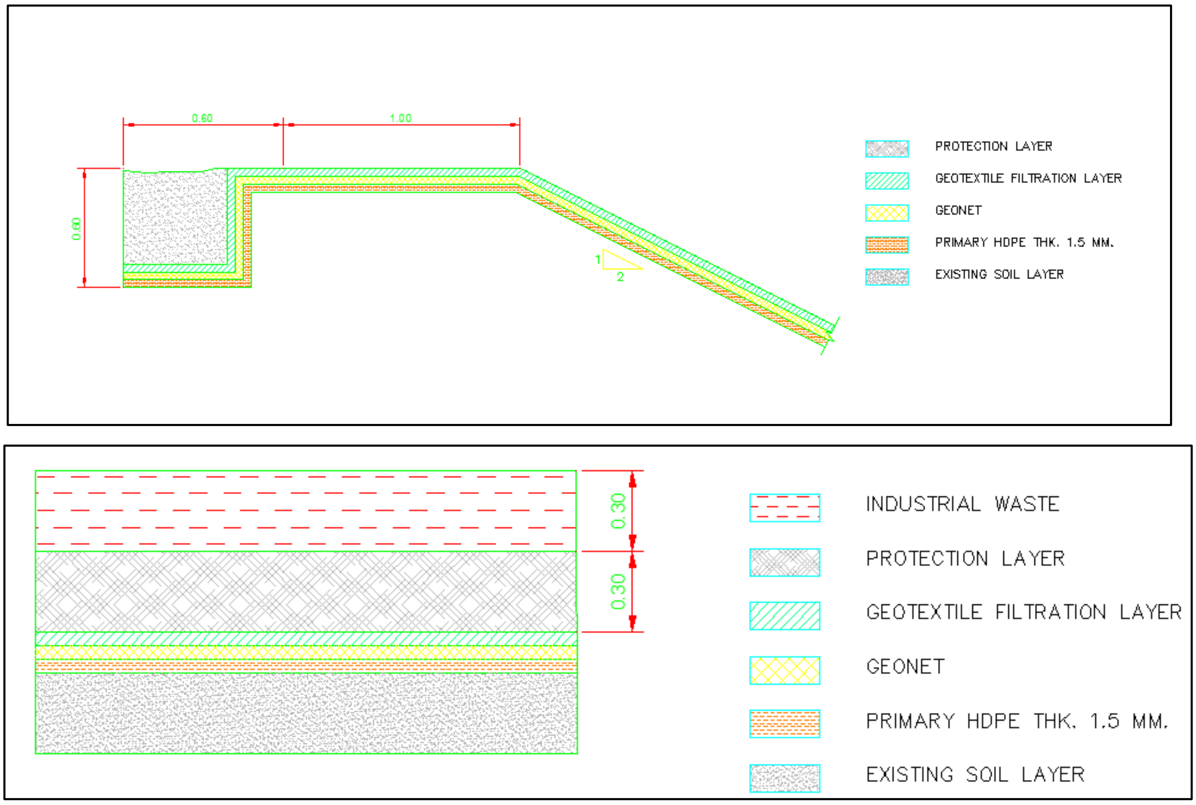
Industrial waste will be disposed in Non-Hazardous waste Landfills number 1 to number 8. Bottom ash from Non-Hazardous Waste incinerator will be disposed in Non-Hazardous Waste Landfills number 9.

The objective in the design of landfill is to minimize the infiltration of leachate into the subsurface soils below the landfill thus eliminating the potential for groundwater contamination. The Non-Hazardous waste landfills are constructing in accordance with the USEPA Guidelines and Guideline for solid waste disposal of the Pollution Control Department of Thailand. A Liner of the Non-Hazardous waste Landfills will be a single composite liner which has been developed to minimize the movement of leachate into the subsurface below the landfill. Details of the liner system applying the Project is following

1) Liner on Side Slope

Figure 4.2-87 is show design of Runout and Trench for non-hazardous waste landfills. Side slope is design with ratio 1:2 for stability and is lining with

- High Density Polyethylene (HDPE) layer will be overlain the exiting soil layers. HDPE is 1.5 millimeter thick.
- Geonet layer will line over the HDPE layer to control erosion and improve drainage.
- Geotextile Filtration layer be laid over the Geonet layer. GeoTextile layers are recommended to protect the bottom from loads of buried waste.
- Protection layer will line on the top to prevent surficial erosion for 30 centimeter.
- Figure 4.2-87 is shown slide slope liner.



Source: IEC (2015)

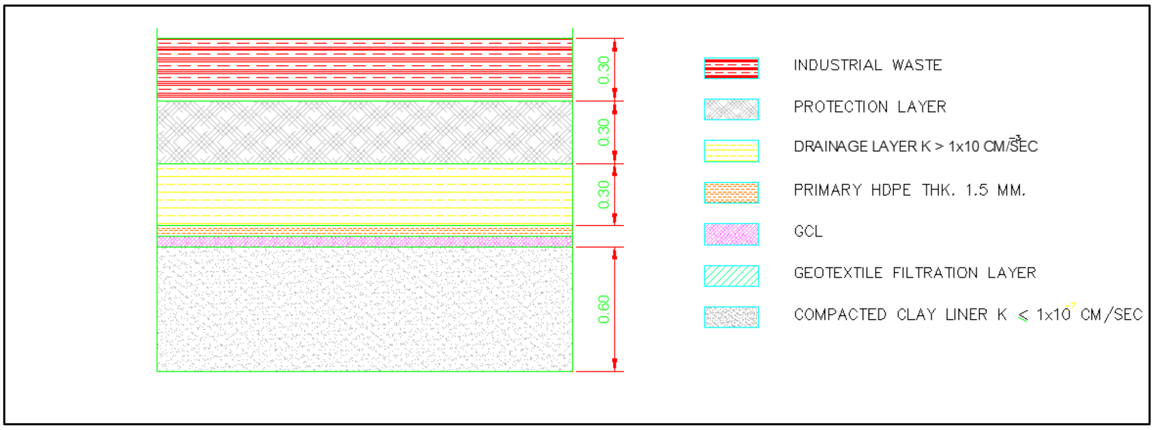
Figure 4.2-87 Design of Rounout and Trench

2) Bottom Liners

- Compacted Clayey Soil layer will be lined at the bottom of the landfills. Suitable materials can be any certain type of clayey soil that must have the hydraulic conductivity less 1.0 X 10-7 cm/s. Figure 4.2-98 present example of suitable clayey soils. This layer need to be lined exactly 100 centimeter in thickness but alternatively, to enhanced capacity of the landfills; the GCL layer will be replaced. Therefore, total thickness of the compacted clayey soil layer will be only 60 centimeters.
- Geo (Synthetic) Clay Liner (GCL) will be lined over the compacted clayey soil layer.
- High Density Polyethylene (HDPE) layer will be overlain the compacted Clayed Soil Layer. 1.5 millimeters each of double HDPE are required.
- Granular Drainage layer will be lined over the GeoTextile cushion. The layer need to be permeable and constructed with granular materials. Leachate Collection Pipping (Figure 4.2-96 Left) will be lined within the layer. The Granular Drainage layer need to be at least 30 centimeters exactly.

- Protection Layer for 30 centimeters will line on the top
- To support stability of the landfills from loads of overburden waste and subsurface pressure, coarse compacted waste are recommended to line at the bottom prior cover or top up with the other kinds of waste.

Bottom liner for non-hazardous waste landfills is presented in Figure 4.2-88



Source: IEC (2015)

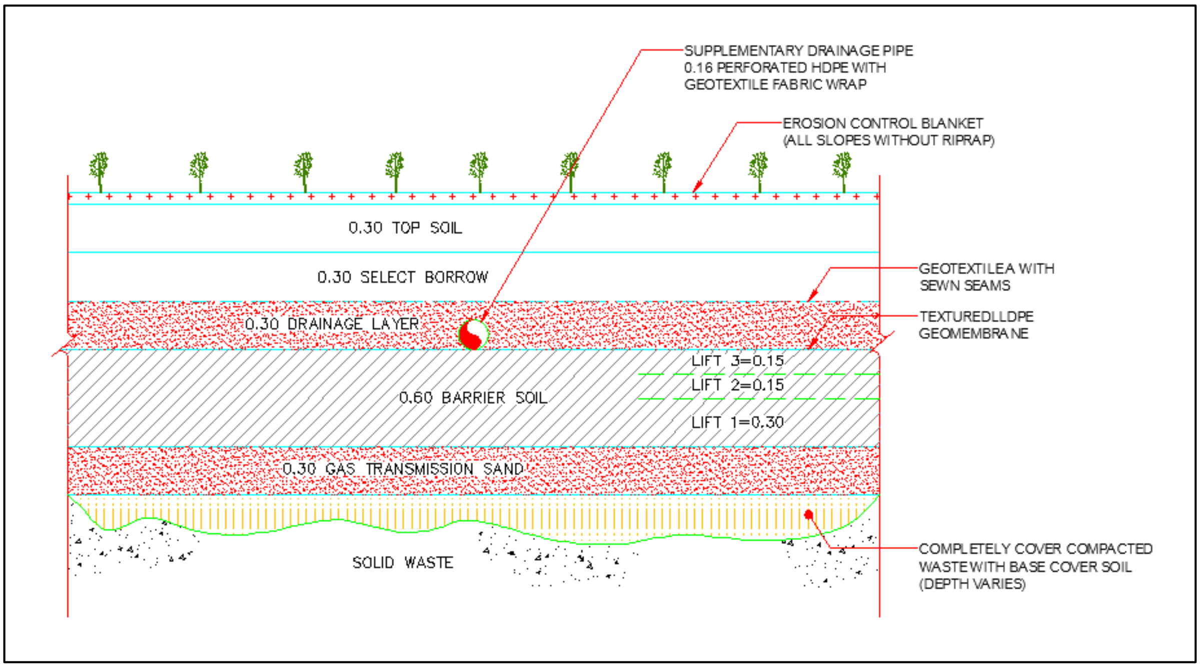
Figure 4.2-88 Bottom liner for non-hazardous waste landfills

3) Final Cover

- Compacted Clayey Soil mixed with compacted waste layer will be lined on the top of the waste.
- Gas Transmission sand will be lined over the previous layer for 30 centimeters.
- Barrier soil layer will be lined over the Gas transmission sand. This layer is 30 centimeters thick.
- Texturedllдpe Geomembrane layer will be lined over the sand barrier layer
- Drainage layer will be lined over the geomembrane. Within this layer, supplementary drainage pip 0.16 perfora TED HDPE with Geotextile fabric wrap will be installed.
- Geotextilea with sewn seams layer will be line over the geomembrane and is to prevent infiltration from precipitation.
- Selected burrow layer will be lined over the Geotextilea for 30 centimeters.
- Top soil layer will be lined over the selected burrow. The layer is 30 centimeters in thickness. Soil composition and it stability of certain slope must be comply.
- Erosional control blanket layer is applied to all slopes without riprap

- Vegetation Cover Layer will be finally cover up to the top of the soil layer. Certain type of vegetation such as the species that preferred slope and / or resistance to soil erosion are recommended. The vegetation Cover Layer will be also encourage aesthetic of the Waste Management Facility

Final cover liner for non-hazardous waste landfills is presented in Figure 4.2-89.

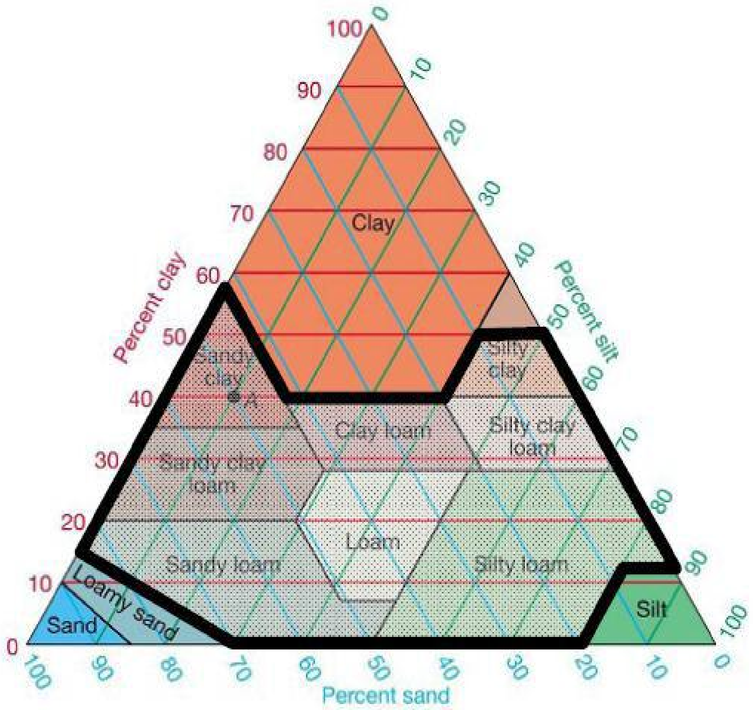


Source: IEC (2015)

Figure 4.2-89 Final cover for non-hazardous waste and hazardous waste landfills

4) Groundwater Interception System

- To monitor and control groundwater underneath the non-hazardous waste landfills, further bottom of the Landfills liners are installed the Groundwater Interception System, which will prevent the Landfills from regional groundwater gradient.



Characteristics of suitable soil for landfill.

Source: IEC (2015)

Figure 4.2-90 Size particles and percentage diagram for the most suitable characteristics of materials for landfill liner

(b) Landfill for Hazardous waste

The Project has 2 Hazardous Waste Landfills (Secure Landfills). The Hazardous Waste Landfill no.1 will be firstly developed for the initial phase of The Project and another one will be developed in the later phases. Volumes and capacity of the Hazardous Waste Landfills are presented in Table 4.2-46.

Table 4.2-46 Volume of Hazardous Waste Landfills

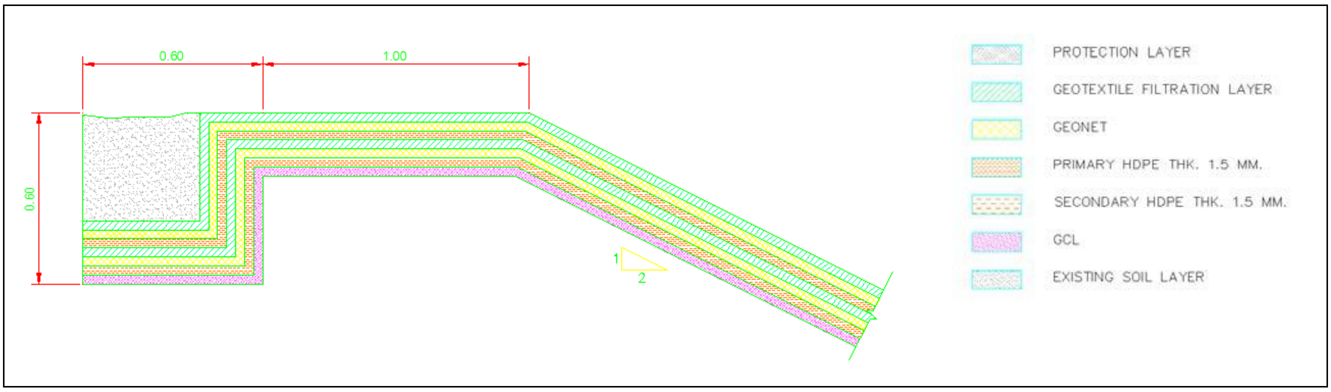
Description	Deep (m)	Slop (x/y)	Surface Area (m^2)	Bottom Area (m^2)	Volume (m^3)
Hazardous Waste Landfill No.1					
Bottom Layer 1	6	2	14,732.78	8,610.51	69,213
Bottom Layer 2	6	2	6,454.09	4,172.04	15,815
Layer 1	2	3	14,732.78	11,504.38	26,171
Layer 2	3	3	9,069.62	5,271.43	21,256
Layer 3	3	3	3,485.22	874.95	6,106
				Total	**138,561**
Non-Hazardous Waste Landfill No.2					
Bottom Layer 1	6	2	18,453.84	12,038.04	90,793
Bottom Layer 2	6	2	9,694.86	7,139.34	25,154
Layer 1	2	3	18,453.84	15,106.15	33,504
Layer 2	3	3	12,529.98	8,382.15	31,160
Layer 3	3	3	6,349.63	3,181.58	14,026
				Total	**194,637**
Cumulative Volume (m^3)					**333,198**

Source: IEC (2015)

To prevent contamination of the Landfills leachates and odors. The Non-Hazardous waste landfills are constructing in accordance with the USEPA and Guideline for solid waste disposal of the Pollution Control Department of Thailand. Liners of the Hazardous waste Landfills (Secure Landfills) will be double composite liners which has two barriers. Details of the liners are following

1) Liner on Side Slope

Design of runout and trench of hazardous waste landfills.



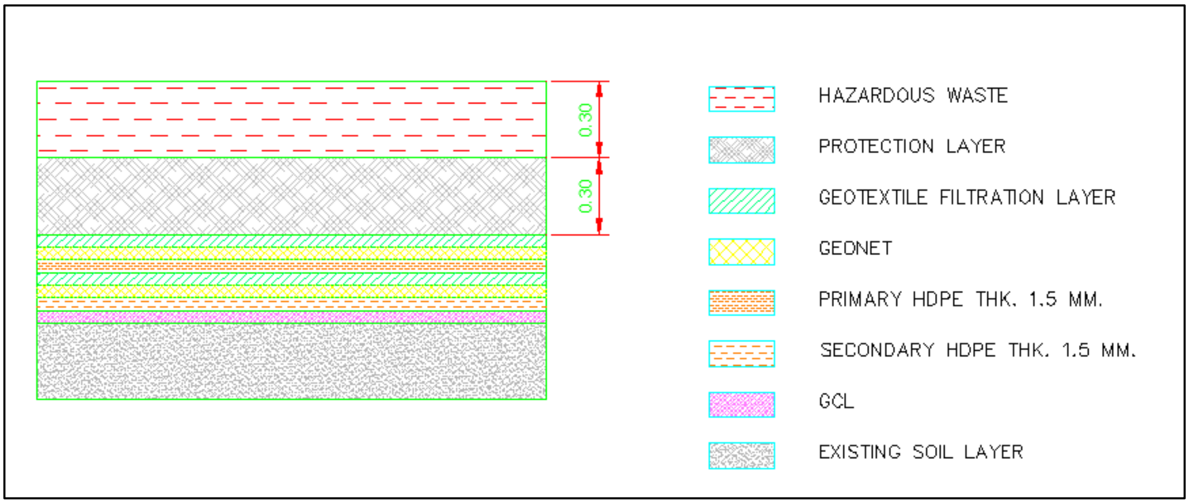
Source: IEC (2015)

Figure 4.2-91 Side slope design for hazardous waste landfill

For stability, side slope is design with ratio 1:2 and is lining with a series liners following:

GeoSynthetic layer, Secondary HDPE 1.5 millimeter thick, GeoNet, Geotextile, Filtration Layer, Primary HDPE 1.5 millimeter thick, Geonet, Geotextile filtration layer, Protection layer for 30 centimeter thick.

Figure 4.2-92 is show side slope liners for hazardous waste landfills.



Source: IEC (2015)

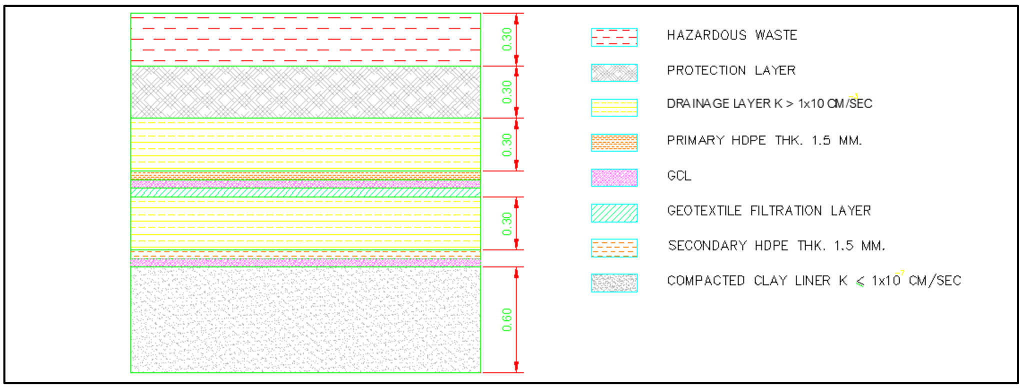
Figure 4.2-92 Side slope liner for hazardous waste landfills

2) Bottom Liner

Bottom of the hazardous waste landfills will be lined with series of the following liners:

60 centimeter of compact clay layer with hydraulic conductivity less than 1 x10^{-3} centimeter per second, GCL, Secondary HDPE 1.5 millimeter thick, 30 centimeter of drainage layer with hydraulic conductivity more than 1 x10^{-3} centimeter per second, Geotextile Filtration layer, GCL, Primary HDPE 1.5 millimeter thick, drainage layer for 30 centimeter thick and protection layer for 30 centimeter thick.

Figure 4.2-93 is shown bottom liner for hazardous waste landfills. .



Source: IEC (2015)

Figure 4.2-93 Bottom liner for hazardous waste landfill

3) Final Cover

Is the same for non-hazardous waste landfills.

4) Groundwater Interception System

- To monitor and control groundwater underneath the hazardous waste Landfills, further bottom of the Landfills liners are installed the Groundwater Interception System, which will prevent the Landfills from regional groundwater gradient

(c) Landfills Leachate Management System (LMS)

Leachate is a major byproduct of the landfills. Characteristic of typical leachate is presented in Table 4.2-47.

Table 4.2-47 Typical composition of Landfill Leachate

Constituent*	New Landfills (less than 2 years)		Mature Landfills (more than 10 years)
	Range	Typical	
BOD (5-days)	2,000-30,000	10,000	100-200
TOC (Total organic carbon)	1,500-20,000	6,000	80-160
COD	3,000-60,000	18,000	100-500
Total suspended solids	200-2,000	500	100-400
Organic nitrogen	10-800	200	80-120
Ammonia nitrogen	10-800	200	20-40

Table 4.2-47 Typical composition of Landfill Leachate (Cont.)

Constituent*	New Landfills (less than 2 years)		Mature Landfills (more than 10 years)
	Range	Typical	
Nitrate	5-40	25	5-10
Total Phosphorus	5-100	30	5-10
Ortho phosphorus	4-80	20	4-8
Alkalinity as $CaCO_3$	1,000-10,000	3,000	200-1,000
pH	4.5-7.5	6	6.6-7.5
Total hardness in $CaCO_3$	300-10,000	3,500	200-500
Calcium	200-3,000	1,000	100-400
Magnesium	50-1,500	250	50-200
Potassium	200-1,000	300	50-400
Sodium	200-2,500	500	100-200
Chloride	200-3,000	500	100-400
Sulfate	50-1,000	300	20-50
Total iron	50-1,200	60	20-200

Source: ESIA Study Team

Remark: * Unit is mg/L

Volume of leachate can be estimated by equation 2 which considers the maximum daily precipitation rate, the ratio between leachate and rainfall, the surface area of the landfill and the required residence time of the leachate in the pond.

$$v = \frac{p_{max} \cdot r \cdot A \cdot t_{ops}}{1000} \cdot 0.5$$ Equation 4.2-2

Where

v : Volume of leachate treatment pound (m^3)

p_{max} : Maximum precipitation rate (mm/day) for a design storm over a period of t_{ops}

r : Ratio between leachate amount and rainfall (-)

A : Catchment area (Surface area of the landfill) (m^2)

t_{ops} : Optimum residence time of leachate in the treatment ponds (day)

1000 : Conversion factor from (mm) to (m)

0.5 : Factor considering that only part (50%) of the infiltrating rainwater is directly discharge as leachate

Table 4.2-48 Maximum precipitation at Dawei Station in 10,000 years

Return Period	Maximum precipitation at Dawei Station		
	1 day	2 days	3 days
2	234	362	458
5	336	482	599
10	404	562	692
20	469	639	781
25	490	664	809
50	553	739	897
100	616	813	983
200	679	887	1,070
500	762	985	1,184
1,000	825	1,059	1,270
10,000	1,033	1,305	1,556

Source: IEC, 2015

Assumed returned period of storm is 25 years and will be last only 24 hours (1 day), rate of leachate generation is half of maximum precipitation in 25 years and retention of leachate in the retention pond is 1 day. Summarized of input in the equation will be following

1. P_{max} (Return period 25 years, daily) = 490 mm./ day

2. Ratio between leachate amount and rainfall, r = 0.5

3. Active area of Non-Hazardous waste Landfill = 1,600 m^2

4. Active area of Hazardous waste Landfill = 1,600 m^2

5. Retention time (t_{ops}) = 1 day

Table 4.2-49 Generation Rate of Leachate in Dawei area in period of 25 years

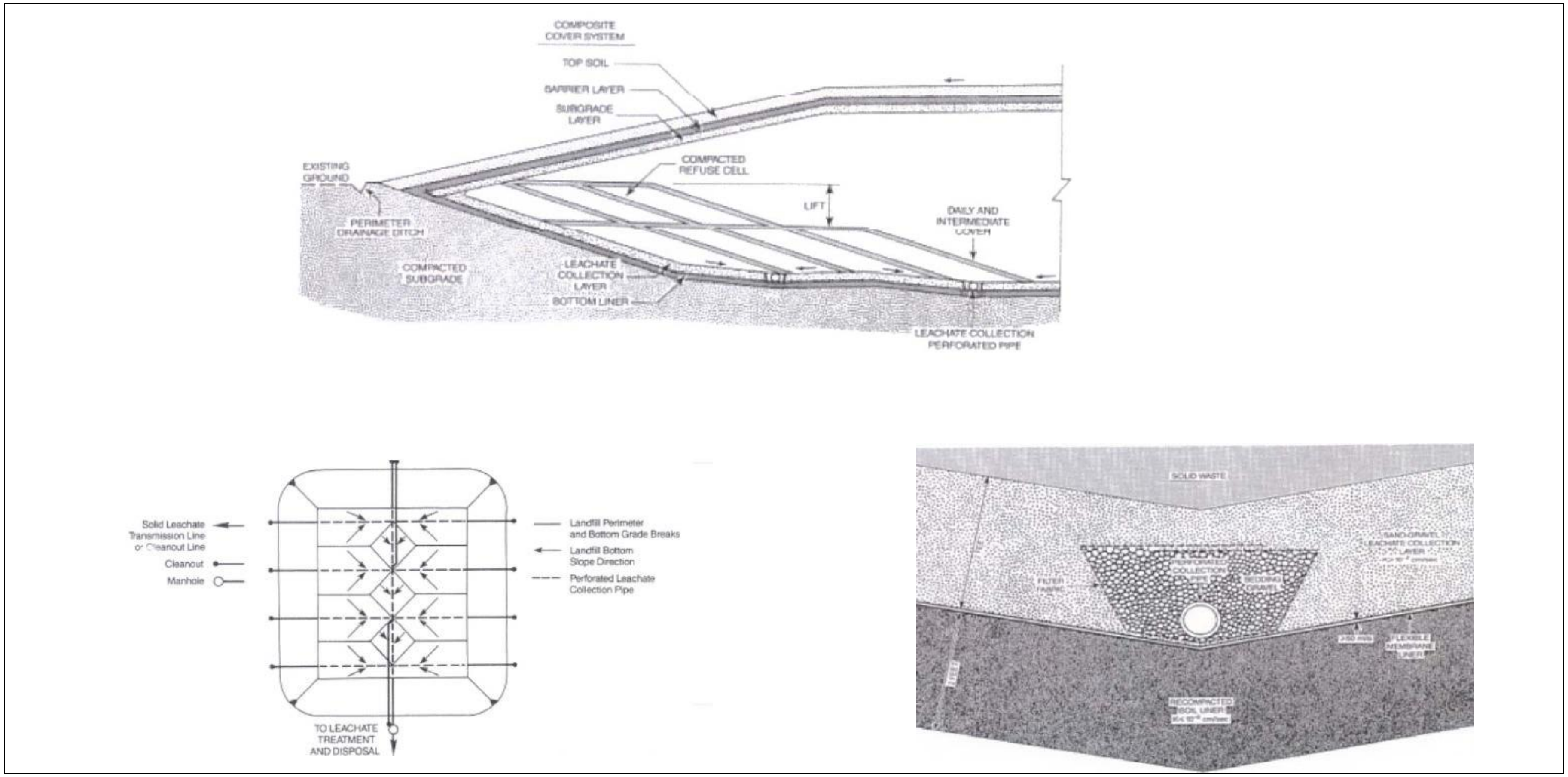
	Generation Rate of Leachate
Non-Hazardous Waste Landfills	196 Cu / day 200 Cu /day
Hazardous Waste Landfills	196 Cu / day 200 Cu /day

Source: IEC (2016)

Leachates are collected by Leachate Collection Pipping. The design of Leachates Collection System in the Landfill is presented in Figure 4.2-96. Leachates will then be delivered to Leachates Treatment System which consists of series of treatment ponds (Figure 4.2-96 Right and Figure 4.2-97) following

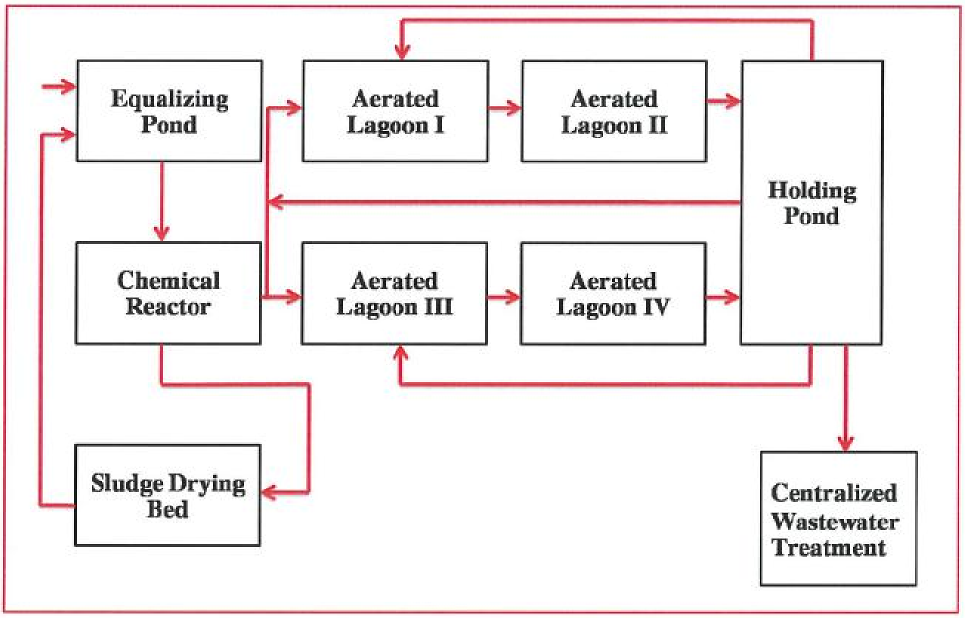
- Equalizing pond
- Chemical Reactor pond
- Aerated Lagoons
- Holding pond
- Sludge Drying Bed pond

Alkalinity (pH) of leachates will be neutralized in the Equalizing pond and then will be stabilized in Chemical Reactor pond. Treated leachates will be aerated to improve its quality in the aerated lagoon number 1 and 2. Then, the treated water will be rested in holding pond for 24 hours. At this stage, quality of treated water will be inspected and if quality of treated water comply by the guideline for Landfill Facility, the treated wastewater can be delivered to the Centralize Wastewater Treatment Plant (WTTP). Leachates treatment process is presented in Figure 4.2-95.



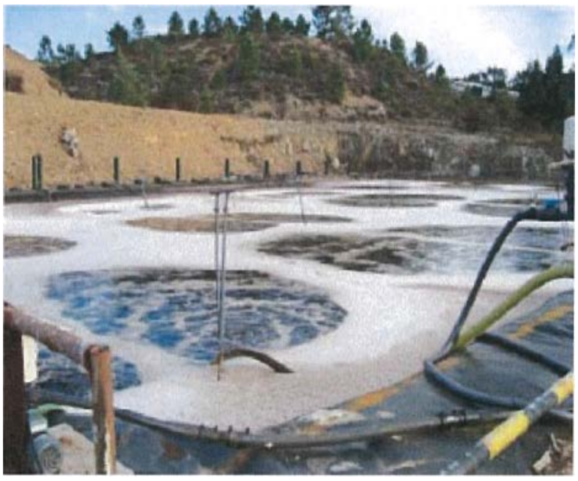
Source: IEC (2015)

Figure 4.2-94 Example of typical Leachate Collection System. Cross section of Leachate pipes system (above), Top view of Leachate pipes system (Left) and Cross section of Leachate pipeline (Right)



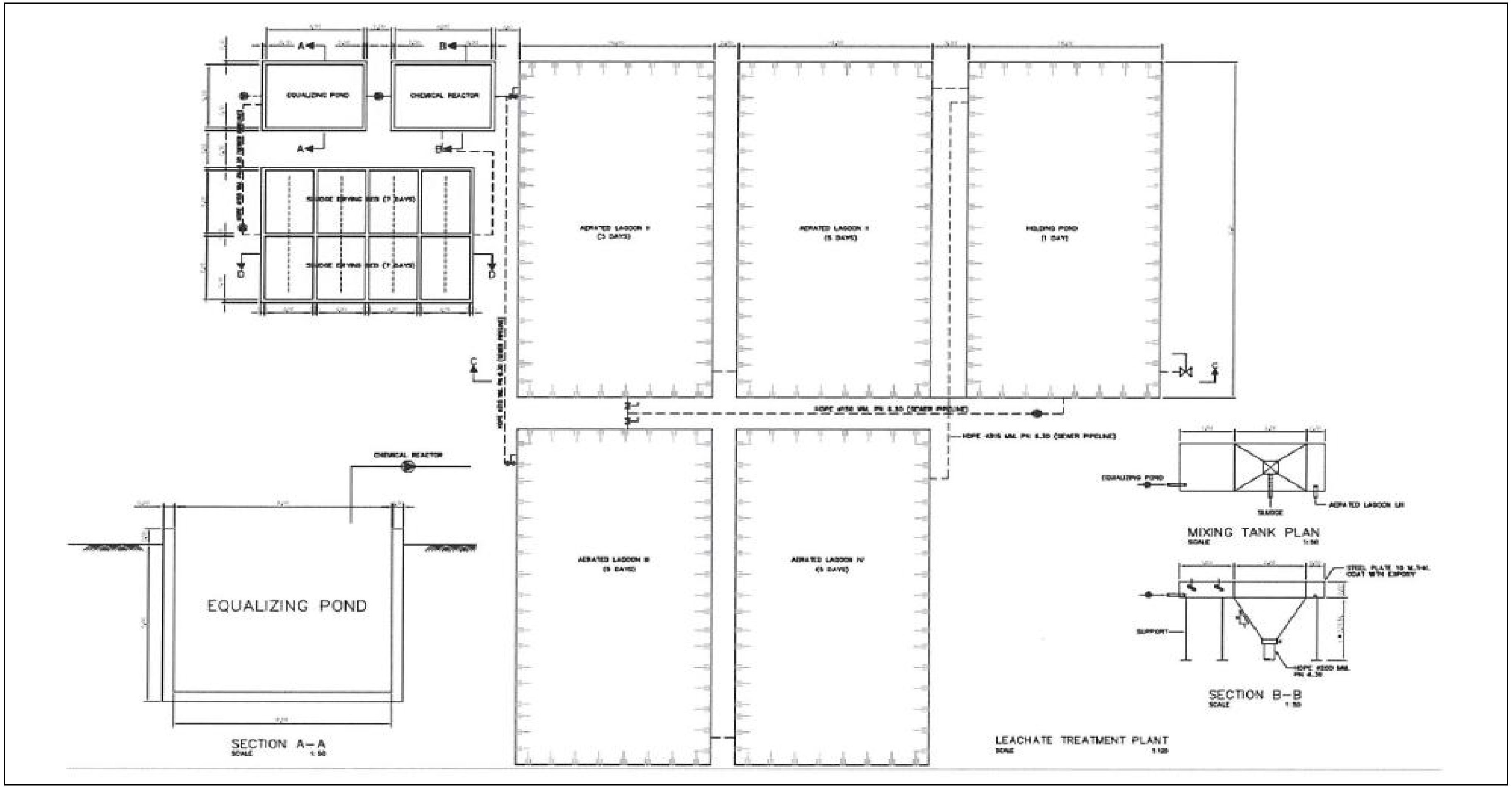
Source: IEC (2015)

Figure 4.2-95 Flow chart of Leachate Treatment Process



Source: IEC (2015)

Figure 4.2-96 Example of installation of Leachate Collect Pipeline (Left) and Leachate Treatment Ponds (Right)



Source: IEC (2015)

Figure 4.2-97 Lay out of Leachate Treatment ponds in Dawei SEZ Initial Industrial Estate

(d) Landfills Gases Management System (LGMS)

Landfills gases are byproducts of landfills. The gases are derived from degradation and decomposition of waste. Rate and Volume of Landfill Gases generated from Non-Hazardous Waste Landfills and Hazardous Waste Landfills are presented in Table 4.2-51 and Table 4.2-52. Composition of typical gases generating from landfill is presented in Table 4.2-50.

Table 4.2-50 Typical constituents found in municipal solid waste Landfill gases

Constituent		Typical concentrations (Percentage v/v)	Trace Component
Methane	CH_4	50 - 60	Hydrogen sulphide, non-methane volatile organic carbons (NMVOCs) and halocarbons.
Carbon dioxide	CO_2	30 - 50	
Nitrogen (from air)	N_2	0 - 15	
Oxygen (from air)	O_2	0 - 2	
Hydrogen	H_2	0 - 2	
Trace components		0 - 1	
Water vapour	H_2O	Saturated	

Source: ESIA Study Team

Landfill gases will be collected by the Landfills Gases Management System, which consists of following

- Passive Gases Collection System
- Active Gases Collection System
- Landfill Gases Monitoring System
- Flaring System

The LGMS are presented in Figure 4.2-98 and Figure 4.2-100

Landfill gases is flammable if it poses in elevated concentration and circumstance such as raising temperature in summer. Combustion which occur here is usually incomplete, thus elevated level of carbon monoxide (CO) can be detected. Measurement of carbon monoxide can indicate level of fire as presented in. Temperature of Landfills each stage is presented in

Table 4.2-51 Rate of Gases Generation from Non-Hazardous Waste Landfills

Year	Disposal Rate metric tons/yr	Waste In-Place metric tons	LFG Generation Rate			Collection System Efficiency	LFG Recovery from Existing and Planned System			Energy Output From Direct Use Project [a]	Energy Output From Electric Generation Project [b]
			(m^3/min)	(m^3/hr)	(m^3/Y)	(%)	(m^3/min)	(m^3/hr)	$MTCO_2e$	(MJ/hr)	(MW)
1	11,787	11,787	0.00	0.00	0	60%	0	0	0	0	0.000
2	26,733	38,520	0.45	26.82	234,967	60%	0	16	1,061	272	0.026
3	39,759	78,280	1.39	83.24	729,153	60%	1	50	3,294	843	0.080
4	53,951	132,230	2.67	160.00	1,401,601	60%	2	96	6,331	1,620	0.155
5	66,977	199,208	4.27	256.41	2,246,169	60%	3	154	10,146	2,596	0.248
6	81,169	280,377	6.11	366.58	3,211,280	60%	4	220	14,506	3,712	0.354
7	94,153	374,530	8.18	490.90	4,300,301	60%	5	295	19,425	4,971	0.474
8	106,815	481,344	10.40	624.29	5,468,750	60%	6	375	24,703	6,321	0.603
9	114,970	596,314	12.74	764.51	6,697,123	60%	8	459	30,252	7,741	0.738
10	123,125	719,439	15.00	900.19	7,885,706	60%	9	540	35,621	9,115	0.870
11	131,280	850,718	17.20	1,032.08	9,041,054	60%	10	619	40,839	10,450	0.997
12	139,435	990,153	19.35	1,160.80	10,168,642	60%	12	696	45,933	11,754	1.121
13	139,435	1,129,587	21.45	1,286.88	11,273,042	60%	13	772	50,921	13,030	1.243
14	139,435	1,269,022	23.20	1,392.18	12,195,514	60%	14	835	55,088	14,096	1.345
15	139,435	1,408,456	24.67	1,480.14	12,966,028	60%	15	888	58,569	14,987	1.430
16	0	1,408,456	25.89	1,553.61	13,609,615	60%	16	932	61,476	15,731	1.501
17	0	1,408,456	21.63	1,297.68	11,367,706	60%	13	779	51,349	13,140	1.254
18	0	1,408,456	18.07	1,083.92	9,495,106	60%	11	650	42,890	10,975	1.047
19	0	1,408,456	15.09	905.36	7,930,979	60%	9	543	35,825	9,167	0.875
20	0	1,408,456	12.60	756.22	6,624,511	60%	8	454	29,924	7,657	0.730
21	0	1,408,456	10.53	631.65	5,533,256	60%	6	379	24,994	6,396	0.610
22	0	1,408,456	8.79	527.60	4,621,764	60%	5	317	20,877	5,342	0.510
23	0	1,408,456	7.34	440.69	3,860,422	60%	4	264	17,438	4,462	0.426
24	0	1,408,456	6.13	368.09	3,224,496	60%	4	221	14,565	3,727	0.356
25	0	1,408,456	5.12	307.46	2,693,325	60%	3	184	12,166	3,113	0.297
26	0	1,408,456	4.28	256.81	2,249,654	60%	3	154	10,162	2,600	0.248
27	0	1,408,456	3.58	214.51	1,879,069	60%	2	129	8,488	2,172	0.207
28	0	1,408,456	2.99	179.17	1,569,530	60%	2	108	7,090	1,814	0.173
29	0	1,408,456	2.49	149.66	1,310,982	60%	1	90	5,922	1,515	0.145

Table 4.2-51 Rate of Gases Generation from Non-Hazardous Waste Landfills

Year	Disposal Rate metric tons/yr	Waste In-Place metric tons	LFG Generation Rate			Collection System Efficiency	LFG Recovery from Existing and Planned System			Energy Output From Direct Use Project [a]	Energy Output From Electric Generation Project [b]
			(m^3/min)	(m^3/hr)	(m^3/Y)	(%)	(m^3/min)	(m^3/hr)	$MTCO_2e$	(MJ/hr)	(MW)
30	0	1,408,456	2.08	125.00	1,095,024	60%	1	75	4,946	1,266	0.121
31	0	1,408,456	1.74	104.41	914,641	60%	1	63	4,132	1,057	0.101
32	0	1,408,456	1.45	87.21	763,973	60%	1	52	3,451	883	0.084
33	0	1,408,456	1.21	72.85	638,123	60%	1	44	2,882	738	0.070
34	0	1,408,456	1.01	60.85	533,006	60%	1	37	2,408	616	0.059
35	0	1,408,456	0.85	50.82	445,204	60%	1	30	2,011	515	0.049
36	0	1,408,456	0.71	42.45	371,865	60%	0	25	1,680	430	0.041
37	0	1,408,456	0.59	35.46	310,608	60%	0	21	1,403	359	0.034
38	0	1,408,456	0.49	29.62	259,442	60%	0	18	1,172	300	0.029
39	0	1,408,456	0.41	24.74	216,704	60%	0	15	979	250	0.024
40	0	1,408,456	0.34	20.66	181,006	60%	0	12	818	209	0.020
41	0	1,408,456	0.29	17.26	151,189	60%	0	10	683	175	0.017
42	0	1,408,456	0.24	14.42	126,284	60%	0	9	570	146	0.014
43	0	1,408,456	0.20	12.04	105,481	60%	0	7	476	122	0.012
44	0	1,408,456	0.17	10.06	88,105	60%	0	6	398	102	0.010
45	0	1,408,456	0.14	8.40	73,592	60%	0	5	332	85	0.008
46	0	1,408,456	0.12	7.02	61,469	60%	0	4	278	71	0.007
47	0	1,408,456	0.10	5.86	51,343	60%	0	4	232	59	0.006
48	0	1,408,456	0.08	4.90	42,885	60%	0	3	194	50	0.005
49	0	1,408,456	0.07	4.09	35,821	60%	0	2	162	41	0.004
50	0	1,408,456	0.06	3.42	29,920	60%	0	2	135	35	0.003
51	0	1,408,456	0.05	2.85	24,991	60%	0	2	113	29	0.003
52	0	1,408,456	0.04	2.38	20,875	60%	0	1	94	24	0.002
53	0	1,408,456	0.03	1.99	17,436	60%	0	1	79	20	0.002
54	0	1,408,456	0.03	1.66	14,564	60%	0	1	66	17	0.002
55	0	1,408,456	0.02	1.39	12,165	60%	0	1	55	14	0.001
56	0	1,408,456	0.02	1.16	10,161	60%	0	1	46	12	0.001
57	0	1,408,456	0.02	0.97	8,487	60%	0	1	38	10	0.001
58	0	1,408,456	0.01	0.81	7,089	60%	0	0	32	8	0.001

Table 4.2-51 Rate of Gases Generation from Non-Hazardous Waste Landfills

Year	Disposal Rate metric tons/yr	Waste In-Place metric tons	LFG Generation Rate			Collection System Efficiency	LFG Recovery from Existing and Planned System			Energy Output From Direct Use Project [a]	Energy Output From Electric Generation Project [b]
			(m^3/min)	(m^3/hr)	(m^3/Y)	(%)	(m^3/min)	(m^3/hr)	$MTCO_2e$	(MJ/hr)	(MW)
59	0	1,408,456	0.01	0.68	5,921	60%	0	0	27	7	0.001
60	0	1,408,456	0.01	0.56	4,946	60%	0	0	22	6	0.001
61	0	1,408,456	0.01	0.47	4,131	60%	0	0	19	5	0.000
62	0	1,408,456	0.01	0.39	3,451	60%	0	0	16	4	0.000
63	0	1,408,456	0.01	0.33	2,882	60%	0	0	13	3	0.000
64	0	1,408,456	0.00	0.27	2,407	60%	0	0	11	3	0.000
65	0	1,408,456	0.00	0.23	2,011	60%	0	0	9	2	0.000
66	0	1,408,456	0.00	0.19	1,680	60%	0	0	8	2	0.000
67	0	1,408,456	0.00	0.16	1,403	60%	0	0	6	2	0.000
68	0	1,408,456	0.00	0.13	1,172	60%	0	0	5	1	0.000
69	0	1,408,456	0.00	0.11	979	60%	0	0	4	1	0.000
70	0	1,408,456	0.00	0.09	818	60%	0	0	4	1	0.000
71	0	1,408,456	0.00	0.08	683	60%	0	0	3	1	0.000
72	0	1,408,456	0.00	0.07	570	60%	0	0	3	1	0.000
73	0	1,408,456	0.00	0.05	476	60%	0	0	2	1	0.000
74	0	1,408,456	0.00	0.05	398	60%	0	0	2	0	0.000
75	0	1,408,456	0.00	0.04	332	60%	0	0	2	0	0.000
76	0	1,408,456	0.00	0.03	278	60%	0	0	1	0	0.000
77	0	1,408,456	0.00	0.03	232	60%	0	0	1	0	0.000
78	0	1,408,456	0.00	0.02	194	60%	0	0	1	0	0.000
79	0	1,408,456	0.00	0.02	162	60%	0	0	1	0	0.000
80	0	1,408,456	0.00	0.02	135	60%	0	0	1	0	0.000
81	0	1,408,456	0.00	0.01	113	60%	0	0	1	0	0.000
82	0	1,408,456	0.00	0.01	94	60%	0	0	0	0	0.000
83	0	1,408,456	0.00	0.01	79	60%	0	0	0	0	0.000
84	0	1,408,456	0.00	0.01	66	60%	0	0	0	0	0.000
85	0	1,408,456	0.00	0.01	55	60%	0	0	0	0	0.000
86	0	1,408,456	0.00	0.01	46	60%	0	0	0	0	0.000
87	0	1,408,456	0.00	0.00	38	60%	0	0	0	0	0.000

Table 4.2-51 Rate of Gases Generation from Non-Hazardous Waste Landfills

Year	Disposal Rate metric tons/yr	Waste In-Place metric tons	LFG Generation Rate			Collection System Efficiency	LFG Recovery from Existing and Planned System			Energy Output From Direct Use Project [a]	Energy Output From Electric Generation Project [b]
			(m³/min)	(m³/hr)	(m³/Y)	(%)	(m³/min)	(m³/hr)	$MTCO_2e$	(MJ/hr)	(MW)
88	0	1,408,456	0.00	0.00	32	60%	0	0	0	0	0.000
89	0	1,408,456	0.00	0.00	27	60%	0	0	0	0	0.000
90	0	1,408,456	0.00	0.00	22	60%	0	0	0	0	0.000
91	0	1,408,456	0.00	0.00	19	60%	0	0	0	0	0.000
92	0	1,408,456	0.00	0.00	16	60%	0	0	0	0	0.000
93	0	1,408,456	0.00	0.00	13	60%	0	0	0	0	0.000
94	0	1,408,456	0.00	0.00	11	60%	0	0	0	0	0.000
95	0	1,408,456	0.00	0.00	9	60%	0	0	0	0	0.000
96	0	1,408,456	0.00	0.00	8	60%	0	0	0	0	0.000
97	0	1,408,456	0.00	0.00	6	60%	0	0	0	0	0.000
98	0	1,408,456	0.00	0.00	5	60%	0	0	0	0	0.000
99	0	1,408,456	0.00	0.00	4	60%	0	0	0	0	0.000
100	0	1,408,456	0.00	0.00	4	60%	0	0	0	0	0.000
Total					**170,437.12**						

Remarks:

[a] assumes gas is combusted in a boiler with 85% efficiency to produce steam

[b] assumes gas is combusted in an engine with 30% efficiency to produce electricity

Methane content of LFG adjusted to: 50%

Methane generation rate constant (k): 0.18 per year

Ultimate methane generation potential (L_0): 60 cubic meters / tons

Conversion factor for volume: 0.0283 cubic meters / cubic foot

Source: IEC (2015)

Table 4.2-52 Rate of Gases Generation from Hazardous Waste Landfills

Year	Disposal Rate metric tons/yr	Waste In-Place metric tons	LFG Generation Rate			Collection System Efficiency (%)	LFG Recovery from Existing and Planned System			Energy Output From Direct Use Project [a] (MJ/hr)	Energy Output From Electric Generation Project [b] (MW)
			(m^3/min)	(m^3/hr)	(m^3/Y)		(m^3/min)	(m^3/hr)	$MTCO_2e$		
1	516	516	0.00	0.00	0.00	60%	0	0	0	0	0.000
2	1,155	1,672	0.02	1.17	10,291.17	60%	0	1	46	12	0.001
3	1,710	3,382	0.06	3.61	31,629.39	60%	0	2	143	37	0.003
4	2,326	5,708	0.12	6.91	60,507.71	60%	0	4	273	70	0.007
5	2,881	8,588	0.18	11.06	96,906.29	60%	0	7	438	112	0.011
6	3,496	12,085	0.26	15.79	138,364.08	60%	0	9	625	160	0.015
7	4,050	16,135	0.35	21.15	185,269.93	60%	0	13	837	214	0.020
8	4,618	20,753	0.45	26.88	235,477.92	60%	0	16	1,064	272	0.026
9	5,048	25,801	0.55	32.96	288,749.60	60%	0	20	1,304	334	0.032
10	5,477	31,277	0.65	39.02	341,801.62	60%	0	23	1,544	395	0.038
11	5,906	37,183	0.75	45.05	394,670.16	60%	0	27	1,783	456	0.044
12	6,335	43,518	0.85	51.07	447,385.46	60%	1	31	2,021	517	0.049
13	6,335	49,854	0.95	57.07	499,972.74	60%	1	34	2,258	578	0.055
14	6,335	56,189	1.03	62.09	543,897.34	60%	1	37	2,457	629	0.060
15	6,335	62,524	1.10	66.28	580,586.24	60%	1	40	2,623	671	0.064
16	0	62,524	1.16	69.78	611,231.39	60%	1	42	2,761	707	0.067
17	0	62,524	0.97	58.28	510,543.37	60%	1	35	2,306	590	0.056
18	0	62,524	0.81	48.68	426,441.67	60%	0	29	1,926	493	0.047
19	0	62,524	0.68	40.66	356,194.02	60%	0	24	1,609	412	0.039
20	0	62,524	0.57	33.96	297,518.26	60%	0	20	1,344	344	0.033
21	0	62,524	0.47	28.37	248,508.14	60%	0	17	1,123	287	0.027
22	0	62,524	0.39	23.70	207,571.45	60%	0	14	938	240	0.023
23	0	62,524	0.33	19.79	173,378.25	60%	0	12	783	200	0.019
24	0	62,524	0.28	16.53	144,817.68	60%	0	10	654	167	0.016
25	0	62,524	0.23	13.81	120,961.90	60%	0	8	546	140	0.013
26	0	62,524	0.19	11.53	101,035.87	60%	0	7	456	117	0.011
27	0	62,524	0.16	9.63	84,392.25	60%	0	6	381	98	0.009
28	0	62,524	0.13	8.05	70,490.33	60%	0	5	318	81	0.008
29	0	62,524	0.11	6.72	58,878.48	60%	0	4	266	68	0.006
30	0	62,524	0.09	5.61	49,179.44	60%	0	3	222	57	0.005
31	0	62,524	0.08	4.69	41,078.12	60%	0	3	186	47	0.005
32	0	62,524	0.07	3.92	34,311.33	60%	0	2	155	40	0.004

Table 4.2-52 Rate of Gases Generation from Hazardous Waste Landfills

Year	Disposal Rate metric tons/yr	Waste In-Place metric tons	LFG Generation Rate			Collection System Efficiency	LFG Recovery from Existing and Planned System			Energy Output From Direct Use Project [a]	Energy Output From Electric Generation Project [b]
			(m^3/min)	(m^3/hr)	(m^3/Y)	(%)	(m^3/min)	(m^3/hr)	$MTCO_2e$	(MJ/hr)	(MW)
33	0	62,524	0.05	3.27	28,659.23	60%	0	2	129	33	0.003
34	0	62,524	0.05	2.73	23,938.20	60%	0	2	108	28	0.003
35	0	62,524	0.04	2.28	19,994.87	60%	0	1	90	23	0.002
36	0	62,524	0.03	1.91	16,701.12	60%	0	1	75	19	0.002
37	0	62,524	0.03	1.59	13,949.95	60%	0	1	63	16	0.002
38	0	62,524	0.02	1.33	11,651.97	60%	0	1	53	13	0.001
39	0	62,524	0.02	1.11	9,732.55	60%	0	1	44	11	0.001
40	0	62,524	0.02	0.93	8,129.31	60%	0	1	37	9	0.001
41	0	62,524	0.01	0.78	6,790.17	60%	0	0	31	8	0.001
42	0	62,524	0.01	0.65	5,671.62	60%	0	0	26	7	0.001
43	0	62,524	0.01	0.54	4,737.34	60%	0	0	21	5	0.001
44	0	62,524	0.01	0.45	3,956.96	60%	0	0	18	5	0.000
45	0	62,524	0.01	0.38	3,305.13	60%	0	0	15	4	0.000
46	0	62,524	0.01	0.32	2,760.68	60%	0	0	12	3	0.000
47	0	62,524	0.00	0.26	2,305.91	60%	0	0	10	3	0.000
48	0	62,524	0.00	0.22	1,926.06	60%	0	0	9	2	0.000
49	0	62,524	0.00	0.18	1,608.78	60%	0	0	7	2	0.000
50	0	62,524	0.00	0.15	1,343.77	60%	0	0	6	2	0.000
51	0	62,524	0.00	0.13	1,122.41	60%	0	0	5	1	0.000
52	0	62,524	0.00	0.11	937.51	60%	0	0	4	1	0.000
53	0	62,524	0.00	0.09	783.08	60%	0	0	4	1	0.000
54	0	62,524	0.00	0.07	654.08	60%	0	0	3	1	0.000
55	0	62,524	0.00	0.06	546.33	60%	0	0	2	1	0.000
56	0	62,524	0.00	0.05	456.34	60%	0	0	2	1	0.000
57	0	62,524	0.00	0.04	381.16	60%	0	0	2	0	0.000
58	0	62,524	0.00	0.04	318.38	60%	0	0	1	0	0.000
59	0	62,524	0.00	0.03	265.93	60%	0	0	1	0	0.000
60	0	62,524	0.00	0.03	222.12	60%	0	0	1	0	0.000
61	0	62,524	0.00	0.02	185.53	60%	0	0	1	0	0.000
62	0	62,524	0.00	0.02	154.97	60%	0	0	1	0	0.000
63	0	62,524	0.00	0.01	129.44	60%	0	0	1	0	0.000
64	0	62,524	0.00	0.01	108.12	60%	0	0	0	0	0.000

Table 4.2-52 Rate of Gases Generation from Hazardous Waste Landfills

Year	Disposal Rate metric tons/yr	Waste In-Place metric tons	LFG Generation Rate			Collection System Efficiency (%)	LFG Recovery from Existing and Planned System			Energy Output From Direct Use Project [a] (MJ/hr)	Energy Output From Electric Generation Project [b] (MW)
			(m^3/min)	(m^3/hr)	(m^3/Y)		(m^3/min)	(m^3/hr)	$MTCO_2e$		
65	0	62,524	0.00	0.01	90.31	60%	0	0	0	0	0.000
66	0	62,524	0.00	0.01	75.43	60%	0	0	0	0	0.000
67	0	62,524	0.00	0.01	63.01	60%	0	0	0	0	0.000
68	0	62,524	0.00	0.01	52.63	60%	0	0	0	0	0.000
69	0	62,524	0.00	0.01	43.96	60%	0	0	0	0	0.000
70	0	62,524	0.00	0.00	36.72	60%	0	0	0	0	0.000
71	0	62,524	0.00	0.00	30.67	60%	0	0	0	0	0.000
72	0	62,524	0.00	0.00	25.62	60%	0	0	0	0	0.000
73	0	62,524	0.00	0.00	21.40	60%	0	0	0	0	0.000
74	0	62,524	0.00	0.00	17.87	60%	0	0	0	0	0.000
75	0	62,524	0.00	0.00	14.93	60%	0	0	0	0	0.000
76	0	62,524	0.00	0.00	12.47	60%	0	0	0	0	0.000
77	0	62,524	0.00	0.00	10.41	60%	0	0	0	0	0.000
78	0	62,524	0.00	0.00	8.70	60%	0	0	0	0	0.000
79	0	62,524	0.00	0.00	7.27	60%	0	0	0	0	0.000
80	0	62,524	0.00	0.00	6.07	60%	0	0	0	0	0.000
81	0	62,524	0.00	0.00	5.07	60%	0	0	0	0	0.000
82	0	62,524	0.00	0.00	4.23	60%	0	0	0	0	0.000
83	0	62,524	0.00	0.00	3.54	60%	0	0	0	0	0.000
84	0	62,524	0.00	0.00	2.95	60%	0	0	0	0	0.000
85	0	62,524	0.00	0.00	2.47	60%	0	0	0	0	0.000
86	0	62,524	0.00	0.00	2.06	60%	0	0	0	0	0.000
87	0	62,524	0.00	0.00	1.72	60%	0	0	0	0	0.000
88	0	62,524	0.00	0.00	1.44	60%	0	0	0	0	0.000
89	0	62,524	0.00	0.00	1.20	60%	0	0	0	0	0.000
90	0	62,524	0.00	0.00	1.00	60%	0	0	0	0	0.000
91	0	62,524	0.00	0.00	0.84	60%	0	0	0	0	0.000
92	0	62,524	0.00	0.00	0.70	60%	0	0	0	0	0.000
93	0	62,524	0.00	0.00	0.58	60%	0	0	0	0	0.000
94	0	62,524	0.00	0.00	0.49	60%	0	0	0	0	0.000
95	0	62,524	0.00	0.00	0.41	60%	0	0	0	0	0.000
96	0	62,524	0.00	0.00	0.34	60%	0	0	0	0	0.000

Table 4.2-52 Rate of Gases Generation from Hazardous Waste Landfills

Year	Disposal Rate metric tons/yr	Waste In-Place metric tons	LFG Generation Rate			Collection System Efficiency (%)	LFG Recovery from Existing and Planned System			Energy Output From Direct Use Project [a] (MJ/hr)	Energy Output From Electric Generation Project [b] (MW)
			(m^3/min)	(m^3/hr)	(m^3/Y)		(m^3/min)	(m^3/hr)	$MTCO_2e$		
97	0	62,524	0.00	0.00	0.28	60%	0	0	0	0	0.000
98	0	62,524	0.00	0.00	0.24	60%	0	0	0	0	0.000
99	0	62,524	0.00	0.00	0.20	60%	0	0	0	0	0.000
100	0	62,524	0.00	0.00	0.17	60%	0	0	0	0	0.000
Total					**7,566,017.98**						

Remarks:

[a] assumes gas is combusted in a boiler with 85% efficiency to produce steam

[b] assumes gas is combusted in an engine with 30% efficiency to produce electricity

Methane content of LFG adjusted to:	50%	
Methane generation rate constant (k):	0.18	per year
Ultimate methane generation potential (L_0):	60	cubic meters / tons
Conversion factor for volume:	0.0283	cubic meters / cubic foot

Source: IEC (2015)

Table 4.2-53 The relation between CO concentrations and fire at fire at the landfills

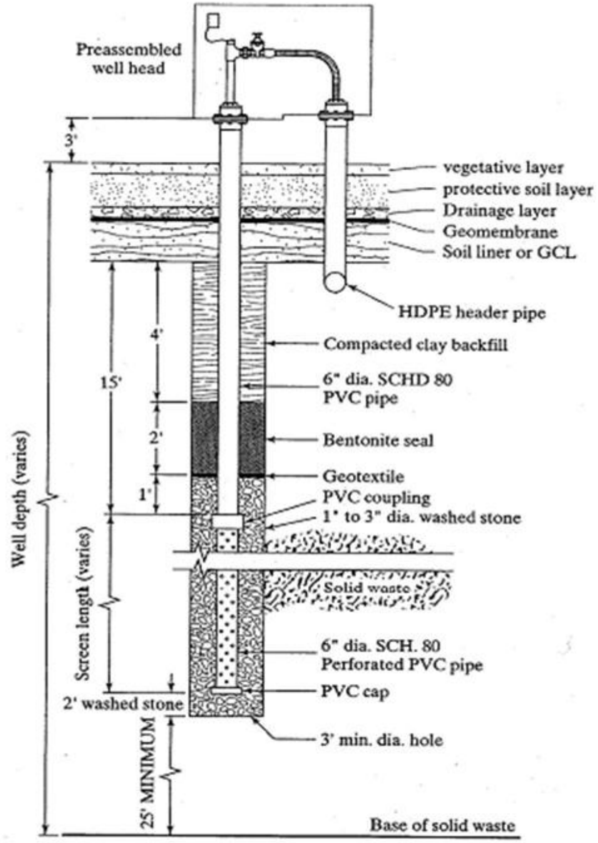
Carbon dioxide (CO) Concentration (ppm)	Fire Indication
0 - 25	No Fire Indication
25 - 100	Possible Fire in Area
100 - 500	Potential Smoldering Nearby
500 – 1,000	Fire or Exothermic Reaction Likely
>1,000	Fire in Area

Source: IEC (2015)

Table 4.2-54 The relation between Landfill conditions and temperature

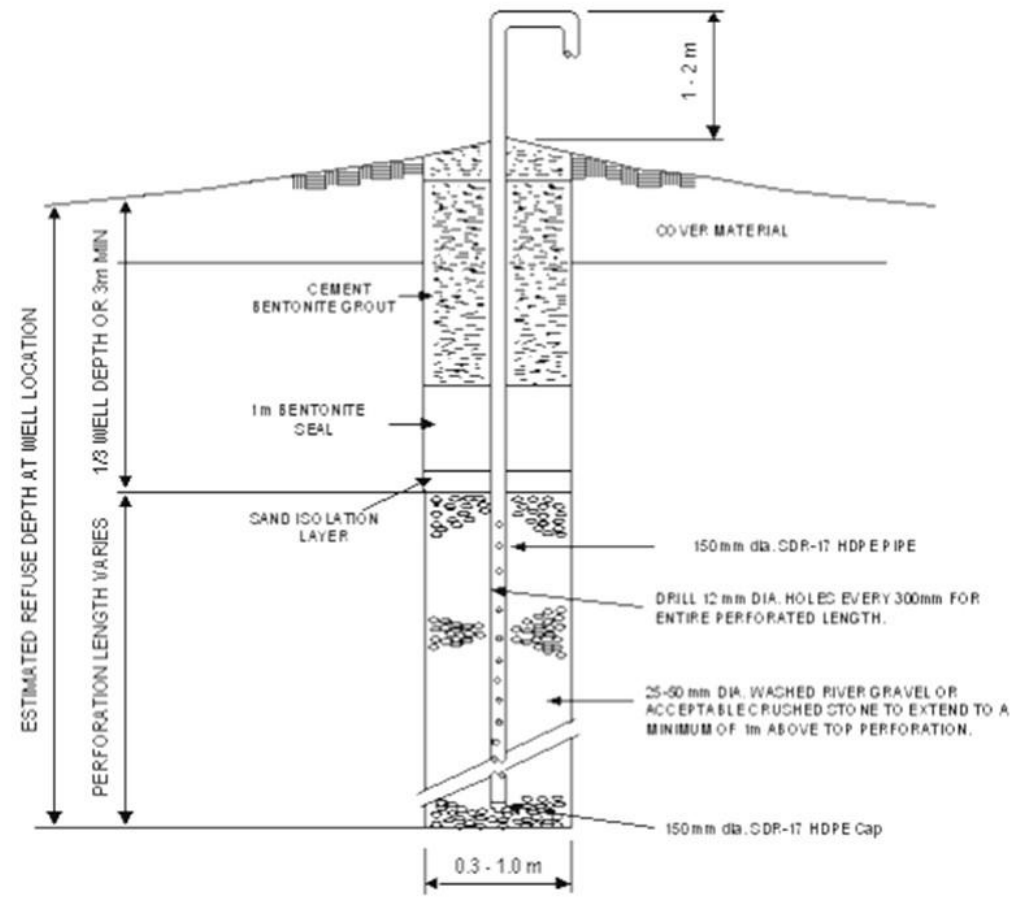
Temperature	Landfill Conditions
<55 °C	Normal Landfill Temperature
55 – 60 °C	Elevated Biological Activity
60 – 70 °C	Abnormally Elevated Biological Activity
>70 °C	Likelihood of Landfill Fire

Source: IEC (2015)



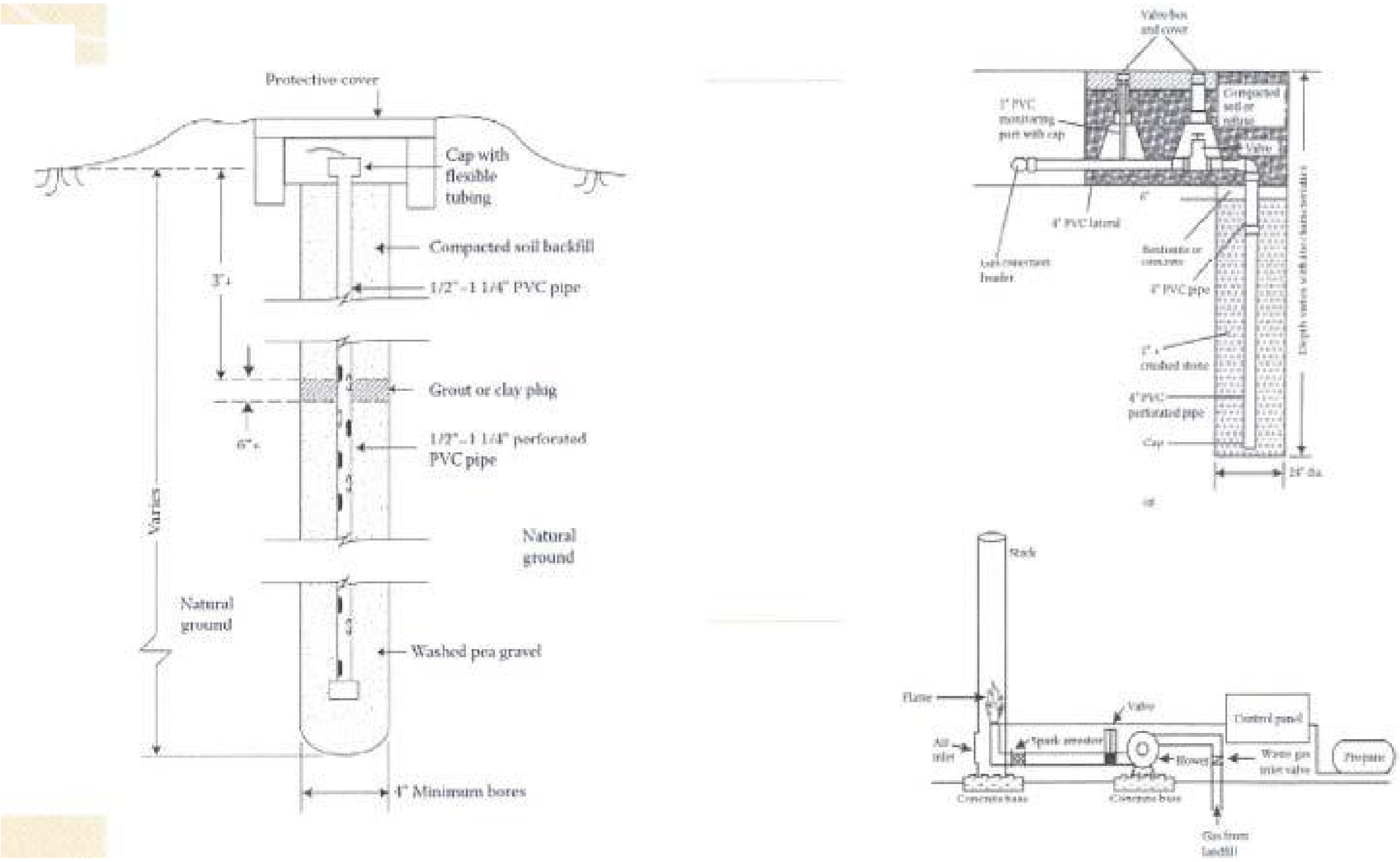
Source: IEC (2015)

Figure 4.2-98 Example of Active Control for Gas Collection System



Source: IEC (2015)

Figure 4.2-99 Example of Passive for Gas Collection System



Source: IEC (2015)

Figure 4.2-100 Cross section and diagram of Gas Monitoring Probe (Left) and Flaring System (Right)

(e) Incineration

In complete phase of the Initial industrial development, the Project will installed and operate the incinerators. There will have two type of incinerators, Non-Hazardous waste and Hazardous waste incinerators. Two of Non-Hazardous waste incinerators will be responsible for disposal of Non-Hazardous waste and one incinerator is responsible for disposal of only Hazardous waste. Management of Non-Hazardous waste incinerator is presented in flow chart of Figure 4.2-101 and for Hazardous waste incinerator is presented in flow chart of Figure 4.2-102. Air emission from both for Non-Hazardous and Hazardous incinerators will be complied the National Emission Quality Guideline for incinerator, as presented in Table 4.2-55.

Incinerator is divided into 3 parts, combustion chamber for waste disintegration, combustion chamber for toxic gases dissociation and filter system. The first combustion chamber will be ignited up to 800 and 1,000 °C. Majority of waste which is organic base-materials are generally ignited and burned. The second combustion chamber is for eliminating toxic gases and elements which will be evolving during the disintegration of organic matter. Toxic gases deriving in this stage are such carbon monoxide, mercury, hydrogen chloride, sulfur compounds, cadmium compounds, aldehyde, formaldehyde, lead, dioxin etc. These gases can be dissociated and destroyed in between 1,200 and 1,900 °C. The filter system consists of technology in order to reduce emission. For example, cyclone system is to sort out certain range in size of particles that generating from the combustion chambers. Water spray system is to assimilate residual waste and cool down temperature in the incinerator and to prevent the formation of toxic chemicals.

Operation on waste disposal is very relying on nature of the waste. In achievement an appropriate disposal and reduction of emission as much as possible, requires optimized condition in the disposal processes. To convert waste materials into inactive or inert compounds or treatable form such as ash or gases. Temperature, turbulence and resident time are important factors in controlling the combustion and sufficient oxygen must be present to endure the combustion undergo. Air, waste and fuel must be raised to the exact temperature in order to disintegrate organic compounds. Oxygenated air need to be optimized and simultaneously with supplement of the fuels such as gas, oil or coal in order to minimize the formation of carbon dioxide and residual hydrocarbon. To incur a complete combustion, turbulence is required for constant mixing between fuel, waste and air in a certain period of resident time.

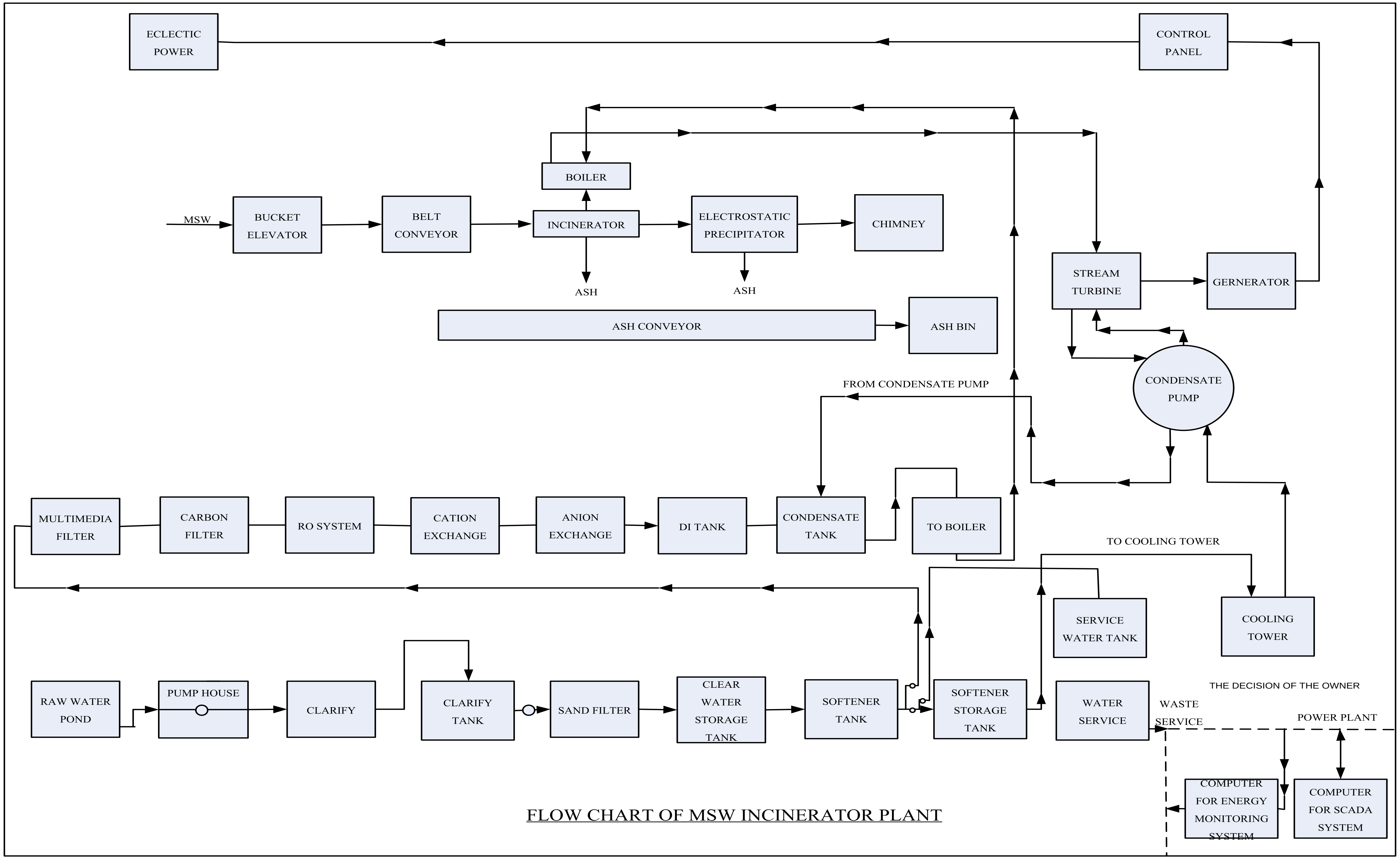
Table 4.2-55 Guideline Values for air emission from Incinerator

Parameter	Unit	Guideline Value
Cadmium	mg/m^3	0.05-0.1 (0.5-8 hour average)
Carbon monoxide	mg/m^3	50-150
Hydrochloric acid	mg/m^3	10
Hydrogen fluoride	mg/m^3	1
Mercury	mg/m^3	0.05-0.1 (0.5-8 hour average)
Nitrogen oxides		200-400 (24 hour average)
Polychlorinated dibenzodioxin and dibenzofuran	Ng TEQ[b]/m^3	0.1
Sulfur dioxide	mg/m^3	50 (24 hour average)
Total metals	mg/m^3	0.05-0.1 (0.5-8 hour average)
Total Suspended Particulates	mg/m^3	10 (24 hour average)

Source: IEC (2015)

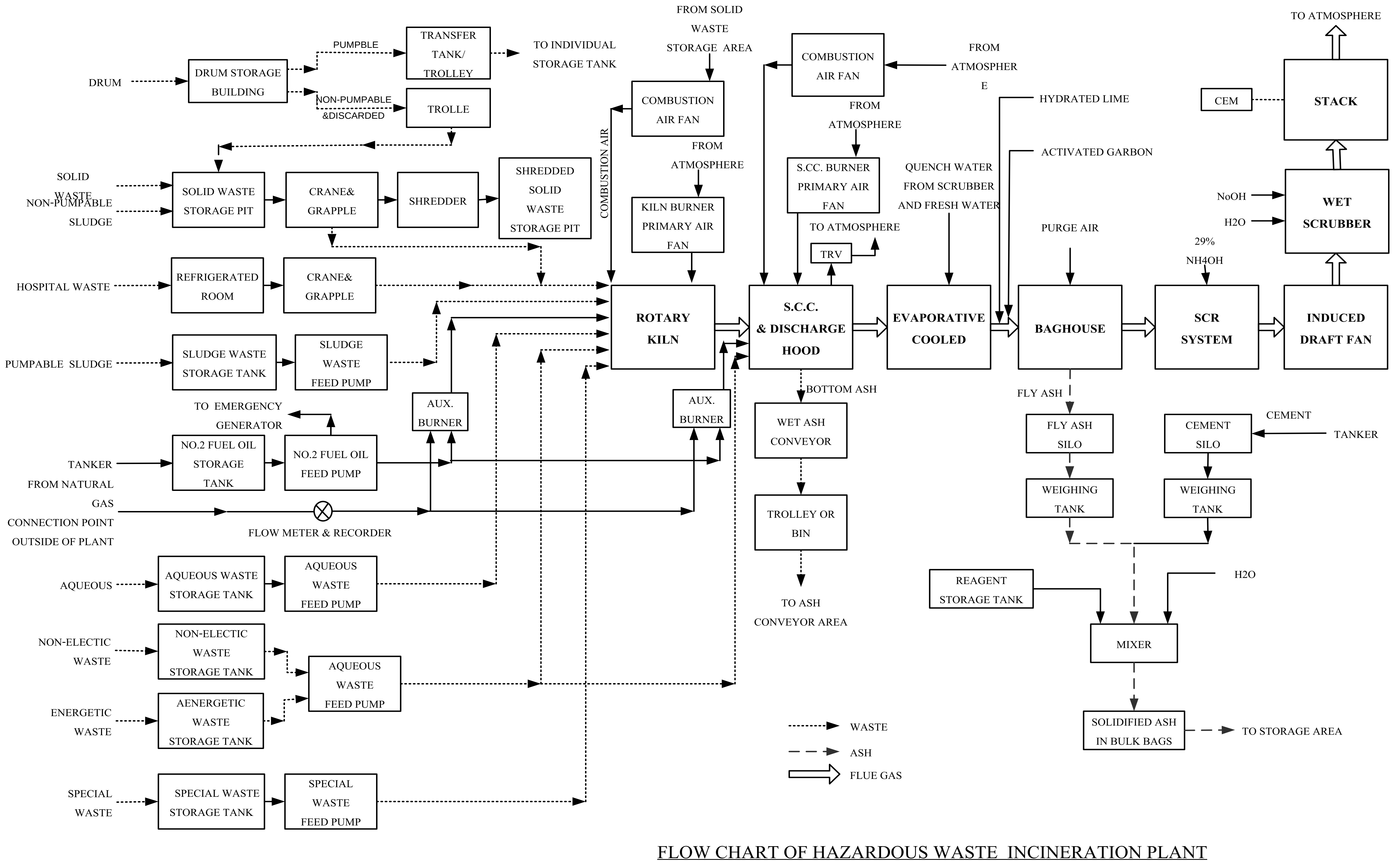
Remarks: [a] Applicable to both municipal solid waste and hazardous waste incinerators

[b] Toxicity equivalence factor



Source: IEC (2015)

Figure 4.2-101 Flow Chart of Non-Hazardous Waste Incinerator Plant

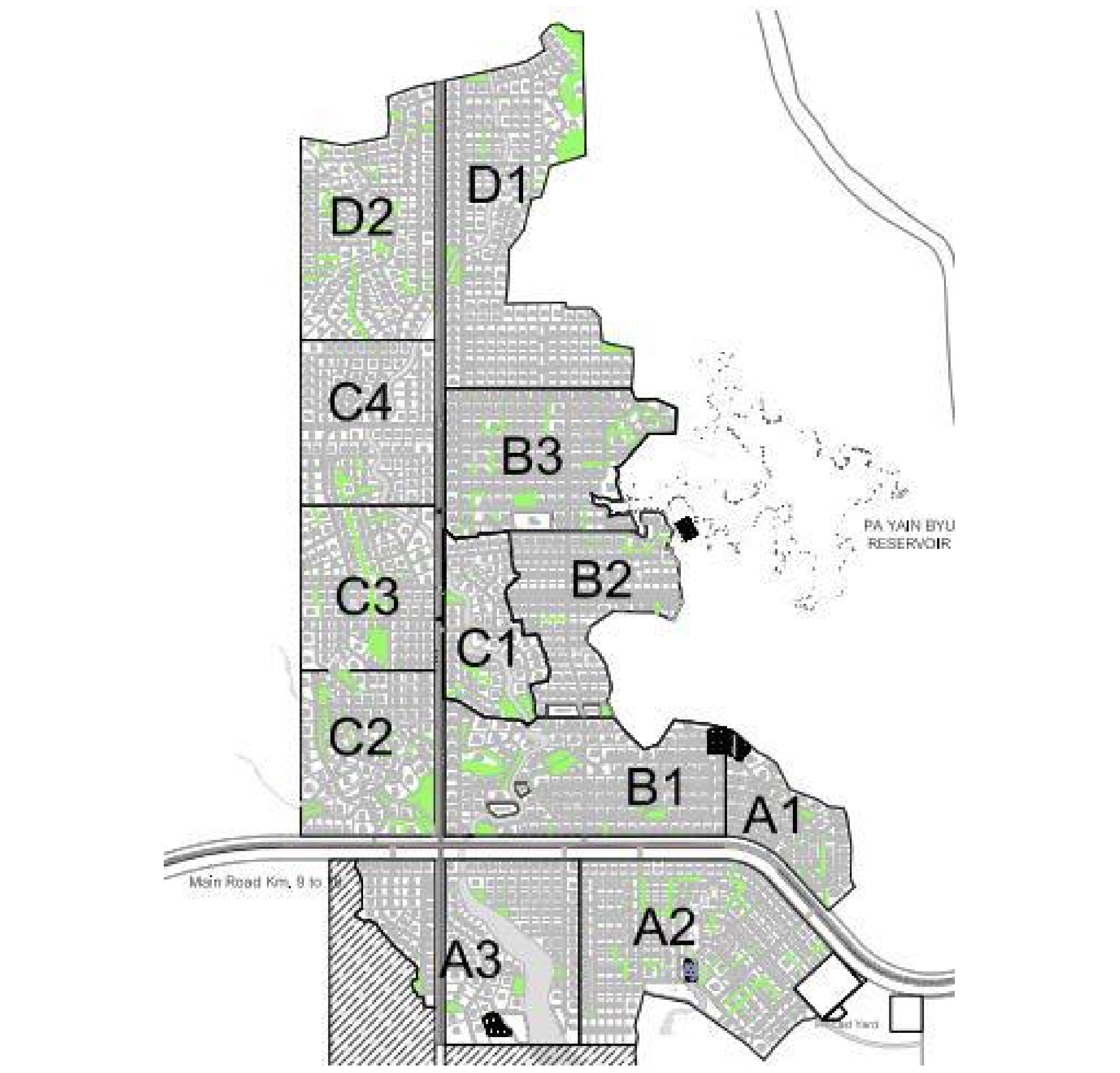


Source: IEC (2015)

Figure 4.2-102 Flow Chart of Hazardous Waste Incinerator Plant

4.2.7 Green Area and Recreation

A 1,350,000 m2 will be created green area for initial establishment of the Industrial Estate as presented in Figure 4.2-103. As recreational park within the industrial estate, workers and staff can enjoy green environment such as parks and plantation along the roadside. Green area is accounting for 5 percent of the total area or 843.75 Rai in full phase (A-D).



Source: IEC (2017)

Figure 4.2-103 Green Area in the DSEZ Initial Industrial Estate

4.2.8 Fire Fighting and Emergency Response System

As enacted in the Fire Brigade Law 2015, Fire station, Fire brigades and the Emergency Response System in case of natural disasters, epidemics and fire are needed for safety and security of people and properties. In addition, to prevent and minimize damages that may incur in many cases, and including recovery and remedy.

4.2.8.1 Fire Fighting System

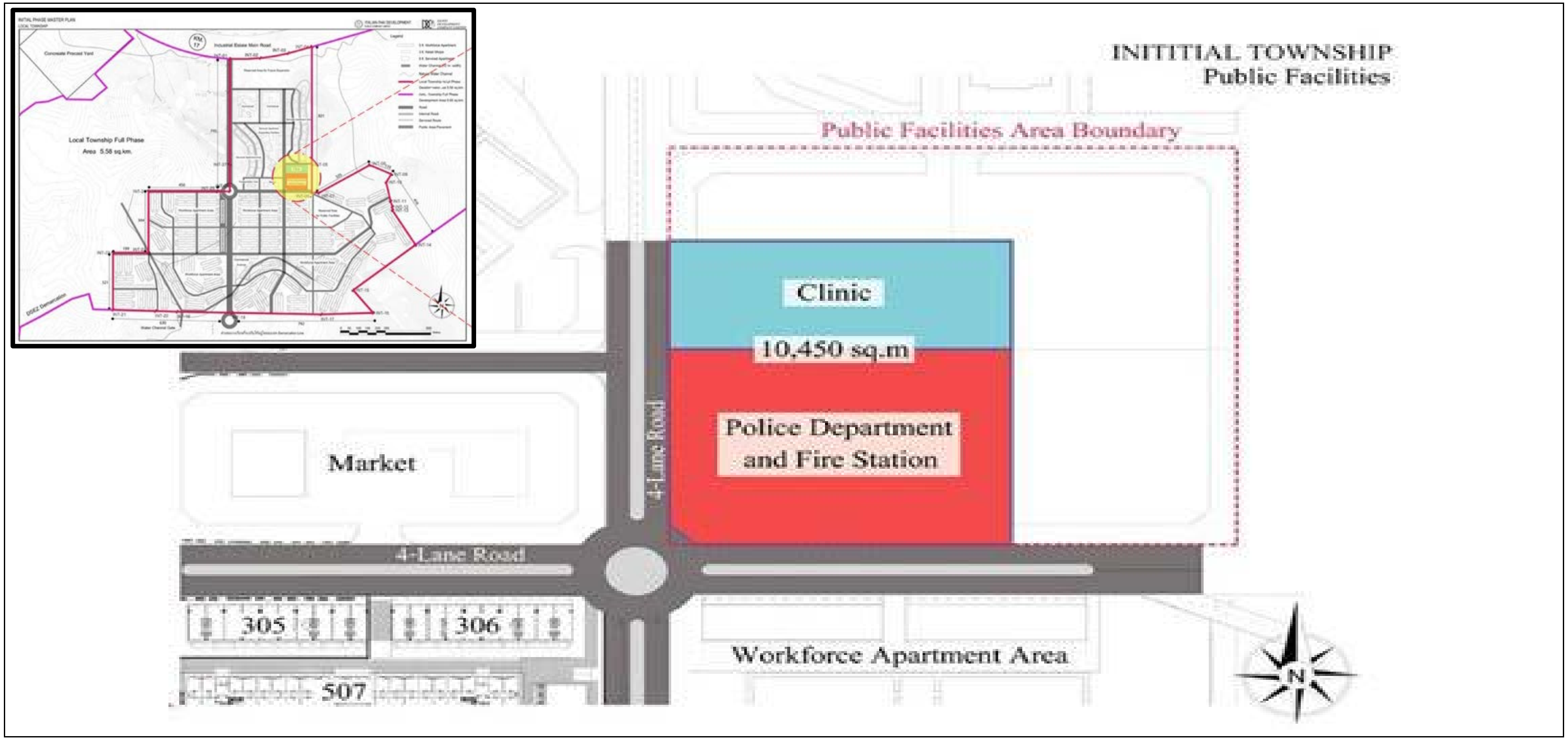
The Project has a plan to establish the fire station, which will be a share facility between the Initial Township and the Project. Also, the Project plans to form reserve fire brigade team, to not only operate and manage the fire station / fire work, but also to co-ordinate with the Fire Service Department and relevant agency in preparation of standardized fire extinguisher or apparatus (See Annex3-2 Guideline of Fire Training and Equipment) and training program for involving brigades and staff and workers.

(a) Location of Fire Station

Location of the Fire Station will be in public facility of the initial township, as shown in Figure 4.2-104. Illustration of the Fire Station is in Figure 4.2-105.The fire station is planned to equip with fire apparatus and features following:

- Hydraulic platform for rescuing in the elevated levels;
- Major pumpers from water sources;
- Special pumpers consisting of fire extinguishing agents such as foam, chemicals;
- Water tanks for transporting large volume of water;
- Foam tanks;
- High-pressure hoses;
- Rescue equipment
- Fire trucks
- The other fire apparatus

Number of fire trucks, pumper trucks, fire equipment are planned to develop in concordance with phases of the Initial Industrial Estate and number of population growth in the initial township (Table 4.2-56) These amounts of the Project's resource is evaluated to be sufficient in controlling Tier 1 level of emergency (Controllable case with in the plant or the factory) and Tier 2 level of emergency (Controllable within the Initial Industrial Estate / Township. However, if a severe emergency occurs (Tier 3 level), which is an emergency case that unable to control by the Project resource and facility and potentially extend and impact beyond the Project area, the Project will need support from local facilities or agencies, such as Fire Station and Fire Brigade team from the nearest Township such as Yebyu Fire station.



Source: DRC (2015)

Figure 4.2-104 Location of the Fire Station (Share facility) in the Initial Township

Source: DRC (2015)

Figure 4.2-105 Illustration of Fire Station

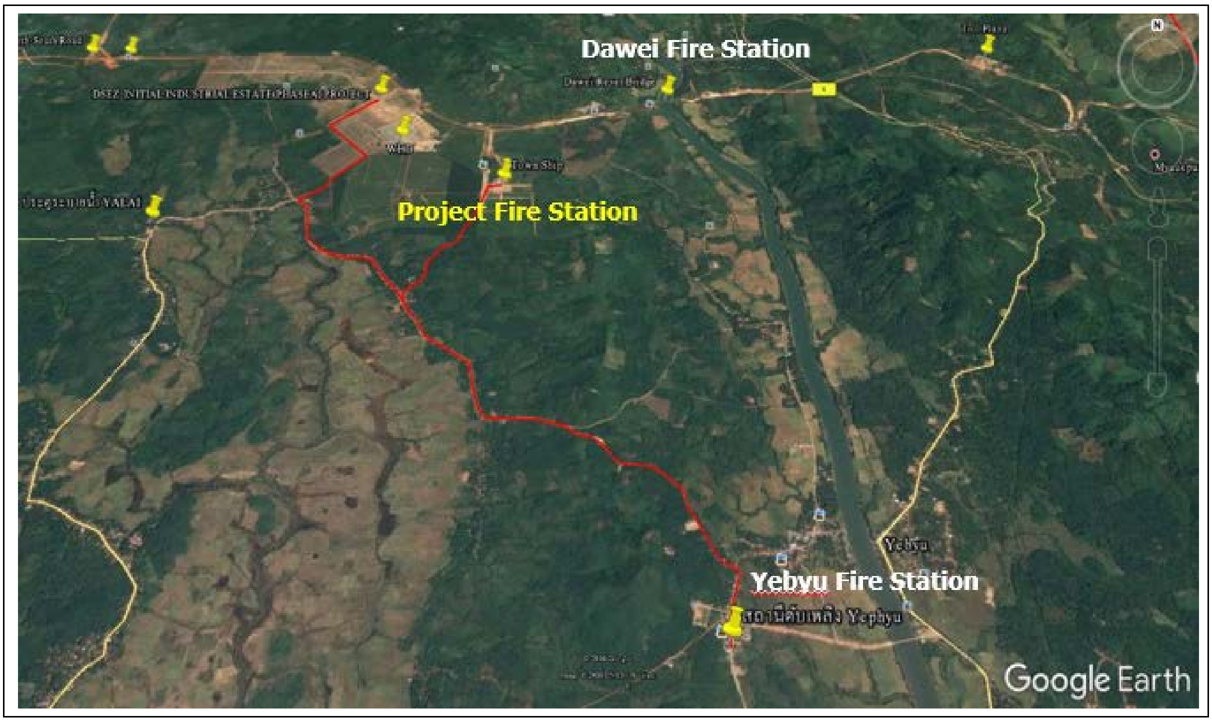
Table 4.2-56 Expected Number of Fire Station Supporting Vehicles

Year	Phase	Fire Truck (No.)	Pumper Truck (No.)
2016-2017	A	1	1
2018-2019	B	1	-
2019-2021	C	1	-
2022-2023	D	1	4
Total		**4**	**5**

Source: DRC (2015)

(b) The Nearest Fire Station

Yebyu Fire Station is located in the Yebyu Township, approximately 6 km from the Project (Figure 4.2-106) and can access the Project by good roads. The Yebyu Fire Station consists of medium fire brigade team (7 fireman) on shift 7/24 and 4 Fire trucks, 1 Fire tank truck, 1 Fire tank tractor, as show in Figure 4.2-107 to Figure 4.2-110. The Fire tanks can supply 30 liters per second and the tank trucks contains approximately 4,000 liters and the tank tractors contains 1,000 liters.



Source: MIE (2017)

Figure 4.2-106 Location of Yebyu Fire Station from the Project Facility

Source: MIE (2017)

Figure 4.2-107 Yebyu Fire Station and facility in Yebu Township

Source: MIE (2017)

Figure 4.2-108 Yebyu Fire Trucks (No.1 and No.2)

Source: MIE (2017)

Figure 4.2-109 Yebyu Fire Trucks (No.3 and No.4)

Source: MIE (2017)

Figure 4.2-110 Yebyu Fire Tank Truck and Fire Tank Tractor (No5 and No.6)

4.3 EMERGENCY RESPONSE PLANS

4.3.1 Emergency Levels and Action Plans

4.3.1.1 Emergency Level

General emergency response plan of the Dawei Initial Industrial Estate can be categorized into 3 levels

- **Tier 1 level** is a small scale of emergency that will occur in limited in area of factory or plant. And accident or incident can be controlled by supporting facility and team of the factory or the plant itself.

- **Tier 2 level is** a medium scale of emergency that likely to extend in the Industrial Estate. The factory or the plant trends to be unable to cope with the emergency and need supporting facility and/or team of the Industrial Estate. However, the emergency trends to be controllable by supporting facility of the Industrial Estate itself.

- **Tier 3 level** is a large-scale of emergency that likely to extend to the nearby community and environment surrounding the Industrial Estate. The emergency trends to cause large scale of impacts, which will be beyond the control and supporting facility of the Industrial Estate. There need supporting facility and team from outside the Industrial Estate or nearby agencies and

4.3.1.2 Emergency Action Plan

For each level of emergency, the action plans are following:

(a) Tier 1 Emergency Action Plan

<u>Responsibility of factory or plant</u>

- In case emergency, it is responsibility of factory or plant operators in capable and controlling the incident or emergency as much as possible to mitigate damages that may incur to properties or people.

- The operator must report the Dawei Initial Industrial Estate Emergency Response Center or the IE Reserve Brigade team within 10 minutes.

<u>Responsibility of the Project</u>

- Once, the Dawei Initial Industrial Estate Emergency Response Center received emergency information.

- The Dawei ER center will record and immediately inform the on-site shift ER manager to investigate the incident, follow up and monitor environmental impacts including be prepared or stand by to inform the other related emergency agencies, outside the Project.

- The on-site ER manager has to evaluate the situation/incidents and be prepared to coordinate with the emergency supporting team. Also, the on-site ER manager must keep reporting to the Dawei Industrial Estate Emergency Commander/ Director (Dawei IE-EC/ED).

- In case the incident is severe and potentially extend. The Dawei IE Emergency Commander/Director must analyze and evaluate the environmental impacts. Also to coordinate and communicate related people for further next step.

(b) Tier 2 Emergency Action Plan

Responsibility of factory or plant

- If the factory or plant evaluates that the incident / emergency is unable to control by the factory / the plant resources and facility, the factory / the plant must immediately report to the Dawei Emergency Center.

Responsibility of the Project

- After receiving report from the factory/plant, the ER Center must follow steps as mentioned in Tier 1.

- If the Dawei IE-EC/ED evaluates that the impacts is intensify, beyond the capability and control of the factory/plant, he/she will announce the Tier 2 Emergency Level. At this stage, he/she must be on duty to manage the incident/emergency with his/her best effort, effective command, facilitate and support in controlling the incident/emergency.

- Dawei IE-EC/ED must directly report to Dawei Initial Industrial Estate Director or Executive or the Person In Charge.

(c) Tier 3 Emergency Action Plan

Responsibility of factory or plant

- If the factory or plant evaluates that the incident / emergency is unable to control by the Dawei Initial Industrial Estate resources and facility and needs a support from outside such as the Administrative Township, District or

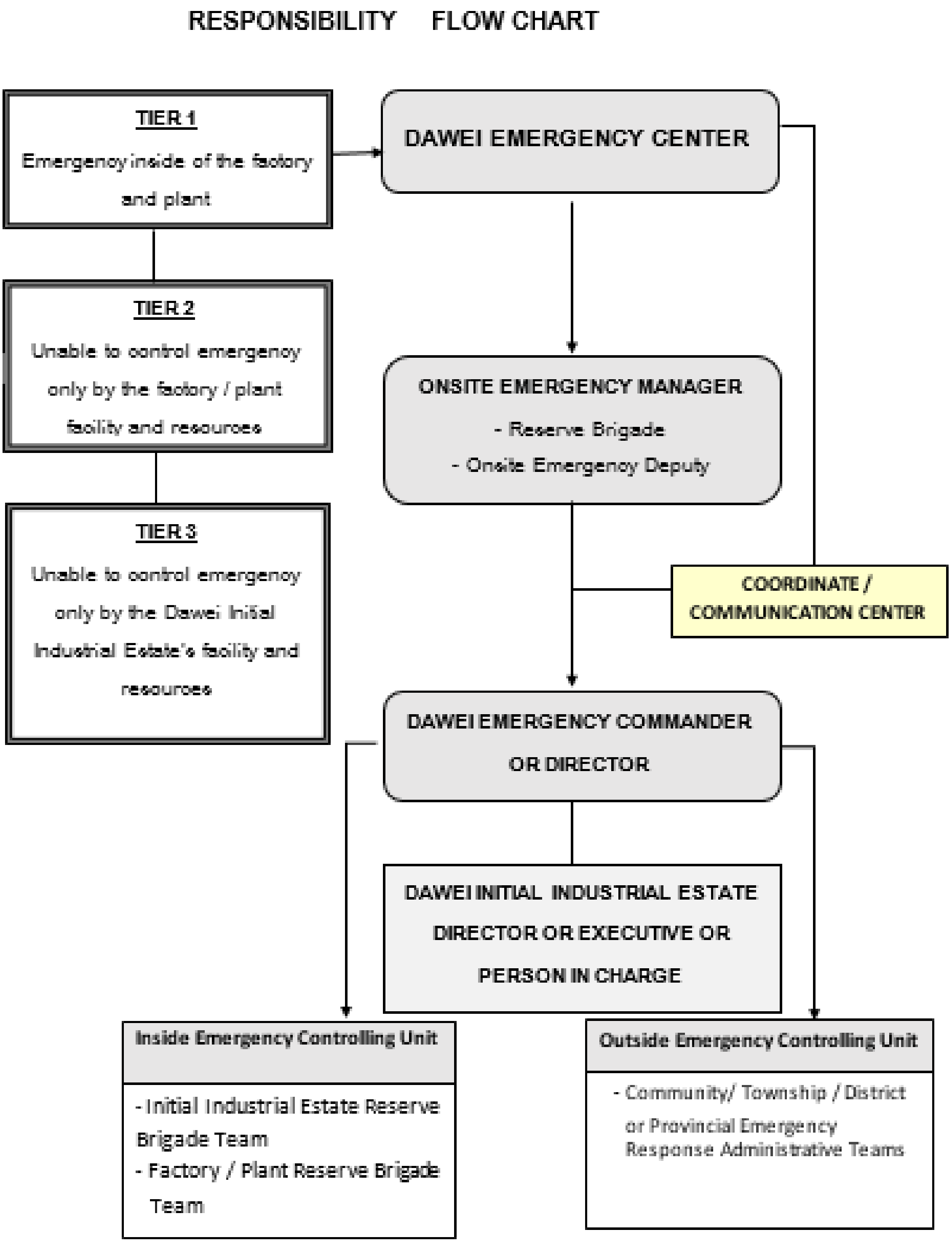
Province / Region, the factory / the plant must immediately report to the Dawei Emergency Center.

- If the Dawei Initial Industrial Estate Emergency Commander/Director announces the Tier 3 Emergency level, the PIC / Reserve Brigade of the factory/plant need to go to and join the Dawei Emergency Center, to cooperate and provide information to related persons and agencies.

Responsibility of the Project

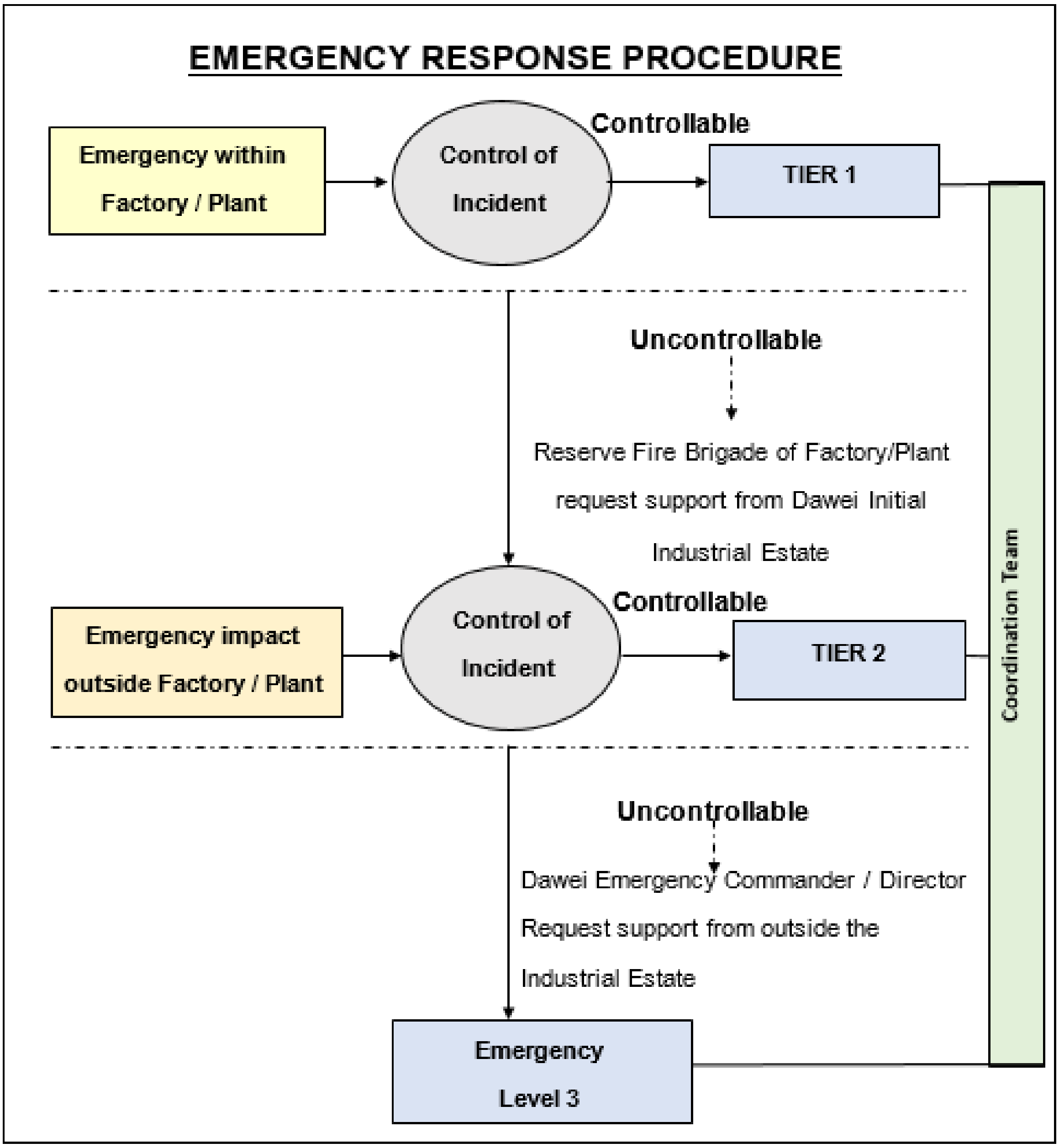
- After receiving report from the factory/plant, the ER Center must follow steps as mentioned in Tier 2
- The Onsite ER manager must analyze and evaluate environmental impacts that may incur both the factory/plant itself and nearby community. Also he/she must keep reporting the Dawei IE EC/ED.
- Once the Dawei IE EC/ED evaluate that the impact is seriously intensify and extending to local or nearby community, he/she will announce Tier 3 Emergency level and he/she must be on duty to manage the incident/emergency with his/her best effort, effective command, facilitate and support in controlling the incident/emergency. In addition, to coordinate with the local community leader, township or district administrators to obtain supports and to consider about announcement of the Emergence in the district or provincial level.
- Dawei IE-EC/ED must directly report to Dawei Initial Industrial Estate Director or Executive or the Person In Charge.
- Dawei IE-EC/ED must go to the Dawei Emergency Center to control the industrial estate emergency to conduct and cooperate in providing information to related agencies such as Township/District/ Provincial Administrative.

Flow charts of the Industrial Estate Emergency Procedure is presented in Figure 4.3-1 and Flow chart of the Industrial Estate Emergency Responsibility is presented in Figure 4.3-2.



Source: ESIA Study Team

Figure 4.3-1 Emergency Response Responsibility



Source: ESIA Study Team

Figure 4.3-2 Emergency Response Procedure

4.3.2 Fire and Explosion Plan

4.3.2.1 Preparation and prevention plan

- Prepare safety storage for chemical in areas that applying chemical. Check, storage, control and prepare chemical emergency plan including increase mitigation measure and investigation of the factory / plant that has high risk of fire and explosion.
- Prepare reserve or secondary water source for fire extinguishing
- Prepare at least 1 fire truck
- Prepare different type of fire extinguishers/apparatus in many spots in the factory / plant and building.
- Install fire alarm for emergency including testing the fire alarm and emergency plan in workplace.
- Prepare apparatus to mitigate environmental impact and prepare those equipment with annual check.
- Annual Fire Campaign especially in hot and dry season
- Inspection and check that fire extinguishers and fire apparatus are always ready to work
- Inform and communicate through effective channels
- Annual practice the fire or emergency evacuation
- Cooperate or support within factories and plants including supporting agencies outside the industrial estate e.g. Township/District Fire Brigade team.

4.3.2.2 Fire Fighting and Evacuation Plan

The fire fighting and evacuation plans are classified into 3 levels.

(a) Level 1 Fire Emergency Plan: small fire within the factory/plant

- Fire watcher or witness shall turn on fire alarm to warn and request a help to fire off by using the existing fire apparatus or fire extinguisher.
- Once the witness or the factory / plant fire reserve brigade evaluates that fire incident is uncontrollable, he/she needs to announce "Evacuation"

- Proceed the evacuation in safety area or the assembly point, check missing persons and cut off the electricity.

- If the fire incident potentially extend or uncontrollable, the factory / plant have to inform the Dawei Initial Industrial Estate Emergency Response Team to fire off.

- Report to Onsite Dawei IE-Emergency Manager and Dawei IE Emergency Commander / Director, respectively.

- Communicate the other factory/plant owners in the Industrial Estate by many effective channel.

(b) Level 2 Fire Emergency Plan: medium fire potentially extend outside the factory/plant

- Once, Dawei IE-Emergency Commander /Director announces Level 2 Emergency. Every factory / plant related teams or persons must follow the Tier 2 Fire Emergency Plan in order to control or stop the fire/explosion incident as much as possible.

- If the fire is controllable, separate the site from the other area for inspection and investigation of causes and damages and report to the Dawei IE-Emergency Commander/Director to waive the Tier 2 Fire Emergency

- If the fire is uncontrollable, and trends to be extended and impacts nearby factories and local community, the Dawei Emergency Center must obtain support from the local emergency agencies e.g Township/District Fire Brigades.

- The Onsite Emergency manager must report to the Dawei IE-Emergency Commander/Director

- Communicate and inform factories/plants in the Industrial Estate by many effective channels.

(c) Level 3 Fire Emergency Plan: severe fire potential extend outside the Industrial Estate

- Once, Dawei IE-Emergency Commander /Director announces Level 3 Emergency. Every factory / plant related teams or persons must follow

the Tier 3 Fire Emergency Plan in order to control or stop the fire/explosion incident as much as possible.

- The Onsite Emergency Fire manager must report to the Dawei IE-Emergency Commander/Director, Executive/Director of the Dawei Initial Industrial Estate/Person In Charge and the director of Myanmar Industrial Estate.

- Communicate and inform factories/plants in the Industrial Estate by many effective channels.

(d) Role and Responsibility of the Emergency Response Center and Team

- Dawei Industrial Estate Emergency Commander / Director
- Emergency Coordination Team
- Dawei Emergency Center
- Communication and coordination Team
- Support and Evacuation Team
- Utility Team

(e) Inspection

Factory / Plant that causes the fire must be inspected by the expert from relevant agency and will be committed a fraud and penalty by the Industrial Estate.

4.3.2.3 Recovery Plan

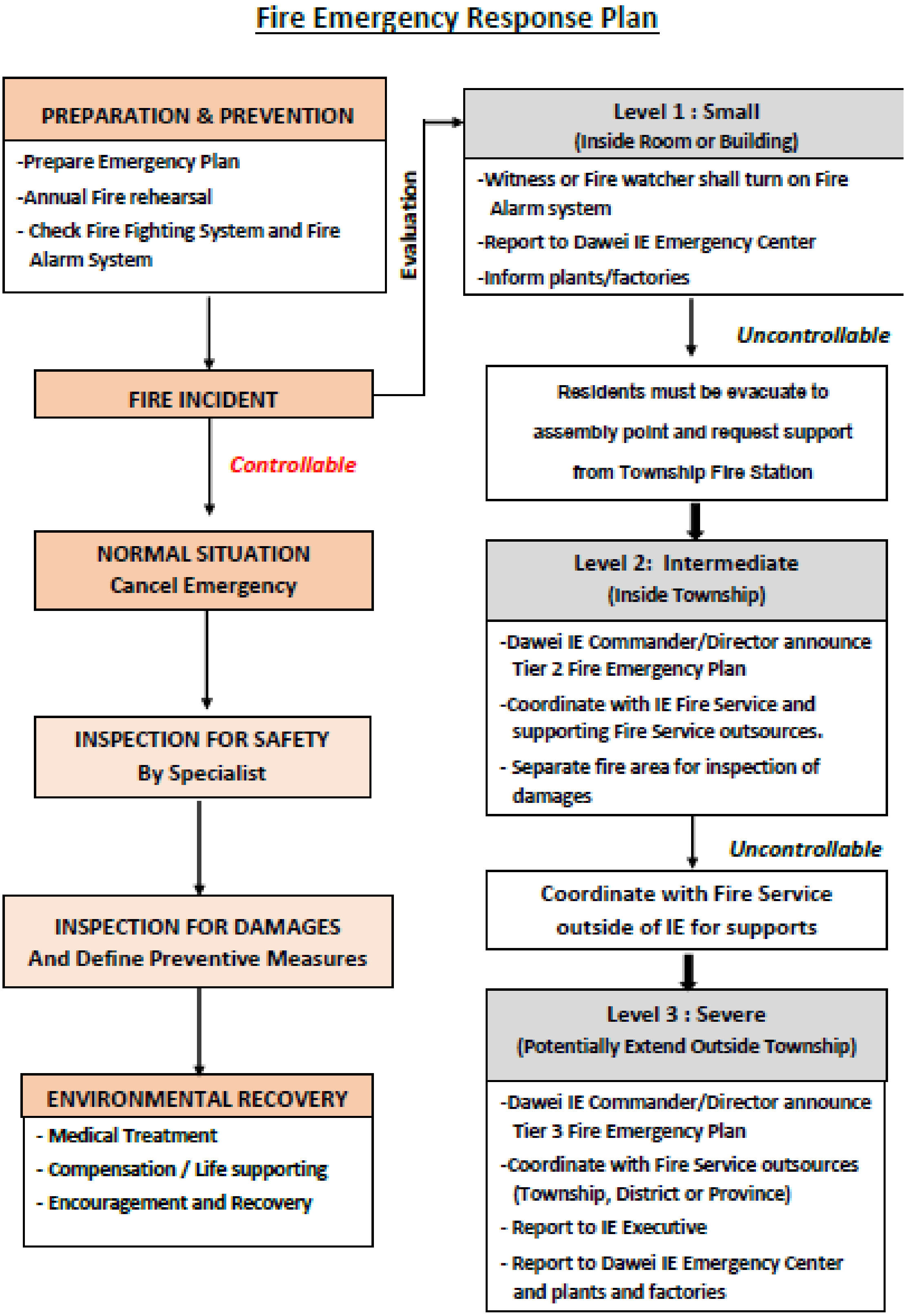
After the fire/disaster, the Dawei Initial Industrial Estate has to coordinate with the supporting agencies both government or private to remediate and recovery from the damages as soon as possible:

- Provide support for medical treatment and provide temporary accommodation and sanitary for victims that have to be evacuated from the fire scene. Remediate and support victims who cannot support their life

- Remove the victims and their belongs to safety area

- Control the areas in security and safety

- Explore if any damages and victims' needs are required and effort to support them.
- Inform victims and people about cause of fire, prevention plan in the future and recovery plan.
- Factory / Plant or who causes a fire must commit the fraud, penalty and compensation according to the laws.



Source: ESIA Study Team

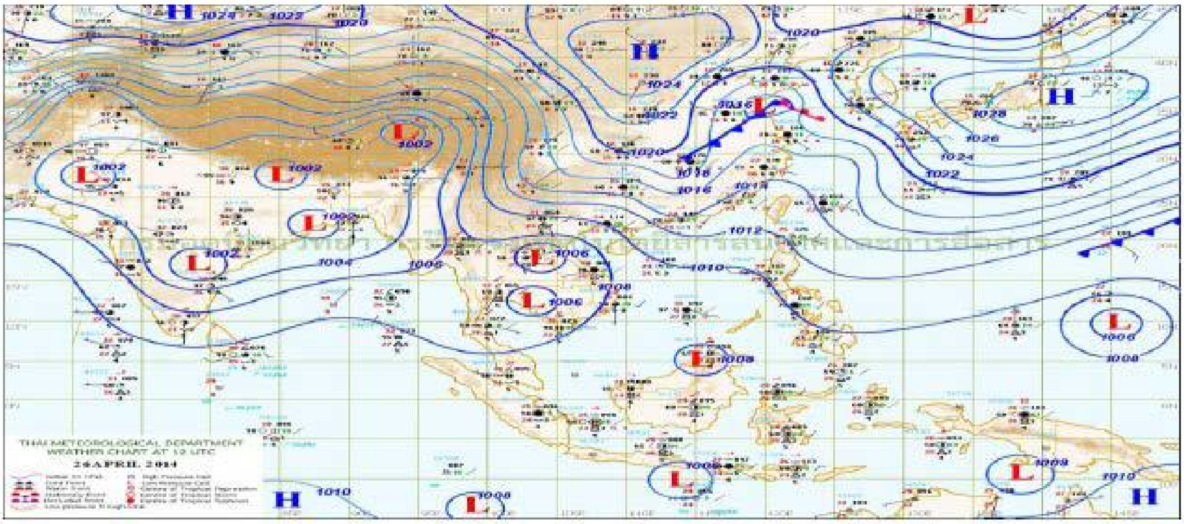
Figure 4.3-3 Emergency Response Procedure for Fire and Explosion

4.3.3 Strom and Flooding Plan

Flooding will be emergency in case the Flood Controlling System such as retention ponds system of the Project cannot hold the rainwater or may include blocking of drainage during storms and heavy rain. Thus, prevention and emergency plan consists of

4.3.3.1 Preparation and prevention plan

- Checking drainage / cannels or creeks and dredging drainage and cannels
- Keep low level in drainage / cannels or creeks
- Monitor level of water in drainage / cannels or creeks
- Inspect and maintenance the polder dikes
- Checking and maintenance pumps and equipment
- Prepare sand bags, back holes, mobile pumps including vehicles and communicable equipment.
- Be aware and follow up weather condition or forecast and flooding announcements from relevant government agencies such as Metrological Department

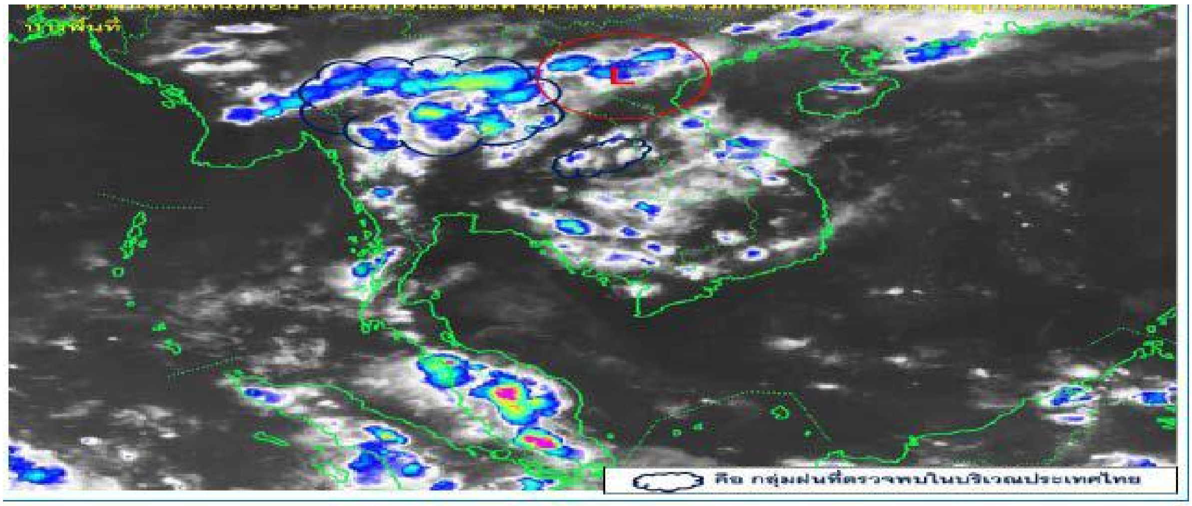


http://www.tmd.go.th/weather_map.php

Source: ESIA Study Team, 2017

Figure 4.3-4 Weather Forecast Map

- Analysis of satellite images / maps about flooding



http://www.satda.tmd.go.th/

Source: ESIA Study Team, 2017

Figure 4.3-5 Flood Hazard Satellite Image

- Follow up levels of water in Kun Chuang river and Dawei River about intrusion of salt water, route and condition and draining of these rivers.

- Follow up and check risk spots, salute gates or drainage of the Industrial Estate

- Establish "WAR Room" to co-ordinate, prevent and solve the flooding problem in the Industrial estate for 24 hrs. Director of the Dawei Initial Industrial Estate will be commander and co-ordinate with the other agencies.

4.3.3.2 Warning and Evacuation Plan

Four levels of warnings and evacuation plan

- Level 1 : Follow up and stand by for emergency
  - Evaluate the situation and follow up
  - Survey and check readiness of the prevention plan
  - Evaluate to the emergency commander / related director
  - Co-operate with plants and factories of the Initial Industrial Estate.

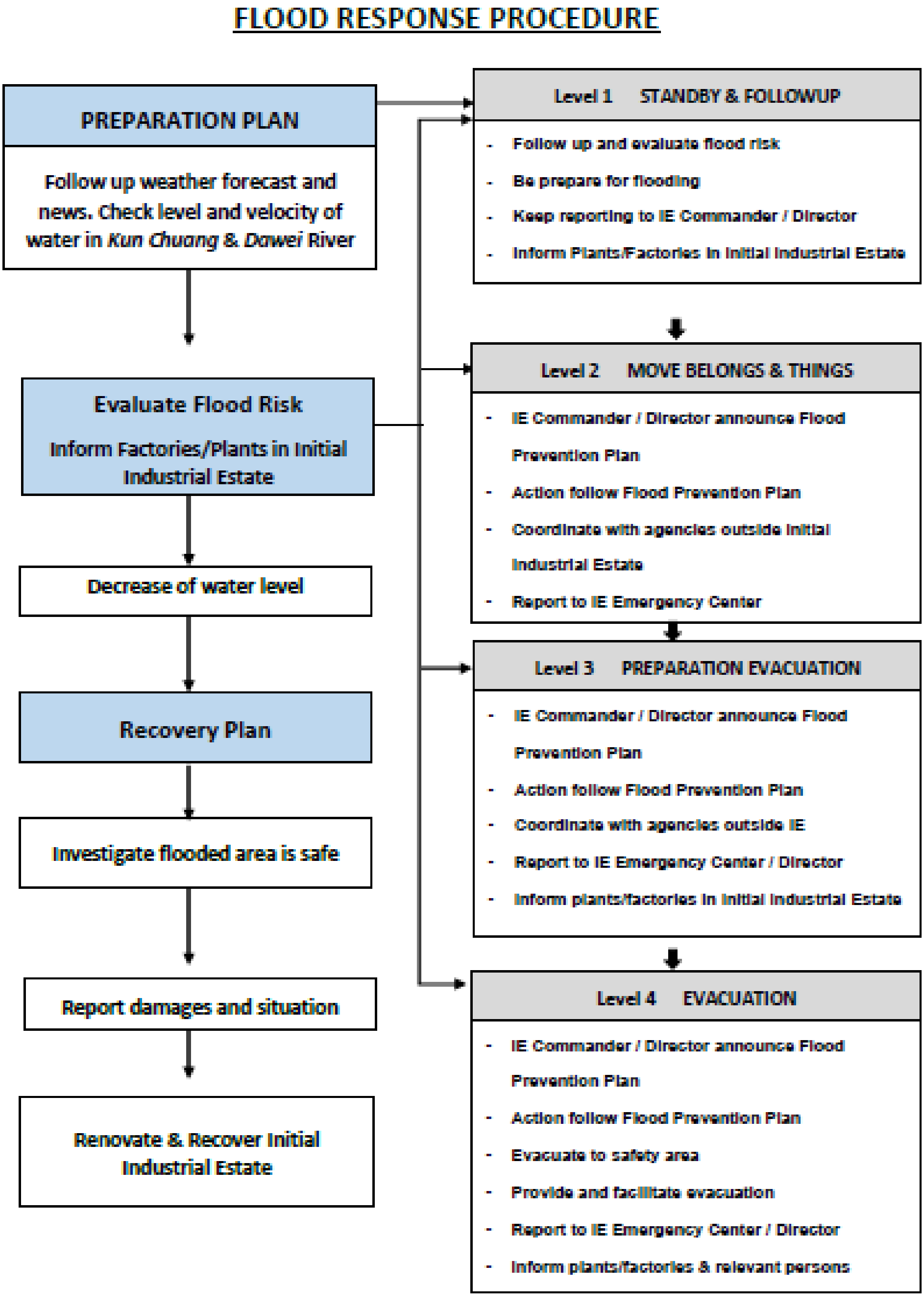
- Level 2: Move belongs / objects to high place to prevent damages
  - Emergency commander announces and command the plan
  - Conduct and follow the plan and coordinate with the other agencies.
  - Report and evaluate the situation to the emergency commander in controlling the emergency
  - Communicate and inform plants / factory operators by channels.
- Level 3: Evacuation preparation
  - Emergency commander announces emergency plan
  - Conduct and follow the plan and coordinate with the other agencies
  - Evaluate and report to emergency commander
  - Communicate and inform factory and plan by channels
- Level 4: Evacuation
  - Announcement and command the plan
  - Follow the prevention plan and evacuation plan
  - Evacuate to provided location and route
  - Provide vehicles; car, truck and facility for evacuation
  - Report and evaluate situation to emergency commander
  - Coordinate and inform relevant agencies by channels

Evacuation team consists of emergency commander, emergency coordinator, flood controlling unit, emergency communicator, safety and traffic and evacuation team.

4.3.3.3 Recovery plan

After flooding events, the Project has prepare the recovery plan as follow:

- Inspection of the flooding area and storage and collect waste that transported with flood
- Renovation from damages such as road, facilities, painting, planting and construction of polder dikes.



Source: ESIA Study Team

Figure 4.3-6 Emergency Response Procedure for Strom and Flooding

4.3.4 Chemical Spills

Spills, leaks or over flows means by a potential damages to environment and cost for cleanup, remedy and management. Thus, it is important that related people shall be aware, control and store chemicals including plan to manage and mitigate the potential impacts.

4.3.4.1 Preparation and prevention plan

Prepare safety plan in storage and uses of chemicals which requires a standardize data such as check list of chemicals, amounts, storage and management as supporting information in emergency including inspection of the risk factories/plants, operation plan and monitoring plan.

4.3.4.2 Chemical Spills Emergency Plan

(a) Spill and Overflows at the loading rack

In case, little volume of chemical spill and the incident is controllable and without risk to properties such as persons or vehicles including workers or employee or equipment in the factory / plant, the plan is following:

- Stop adding or fill chemicals and press Emergency Button to warn the others workers or employee who are working in the process.
- Not start the car / or cause sparkling in the incident scene
- Stop adding or fill chemicals until safety is confirmed.
- Prepare emergency team, equipment / instrument that required i.e. PPE, to be ready in controlling the spill and it extension or severely.
- Report to manager, and related persons.
- Investigate and inspect the incidents including record and report progression.

(b) Spill and Overflows in the loading rack

In case, large volume of chemical spills, the incidents is potentially uncontrollable and extend, a person shall try to control the dispersion or flow by water or injection of water following.

- Control flow of chemical immediately and press Emergency button to warn every workers / employee who are working in the processes to stop.
- Measure and provide barrier to prevent spread of contamination as danger area

- Control the incident scene, no cars shall start engine or cause sparkling.
- Follow the chemical emergency procedure by using the prepared equipment / instrument to control flow of the chemical to extend or disperse as much as possible.
- Report the incidents to mangers/directors and related persons, to evaluate the situation and report to the Dawei Industrial Estate Emergency Commander / Director, respectively.
- Once evaluated, the team cannot control the incident, the team must report and request support from the Dawei Industrial Estate Emergency Center or related agency to stop the spills, together.
- Investigate and inspect the causes of spills, record, and collect data and report the progression.

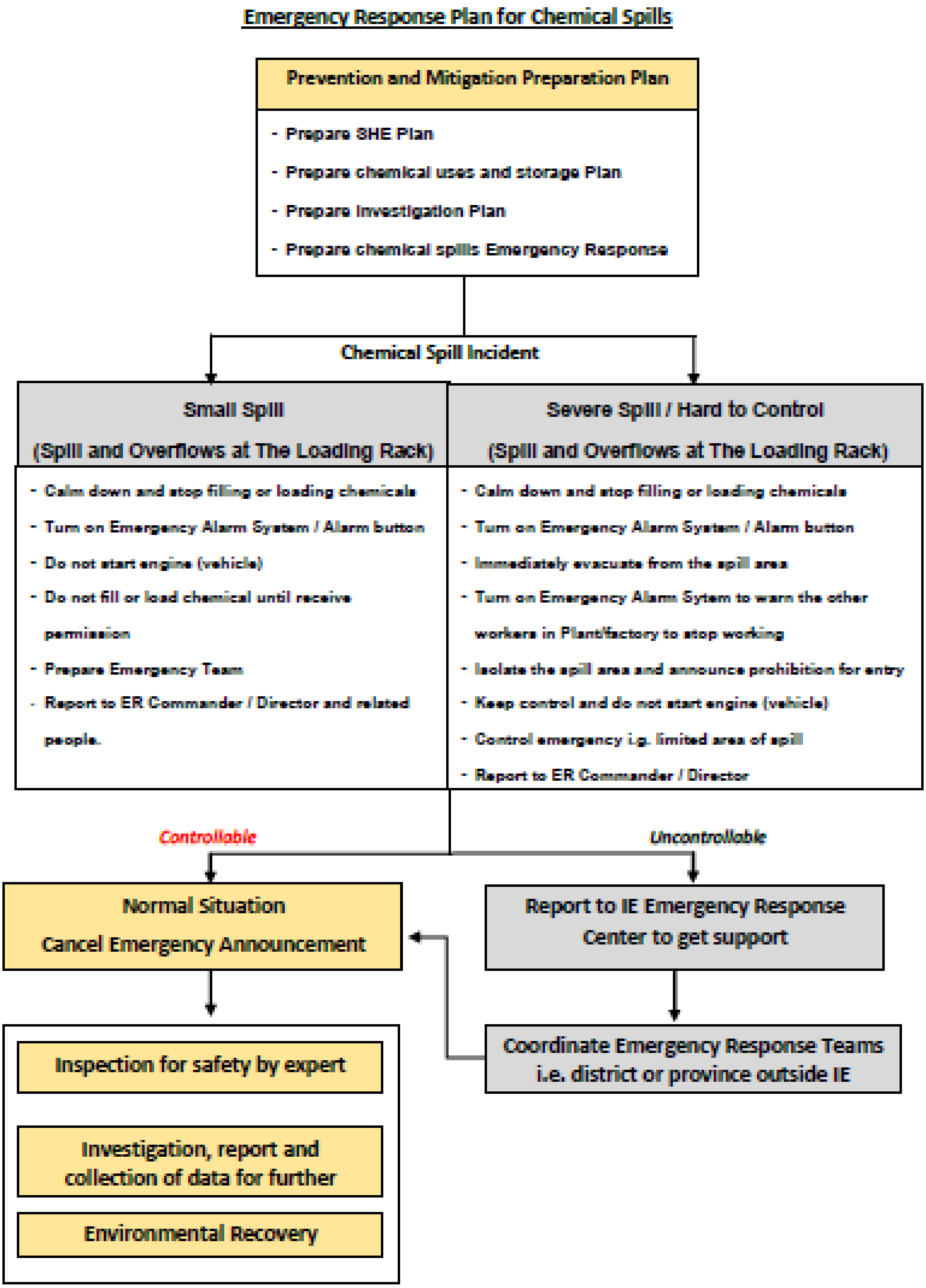
(c) Roles and Responsibility of Industrial Estate Emergency Team

- Dawei Industrial Estate Emergency Commander / Director
- Emergency Coordination Team
- Dawei Flood Controlling Emergency Team
- Communication and coordination Team
- Traffic and Safety Team
- Support and Evacuation Team

4.3.4.3 Recovery Plan

Prepare the recovery plan for the incident scene and must do immediately after the incident is stopped and investigation of damages is finished; for examples:

- Check equipment and instrument that are necessary to use or to install new ones for the operation as soon as possible.
- Fix or renovate the scene, area, building and others that are also affected as soon as possible.
- Provide equipment and instrument in order to control emergency as soon as possible
- Prepare report and evaluation of the incident including suggestion to improve, prevention plan and mitigation measures for the future.



Source: ESIA Study Team

Figure 4.3-7 Emergency Response Procedure for Chemical Spills

4.4 OCCUPATIONAL HEALTH SAFETY ADMINISTRATION

4.4.1 Safety Health Environment (SHE) Policy

The Project recognizes an important of occupational safety, health, and working environment which affect to our employees. The Project, therefore, has established the policy that also concordance with the National Profile of Occupational Health and Safety as follows;

- Occupational safety and good working environment maintenance are responsibilities of all employees to cooperative perform in order to afford safety to themselves, company, and related person.
- The Project encourage all employees to understand and recognize occupational safety and health concern in their operation.
- The Project recognizes an important of operational accident prevention.
- The Project support and promote the improvement of working environment and working with safety and healthy.
- The management shall supervise occupational safety, health, and working environment of the subordinates according to related Company's regulation.
- The Project shall support and promote safety campaign for maximum effectiveness of an application of the policy in practice.
- The Project shall monitor and evaluate an application of the policy on occupational safety, health, and working environment for efficient and effectiveness according to legal requirements.

4.4.2 Safety Health Environment Master Plan (SHE-MS)

To ensure that factories, facilities in the industrial estate Project will encounter the lowerest risk in operation and will be in effective control. Thus, the Project has initial the SHE Master plan that will be concordant between Project activities, National Myanmar Standard and International Standard. Besides, to comply with the other standard such as ISO 14001, ISO9001 and OHSAS 18001.

The Project believes that the achievement in SHE-MS will need cooperation from executives of factories to employee and staff in operation, control and manage risk that may expose in workplace and believes that the effective and good SHE-MS Master plan will help to mitigate risk of accidents, injuries and occupational health diseases in long-term.

The SHE-MS consists of 7 components as present in Table 4.4-1 and Figure 4.4-1, respectively

Source: ESIA Study Team, 2017.

Figure 4.4-1 Governing Safety, Security, Health and Environment Management System of DSEZ Initial Industrial Estate Policy and Action Plan

Table 4.4-1 Covenants in conducting Safety, Security, Health and Environments of DSEZ Initial Industrial Estate

SHE Management System	Sources
1. Leadership and Commitment	Commitments from every levels of executives and safety culture in the organization.
2. Policy & Strategic Objectives	Strategy, targets and safety policy.
3. Organization Resource & Documentation	Form safety organization, resources in management with documents and records of safety.
4. Evaluation & Risk Management	Evaluation and management of risk in every activities.
5. Planning and Operational Control	Plan, proceed and management of changes and preparation for emergency.
6. Implementation and Monitoring	Implement action plans and steps including evaluation according to key performance indicators.
7. Audit and Review	Continuously evaluate the effectiveness of safety procedure and improvement.

Source: ESIA Study Team

4.4.2.1 Safety

(a) Permit to Work System (PTW)

For dangerous jobs that likely to cause fetal, death or serious injuries, workers/employee require the Permit To Work (PTW). To ensure that the threats will be controllable and mitigation measures will be implemented from start until end. Permit to work system is evaluation on hazards, reviews all necessities and requirement in operation of the job in manners of safety for workers him/herself, equipment/instruments and system. The Project has set that all factories who establish in the enterprise, workers who will relate to all levels of dangerous job need to receive the permission to work (PTW) before starting their jobs. Step in receiving Permit To Work, for examples; hazard categories must be evaluated, plan to work and details of workplace and working condition must be recorded and evaluated. Safety plan must always be prepared including solutions and mitigation measures in managing and mitigating the hazards before starting the job. Details of the safety plan must be proposed to a Person In Charge (PIC) / Job mangers / director, Plant Supervisor or Field Supervisor etc.

(b) Personnel Protective Equipment (PPE)

The Project set that operation with work that may expose to hazards or risky job, workers/employee, sub-contractor or involvers will have to wear / apply appropriate standard Personnel Protective Equipment (PPE) according to the Standard listed by Myanmar relevant agencies or international standard. Details of the Standard PPE and PPE relates to the Project summarizes in Table 4.4-2.

Table 4.4-2 Type of activities and PPE

Activities / Operation area	Equipment
1. Working area	Safety helmet, shoes and glasses
2. Lawn area	Safety helmet, shoes, ear plugs, glasses, gloves and uniform.
3. Petroleum fuel handling area	Safety helmet, shoes, glasses, leather gloves and uniform
4. Welding area.	Safety Welding Visor, shoes, glasses, leather gloves and uniform
5. Dusty area	Safety helmet, shoes, glasses, mask, leather gloves and uniform
6. Chemical area	Safety helmet, glasses, shoes, PVC gloves, PVC apron and mask.
7. Heavy machine area / Generator	Safety helmet, Ear muff, shoes, glasses, mask, leather gloves and uniform

Source: ESIA Study Team, 2017

(c) Land Transportation

Safety rules for land transportation will be implemented for safety of all type of the Project's vehicles and relevant persons/parties or agencies that will involve the Project. Mitigation measures are such as

- Drivers must have license concordantly with their type of vehicles. The drivers must be healthy, not drunk, been tested and trained about traffic before work.

- Limit speed for each type of vehicles according to routes and installed some equipment for emergency i.e tire, car fixing equipment, fire extinguisher, emergency plate, first aids kid and reflex jacket.

- Transportation within the project will have to undertake during working hours defined by the Project (6.00-18.00). If there have necessity to work or transport beyond the mentioned period. The task/workers must be received permission from PIC, Manager, and Supervisor. Truck drivers, especially for hazardous substance, fuels or chemicals must obey and commit the Handbook for Road Tanker Drivers of the DSEZ Industrial Estate. Some rules are following:

  - Knowledge about trucks/tankers and dangers from carried objects/items/substances.
  - Management of hazards
  - Maintenance of vehicles and inspection
  - Techniques in prevention of road accidents, acceleration, stopping, changing gears, parking on roadside and driving behaviors
  - Steps in loading petroleum fuels or chemicals
  - Practical steps, what to do in emergency i.e. accidents, corrective actions and report of spills and fire.

(d) Construction

Safety system during the construction has been established for the Project as procedure and specification including maintenance and operation such as

- Civil Construction Specification

- Electrical Construction Specification

- Instrument Construction Specification
- Mechanical and Piping Construction Specifications

Relevant safety mitigation measures is in Table 4.4-3. Besides the Project has set the measures with in guideline for sub-contractors.

Table 4.4-3 Mitigation measures during construction

Subjects	Mitigation measures
Construction area	• Provide fences • Installation of signs / signals • Checking exist and entrances • 24 hrs security
Earthwork & Excavation	• Have Permit To Work • Dangerous sign • Check obstruction or blocking of drainage/creek system
PPE	• Provide PPE for workers • Follow the PPE Standard

Source: ESIA Study Team, 2017

(e) Preventive maintenance

The Project will inspect and maintenance equipment and instrument during construction and operation which include waste management system. The Project has divided the inspection according to types of equipment/instrument in manual and procedures.

4.4.2.2 Health

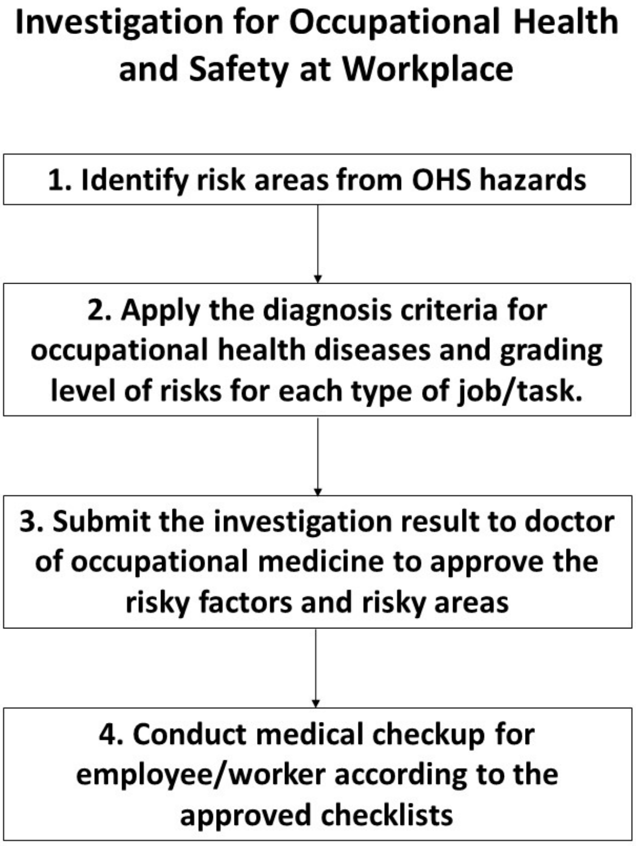
Health mitigation measures have been proposed for workers and sub-contractors for their health in order to prepare readiness, reduce accidents and damages at works due to health problems. The programs are such as annual checkup, drugs check, smoking area and standard of working condition including food, as summarized in Table 4.4-4

Table 4.4-4 OSH Policy and Measures at Workplaces

Policy and Measures	Description
Annual health check up	To ensure that workers will be healthy and ready to work
Drug check	To determine that every workers are not influenced by alcohols during work, to reduce risk of damages and accidents. Provide supports in treatment and recovery of workers' health problems due to alcohols.
Smoking area	No smoking in the defined area
Standard of Working condition	Formulate standard of working condition and mitigation measures following: Noise: o 80 dB(A) – Installation of warning sign 80 dB(A) o Over 80 dB(A)-Ear muff o Over 85 dB(A)- Installation of warning sign 85 dB(A) and Ear muff. Chemicals: o Obey the Chemical Handling Procedure o Safety Data Sheet for all chemicals o Registered Chemical List must be allowed from relevant person prior handling o Do not use Carcinogens, Suspected Carcinogens, Mutagens and Sensitizers compounds Heat: o Barriers and ventilation fan must be installed and drinking water and water must be provided in heat area. Others: o Vibration and Asbestos etc.
Food	Management of food e.g. cleanliness, storage, cooking and preparing and food waste disposal.

Source: ESIA Study Team, 2017

Health condition of Employee / workers including the diseases related occupational health and safety will be investigated and monitor through the program of occupational health and safety risk at workplace. Employee / workers will have annual medical checkup according to risk exposure in their jobs or tasks. Formulation of the occupational health disease and checklist is presented in Figure 4.4-2.



Source: ESIA Study Team

Figure 4.4-2 Investigation of Occupational Health Disease and Risky Area

4.4.2.3 Environment

The Project aims to operate business with responsibility and valued SSHE of workers, staff properties and local community in vicinity of the Project and sustainable development of environment and social. The Project will apply and implement principal, scope and operation with responsibility with substantial improvement from executive's level to until operation level. Also, including sub-contractors to co-operate to achieve the same goals. For examples:

- Support and establish organization culture about SSHE
- Focus on worker and sub-contractors to aware SSHE of themselves including working area and communities.
- Stringently conduct and operate in compliance with laws, regulations and standards of SSHE

- Support skilled development for workers and sub-contractors for efficient SSHE at workplace.
- Identify risks, management of risks that may expose to the workers and sub-contractors, apply mitigation measures to reduce risks.
- Develop and improve the Emergency Responses Plans
- Develop and improve management of accidents, such as safety report and investigation of root causes, to prevent repeat.
- Establish the SSHE Excellent Operation Program
- Support effective safety communication through/inside of the organization and surrounded community including government agencies in the areas.

4.4.2.4 Waste management

Waste generated from Project's activities, workers and sub-contractors will be managed according to the Dawei Waste Management Plan, which is the standard of municipal and industrial waste management, and concordance with the Pollution Control and Cleaning Department (PCCD) waste management policy and procedures.

The Project will implement mitigation measures that will conserve energy and the efficient uses about waste management in sequences such as Remove source, Reduce at source, Reuse, Recycle, Recover, Treat and Disposal. Besides, waste will be segregated or separated according to their characteristics. Basically, there are non-hazardous waste and hazardous waste, details are in Chapter 4, Solid Waste Management System and summarized below:

4.4.2.5 Segregation and/or separation before disposal

All types of waste needs to be segregated/separated before disposal. The Project will provide segregation bins in color according to their characteristics follows

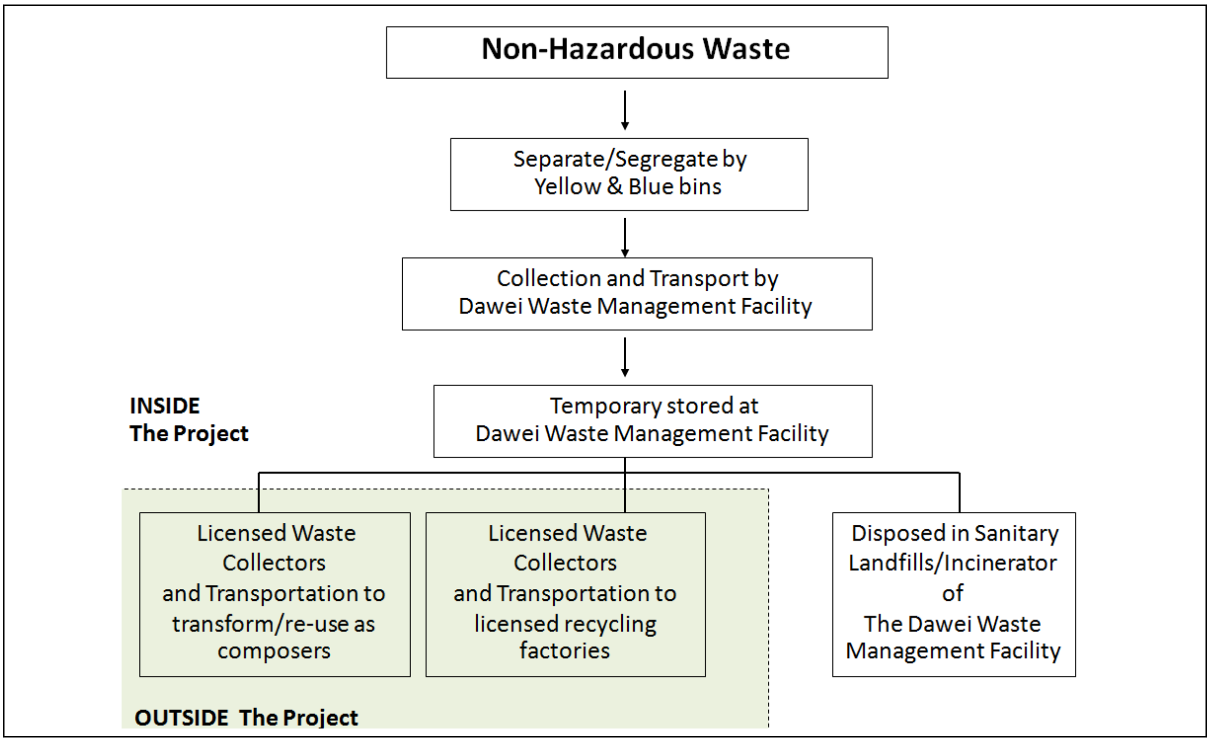
- Yellow bin is for non-hazardous (and dry waste) for recycling
- Blue bin is for non-hazardous (and wet waste) for non-recycling
- Red bin is for hazardous waste

Source: ESIA Study Team

Figure 4.4-3 Segregating or Separating color bins for waste

4.4.2.6 Waste Management

- **Non-hazardous waste and recycling** are aluminum can, plastic bottles and paper etc. will be initially stored in the labeled yellow bins (Figure 4.4-4) and will then be collected and managed further for recycling. Duration of the storage will be around a week.
- **Non-hazardous waste and non-recycling** are such as food waste or plastic for food containers. The waste will be stored in the labeled blue bins before further management such as transformed the waste into compose or disposal. The waste will be collected daily and will be delivered to the Waste Management System (see details in Chapter 4) by licensed third party or Dawei Waste Management Center for disposal or transformation to the other materials.

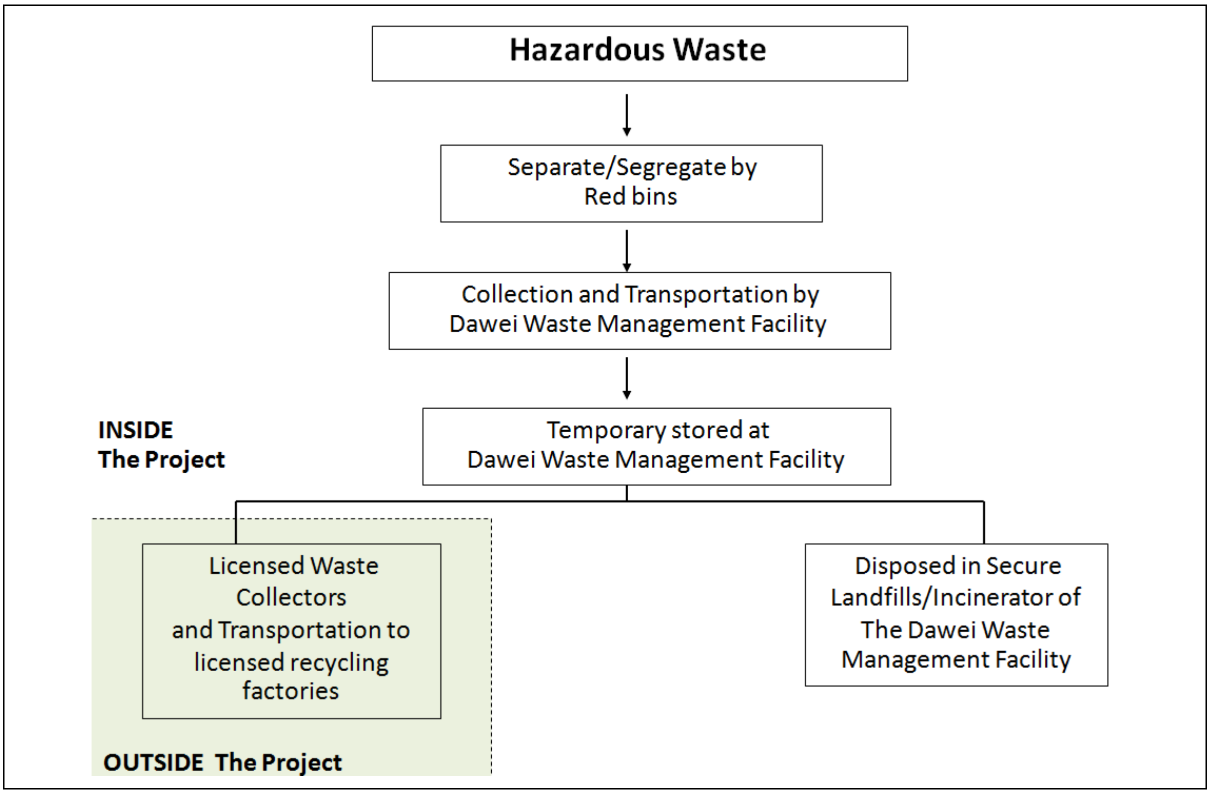


Source: ESIA Study Team

Figure 4.4-4 Management of Non-Hazardous Waste generated in the Project

- **Hazardous waste** will be initially stored in red containers. Hazardous waste will be collected on bi-weekly basis and delivered to the Dawei Waste Management Facility. Handling of hazardous waste will require manifest and will be managed by licensed third party or the Dawei Waste Management Center itself.

The waste will be stored in 200 liters of drums/ or appropriate containers according their hazardous characteristics at the center facility. Storage of hazardous waste will be complied by the relevant laws. Basically, the waste will be stored under confined and roof buildings that lay on concrete floor, which having good sum pit to collect wastewater, and in good ventilated condition. The waste will be stored no more than 6 months before treatment and/or disposal in the hazardous waste landfills or incinerator of the Dawei Waste Management Facility.



Source: ESIA Study Team.

Figure 4.4-5 Management of Hazardous Waste generated in the Project

4.4.2.7 Chemicals handling

Handing of chemicals will follow the "Chemical Management Procedures" which covering safety practices such as purchase, storage, training, waste and handling, transport and spill response.

4.4.3 SHE Master Plan Timeline And Implementation

Aims of the SHE master plan are

- To reduce the rates of workplace injuries and associated fatalities,
- To increase awareness and knowledge on OSH
- To reduce the number of critical diseases in the region such as occupational lung diseases, occupational noise induced hearing loss and occupational skin diseases,
- To minimize their adverse impacts on efficiency, productivity and business performance.

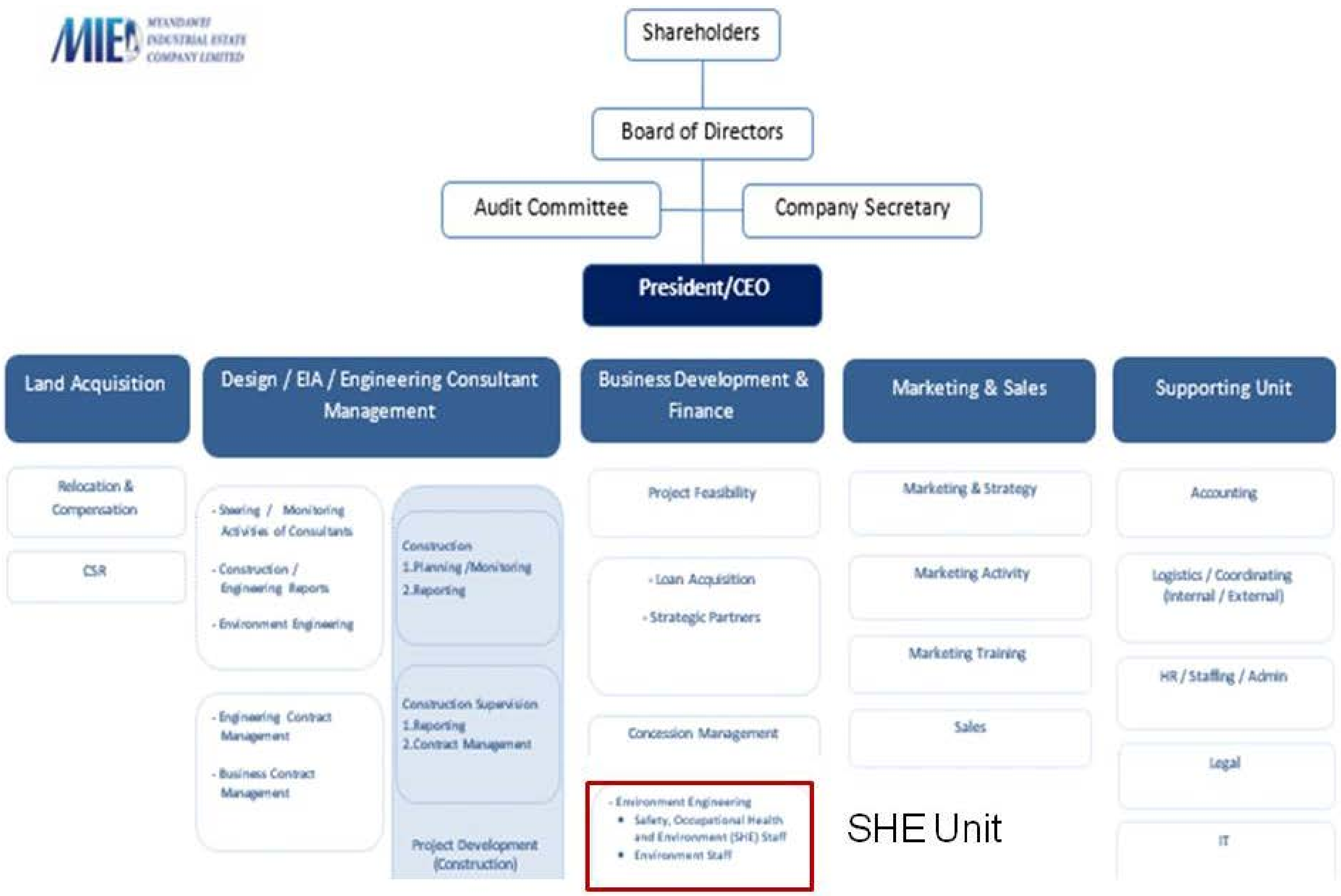
OSH strategic drivers and expected outcomes of SHE Master Plan within 10 years approaches since the first operation of the Initial Industrial Estate is summarized in Figure 4.4-6

Source: ESIA Study Team

Figure 4.4-6 OSH Master Plan for Initial Industrial Estate (2016-2032)

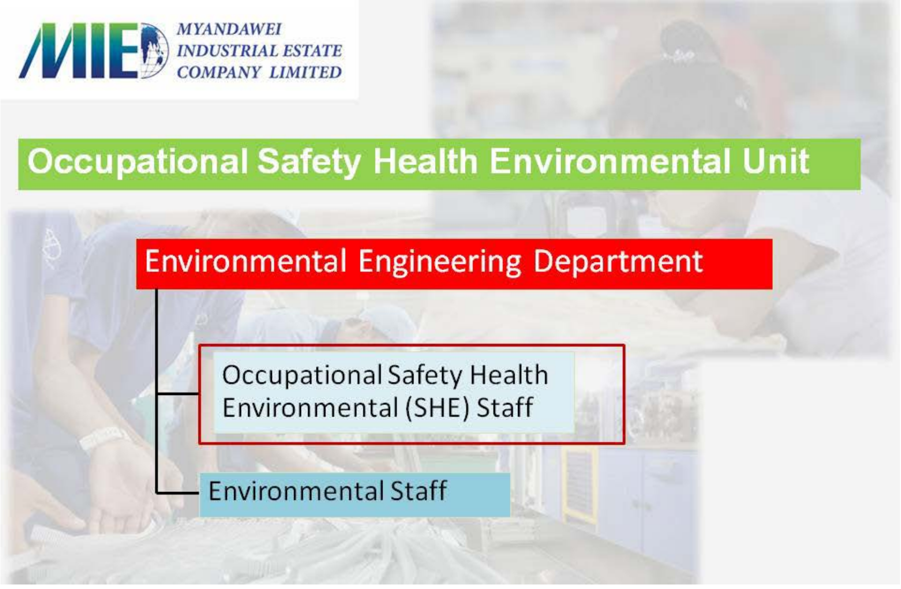
The SHE Master plan as staged in the previous sections will be implemented through the SHE unit in the Environmental Engineering Department as follow:

- Safety communication in daily work (brief of job hazard analysis) prior working or monthly meeting regarding to safety workers
- Providing of PPE and First Aids Kids. Including supporting equipment in case emergency at hazard risk spots; fire extinguishers, masks, neutral agents or relief medication including the Health and Safety Plan for fetal cases.
- Conducting safety report and safety investigation in case of near miss, incidents or accidents and prevention plan in the future.
- Conducting annual health in diseases related to occupation or health surveillance including the annual rehearsal all Emergency Response Plans as stated in Chapter 4, Section 4.3 Emergency Response Plans, which including natural disasters plans; vegetative/bush fire, storms (cyclone) and flooding response plan and chemical spill plan.



Source: MIE (2016)

Figure 4.4-7 SHE Unit in MIE Organization Chart



Source: ESIA Study Team

Figure 4.4-8 SHE Unit in Environmental Engineering Department

- Establishing safety awareness culture and community to surveillance of hazards in work place.
- Cooperate with the external investigation, visit and surveys in work place.
- Conduction the CSR activities in regarding to preparedness and relief of natural disasters such as dredging of cannels. Including maintenance of the health and safety and emergency prevention instruments.

4.4.4 SHE Unit And Responsibilities

The Project Proponent has SHE unit, which stay in Environmental Engineering Department. The unit is governed by the Business and Finance unit, as presented in organization chart in Figure 4.4-7. The Department includes two units of the Occupational Safety Health and Environment (OSHE or SHE) personnel and Environmental Staff (Figure 4.4-8).

The SHE unit of the DSEZ Initial Industrial Estate carries out all relevant environmental health and safety duties and responsibilities following:

- Implement SHE policy and SHE plan to prevent and reduce rate of accidents, occupational diseases or nuisance in workplace as stated in Section 4.4.1 for Safety Health Environment Policy and Section 4.4.2 for Safety Health Environment Master Plan.

- Report / recommend and improve SHE in workplace in order to comply with relevant laws and regulations including proposed mitigation measures to the business and financial units.
- Cooperate with external relevant government agencies e.g. the labor union, safety associations; Factories and General Labor Inspection Department (FGLLID), suppliers or worker safety and insurance boards including other environmental organization.
- Leading, supporting and promoting health and safety activities in workplace including announcement of regulations and SHE guideline in workplace.
- Conducting internal investigation of accidents and occupational diseases and other dangerous occurrences.
- Maintain records of accidents and occupational diseases in good statistical order with relevant provisions as in Annex 4-5 of the ESIA Main Report.
- Conduct surveys of workplaces by using equipment and control of hazards of improve working environment.
- Provide technical and information services to investors, employers and employees particularly with surveillance of working environment.
- Conduct in OSH education and training programme for workers and staff.
- Internal SHE in workplace and collect accidental data in accordance with relevant regulations and provisions.

4.5 SOCIAL PROGRAM

4.5.1 Skill Training Program

To prepare and support the employment in the Initial Industrial Estate and new business opportunities that coming with the Project, short-term training will be provided. In various skills will be in demand in the initial development e.g. construction skills.

The project aims to establish the "*Dawei Skill Training Center*" to support demand of skilled workers that is pursuant the type of Factories that will be invested or raised in the Initial Industrial Estate. This type of skill training will be an agreement between employers and employee, in choosing the best program for their employment. The skilled program are such as

- Construction related skills including carpentry, painter and masonry;
- Computer skill Training
- Language skill Training
- Forklift operation
- Key board Training
- Security Training
- Car Driving Course

Another skill training program which will establish for the livelihood restoration due to resettlement and relocation or/and also for general people who interest to raise their income. Such proposed skills program are;

- Motorcycle repair;
- Computer repair and home appliance repair;
- Small business management;
- Handicraft making
- Metal bending and installation Training
- Welding Training
- Food Production Training
- Furniture Production Training
- Electricity installation Course Training
- Car repairing Training

Each training will require about 40-75 hours, about 5-10 days to accomplish. A skill training requirement survey will be carried out to design an appropriate program.

At this stage of planning, a budget is tentatively estimated at about 236,000 US$ adequate for training in about 8 skills for about 1,600 training days (=8 training session x 20 person x 10 day for each session).

Training program will be established in accordance with the relevant laws as mentioned in Chapter 3. The center will also authorize to conduct vocational training for works and staff including students; provide outsourcing services and agencies in the region.

4.5.2 Cooperate Social Responsibilities Program

The Project Proponent commits to conduct the CSR activities regularly every year. The CSR spending normally depends on corporate financial readiness. The investment in CSR are gradually increasing each year until it reaches budget of 3 million THB per year (90,000 US$). However, CSR budget might be varied depending on the overall corporate performance.

CSR program has been planned along with Project life. Three (3) programs will undertake, within 50 years periods of the Concession Agreement (Extra 20 years of extension) and covering construction phase and operation phase. For initial phase of the development, the Project plans to simultaneously sustain with Dawei local communities and environment by implementing these programs:

- Education
- Financial
- Social Needs

The three programs above will be principle and scope in planning and implementing for variety of the CSR activities, which are carrying out together with public participation in order to achieve their intrinsic needs of local communities and overall union's society. The program and example of the activities during the construction phase are summarized in Table 9.10-1.

4.5.2.1 Education Program

<u>Scholarship awards</u>

Aim of the scholarship program is financial support for students in various levels e.g. primary education to university levels. Eligible students, whom are from education institutes in Dawei region or in vicinity of the Project development area. Especially indigent students who are member of the PAPs are encouraged to apply. The scholarships will be awarded every Q3 of each financial year.

<u>Agricultural related occupational training</u>

Aim to support adult learning in agricultural related occupation. Several programs had already been trial run in the Project's area i.e. the Training In Home Vegetable Gardening and Training in Mushroom Cultivation. A training program i.e. Training in Food/Fruit Preparation, Processing and Preservation will serve a woman group in particular as they play the major role on household nutrition and hygiene. The training will carry out in area of the demonstration plots for training. Duration for each session and number of attendance will depend on which

program, ranging from 4-15 sessions and 20-30 persons. One (1) training program will be selected for running each year.

4.5.2.2 Financial Program

Micro-Credit

Micro-credit program has proved to be an effective means to help financing small investment by persons with no collaterals. A bank will be needed to operate the micro-credit with fund to be provided by MIE. Local community in vicinity of the Project will be eligible for micro-edit financing but priority should be PAPs. A detailed operation procedure of the micro-credit program will be consulted with the relevant agencies and villagers.

4.5.2.3 Social Needs Program

Natural Disaster Relief and Recovery

Aim to donate, support and relief local communities or in the Dawei region during the natural disasters or emergency such as fire, flooding, epidemic or terrorism. The donation will include such life supporting bags and food and water and some elementary rescue equipment. Supports during recovery period e.g. cleaning, clearing blocking drainages or canals.

Community Organization

Aim to provide two full-time rural development specialists to help organize communities for productive purposes, particularly for new business ventures for settlers. The settlers will be assisted in various aspects i.e. collaboration among members of the product groups in marketing, buying of production inputs, exchanging experiences of the business, and productivity improvement.

Estimate percentage of CSR contribution through initial stage of the Project development are following:

Table 9.10-1 Summary of CSR activities/Projects for DSEZ Initial Industrial Estate

CSR Activities	Project Description/Activities	Target Group	Budget[1]/Year (US $)
1.Education Program			
1.1 DSEZ IE Scholarship	Provide scholarship for indigent students	Students in Dawei or in vicinity of the Project Development Areas	16%
1.2 Agricultural Occupational Training	Adult training in agricultural related occupation	Interested persons in DSEZ or PAPs	16%
2. Financial Program			
2.1 Micro-Credit	Financial helps for personal investment	Interested persons in DSEZ or PAPs	40%
3. Social Need Program			
3.1 Natural Disaster Relief and Recovery	Donation and support to relief and recovery during natural disaster or emergency	Victims in the disasters	12%
3.2 Community Organization	Business supports for communities' products	DSEZ communities	16%
Total Budget[1]			**100%**

Remark: [1] Estimate budget for CSR, which is varied depending on the overall corporate performance. The Project Proponent will invest in CSR and gradually increase each year until it reaches budget of 90,000 US$ per year.

Source: ESIA Study Team

4.6 COMPARISON AND SELECTION OF THE PROJECT ALTERNATIVES

4.6.1 Alternatives for the Project Site

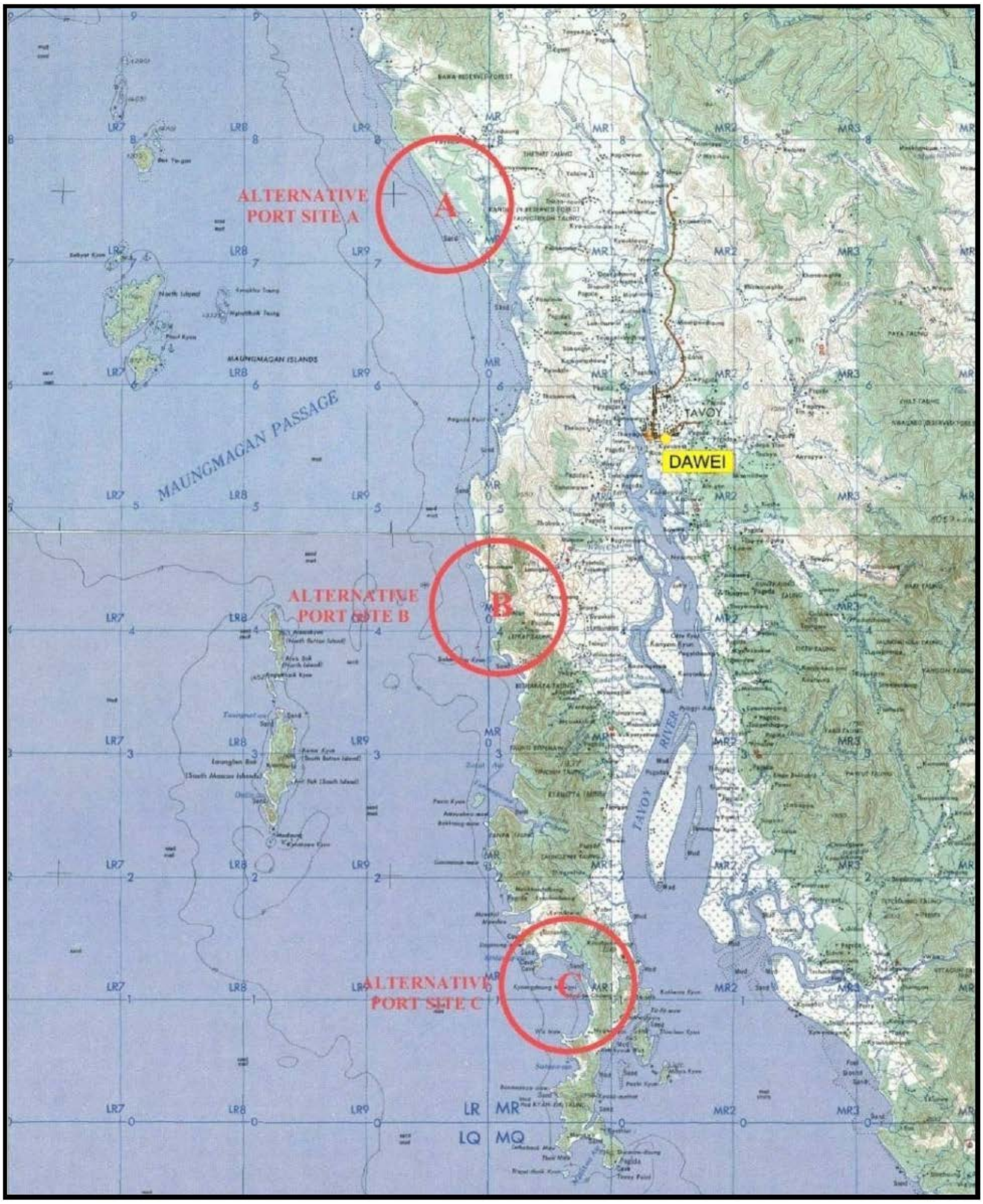
This section described the important alternatives to the project that have been evaluated in the associated feasibility studies. The following documents are the main references to this section of the EIA:

- Preliminary Feasibility Study of Dawei Deep Sea Port and Industrial Estate and Trans-Border Corridor Links (ITD, 2010); and
- Existing Conceptual Master Plan Development Review and Update – Final Report (SEATEC, 2012a).

Key alternatives that have been considered in the previous studies include:

Two alternative sites were considered in the Preliminary Feasibility Study (ITD, 2010). The locations of the three sites are show Figure 4.6-1. Details of each site, summarized from the feasibility study, can be described as follow:

- **Site A**: 28 km North of Dawei on the northern part of Maungmagan Bay. The site has a natural sand beach, backed by a huge open coastal plain. From engineering perspective, the site is suitable for large scale industrial estate and port because the industrial estate can be directly linked with the port facility. However, since the area has no natural protection against monsoon, breakwaters will be required.
- **Site B**: This site is located at San Lan Bay, 20 km southwest of Dawei. The area is protected against westerly monsoon by an island, thus no large scale breakwater will be required. Due to shallow water depth around the area, considerable amount of dredging will be needed. The area has narrower coastal plain and shorter beach compared with Site A resulting in smaller potential development of port and industrial estate facilities.
- **Site C**: The site is located in Nyaw-Byin Bay, 48 km south of Dawei. Part of the area is fully exposed to Andaman Sea and will require a breakwater to protect the port area. Land reclamation may be needed in parts of the bay where water depth is shallow.



Source: MIE (2015)

Figure 4.6-1 Site Selection Alternatives

The following evaluation criteria are used in considering the appropriate site location (ITD, 2010):

- The port sites should be well-protected and have a natural water depth sufficient to safely accommodate large-size oceangoing vessels;
- The sites should have sufficient backup area inshore, free of seasonal flooding;
- The port should not be built close to or in areas with extremely strong currents;
- The sites should be at a safe distance from environmentally sensitive zones;
- The site should have good access to the main roads for transportation in terms of distance and road alignment, both vertical and horizontal;
- The port sites should be as near as practically possible to the industrial estates;
- The sites should be wide enough both inland and offshore that will allow future expansion; and
- The subsoil of the site shall be suitable to allow land reclamations.

Considering all of the above criteria, Site A was selected as the most appropriate site for the construction of port and industrial estate facilities (Table 4.6-1).

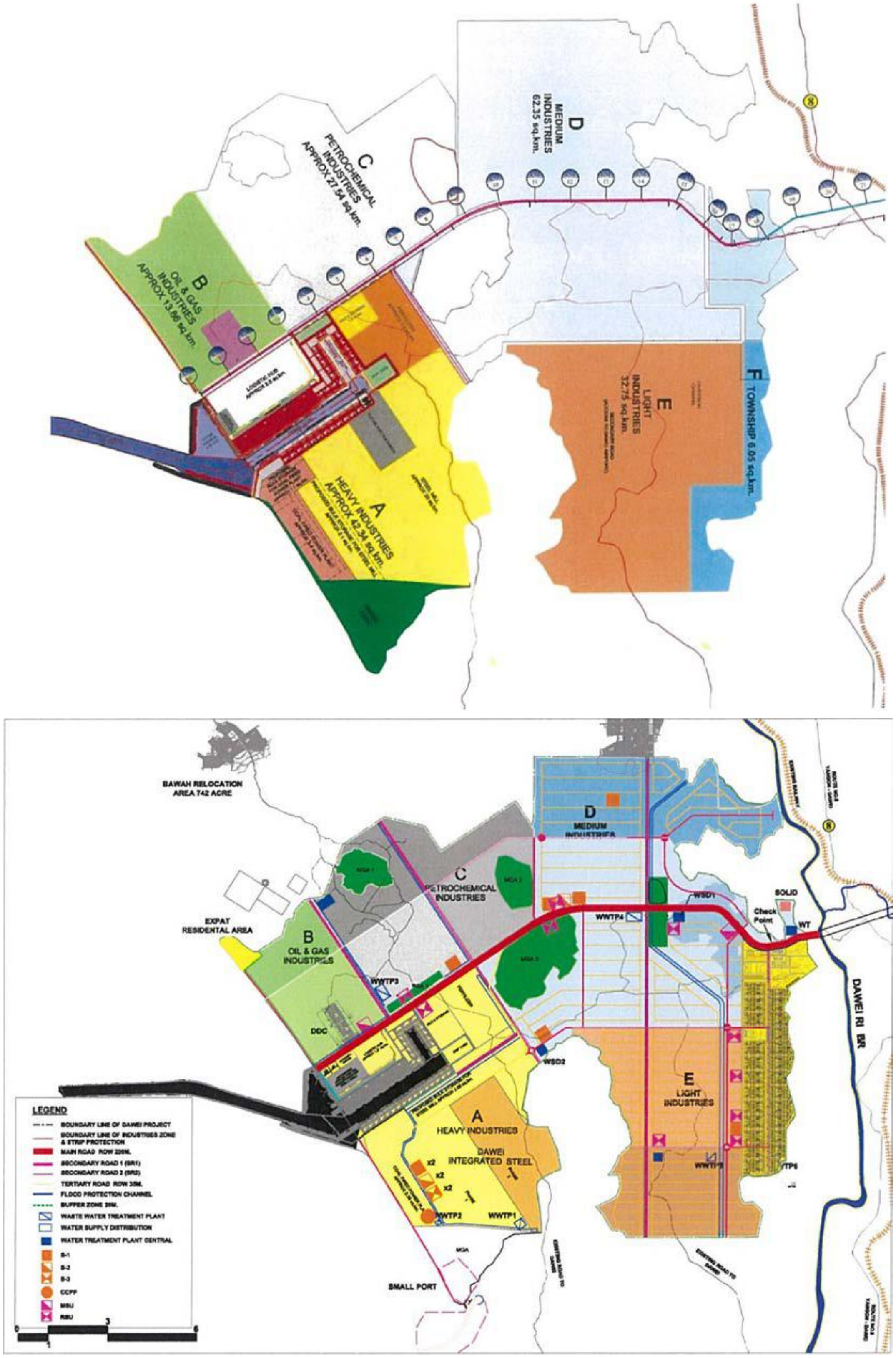
Table 4.6-1 Evaluation Matrix for Site Selection

Evaluation Points	Alternative Port Site		
	A	B	C
1) Natural Water Depth	○	○	⊙
2) Natural Protection	×	×	○
3) Backup Area Inshore	⊙	×	○
4) Effect of Tidal Currents	○	○	○
5) Environmental issues	×	○	○
6) Access to Road	○	○	○
7) Access to Industrial Zone	○	⊙	○
8) Large-scale Expansion	⊙	×	○
9) Distance to Tavoy City	○	○	×
10) Land Reclamation	⊙	○	○
Recommendation	1	3	2

⊙ Excellent ○ Good × Poor

Source: ITD (2012)

Upon selection of the appropriate site, the Preliminary Feasibility Study (ITD, 2010) provides conceptual layout of the port and industrial estate facilities for Site A). The industrial estates were divided into 6 different zones namely: two heavy industry zones, medium-heavy industry zone, medium industry zone, light industry zone and township zone with the estimated project area of 250 square kilometers.



Source: SEATEC (2012)

Figure 4.6-2 Project Layout and Master Plan Alternatives

ITD assigned SEATEC to prepare a revised master plan to further develop the concept of the project with further details on infrastructure and utility design. Major components that are developed during the master plan preparation include (SEATEC, 2012a):

- Relocation of township area (Zone F) closer to the entrance of the area to make it more convenient to access;
- Increase the size of the green area;
- Conceptual layout of Zone B (petrochemical industry), Zone D (medium industry) and Zone E (light industry);
- Improvement of road network within the industrial estate area; and
- Conceptual design of infrastructure and utility systems.

Figure 4.6-2 shows a comparison of layout of the industrial estate in ITD master plan and the revised master plan as proposed by SEATEC, 2012.

Table 4.6-2 shows a comparison of areas for each zone within the industrial estate of both alternatives.

Table 4.6-2 Summary of Area Allocation in Master Plan Alternatives

Description	ITD Master Plan Area (km^2)	Updated Master Plan Area (km^2)
Zone A – Heavy Industries	43.81	41.84
Zone B – Oil and Gas	13.76	12.95
Zone C – Petrochemical Industries	28.85	25.80
Zone D – Medium Industries	65.08	50.70
Zone E – Light Industries	33.07	24.97
Zone F - Township	6.00	12.33
Expat Residence	0.76	0.74
Green Area	9.13	20.83
Infrastructure and Utilities	4.04	14.34
Total	204.5	204.5

Source: SEATEC (2012)

The alternative in the revised master plan was the one selected for the assessment of potential impact in this EIA report.

Dawei Development Project design and planning has been very dynamic during the preparation of this EIA. The scenario used in the EIA report is the one considered most appropriate at the time of the report preparation.

One of the examples is the project layout and the land acquisition. It should be noted that one of the basic assumption of the project's site selection is that the land area belongs to the government of Myanmar and acquisition of lands necessary for the project was not expected to be a major problem. However, the actual implementation and change in Myanmar's politics may not be according to the assumptions.

As of the first half of 2013, DDC has been preparing an alternative to the project layout to avoid having to acquire existing agricultural and residential lands in the southeast portion of the project area.

4.6.2 Description of Project Alternatives

There are 3 alternatives before master plan of the project would be finalized.

- Zone D Medium Industry
- Zone E Light Industry
- The Present Master plan.

Zone D and Zone E were underwent and studied about their social impacts on settlement of the Industrial Estate. The results reveal that the settlement would have high impacts in Zone E more than in Zone D and in the Present Master plan, respectively. By ratio of developing area and relocation villages of these three alternatives. The present Master plan has the least impact on relocation as summarized in Table 4.6-3. Therefore, the present project Master Plan is finally selected as the best alternatives.

Table 4.6-3 Total relocated villages in relating to development of the present Master Plan of the Initial Industrial Project

No.	Initial Phase Development Project	Estimated Amount		From Existing Village
		Household	People	
1	A two-lane road, connecting Dawei SEZ with the Thai border	26	104	Thi Khee
		9	36	Dauklauk, Myauk Pu, Talaing Yar, Yebouk, Thit Ka Done (KM18+000 - KM47+750)
2	A small port (Coastal Road to Small Port, width=20M)	12	47	Nga Pi Tat
3	An Initial Industrial Estate			
	- Zone A3	8	32	Pagaw Zoon, Yalai
	- Zone B1	1	4	Pagaw Zoon, Khamaung Chaung
	- Zone C1	116	464	Wet Chaung, Khamaung Chaung
	- Zone C2	10	40	Yalai
	- Zone C3	16	64	Yalai, Khamaung Chaung
	- Zone C4	128	512	Khamaung Chaung
	- Zone D1	-	-	
	- Zone D2	2	8	Khamaung Chaung
4	A small power plant	-	-	
5	An initial township	-	-	
6	A small water reservoir	3	12	Payin Phyu, Otayan *Outside Initial Phase = 9 Household
7	A telecommunications landline	-	-	
8	Main Road	7	28	Pa Gaw Zoon, Yalai
9	North Road	3	12	Khamaung Chaung
Total		**341**	**1,363**	

Source: ESIA Study Team

CHAPTER 5
DESCRIPTION OF THE ENVIRONMENT

5.1 SETTING AND STUDY LIMITS

In the ESIA study, it is necessary to establish baseline information on the environment and socio-economic settings of an area which could receive and indirectly impacts from the Project construction and operation. The baseline information serves two purposes. Firstly, it is used, in conjunction with the information on the project for identification of potential impacts of the Project and assessment of their significance. Secondly, it serves as the benchmark for evaluating environmental and social management performance of the Project construction and operation

For the purpose of establishing baseline information on the environmental, the study limits are to consist of geographical limit and contextual to guide the baseline information collection

5.1.1 Geographical Study Limit

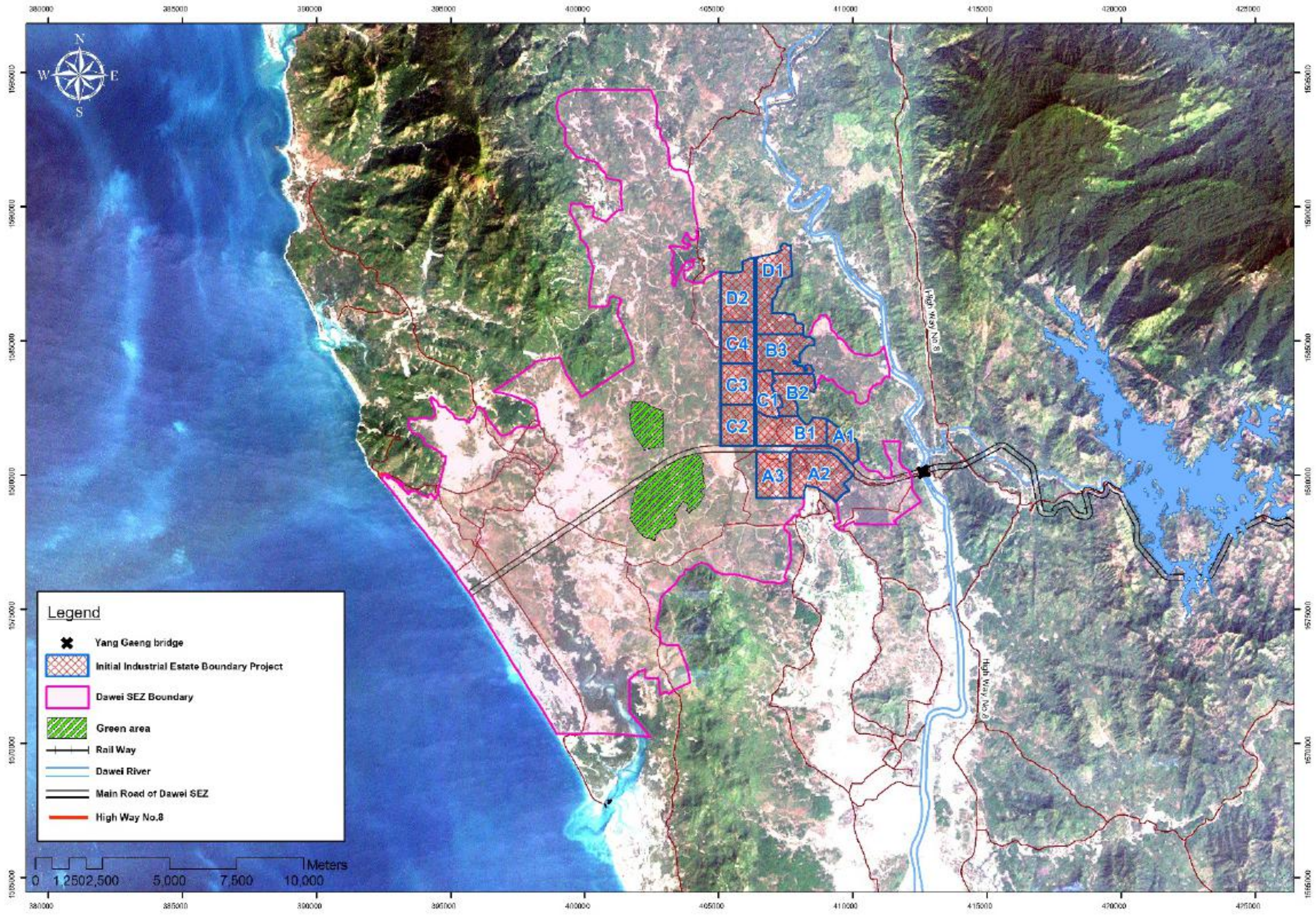
The geographical study limits is defined as an area surrounding the project site from which the baseline information collection should be collected. In this Scoping Study, the geographical study limit is about 5 km extending from the center of the project site. This geographical study limit covers 78.57 km2 of circular area around the project site as shown in a map in Figure 5.1-1. This area is referred to in subsequent sections of this Scoping Report as "the study area" The study area should cover sensitive receptors of environmental impacts of the Project during project construction and operations. However, the air pollution study will cover a larger area than the study area if sensitive receptors are found to exist beyond the 5 km limit.

5.1.2 Contextual Study Limit

The ESIA Guideline defines the contextual study limit to consist of five groups of components: (i) physical components; (ii) biological components; (iii) socio-economic components; (iv) cultural components and (v) visual components. Considering the nature of this Project and its potential environmental issues, the composition of each main component is presented below:

(1) Physical Components

- Topography and Soils
- Geology and Seismology
- Hydrology
- Climate and Air Quality



Source: SEATEC, 2012b

Figure 5.1-1 The Geographical Study Limits

- Noise and Vibration
- Groundwater Quality
- Surface Water and Sediment

(2) Biological Components

- Surface Water Biology and Fisheries Activities
- Forests
- Wildlife

(3) Socio-Economics Components

- Initial Township Development
- Studied Villages
- Economic Profile
- Health Profile
- Infrastructure Facilities
- Traffic and Transportation
- Land Use

(4) Cultural Components

- Historical and Archeological sites

5.2 PHYSICAL COMPONENTS

5.2.1 Topography and Soil

5.2.1.1 Study Area

The proposed project activities comprised of land leveling, excavation, and others may cause alteration tothe topographic condition. Dawei Industrial Estate Project is bounded by Dawei River in the East and the Andaman Sea in the West. The study area will be divided into two levels including topography of Dawei city and topography within Dawei Industrial Estate.

5.2.1.2 Baseline Topography and Soil Conditions

Topography and soil conditions information from the following relevant environmental studies were reviewed:

- Final Report for consultancy services for the Main Road, Flood Control, Infrastructure & Utilities, Task 2 Industrial Estate Flood Control & Drainage Study and Conceptual Design (SEATEC, 2012)
- Topographical Map of Tavoy Burma 1:250,000 Series U542, Sheet ND 47-6, Edition 1-AMS, 1957 (USACE, 1957)
- Initial Environmental Examination (IEE) for Dawei Sea Port & Industrial Estate Development (TEAM, 2012).
- Final Study of Environmental and Health Impact Assessment (EHIA) for the Dawei Sea Port (TEAM, 2013).
- Environmental Impact Assessment (EIA) for Main Road (SEATEC, 2012).

The following sections summarize the information from the above documents.

Topography

Terrain Regions in Myanmar are divided into five zones which are: 1.) Central Myanmar; 2.) Western Mountains and Arakan Coast; 3.) Northern Myanmar; 4.) Shan Highlands; and 5.) Tenasserim. Dawei is classified into Tenasserim or Burmese Tanintharyi, which refers to the narrow coastal region in Southeastern Myanmar, bordered to the East by Thailand and to the West by the Andaman Sea. (Figure 5.2-1)

Dawei is a city in Southeastern Myanmar, situated about 614.3 km (381.7 mi) South of Yangon on the Northern bank of the Dawei River. Dawei is a port at the head of the Dawei River estuary, 30 km (18.6 mi) from the Andaman Sea.

The general topographic condition of Dawei River Basin is characterized by a plain alternating with hills in the valley with high mountains surrounding the area. There are a number of natural streams flowing from mountains to the central of the area, forming the main river, Dawei. The Dawei River flows through the project site which situates in Myanmar, close to Kanchanaburi Province of Thailand. (Figure 5.2-2)

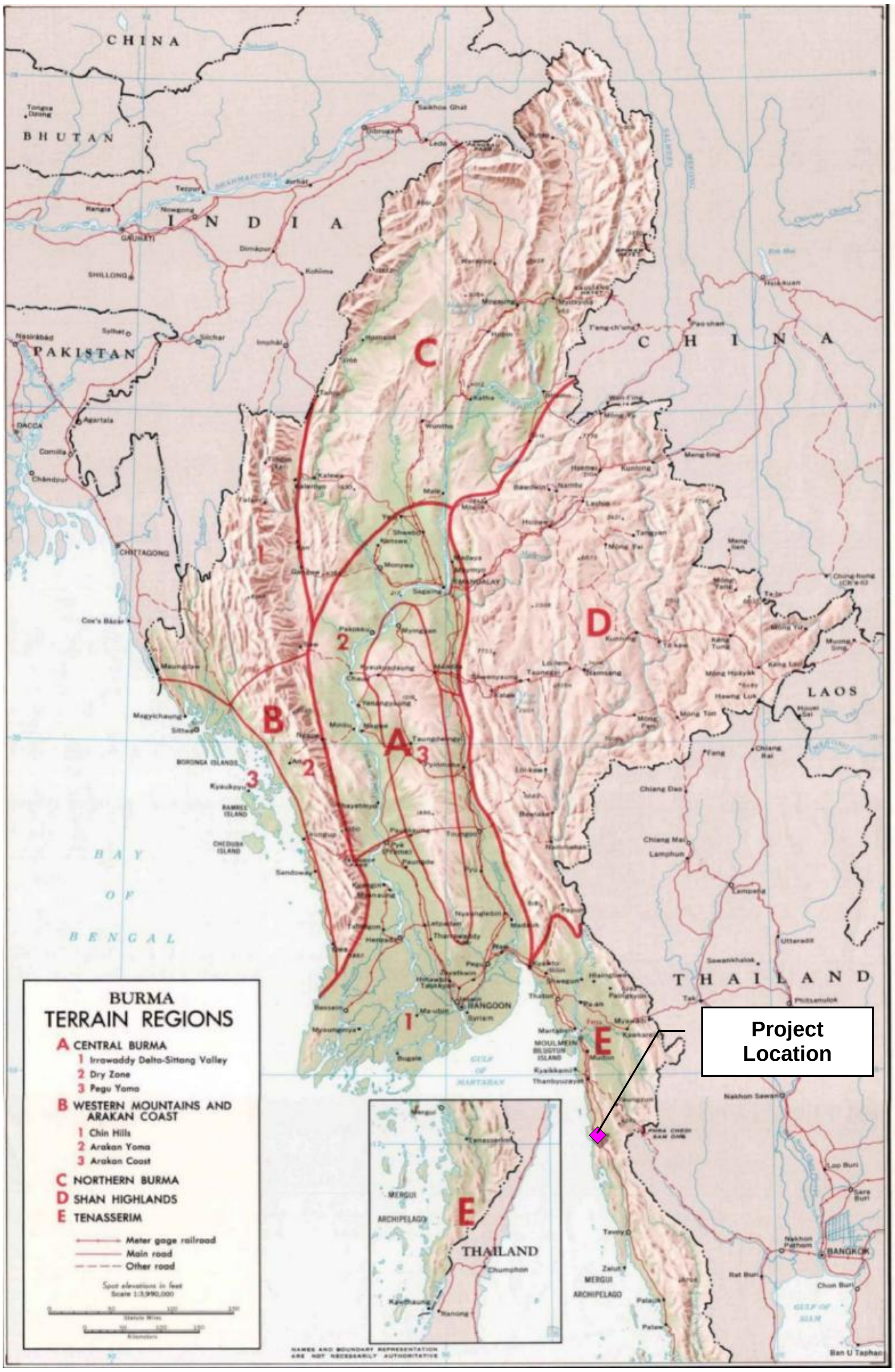
The industrial estate is bordered by National Road No. 8 and the Tanintharyi nature reserve to the East. The topography of the Dawei Industrial Estate is relatively flat with variable crests. The beach has a gentle sloping uniform profile along the majority of its length, indicating a relatively stable beach system. The beach profile flattens towards the low tide mark, followed by a shallow gradient, extending seaward.

The project area is comprised almost entirely of flat plains with some small hills at the center of the project area. The highest terrain is found at Pandat, A National Forest, which is about 1,065 m. MSL height. There are four rivers running from the North to the South of the project area: Nabule River; Dawei River; Kunchaung River, and Pan Din In River (Figure 5.2-3)

Soil

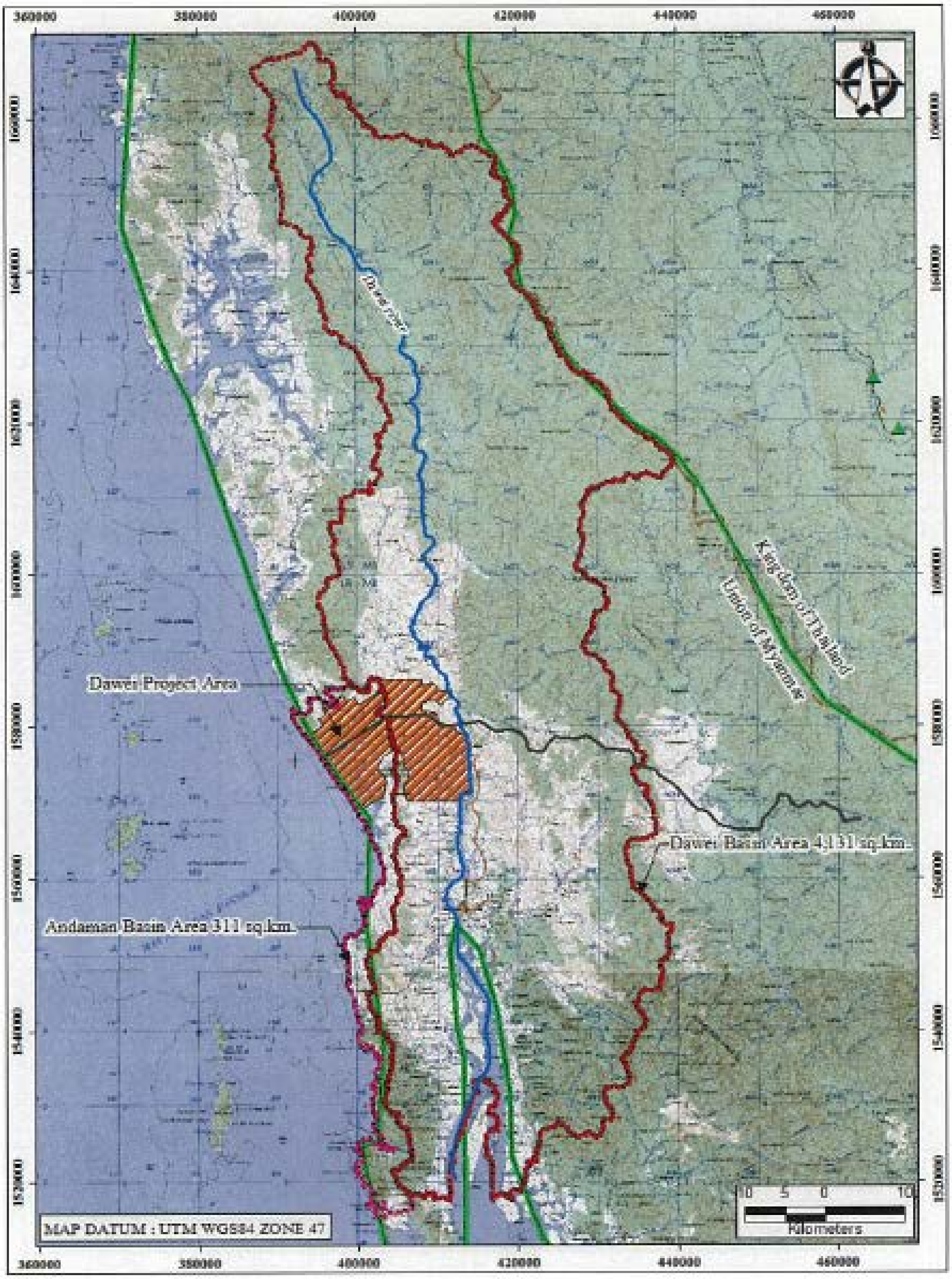
There are nine types of soil in Myanmar (Figure 5.2-4). Major soil types of the project area are occupied by the Saline Swampy Meadow Gley (GL-Gleysol). These soils occur in

the Ayeyarwady Delta, 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 constant tidal sea water, the land can only by utilized for prawn breeding and mangrove firewood forests. The adjacent soil type of GL-Gleysal is Light Forest Soils (Cinnamon), or NT-Nitisol. These soils mostly occur on the very gently sloping alluvial-deluvial under the mountainous plains of the Dry zone area and are also found on the lowest parts of the Shan Plateau. The physical properties of these soils are very favorable and, in spite of being sandy, they are pervious and not heavy in which to work. The soils are generally fertile, which is related to their position in the mountainous plains.There is a constant supply of nutrients from the surrounding mountains because of the surface run-off. These soils are suitable for the cultivation of Ya crops (dry cropping on uplands).



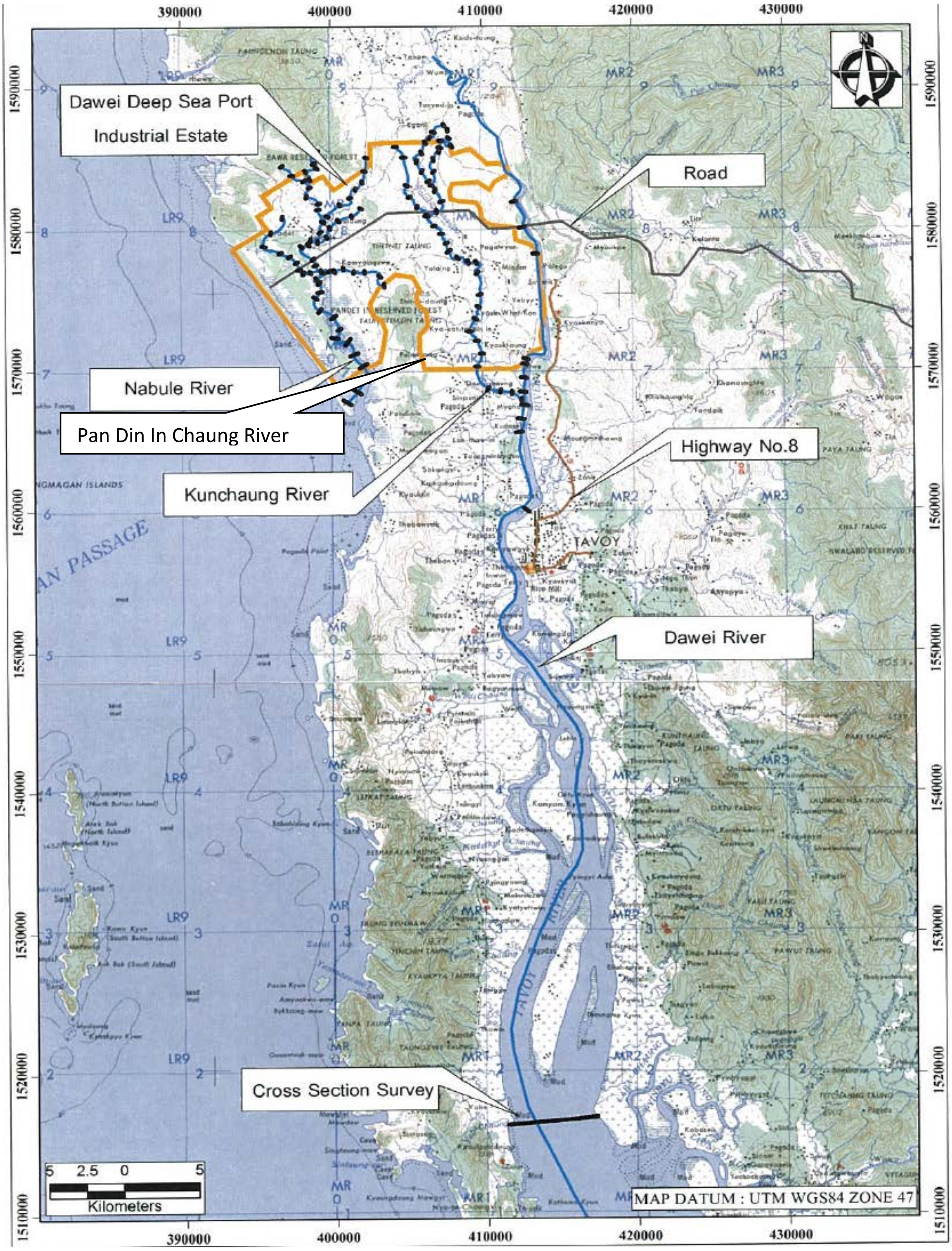
Source: http://www.tec.army.mil/Burma/maps/TerrainRegions1968.jpg accessed on 15th November 2012

Figure 5.2-1 Myanmar Terrain Regions



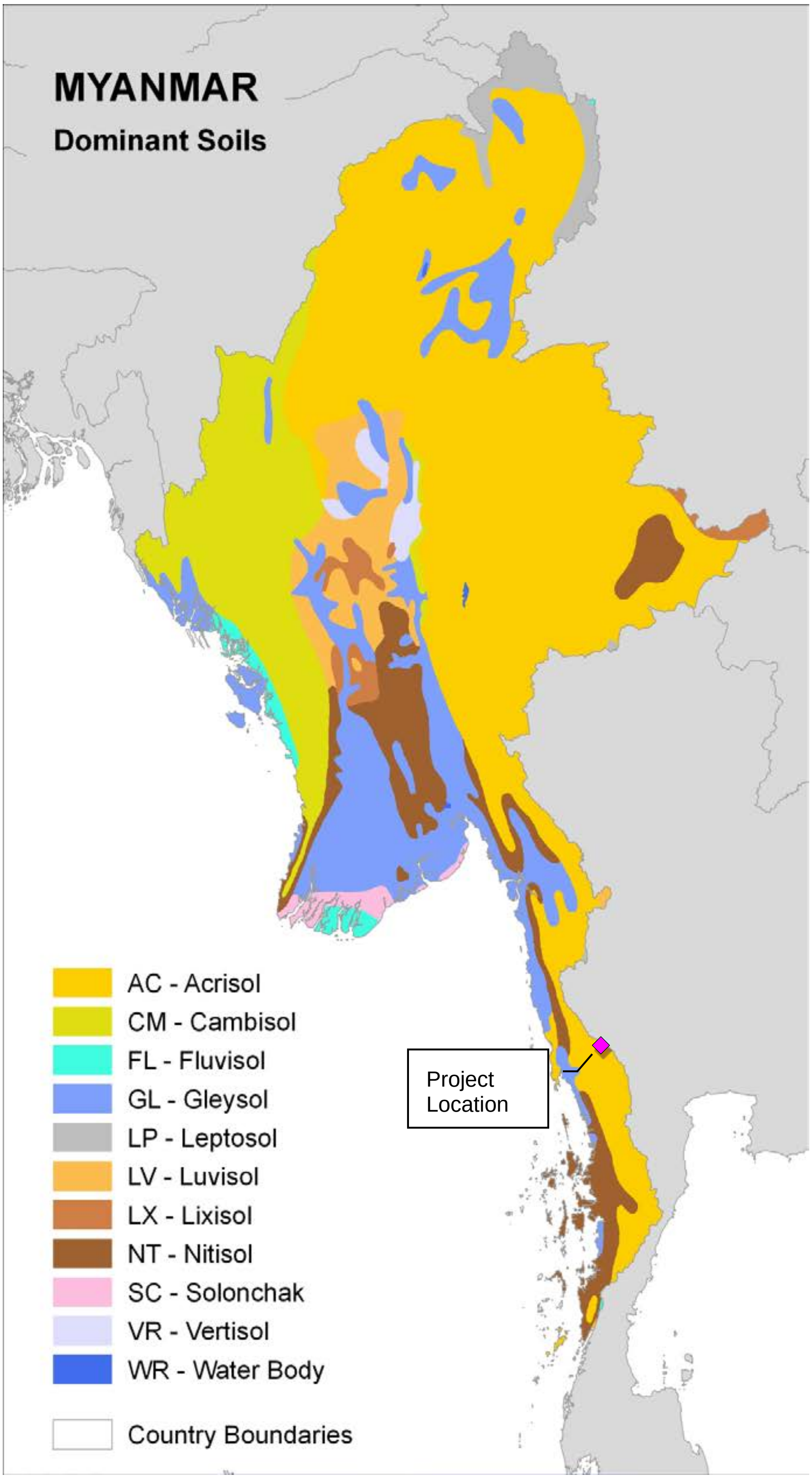
Source: SEATEC (2012)

Figure 5.2-2 Topography and Important Basins



Source: SEATEC (2012)

Figure 5.2-3 Location of River in the Project A



Source: http://www.tec.army.mil/Burma/maps/SoilMap_Myanmar_300dpi.jpg accessed on 15th November 12

Figure 5.2-4 Myanmar Soil Types

5.2.2 Geology and Seismology

5.2.2.1 Study Area

Geological information can be used to indicate potentials of earthquakes and mapping of any potential mineral deposit. Seismology has been a serious concern for construction design because of its potential to cause threats to the project. The geological map of the project area and the area within a 5 km. radius of the project boundary will be considered while the seismologic study will provide the seismic record of the country.

5.2.2.2 Baseline Geological Conditions

Information on geological conditions of Myanmar is rather limited and most of the information available on public domains is on regional level. The following documents are reviewed in this section:

- Geological Map of the Socialist Republic of the Union of Burma (USACE, 1977)
- Burma Rock Types (USACE, 1990)
- Regional Geology of Myanmar (Pramumijoyo et al., 2010)

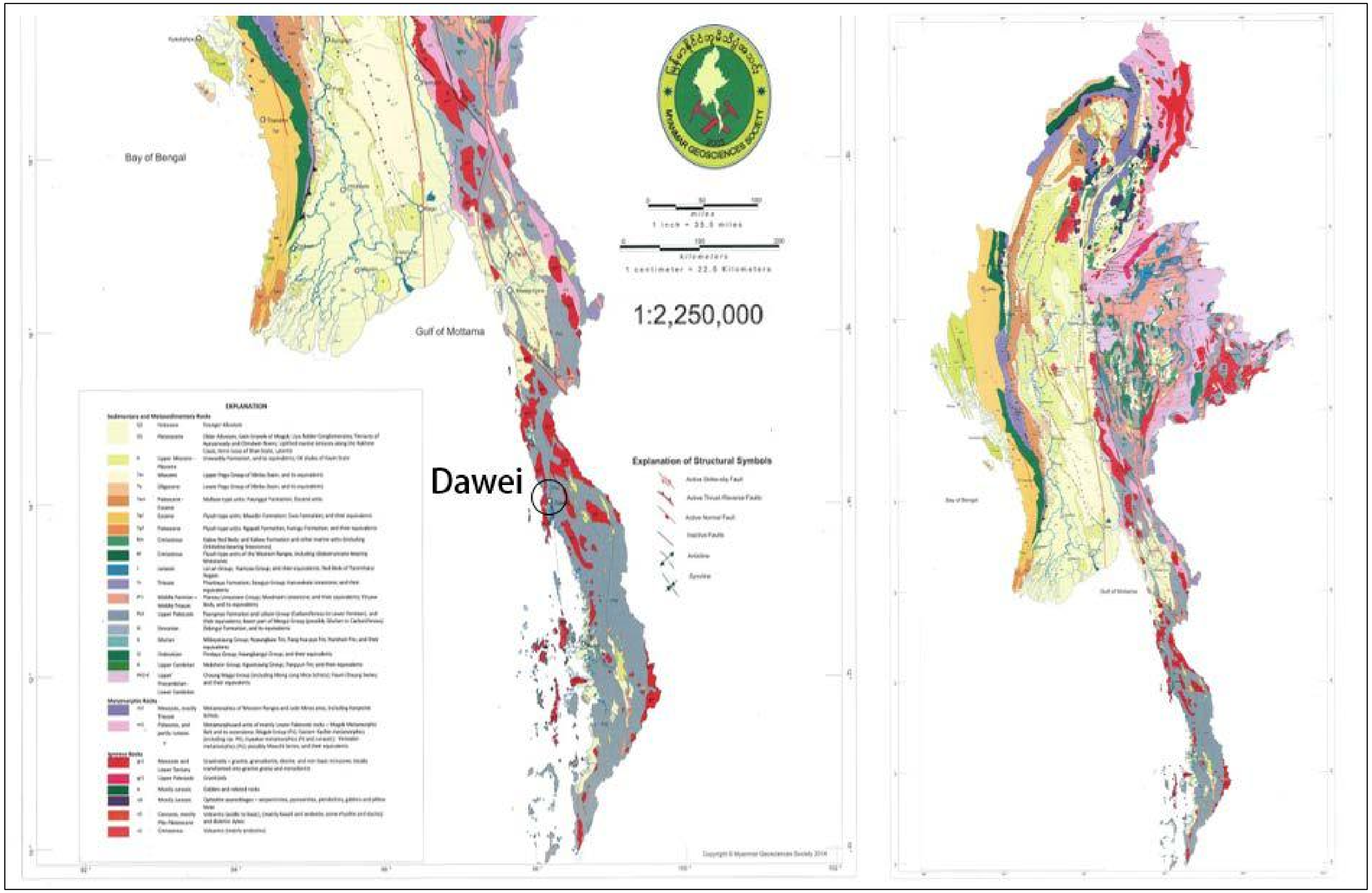
The description below discusses the regional geological settings of the area.

Results of the Studies

The Western part of Myanmar, called "Western Fold Belt", mostly consists of very thick sequences of flysch type sedimentary rocks and tectonic mélange of basic and ultrabasic rocks and exotic limestone in the form of ophiolite. This is a result of the subduction of the Indian Tectonic Plate underneath the Burmese Tectonic Plate along the Bengal tectonic boundary. Continued collision between these two plates lead to a high mountain arc in the West and Northwestern parts of Myanmar (Pramumijoyo et al., 2010).

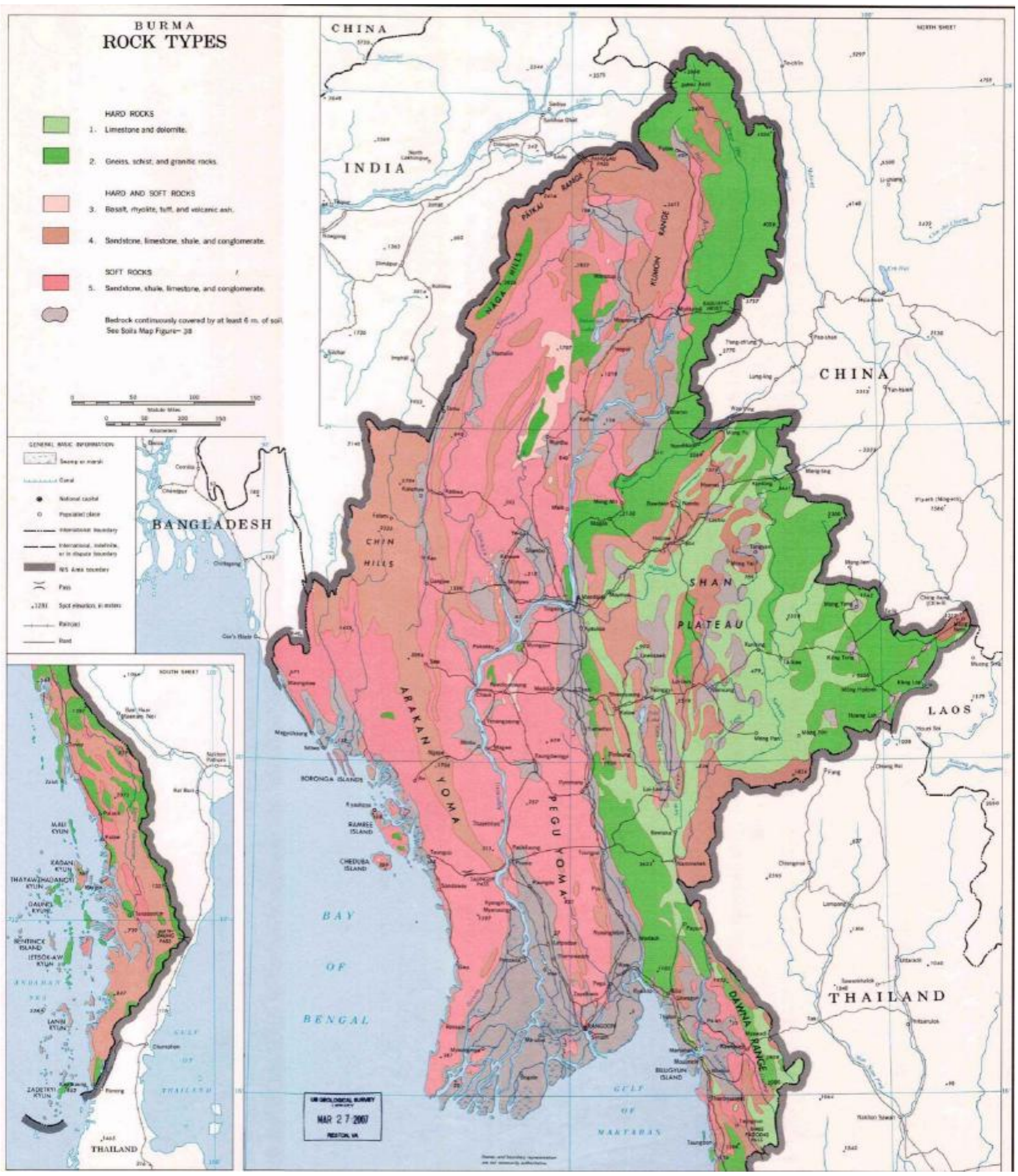
The project area located in Q2-alluvial (Holocene), with reference to the Geological map of the Socialist Republic of the Union of Burma (USACE, 1977). (Figure 5.2-5). There was fine to coarse gravel and sand, silt, and light-to medium-gray and yellowish-gray clay.

The predominant rock types of the project area arehard and soft rocks which are mainly Basalt, rhyolite, tuff and volcanic ash. (Figure 5.2-6) Central Myanmar Basin and Central Andaman Basin records an active extensional process that varies laterally from continental rifting in the North and sea-floor spreading in the South. The majority of these volcanic rocks are volcanic ash, volcanic tuff, lava flow, different types of basalt, andesite, dolerite, and rhyolite. Bimodal basalt-rhyolite with the presence of intermediate composition and compositional variations of volcanic rocks indicate that the volcanic rocks were formed by assimilation and the fractional crystallization of the crustal components and magma mixing. Associated host rocks of the volcanic material are sedimentary rocks of the Peguan (Miocene) and Irrawaddian (Pliocene-Pleistocene). Volcanic occurrences are mostly in the Central Myanmar Basin and in the Andaman Sea.



Source: The Geological map of the Repulic of the Union of Myanmar (2014)

Figure 5.2-5 Geological Map of the Project Area



Source: The Geological map of the Socialist Republic of the Union of Burma (USACE, 1977)

Figure 5.2-6 Burma Rock Type

5.2.2.3 Baseline Seismological Conditions

The key information referred to in the studies related to seismological conditions include:

- The Volcanic Occurrences in relation to Tectonics in Central Myanmar Basin (HlaHla/Aung, 2010)
- Seismic and Tsunami Activities in Myanmar (Thein et.al, 2011),

Results of the Studies

Seismic Zone Map

The seismic zone map of Myanmar is shown in Figure 5.2-7 (Maung Thein and Tint Lwin, 2006). Five seismic zones are leveled from low to high risk zone, a probable maximum range of ground acceleration in (g) values and equivalent Modified Mercalli Scale classes are given for each zone. The descriptions of each zone are described:

- Zone V (Zone of very severe damage) - A range of ground acceleration more than 0.3 g, which is equivalent to Modified Mercalli Intensity (MMI) class IX.
- Zone IV (Zone of severe damage) – A range of ground acceleration 0.2-0.3 g, which is equivalent to MMI class VIII.
- Zone III (Zone of highly damage) – A range of ground acceleration 0.1-0.2 g, which is equivalent to MMI class VII.
- Zone II (Zone of moderate damage) – A range of ground acceleration 0.075-0.1 g, which is equivalent to MMI class V/VI.
- Zone I (Zone of minor damage) - A range of ground acceleration less than 0.075 g, which is equivalent to MMI class V and less.

The project area located in Zone I, which is of minor damage, can be seen in Figure 5.2-7.

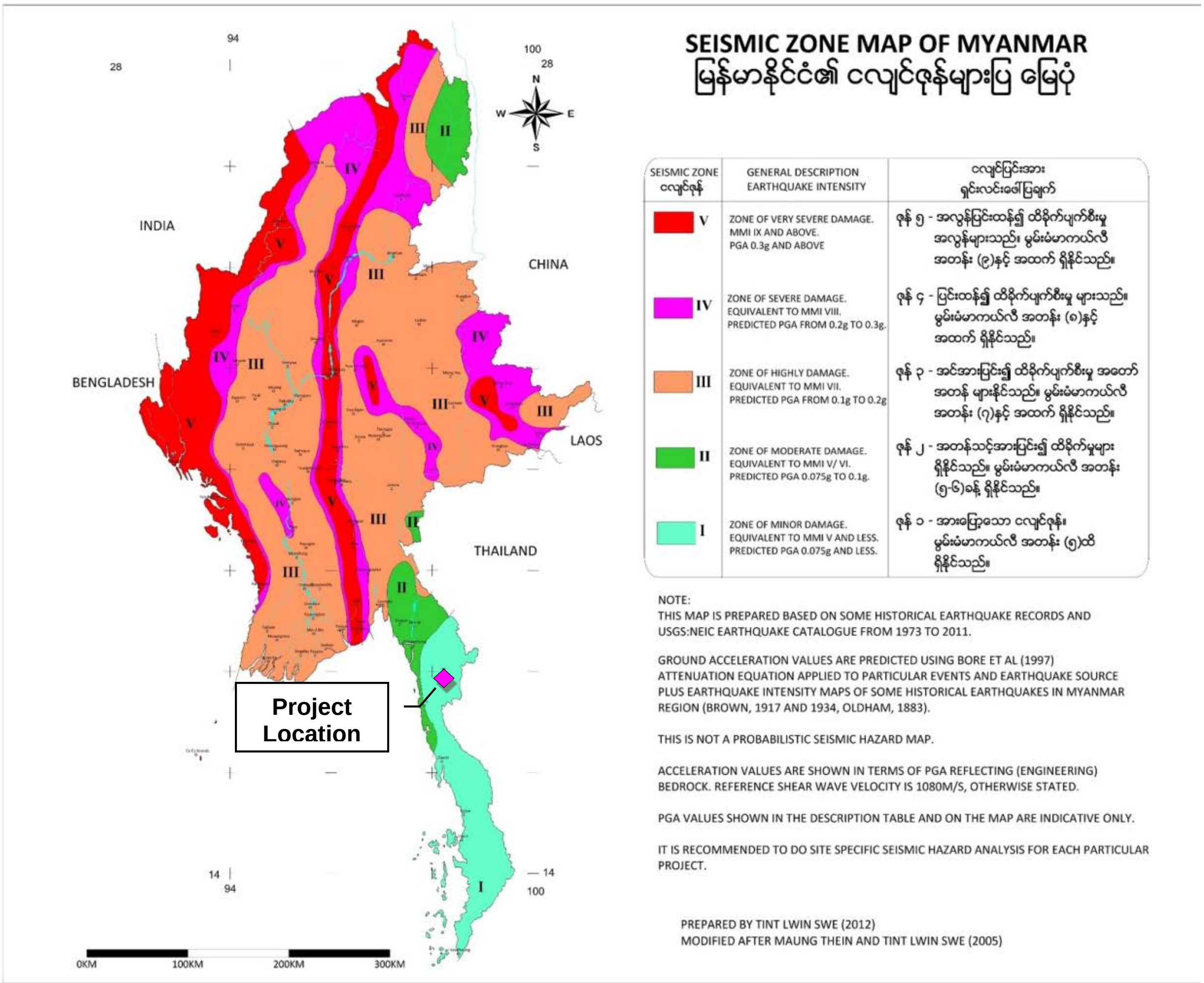
Seismic History

Myanmar lies on the earthquake belt of the Himalayan range. The Northeastern part of the Indian plate subcontinent is seismically active. It comprises of East-West extending the Eastern Himalayan belt, which marks the collision boundary between the under thrusting Indian plate and the Eurasia plate; approximately N-S extending Indo-Burmese Arc, which extends further Southward to join the Andaman Arc and Eastern Himalayan Syntaxes. Subduction occurs along the Andaman arc. The Indian plate moveswith respect to the Eurasian plate, and is highly oblique to the margin on the subduction zone. The right-lateral Sagaing shear fault, shown in Figure 5.2-8, is delineated in the West by the Andaman-Nicobar Trench.

The Department of Meteorology and Hydrology started to observe the sea level after the Great Sumatra Earthquake of 2004. The seismic record shows that there have been at least 15 major earthquakes bearing magnitude M ≥7.0 within the territory of Myanmar for the past 100 years. The seismicity in Myanmar is attributable to the following two reasons:

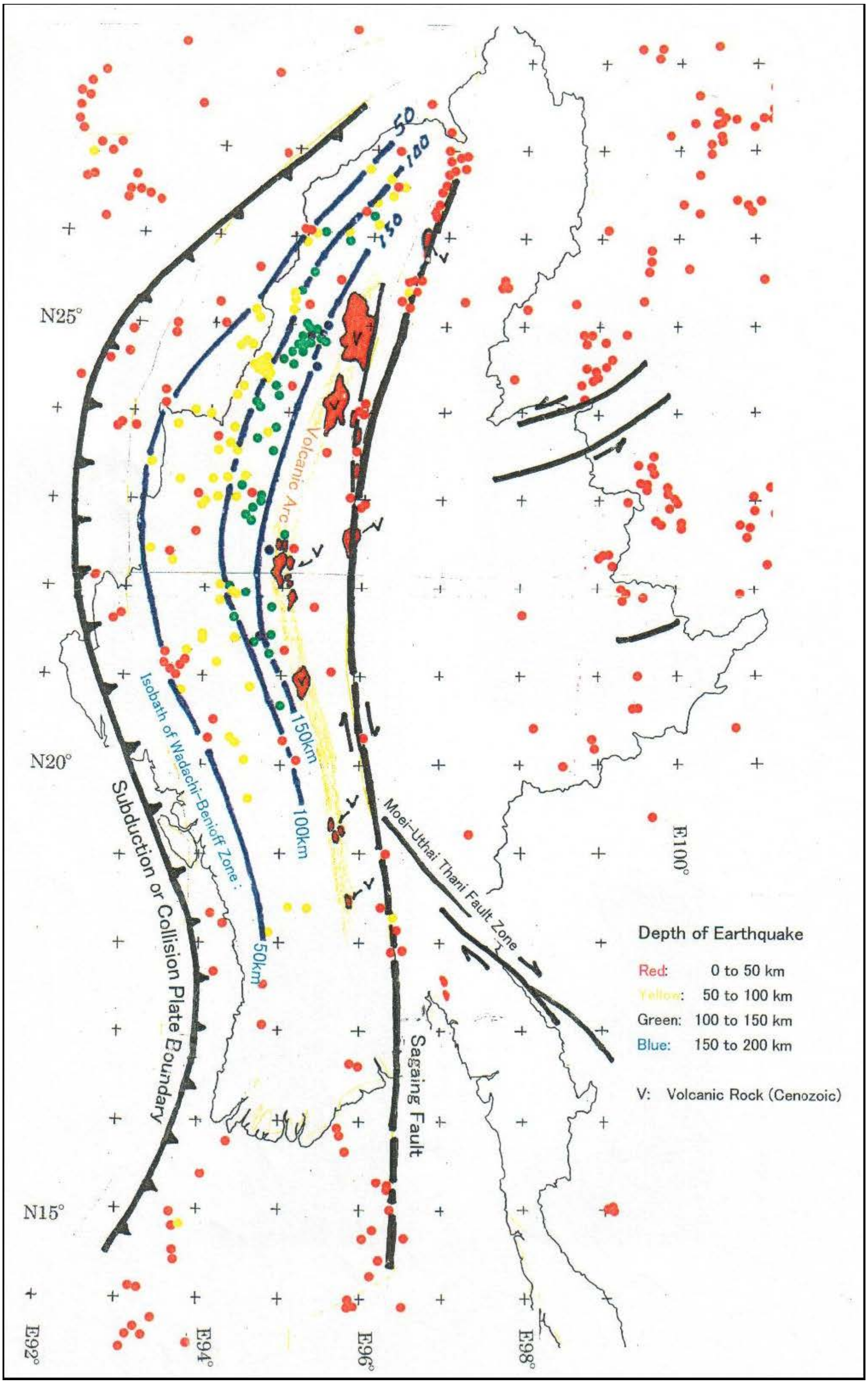
- The continued subduction with collision only in the North of the Northward-moving Indian Plate underneath the Burmese Platelet (which is a part of the Eurasian Plate) at an average rate of 5.5 cm/yr.
- The Northward movement of the Burmese Platelet from a spreading centre in the Andaman Sea at an average rate of 2.5-3.0 cm/yr. Very large over thrusts along the Western Fold Belt resulted from the former movement, and the Sagaing and related faults from the latter movement. Intermittent jerks along these major active faults resulted in the majority of earthquakes in Myanmar.

According to the information from Myanmar Earthquake Committee, the seismic records indicated that during 1912-2011 there were at least 14 major earthquakes (Richter Scale ≥7.0) in Myanmar and nearby regions, however, no earthquakes occurred in Dawei and the project area. The frequency with respect to time is summarized in Table 5.2-1 and Table 5.2-2.



Source: Myanmar Geo-Science Society

Figure 5.2-7 Seismic Zone of Myanmar



Source: http://www.seis.nagoya-u.ac.jp/kimata/jica/kyawkyaw.pdf

Figure 5.2-8 Tectonics and Depths of Earthquakes in Myanmar

Table 5.2-1 List of Some Major Earthquakes in Myanmar within the Myanmar and Nearby Regions during the Period 1839-2011

Date	Epicenter		Magnitude (Richter Scale)	Remarks
	Latitude	Longitude		
1) 23 May 1912	21.00	97.00	8.0	North of Taunggyi serious landslides
2) 6 March 1913	17.00	96.50	7.0	"Golden umbrella at the peak" of Shwe-maw-daw Pagoda grounded
3) 5 July 1917	17.00	98.50	7.0	"Golden umbrella at the peak" of Shwe-maw-daw Pagoda grounded
4) 19 January 1929	25.90	96.25	7.0	Brick building destroyed at Htaw-Gaw
5) 8 August 1929	19.25	98.50	7.0	Brick building destroyed at Swa
6) 16 December 1929	25.90	96.25	7.0	Landslide
7) 5 May 1930	17.00	95.50	7.3	Many houses destroyed, 500 killed in Bago. Some houses destroyed, 50 killed in Yangon.
8) 3 December 1930	18.00	96.50	7.3	Some houses destroyed, about 30 killed
9) 27 January 1930	25.60	96.80	7.3	Brick building collapse, Landslide
10) 12 September 1946	23.50	96.00	7.5	Pagodas collapse
11) 15 August 1950	28.50	96.50	8.6	Under the influence of Assam earthquake, Chindwin river at Mawlaik and Kalewa, Ayeyarwady river at Aunglan flow upstream
12) 16 July 1956	22.00	96.00	7.0	Pagoda&building at Sagaing destroyed, about 40 killed Sagaing bridge, moved slightly
13) 8 July 1975	21.50	94.70	6.8	Many historical pagodas at Bagan destroyed, 2 killed
14) 5 January 1991	23.48	95.98	7.1	Landslide & some buildings destroyed at Tagaung and surrounding area, 2 killed
15) 6 August 1988	24.15	95.13	7.3	Myanmar-India border, no casualty reported
16) 22 September 2003	19.94	95.72	6.7	Landslide, liquefaction and sand Eruption. Pagodas, some bridges, houses and schools destroyed at Taungdwingyi and surrounding areas, 7 killed.
17) 24 March 2011	20.71	99.95	6.8	East of Shan State (Tachileik town), Serious land slide and two after shock, 74 killed and 111 injured.

Source: TEAM (2012)

Table 5.2-2 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	7-7.39	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

Source: TEAM (2012)

Tsunami

Tsunamis were caused by earthquakes at sea. A notable incident occurred due to an earthquake west of North Sumatra, on 26 December, 2004. An earthquake, with a magnitude of 9.0 on the Richter scale, jolted at the bottom of the sea about 155 miles Southeast of Banda Ache in North Sumatra. The epicenter of the earthquake was between 3°31' North and 95°97' East, off the West coast of North Sumatra. This Tsunami arrived in Myanmar only with aheight of three to seven feet. The Tsunami disaster left 31 people dead, 41 injured, 517 homes destroyed, and 2,145 persons homeless in Ayeyawady Division; 8 dead, 1 injured, 83 homes destroyed, and 447 persons homeless in Taninthayi Division; 22 dead but without damages to homes in Rakhin State; and 1 home damaged in Yangon Division. Historically, a tsunami recorded at the Myanmar coast showed that a strong earthquake, with associated ground movements, along the Arakan coast were recorded during a survey in 1841 by the British ship Childers18, commanded by Captain E. Halsted. Halsted recorded evidence of 3-7 m. of uplift along the coasts of Ramree, Cheduba, and Foul islands, which lie offshore of and parallel to the Arakan coast of Myanmar. Another earthquake, with a magnitude of 7.9 on the Richter scale, took place at Nicobar Islands on 31 December 1881 and another earthquake with magnitude of 8.7 Richter scale occurred at Andaman Islands on 26 June 1941. (Thein, et.al. 2014)

The recent recorded effect of the tsunami to the Myanmar coast was relatively small. Based on post-tsunami site reconnaissance surveys after the earthquake on 26 December 2004 (Satake et al., 2005), the wave height along the Myanmar coast was generally in the range of 1 to 3 m., and are estimated to be in the range of 2 m. at the project site. The maximum water level recorded (based on observations) was 0.5 m. lower than the highest tide during that particular rainy season (Satake et al., 2005). There was no observed major shoreline damage along the Dawei coast in terms of large areas of sediment loss or accretion.

5.2.3 Hydrology

5.2.3.1 Study Area

There are four rivers within the project site: Nabule River; Dawei River; Kunchaung River; and Pan Din In River. In the case of project development, all fours rivers and their tributaries may be adversely affected by project construction activities. The effects might include an increase of sediments, or a change in river velocity or direction.

5.2.3.2 Baseline Hydrological Conditions

- Hydrological conditions of the project areas in the previous studies can be found in Final Report: Task 2: Industrial Estate Flood Control & Drainage Study and Conceptual Design (SEATEC, 2012)
- Final Study of Environmental Impact Assessment for the Dawei Sea Port (TEAM, 2013)

Summary of the key hydrological conditions of the project area is as follow.

<u>Results of the Studies</u>

Referring to flood study in the project area, there are four main rivers near and within the project area including:

- Dawei River – Dawei River or Tavoy River is a river of Myanmar and is the primary river in this area, flowing from North to South at the foothills of the Taninthayi mountain range and enters into the Andaman Sea at the Taninthayi Coast Region. The riveris located at the project boundary in the East. There are many tributaries flowing into Dawei River from East and West. The river delta is brackish.
- Nabule River – This river originates from Hincha Chang and Madu Chang at the Northeastern part of the project area near the Htein gyi village.It flows from North to South, parallel with the coast, and ends in the Andaman Sea, around 1.5 kilometer outside the project area. The river delta is brackish.
- Kunchaung River (Kyaing Chaung) – This river is a combination of many canals in the North: Sin Pu Nit Chaung; Pein Shaung Chaung; and Ya Laing Chaung. It flows from North to Northeast and empties into the Dawei River.
- Pan Din In Chaung River – This river flows from East to West and ends in the Andaman Sea. The river originates from the hills to the South of the project area. This river delta is brackish.

The natural drainage system of the project area is composed of two sub basins. On the Eastern sub basin, water is flowing to the Dawei River through a natural stream which carries the water along the main slope of the terrain in a North-South direction, and the accumulated water from the hills along the left side and the right side of the bank. The hillside

water flows along the minor slope in the direction perpendicular to the main slope from East to West and West to East. These two sources of water drained to the Dawei River at the Yebyu Community (Figure 5.2-9). The sub basin in the Western is similar to the Dawei River sub basin; i.e., the water flow from upstream along the main slope in North-South direction combines with the accumulated flow from the hills along the left side and right side of the bank. The hillside water flows along the minor slope in the direction perpendicular to the main slope from East to West and West to East. These will be drained to the Andaman Sea around the Pandin-In communit

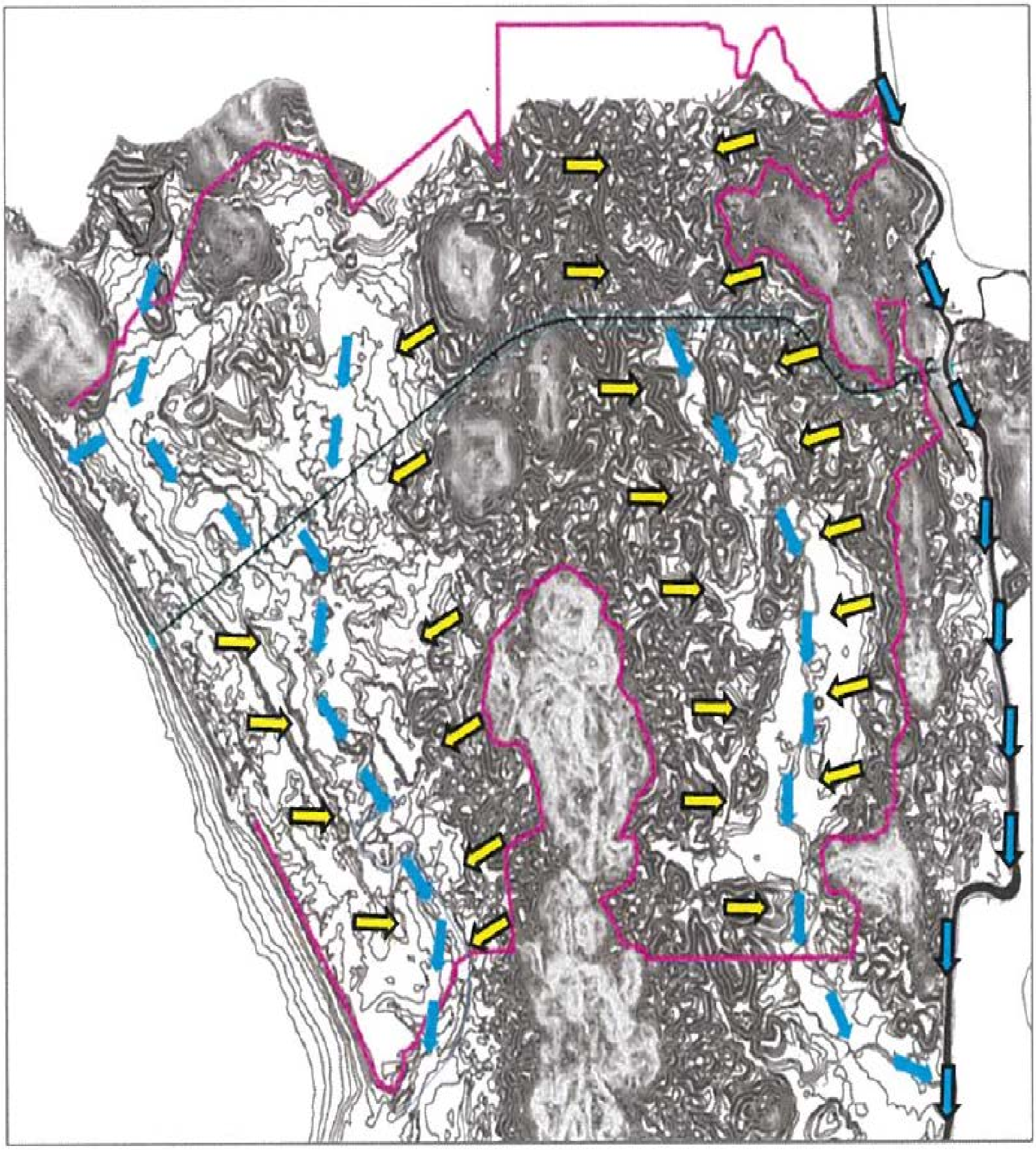


Figure 5.2-9 Topographic Condition and the Main Slope of the Project Area

The watershed in the project area comprises of two main basins; namely, Dawei basin and Andaman basin. Dawei basin situates in the East side of project area with natural water course flows from North to South and joins the Dawei River at the Southeast corner of the Project Area at Yebyu community. The Andaman basin situates in the West side of the project area with its natural watercourse flow in the direction of North-South and down to Andaman Sea in the vicinity of the Pan Din In community (Figure 5.2-10).

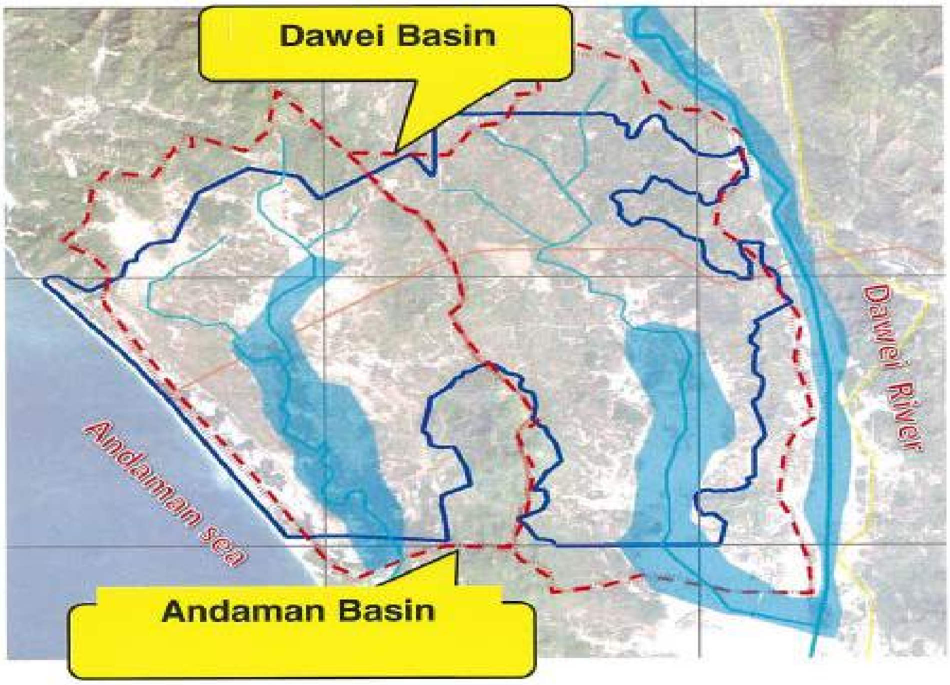


Figure 5.2-10 Basins in Dawei Project Area

Referring to the information from site reconnaissance by SEATEC (2012b), the maximum flood occurred on 10 August 2006 with the highest water level at +13.0 m. due to the overflow of Dawei River into the Dawei basin of the project. The Andaman basin inundates throughout the year, especially downstream of the basin, because the lowland nature of the area. The flood map of the historical events is depicted in Figure 5.2-11.

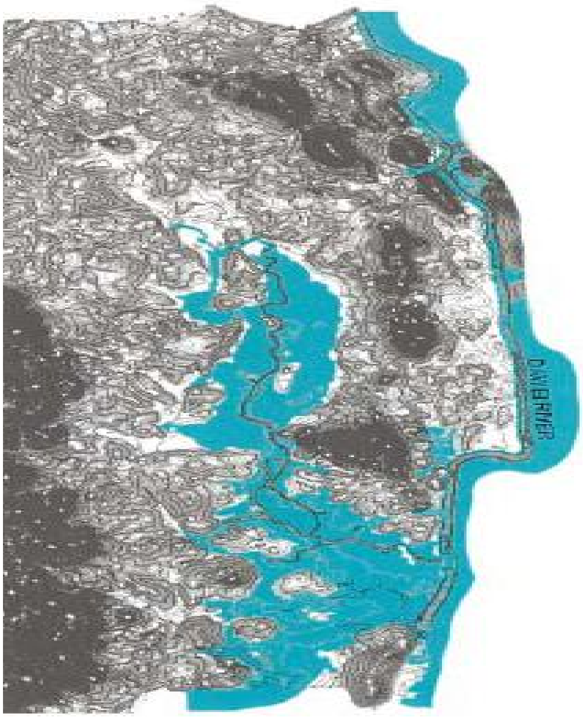


Figure 5.2-11 Historical Flood Map of Dawei Basin in August 2006

5.2.4 Climate and Air Quality

5.2.4.1 Study Area

The study area will cover the project boundary and the area potentially impacted by the project activities. For the study of climate, the secondary data from the local government in the adjacent area will be considered. For the study of air quality, the area both up and downwind of the study area will be covered. Also, the nearest sensitive area and permanent area of impact will be considered for ambient air quality.

5.2.4.2 Baseline Climate Conditions

The following previous studies in the area of Dawei Industrial Estate are reviewed:

- The Geology of Myanmar: An Annotated Bibliography of Burma's Geology, Geograhpy and Earth Science (USACE, 2008).
- Initial Environmental Examination (IEE) for Dawei Sea Port & Industrial Estate Development (TEAM, 2012).

Details of the methodology and results of the previous surveys and studies are summarized below.

Precipitation

The coastal region of Myanmar normally receives more than 200 inches (5,000 mm.) of precipitation, annually (USACE, 2008). The average annual rainfall from 1961-1990 in Dawei was in the range of 5,500-6,000 mm./year which was the zone with the highest rainfall in Myanmar. The highest rainfall recorded was 1,342 mm., occurring in August while the lowest rainfall recorded was 5 mm. occurring in December (Figure 5.2-12).

Considering the thirty year record from the Meteorological and Hydrological Department of Myanmar (TEAM, 2012), the highest rainfall recorded from 1979-2008 was 7,208.27 mm. in 1999, and the lowest was 4,027.17 mm. in 1988 (Table 5.2-3). From 1999-2010, the highest amount of rainfall was 6,818 mm. in 2006 and lowest was 3,068 mm. in 2010. The maximum average monthly rainfall generally occurred in August/July and the minimum average monthly rainfall generally occurred in December/January (Table 5.2-4).

Monsoons

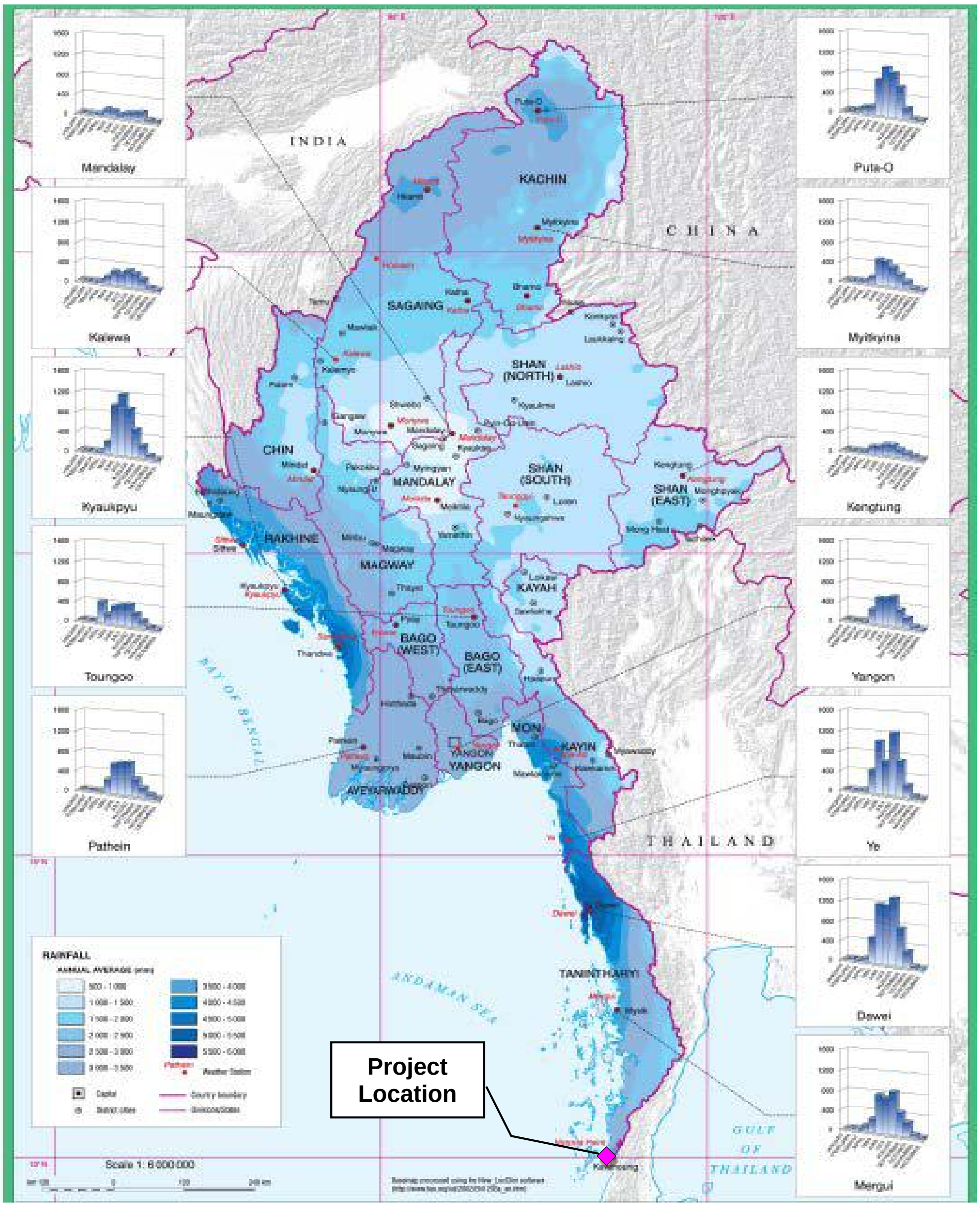
The monsoonal climate of the area along the Coast of Andaman Sea is generally hot and humid. From December to March, the temperature, humidity, and rainfall tend to be lower; therefore, it is known as the dry season. Violent thunderstorms occur during the wet season, mid-May to the end of September, forming from the South-West; while cyclones usually form to the South, West, and North of the Andaman Sea (Figure 5.2-13). The frequency of tropical cyclonic storms in the Bay of Bengal during 1891-1960 is shown in Figure 5.2-14.

Myanmar has a monsoon climate with three main seasons: the hot season; the rainy season; and the cool season. The hottest season is between February and May, with little or no rain. At the end of this season, generally from March to April, the average monthly temperature reaches the upper 30's^{o}C in many parts of Myanmar. The monsoon, or rainy, season occurs from May to October. During this rainy season, rain falls nearly every day, and sometimes all day long. Almost all of Burma's annual rainfall occurs during the rainy season. Rainfall during the monsoon season totals more than 250 cm. (100 in.) in lower Myanmar. The annual precipitation in most of lower Myanmar averages about 5,080 mm. (about 200 in.). The climate is tropical; with wet, hot, and humid summers during the height of the monsoon season, from June to September. The cool season runs from late October to mid-February.The temperature for January averages 25°C in Lower Myanmar. The average daily temperatures in Yangon range from 18°C to 32°C in January (USACE, 2008).

Temperature

The mean annual temperature is 27°C. Although Myanmar is a tropical country, temperatures are not uniformly high throughout the year. The average daily temperatures in lower Myanmar, especially in the river delta and along the coastal regions, are the most humid. The coastal and delta regions have a mean annual temperature of 32°C (USACE, 2008).

According to the TEAM (2012), the recorded average temperature of Dawei Meteorological Station from 1991-2005 is ranged from 32oC in December to 34oC in April. Annual Average temperature in the Yebyu Township, Dawei area, from 1991 to 2005, is presented in Table 5.2-5.



Source: http://dwms.fao.org/atlases/myanmar/downs/atlas/p031_rainfall_map.pdf accessed on 3 June 2015

Figure 5.2-12 Average Rainfall in Myanmar

Table 5.2-3 Annual Rainfall of Dawei Area (1979-2008)

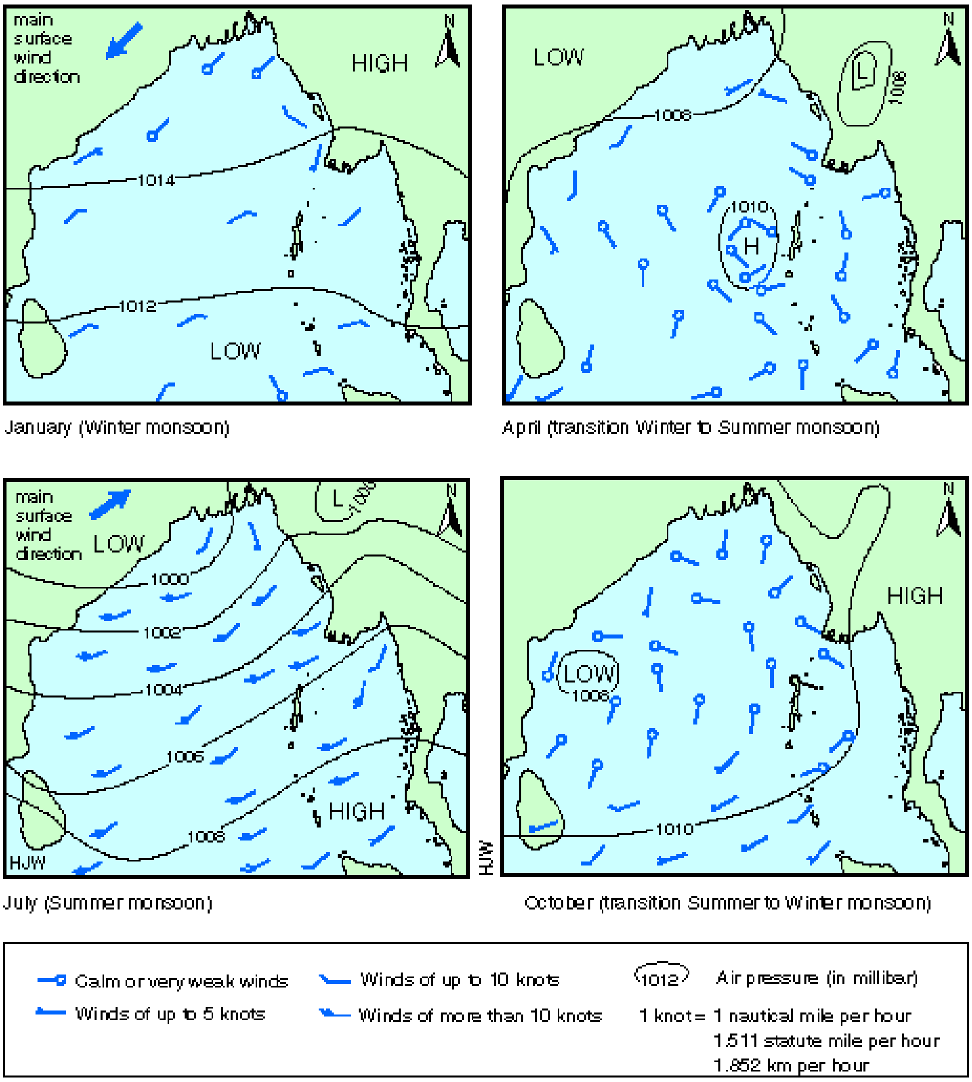
Year	Annual Rainfall (mm)	Year	Annual Rainfall (mm)	Year	Annual Rainfall (mm)
1979	5017.22	1989	4536.95	1999	7208.27
1980	6443.47	1990	5570.22	2000	5867.15
1981	5433.31	1991	5487.42	2001	5922.01
1982	2711.45	1992	4588.51	2002	5849.62
1983	4842.76	1993	4794.00	2003	5377.18
1984	6500.37	1994	6017.51	2004	5487.92
1985	5373.88	1995	5486.15	2005	5857.24
1986	4381.50	1996	5227.32	2006	6831.84
1987	5161.03	1997	6732.27	2007	5385.31
1988	4027.17	1998	4035.55	2008	5507.74

Source: Department of Geography, University of Yangon (2012)

Table 5.2-4 Average Rainfall at Dawei Station (LAT:14º 16'N LONG: 98º 13'E) between 1999-2010

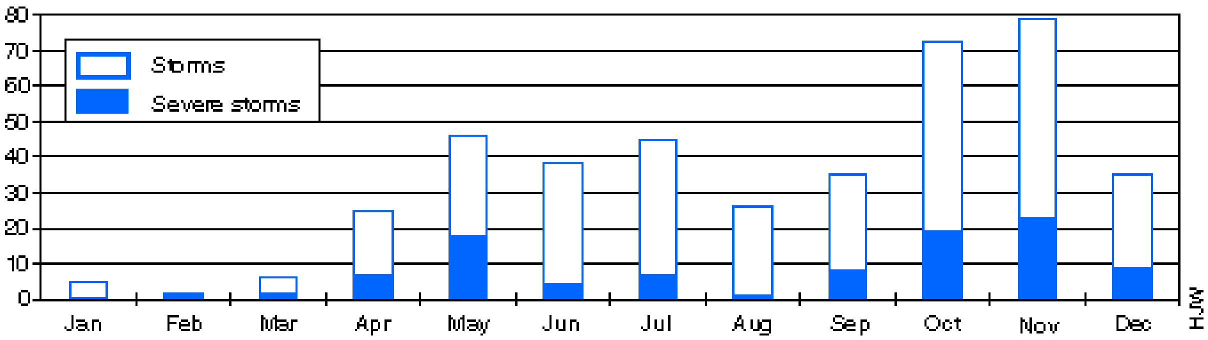
Year	Average Rainfall (mm.)												Annual
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1999	52	7	120	916	747	1145	525	1341	755	410	176	1	6195
2000	12	25	49	267	815	1131	1377	1247	927	285	6	0	6141
2001	7	6	113	6	980	1311	986	1974	323	184	21	9	5920
2002	0	0	13	47	972	959	1278	1471	1346	116	114	15	6331
2003	1	1	189	68	566	904	1431	1205	706	256	0	0	5327
2004	3	11	57	8	931	1030	665	1370	268	109	0	0	4452
2005	0	8	8	20	419	1234	1664	1011	857	186	120	6	5533
2006	0	24	67	215	759	738	2081	1880	604	448	0	0	6816
2007	1	0	0	117	610	620	1460	1228	815	454	7	0	5312
2008	0	52	47	188	975	1026	1038	766	1149	259	51	0	551
2009	0	0	47	283	416	1223	1825	903	1107	440	6	0	6250
2010	31	0	0	0	411	478	478	832	417	381	0	40	3068
SUM	107	134	710	2135	8601	11799	14808	15228	9274	3528	501	71	66896
Average	9	11	59	178	717	983	1234	1269	773	294	42	6	5575
Distribution Ratio %	0.16	0.20	1.06	3.19	12.86	17.64	22.14	22.76	13.86	5.27	0.75	0.11	100

Source: Meteorological and Hydrological Department (2010)



Source: http://www.andaman.org/maps/textmaps.htm accessed on 19 November 2012

Figure 5.2-13 Seasonal Winds and the Monsoon in the Bay of Bengal



Source: http://www.andaman.org/maps/textmaps.htm accessed on 19 November 2012

Figure 5.2-14 Frequency of Tropical Cyclonic Storms in the Bay of Bengal during 1891-1960

Table 5.2-5 Temperature Condition of Dawei Meteorological Station between 1991-2005

Year	Temperature (degree Celsius)												Average
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1991	24	26.11	27.78	29.72	29.72	28.1	26.38	25.55	27.2	25.83	24	25	26.68
1992	23	23	25.55	27.2	29.72	27.5	26.11	26.67	27.5	26.94	25	22.78	25.93
1993	23	26.67	27.78	28.61	30	27.5	26.11	26.11	26.94	26.94	26.3	24	27.3
1994	25.27	26.38	26.67	29.16	28.33	27.5	27.2	26.67	28.61	27.2	26.38	27.5	27.3
1995	23.33	25.83	27.78	29.16	29.16	28	27.2	26.94	27.5	27.78	26.11	22.5	26.78
1996	22.5	25	28.61	29.16	27.2	28.3	26.94	26.94	26.11	27.2	26.67	22.78	26.46
1997	22.78	23.61	28.33	28.88	29.16	28	27.27	26.38	26.38	28.3	28.61	26.67	26.87
1998	27.5	27.27	27.5	28.83	19.72	26.38	26.38	25.55	27.5	26.11	25.83	25.56	26.62
1999	23.61	26.11	24	29.16	26.94	27.2	27.2	25	28	27.2	25.83	20.83	25.83
2000	24.16	25	26.94	27.78	28.88	28	27.5	29.16	27.78	29.44	27.2	25	27.24
2001	26.94	25.78	28.78	29.5	27	27.78	26.3	24.6	27.27	28.1	24.22	26.61	26.56
2002	24.78	24.78	29.44	28.78	30	27.1	32	26.33	26.78	26.38	27	26.2	27.95
2003	24.16	26.38	27.61	27.72	29	25.83	26.11	26.5	26.16	27.38	26	24.3	26.35
2004	25.5	25	26.62	30.67	31	27.38	26.88	26.3	27.89	26.5	29.5	32.22	29.95
2005	25	26.22	27.8	28.4	27.88	26.38	26	25.9	32.1	27	26.61	25.2	26.88
Average	24.26	25.41	27.44	28.82	28.91	26.92	26.8	26.25	27.08	27.16	26.5	25.1	-

Source: Meteorological and Hydrological Department (2012)

5.2.4.3 Baseline Air Quality Conditions

(a) Results from Previous Surveys and Studies: The following previous studies are reviewed;

- Initial Environmental Examination (IEE) for Dawei Sea Port & Industrial Estate Development (TEAM, 2012a).
- Final Study of Environmental Impact Assessment (EIA) for the Dawei Sea Port (TEAM, 2013).
- Environmental Impact Assessment (EIA) for Main Road (SEATEC, 2012a)

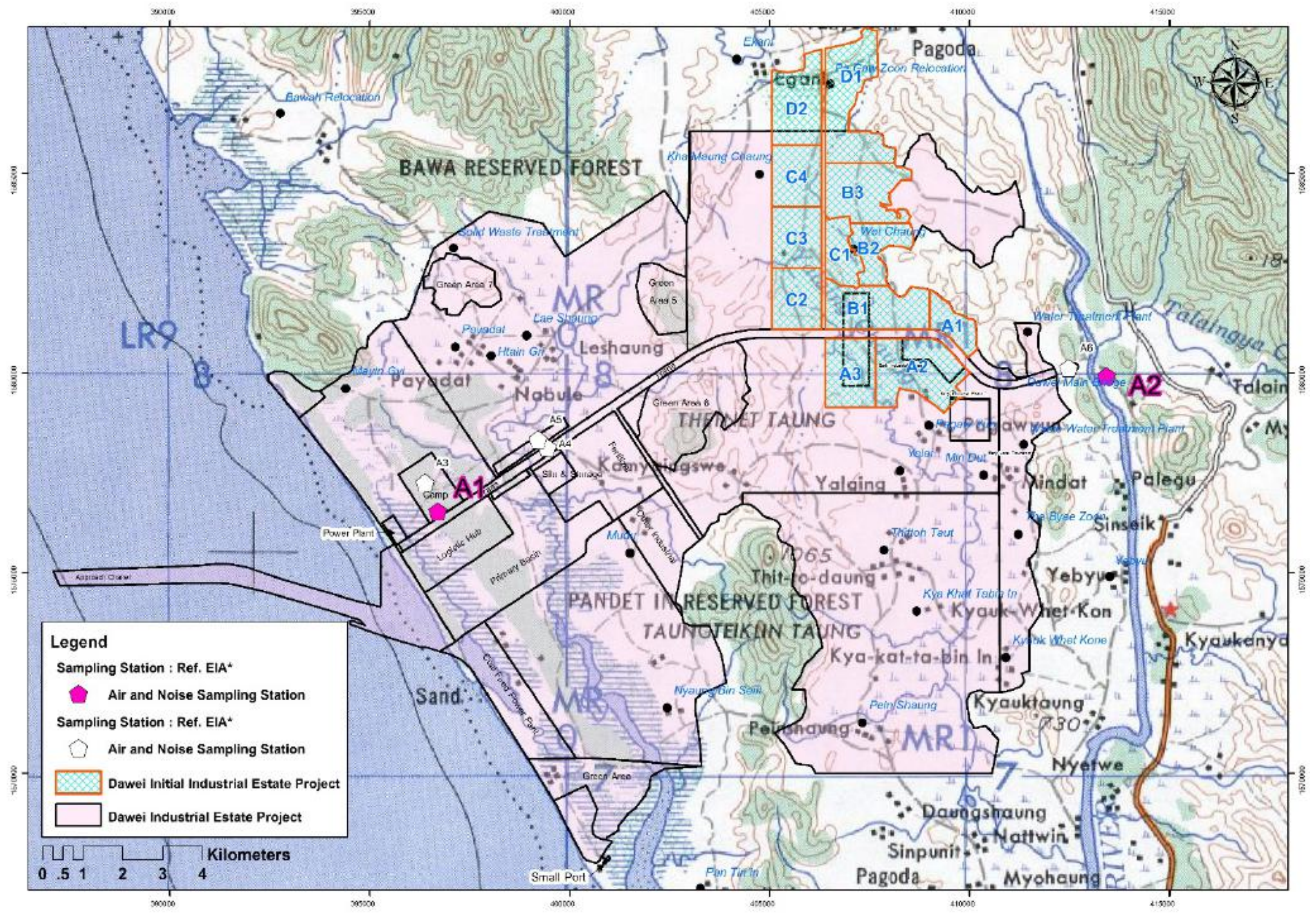
Details of the results of the previous surveys and studies are summarized below.

<u>Methodology</u>

- There are four stations **Figure 5.2-15** for air quality measurement from the previous studies:
- There are six stations for air quality measurement from the previous studies:
  - Station A3: The Construction Area (396,389 E, 1,577,260 N)
  - Station A4: The Guard House (399,444 E, 1,578,143 N)
  - Station A5: Km. 4+500 of Main Road (399,211 E, 1,578,342 N)
  - Station A6: Km. 18+900 of Main Road (412,483 E, 1,580,131 N)

<u>Results of the Studies</u>

From the previous studies (the results are shown in Table 5.2-6), the concentration of TSP (an average of 24 hours) and PM10 (an average of 24 hours were quite high compared to the other pollutants, especially during the dry season. The maximum concentration of PM10 during the dry season, for station A5 and A6, exceeded WHO ambient air quality guidelines, but there still met U.S. EPA National Ambient Air Quality Standards. The concentration of gas pollutants: SO2; NO2; and CO were within the World Bank Group, U.S. EPA and WHO standards. The THC, MHC, and NMHC were measured in preparation of baseline data, even though there were no standards given.



Remark:* Ref. EIA is "Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (2013)."

Figure 5.2-15 Reviewed Air Quality and Noise Measurement Stations Compared with Stations of The Environmental Impact Assessment for Dawei Industrial Development Estate Project (Previous Area for 2013)

Table 5.2-6 Result of the Reviewed Air Quality Data from Previous Studies

Parameter	Unit	Dry Season		Wet Season				Standard
		A5	A6	A3	A4	A5	A6	
TSP- 24 hr.	µg/m^3	163-198	116-212	16.74-36.60	42.60-64.89	18-27	13-19	230[1/]
PM_{10}-24 hr.	µg/m^3	85-106	46-72	-	-	12-16	4-9	150[2/],50[3/]
SO_2-24 hr.	µg/m^3	-	-	<50	<50	-	-	150[1],125[3//]
NO_x-1 hr.	ppm	0.0102-0.0218	-	-	-	0.0068-0.0109	0.0036-0.0047	-
NO-1 hr.	ppm	0.0031-0.0081	-	-	-	0.0031-0.0055	0.0016-0.0022	-
NO_2-1 hr.	ppm	0.0076-0.0103	-	-	-	0.0040-0.0054	0.0020-0.0025	0.11[3/]
NO_2-24 hr.	ppm	-	-	<18.0	<18.0	-	-	150[1/]
CO-1 hr.	ppm	0.5-0.7	-	-	-	0.3-0.4	0.3	35[2/], 25[3/]
THC	ppm	2.60-3.38	2.33-2.88	-	-	-	-	-
MHC	ppm	2.33-3.22	2.16-2.84	-	-	-	-	-
NMHC	ppm	0.16-0.27	0.04-0.19	-	-	-	-	-

Remark: [1/] Ambient Air Quality in Power Plant “Thermal Power: Guide lines for New Plant”, Pollution Prevention and Abatement Handbook (World Bank, 1999).

[2/] U.S. EPA National Ambient Air Quality Standards (U.S. EPA, 2011)

[3/] WHO Ambient Air Quality Guidelines (WHO, 2006)

(b) Results from the Study of EIA for Dawei Industrial Estate Project:

- Air quality measurements were conducted during December 2012 (after monsoon season) and March 2013 (before monsoon season). The air quality was measured at two sampling stations, located on east and west sides of the project area with relevant to the direction of northeast and southwest monsoons (Figure 5.2-16):
  - Station A1: VIP Resident at ITD Camp (396,821 E, 1,576,646 N)
  - Station A2: Doot Loot Temple (413,446 E, 1,579,929 N)

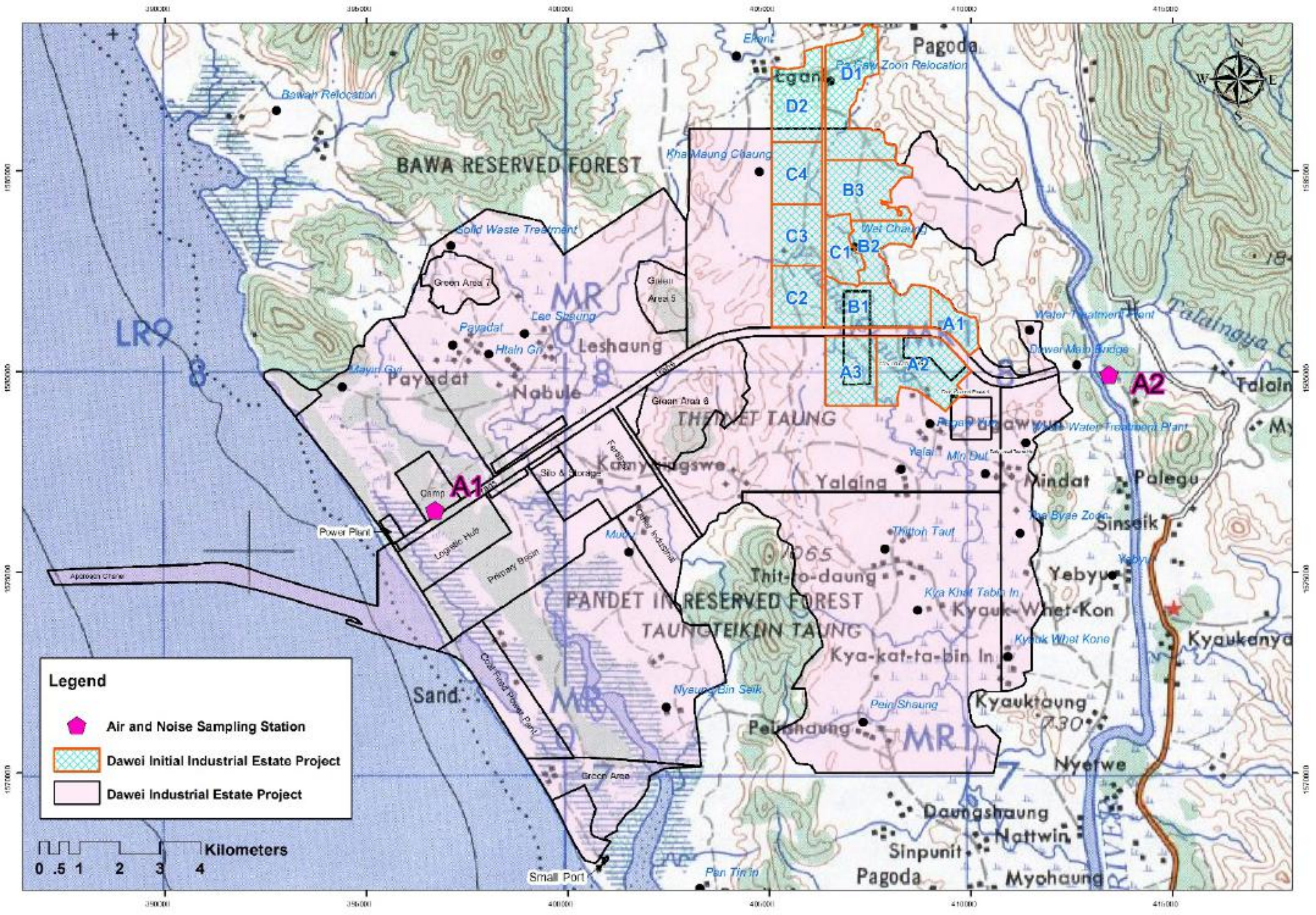
- The concerned air quality parameters include: TSP; PM_{10}; SO_2; NO_2; CO; THC/MHC/NMHC; and wind speed and direction.
  - Station A1: VIP Resident at ITD Camp (UTM (WGS84) 47P 396,821 E, 1,576,646 N)

The air quality results from the EIA for Dawei Industrial Estate Project which sampled on 2-5 December 2012 and 4-7 March 2013 are shown as follows;

From both sampling events, the concentrations of TSP (average 24 hours) were between 122-142 µg/m^3 and 120-210 µg/m^3, particulate size less than 10 micron (PM_{10}) (average 24 hours) were between 63-90 µg/m^3 and 84-104 µg/m^3, respectively. Most of particulate matter results were not over standard except PM_{10} which complied with the recommendations of the World Bank (World Bank, 1999) and U.S. EPA (U.S. EPA, 2011) but did not comply with the recommendation of WHO (WHO, 2006).

The major activities, which may cause high concentrations of PM_{10}, may include: dust dispersion from road transportation near sampling station, and emission from diesel engine vehicles, such as trucks and heavy equipments, or machines. Dry weather could also be another factor for high levels of TSP and PM_{10}. Additionally, higher PM_{10} in the second survey may be constituted by nearby construction activities.

The concentrations of NO_2 (1 hour) from both sampling events were between 0.0006-0.0072 ppm and 0.0019-0.0096 ppm, respectively. CO concentrations (1 hour) were between 0.29-1.57 ppm and 0.53-1.97 ppm, respectively.The concentrations of SO_2 (1 hour) from both sampling periods were between 0.0008-0.0053 ppm and 0.0035-0.0245 ppm and the concentration of SO_2 (24 hours) were between 3.93-6.02 µg/m^3 and 4.45-5.76 µg/m^3 respectively. The results of these parameters are within standards (Table 5.2-7). THC, MHC and NMHC were measured as baseline data despite of no standard requirements (Table 5.2-8) The average wind directions at this station from both sampling periods are predominantly from East North East (ENE) and East (E) as shown in Table 5.2-9 and Figure 5.2-16 The air quality results of A1 station are not much different from the results collected during the dry season from previous studies. This is mainly because the activities in the study area are quite similar, construction of the access road, and clearing the land.



Source: Environmental Impact Assessment (EIA) for Dawei IndustrialEastate Development Project (2013).

Figure 5.2-16 Ambient Air Quality and Noise Sampling Station (Previous Area, 2013)

Table 5.2-7 Result of Particulate Matters, SO_2, NO_2, and CO Analysis in December 2012 and March 2013

Parameter	Unit	December 2012						March 2013						Standards			
		Station A1			Station A2			Station A1			Station A2						
		2-3 Dec	3-4 Dec	4-5 Dec	2-3 Dec	3-4 Dec	4-5 Dec	4-5 Mar	5-6 Mar	6-7 Mar	4-5 Mar	5-6 Mar	6-7 Mar	a	b	c	d
TSP (24 hours)	µg/m^3	122	142	142	48	55	52	179	210	120	77	91	194	230	-	-	330
PM_{10} (24 hours)	µg/m^3	63*	86*	90*	36	42	42	84*	104*	90*	54*	64*	106*	150	150	50	120
SO_2(24 hours)	ppm	0.0015	0.0018	0.0023	0.0018	0.0012	0.0014	0.0017	0.0019	0.0022	0.0041	0.0033	0.0030	-	-	-	-
	µg/m^3	3.93	4.71	6.02	4.71	3.14	3.66	4.45	4.97	5.76	10.73	8.64	7.85	150	-	125	300
SO_2(1 hour)	ppm	0.0009-0.0022	0.0008-0.0050	0.0010-0.0053	0.0007-0.0035	0.0007-0.0017	0.0007-0.0027	0.0035-0.0078	0.0040-0.0245	0.0036-0.0196	0.0030-0.0218	0.0010-0.0250	0.0033-0.0268	-	-	-	0.30
NO_2(1 hour)	ppm	0.0006-0.0039	0.0008-0.0066	0.0008-0.0072	0.0013-0.0052	0.0010-0.0066	0.0009-0.0068	0.0019-0.0038	0.0026-0.0096	0.0019-0.0065	0.0013-0.0180	0.0004-0.0233	0.0016-0.0248	-	-	0.11	0.17
CO (1 hour)	ppm	0.29-1.33	0.74-1.54	0.34-1.57	0.75-1.48	0.74-1.35	0.92-1.94	0.64-1.69	0.59-1.97	0.53-1.77	0.56-1.78	0.45-2.86	0.81-3.66	-	35	25	30

Remark:

a : Ambient Air Quality in Power Plant "Thermal Power: Guidelines for New Plant", Pollution Prevention and Abatement Handbook (World Bank, 1999)

b : U.S.EPA National Ambient Air Quality Standards (U.S.EPA, 2011)

c : WHO Ambient Air Quality Guidelines: Global Update 2005 (WHO, 2006)

d : Thailand Ambient Air Quality Standards

TSP, PM_{10} and SO_2 average 24 hours - No.24, B.E 2547 (2004)

SO_2 average 1 hour - No.21, B.E.2544 (2001)

NO_2 average 1 hour - No.33, B.E.2552 (2009)

CO average 1 hour - No.10, B.E.2538 (1995)

* The result did not comply with WHO Ambient Air Quality Guidelines, Global update 2005

Table 5.2-8 Result of Hydrocarbon Analysis in December 2012 and March 2013

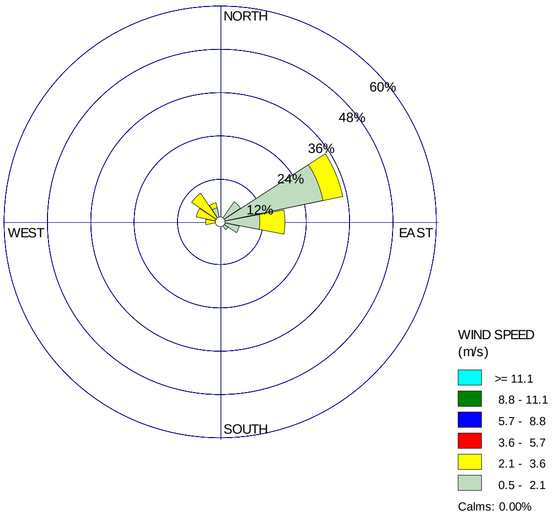
Parameter	Unit	December 2012						March 2013					
		Station A1			Station A2			Station A1			Station A2		
		2-3 Dec	3-4 Dec	4-5 Dec	2-3 Dec	3-4 Dec	4-5 Dec	4-5 Mar	5-6 Mar	6-7 Mar	4-5 Mar	5-6 Mar	6-7 Mar
Total Hydrocarbons	ppm	2.45	2.89	3.22	2.28	7.99	4.02	2.58	2.77	2.74	2.94	2.67	2.73
Methane Hydrocarbon	ppm	2.45	2.89	3.22	2.28	2.56	2.28	2.26	2.77	2.74	2.43	2.57	2.73
Non-Methane Hydrocarbon	ppm	<0.05	<0.05	<0.05	<0.05	5.43	1.74	0.32	<0.05	<0.05	0.51	0.10	<0.05

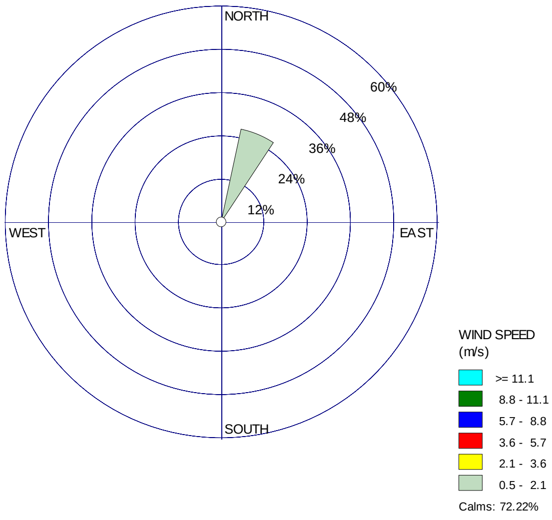
Source: Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (2013).

Table 5.2-9 Result of Wind Speed and Wind Direction in December 2012 and March 2013

Parameter	Unit	December 2012						March 2013					
		Station A1			Station A2			Station A1			Station A2		
		2-3 Dec	3-4 Dec	4-5 Dec	2-3 Dec	3-4 Dec	4-5 Dec	4-5 Mar	5-6 Mar	6-7 Mar	4-5 Mar	5-6 Mar	6-7 Mar
Wind Speed	m/sec	0.7-2.8	0.7-3.3	0.8-3.5	0.3-0.6	0.3-0.8	0.3-0.7	1.7-5.6	1.2-4.0	0.7-5.5	0.3-1.6	0.3-1.3	0.3-1.4
Wind Direction	-	ENE	E	ENE	NNE	NNE	NNE	ENE	E	E	W	WSW	NNW

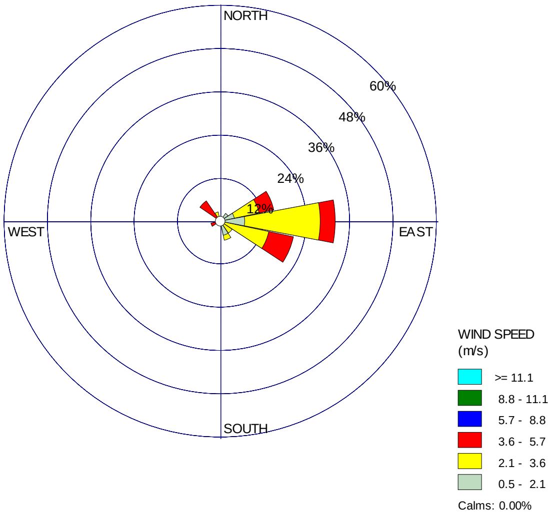
Source: Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (2013).

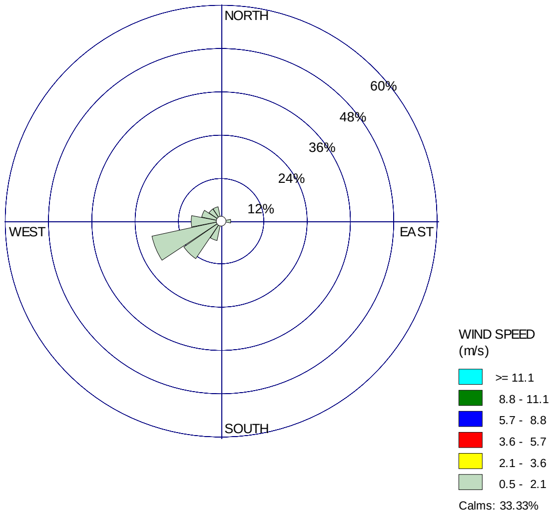




Station A1: VIP Resident at ITD Camp **Station A2: Doot Loot Temple**

1) Wind Direction on 2-5 December 2012





Station A1: VIP Resident at ITD Camp **Station A2: Doot Loot Temple**

2) Wind Direction on 4-7 March 2013

Figure 5.2-17 Wind Direction on 2-5 December 2012 and 4-7 March 2013

Station A2: Doot Loot Temple (UTM (WGS84) 47P 413,446 E, 1,579,923 N)

The air quality samplings were conducted on 2-5 December 2012 and 4-7 March 2013.Sampling locations of both sampling periods were slightly different. Due to construction activities with the wood shaving machine placed at the sampling area.

The concentrations of TSP (average 24 hours) were between 48-55 µg/m^3 and 77-194 µg/m^3, particulate size less than 10 micron (PM_{10}) (average 24 hours) were between 36-42 µg/m^3 and 54-106 µg/m^3, for the first and second sampling respectively. Most results of particulate matter were not over standard except for PM_{10} from the second sampling which complied with the recommendations of the World Bank (World Bank, 1999) and U.S. EPA (U.S. EPA, 2011) but did not the recommendation of WHO (WHO, 2006). The major activity that may cause high PM_{10} during the second sampling was burning dry leaves and construction activities about 10-20 m. nearby the sampling station. Also, wood shaving was observed during daytime of sampling period.

The concentrations of NO_2 (1 hour) from both sampling periods were between 0.0009-0.0068 ppm and 0.0004-0.248 ppm, and CO (1 hour) were between 0.74-1.94 ppm and 0.45-3.66 ppm, respectively. The concentration of SO_2 (1 hour) from both sampling periods were between 0.0007-0.0035 ppm and 0.0010-0.0248 ppm and the concentration of SO_2 (24 hours) were between 3.14-4.71 µg/m^3 and 7.85-10.73 µg/m^3 respectively. The results of these parameters were within standards (Table 5.2-7). However, high levels of TSP, PM_{10}, NO_2 and CO were observed on the third day of second sampling period. These high levels may be caused by burning dry leaves in the garden closed to the sampling station on that day.

THC, MHC and NMHC were measured for preparation of baseline data eventhough no standards have been established. However, the higher levels of THC and NMHC on the second sampling day of first sampling period could be caused by burning wooden charcoal in the kitchen nearby area.

The wind directions at this station from both sampling periods were predominantly from North North East (NNE) and West South West (WSW), respectively, as shown in Table 5.2-9 and Figure 5.2-17. Notice that at A2 the sampling area was surrounded by very high betel trees, mostly much higher than the wind speed and direction pole.

Comparisons of air quality results between parameters measured in the previous studies and the EIA for Dawei Industrial Estate Project study during the dry season indicated not much differences levels of TSP and PM_{10} (average 24 hours), NO_2 (1 hour), and CO (1 hour). Several high levels observed during this study were caused by specific activities at each location occurring only at the sampling period, not the usual activity in the area.

(C) Results of AERMOD from the Study of EIA for Dawei Industrial Estate Project:

Estimated result during operation phase of the Dawei Industrial Estate Project that been predicted by AERMOD mathematical modeling showed that the calculated assimilative capacity of ambient air concentration is used in the air pollution modeling analysis. Trial and error method is employed by varying the emission of stack emissions in order to achieve these values. Parameters of air pollutants in this analysis are PM10 (24 hr average), NO2 (1 hr

average) and SO2 (24 hr average). Results from AERMOD analysis are emission rate and ambient ground level concentration at receptor points as shown in Table 5.2-10. The isopleths of air pollutant concentration are as illustrated in Figure 5.2-18 to Figure 5.2-20 Results can be summarized as follow:

PM_{10}

It is found that, the emission rate of about 0.0025 kg/ha/day at the stacks will result to maximum ground level concentration of PM_{10} as about 44.98 µg/m^3. These values are about 29.98% of ambient air quality guideline of PM_{10} as designated by the World Bank (≤150 µg/m^3, 24 hr average).

Nitrogen dioxide (NO_2)

It is found that, the emission rate of about 0.0031 kg/ha/day at the stacks will result to maximum ground level concentration of NO_2 as about 166.92 µg/m^3. These values are about 83.92% of ambient air quality guideline of NO_2 as designated by the World Bank (≤ 200 µg/m^3, 24 hr average).

Sulfur dioxide (SO_2)

It is found that, the emission rate of about 0.0075 kg/ha/day at the stacks will result to maximum ground level concentration of SO_2 as about 128.93 µg/m^3.These values are about 85.95% of ambient air quality guideline of SO_2 as designated by the World Bank (≤ 150 µg/m^3, 24 hr average).

These estimated results indicate that by using these emission limit, the concentration of ambient air quality (PM_{10}, NO_2 and SO_2) will not exceed the ambient air quality guideline, designated by the World Bank and WHO as well as be within the assimilative capacity of the area which are set as 45, 167 and 129 µg/m^3 for PM_{10}, NO_2 and SO_2, respectively

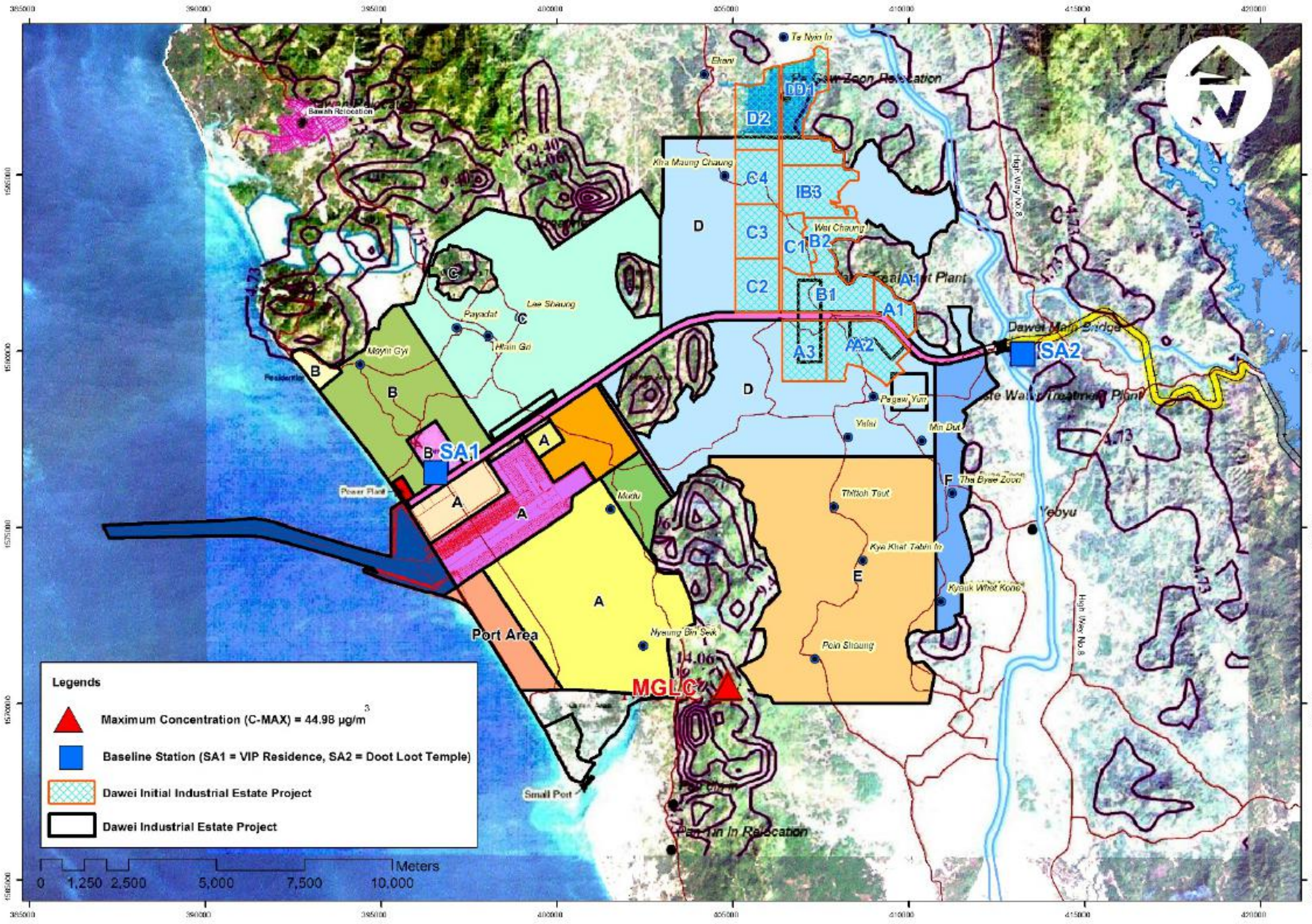
Table 5.2-10 Emission Rate and Ambient Air Concentration at Receptor Point

Air pollutants	Air quality guideline	No. of stack	Emission loading		Ambient air concentration		Maximum ground level concentration	
					(SA1) VIP Resident at ITD Camp	(SA2) Doot Loot Temple	Geographical coordinate	concentration
	(μg/m^3)		(g/s)	(kg/ha/day)	(μg/m^3)	(μg/m^3)	(UTM)	(μg/m^3)
PM_{10} (24 hr average)	150 [1/] 45 [3/]	185	0.577	0.00250	2.40	2.93	405000E, 1570500N	44.98
NO_2 (1hr average)	200 [2/] 167 [3/]	185	0.642	0.003125	7.92	8.42	411000E, 1571500N	166.92
SO_2 (24 hr average)	150 [1/] 129 [3/]	185	1.654	0.00750	6.89	4.59	405000E, 1570500N	128.93

Remark: [1/] Pollution Prevention and Abatement Handbook WORLD BANK GROUP Effective July, 1998

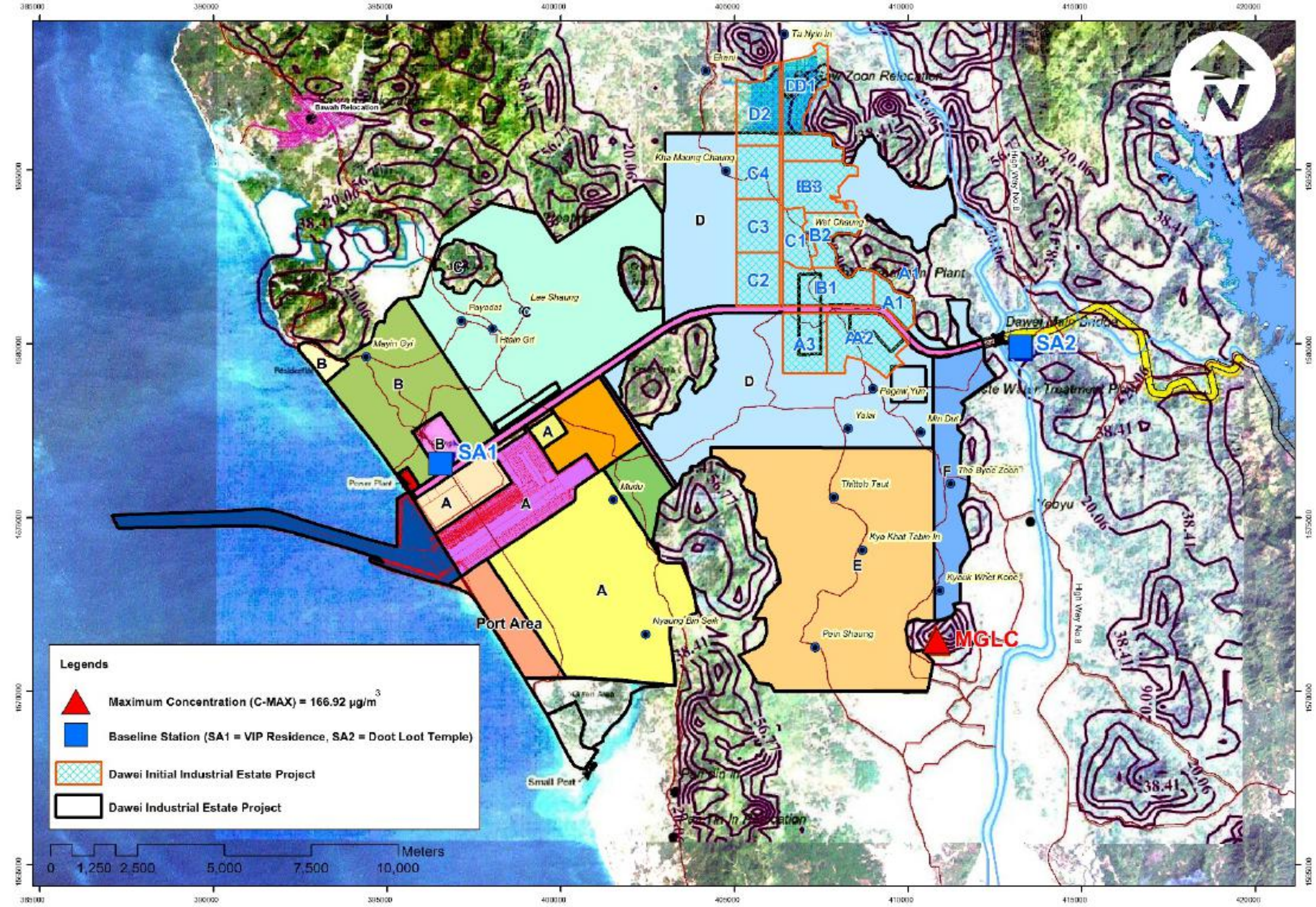
[2/] WHO Ambient Air Quality Guidelines stated on Environmental, Health, and Safety Guidelines: Environmental Air Emissions and Ambient Air Quality of International Finance Corporation, April 30, 2007

[3/] From Assimilative capacity values



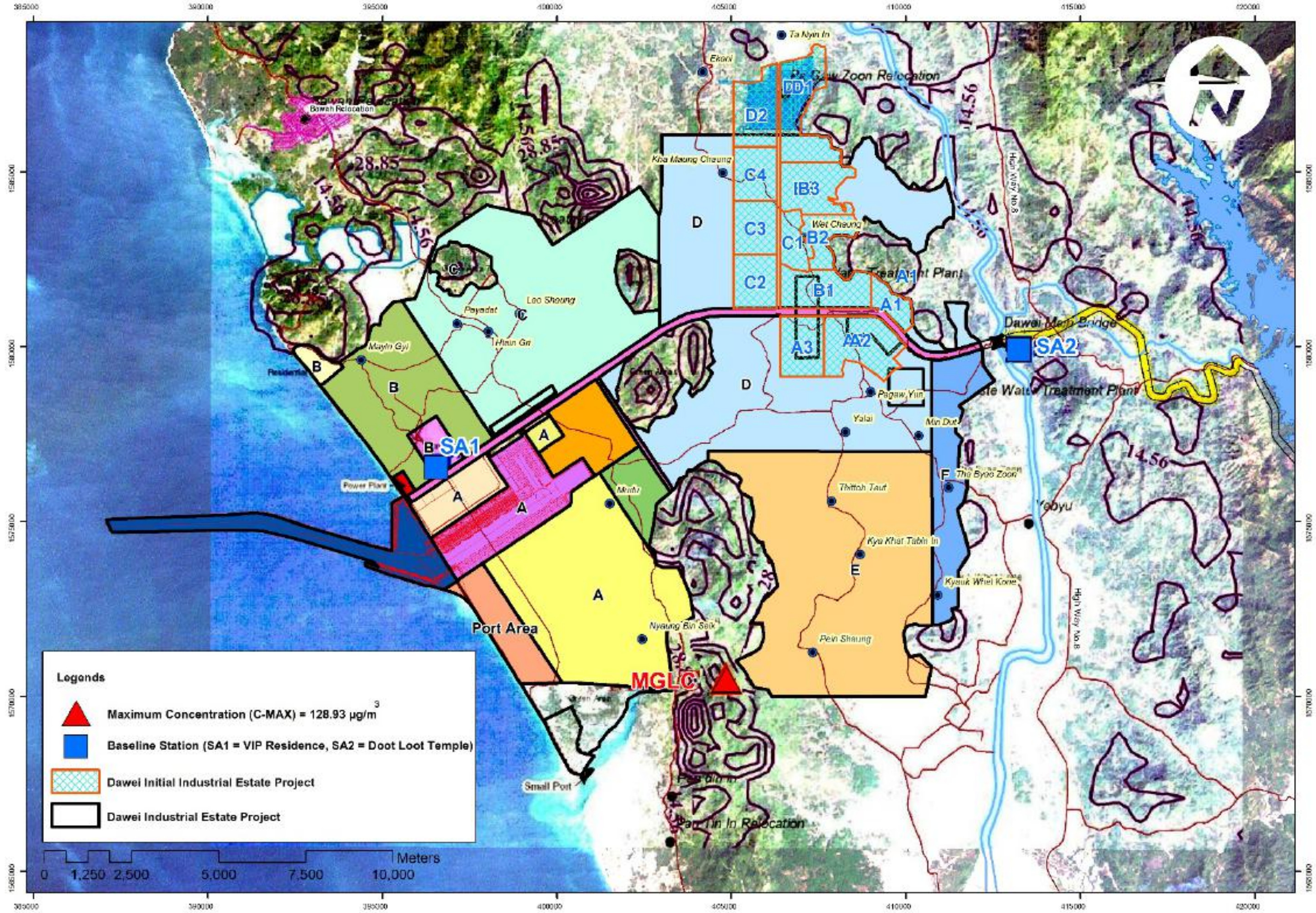
Source: Study of EIA for Dawei Industrial Estate Project (SEATEC, 2013)

Figure 5.2-18 Isopleth of PM_{10} Concentration (24 hr Average)



Source: Study of EIA for Dawei Industrial Estate Project (SEATEC, 2013)

Figure 5.2-19 Isopleth of NO_2 Concentration (24 hr Average)



Source: Study of EIA for Dawei Industrial Estate Project (SEATEC, 2013)

Figure 5.2-20 Isopleth of SO_2 Concentration (24 hr Average)

Summary of the air pollution assessment

Dispersion of air pollutant of this study I carried out by using the AERMOD dispersion model. Parameters of air pollutant in this analysis are PM10, NO2 and SO2. The assimilative capacity value of these air pollutants are estimated taking into account the ambient air quality guideline values, designated by the World Bank and WHO together with the maximum ground level concentration of air pollutant from the measurement. As for conservative purpose, the 90% of ambient air quality guideline are employed in the analysis. However, the results are presented in both 80% and 90% of the guideline values as an option for further consideration in area-based air pollution control as shown in Table 5.2-11 It is expected that the impact caused by air pollution in this area will be as the minimum to moderate level if the industrial complex can control the emission amount of air pollution according to this calculated values.

Table 5.2-11 Calculated Emission Rate of Stack Sources

Air pollutants	Stack height	Emission rate	
	(m)	(g/s)	(kg/ha/day)
PM_{10}	0 - 200	0.577	0.0025
Nitrogen dioxide (NO_2)	0 -200	0.642	0.003125
Sulfur dioxide (SO_2)	0 -200	1.654	0.0075

5.2.5 Noise and Vibration

5.2.5.1 Study Area

The study area covers the areas that may be affected the potential impact from project construction and operation. The nearest sensitive areaswere selected to represent the existing condition of the study area.

5.2.5.2 Baseline Noise and Vibration Conditions

(a) Results from the Previous Surveys and Studies

Noise and vibration measurements from relevant environmental studies are reviewed:

- Initial Environmental Examination for Dawei Sea Port & Industrial Estate Development (TEAM, 2012).
- Final Study of Environmental Impact Assessment for the Dawei Sea Port (TEAM, 2013).
- Environmental Impact Assessment for Main Road (SEATEC, 2012).

Summary of methods and results from the previous studies are presented below.

Methodology

- There are 4 stations for noise measurement from the previous studies which are the same location as the air quality stations:
  - Station A3: The Construction Area (396,389 E, 1,577,260 N)
  - Station A4: The Guard House (399,444 E, 1,578,143 N)
  - Station A5: Km. 4+500 of Main Road (399,211 E, 1,578,342 N)
  - Station A6: Km. 18+900 of Main Road (412,483 E, 1,580,131 N)
- There are 2 stations for vibration measurement from the previous studies:
  - Station A5: Km. 4+500 of the Main Road (399,211 E, 1,578,342 N)
  - Station A6: Km. 18+900 of the Main Road (412,483 E, 1,580,131 N)

The collected noise measurements (Table 5.2-12) showed that all of L_{Aeq} at 24 hr. and L_{Amax} data, both dry and wet seasons, were within the U.S.EPA and Thai standards; however, the $L_{Aeq\text{-}24\ hr}$ in the construction area (A3) and Km 18+900 of the main road (A6) were higher than the other stations because these areas have many construction activities.The primary noise sources were from mobilization of the construction equipment. The results of the study of vibration (Table 5.2-13) found that the Peak Particle Velocity of both stations, A5 and A6, did not affect any building more than 2.0 mm./s. The major sources of vibration were from trucks on the existing road.

(b) Results from the Study of EIA for Dawei Industrial Estate Project

- Noise level measurements were conducted during December 2012 (after monsoon season) and March 2013 (before monsoon season), which is the same period of air quality sampling. Two sampling stations are located at the same location as the air quality sampling station:
  - Station A1: VIP Resident at ITD Camp (396,821E, 1,576,646N)
  - Station A2: Doot Loot Temple (413,446E, 1,579,923N)
- Noise level parameters include: $L_{Aeq\ 1\ hour}$, $L_{Aeq\ 24\ hour}$, L_{A90}, L_{Amax}, L_{Adn}, L_{A5min}, and L_{A90} for nuisance noise.

Station A1: VIP Resident at ITD Camp

The results from the EIA for Dawei Industrial Estate Project which surveyed during 2-5 December 2012 and 4-7 March 2013 found that $L_{Aeq\ 1\ hour}$ were between 49.5-61.7 dB(A) and 45.1-54.9 dB(A), $L_{Aeq\ 24\ hours}$ were between and 53.2-54.9 and 50.4-50.5 dB(A), L_{Amax} were between 65.5-91.4 and 59.4-80.7 dB(A), and L_{Adn}, were between 58.6-58.8 and 55.1-55.7 dB(A) respectively. In additional L_{A90} were between 45.4-54.2 and 40.0-47.1 dB(A).

All the noise levels were within the U.S. EPA standard (Table 5.2-14). The ambient noise levels from the second sampling are slightly lower than the first sampling.

Comparing the results with the previous measurement at station A3, the ambient noise levels from the baseline surveys are lower than the previous studies, possibly due to completion of construction activities surrounding the stations.

The annoyance noise measured on 3 March 2013 was 10.6 dB(A) exceeding the proposed standard (Table 5.2-15). Primary noise sources at this station were from road transportation nearby the sampling station and from the construction activity closed to the sampling area.

Station A2: Doot Loot Temple

The results from the survey during 2-5 December 2012 and 4-7 March 2013 found that $L_{Aeq\ 1\ hour}$ were between 44.4-53.5 and 44.6-61.8 dB(A), $L_{Aeq\ 24\ hours}$ were between 47.9-49.1 and 54.1-55.4 dB(A), L_{Amax} were between 54.5-78.3 and 55.0-89.3 dB(A), L_{Adn}, were between 52.4-53.1 and 56.4-59.0 dB(A), respectively. In additional L_{A90} were between 40.0-46.1 and 41.5-53.0 dB(A). The noise level was within the US EPA standard. The ambient noise levels from the second sampling period are higher than the first sampling period possibly due to wood shaving activity occurred during daytime near the sampling station.

Baseline noise level at station A2 was higher than the previous studies at the nearby station A6 due to the ongoing construction activities near the station.

The annoyance noise measured on 3 March 2013 was 10.2 dB(A) exceeding the proposed standard (Table 5.2-15) most likely due to the said construction activities in the vicinity.

Table 5.2-12 Result of the Reviewed Noise Level from Previous Studies

Parameter	Dry Season (dB(A))				Wet Season (dB(A))		Standard
	A3	A4	A5	A6	A5	A6	
$L_{Aeq\text{-}24\ hr}$	59.5-61.8	54.9-57.8	49.3-49.8	45.9-46.5	51.2-53.1	52.1-55.4	70[1/]
L_{Amax}	94.5-96.5	90.9-96.4	81.8-86.7	78.0-85.7	91.6-97.1	90.2-106.4	115[2/]
L_{Adn}	62.1-63.3	59.5-62.8	53.6-56.6	50.8-51.4	55.7-60.9	56.1-58.9	-
L_{A90}	50.5-55.5	51.0-52.9	37.6-43.3	39.3-41.5	44.3-48.0	40.6-42.2	-

Remark: [1/] U.S. EPA, Noise Effects Handbook (U.S. EPA, 1981)
[2/] Ambient Noise Standards, Notification of the National Environment Board, No.15, B.E.2540 (1997)

Table 5.2-13 Result of the Reviewed Vibration Level from Previous Studies

Measured Date	Result			Standard[2/]	Effects of vibration on structure[3/]
	Time	Peak particle velocity[1/] (mm/s)	Frequency (Hz)	Peak particle velocity; (mm/s)	
Station A5 (KM 4+500) – Dry Season					
April 1, 2012	15:08:41	0.410 (Vert)	27	9.25	No effects to building
April 2, 2012	07:19:22	0.347 (Vert)	8.8	5	No effects to building
April 3, 2012	15:57:15	0.292 (Long)	37	11.75	No effects to building
April 4, 2012	07:49:24	0.236 (Long)	39	12.25	No effects to building
Station A6 (KM 18+900) – Dry Season					
April 5, 2012	11:02:32	0.229 (Tran)	3.5	5	No effects to building
April 6, 2012	08:04:27	0.213 (Tran)	6.5	5	No effects to building
April 7, 2012	16:41:20	0.224 (Tran)	5.2	5	No effects to building
April 8, 2012	-	<0.200	N/A	5	No effects to building
Station A5 (KM 4+500) – Wet Season					
May 24, 2012	18:38:02	0.426 (Long)	17	6.75	No effects to building
May 24, 2012	20:16:17	1.800 (Long)	>100	20	No effects to building
May 26, 2012	16:51:59	0.615 (Long)	>100	20	No effects to building
May 27, 2012	08:13:27	0.599 (Long)	30	10	No effects to building
Station A6 (KM 18+900) – Wet Season					
May 27, 2012	-	<0.200	N/A	5	No effects to building
May 28, 2012	16:20:06	0.489 (Tran)	15	6.25	No effects to building
May 29, 2012	10:28:55	0.835 (Tran)	16	6.5	No effects to building
May 30, 2012	16:26:36	0.497 (Tran)	18	7	No effects to building

Remark: [1/] Peak Particle Velocity; Vert = Vertical, Long = Longitudinal, Tran = Transverse
[2/] Thailand Standard of Protection against Vibration in Building Construction.
[3/] DIN 4150-3 1999; Structural Vibration, part 3 effects of vibration on structure
N/A = Not Available

Source: EIA for Main Road, August 2012 (SEATEC, 2012c)

Table 5.2-14 Results of Ambient Noise Level in December 2012 and March 2013

Parameter	December 2012						March 2013						Standard
	Station A1			Station A2			Station A1			Station A2			
	2-3 Dec	3-4 Dec	4-5 Dec	2-3 Dec	3-4 Dec	4-5 Dec	4-5 Mar	5-6 Mar	6-7 Mar	4-5 Mar	5-6 Mar	6-7 Mar	
$L_{Aeq\ 1\ hour}$	49.9-59.2	49.6-61.4	49.5-61.7	44.4-52.5	44.4-51.7	44.9-53.5	46.5-53.6	45.2-53.6	45.1-54.9	44.6-61.8	44.8-59.4	45.6-59.4	
$L_{Aeq\ 24\ hours}$	53.2	54.4	54.9	47.9	48.8	49.1	50.5	50.4	50.5	55.4	55.1	54.1	70[1/]
L_{Amax}	65.8-86.3	66.2-86.9	65.5-91.4	54.5-77.2	55.3-73.9	55.1-78.3	59.4-80.7	59.9-77.2	60.5-80.0	55.0-89.3	59.0-86.2	59.5-86.2	115[2/]
L_{A90}	45.5-50.8	45.5-54.1	45.4-54.2	40.0-44.9	40.0-45.7	40.2-46.1	41.6-47.1	40.0-43.7	40.6-46.9	41.5-53.0	42.5-50.0	42.9-50.0	
L_{Adn}	58.8	58.6	58.6	52.4	53.1	53.1	55.3	55.7	55.1	59.0	57.3	56.4	

Remark: [1/] U.S. EPA, Noise Effects Handbook (U.S. EPA, 1981)
[2/] Ambient Noise Standards, Notification of the National Environment Board, No.15, B.E.2540 (1997)

Source: Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (2013).

Table 5.2-15 Result of Annoyance Noise Level in December 2012 and March 2013

Monitoring Station	December 2012					March 2013				
	Specific Noise Level	Residual Noise Level	Specific Noise Level (Improve Noise Level)	Background Noise Level[1/]	Annoyance Noise Level	Specific Noise Level	Residual Noise Level	Specific Noise Level (Improve Noise Level)	Background Noise Level[1/]	Annoyance Noise Level
1. Station A1: VIP Resident at ITD Camp	52.8	48.9	50.8	42.7	8.1	55.3	49.5	53.8	43.2	10.6*
2. Station A2: Doot Loot Temple	49.9	47.9	45.4	43.6	1.8	54.9	51.7	51.9	41.7	10.2*
Standard[2/]	-	-	-	-	10	-	-	-	-	10
Unit	dB(A)									

Remark: [1/] Background noise level, the median of L_{A90} of 5 times
[2/] The Annoyance Noise Level Standard (Notification of The National Environmental Board No.29, B.E.2550 (2007))
* The result did not comply with standard

Source: Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (2013).

5.2.6 Groundwater Quality

5.2.6.1 Study Area

Groundwater is the major source of water supply in the adjacent area as well as project construction activities. The study area of groundwater will cover the area potentially affected by project development, including existing wells in the communities located at the Northern part of project area, Pa Ya Dat Village, to the proposed solid waste storage area, and another location in the Pan Din In Village. These are the nearest communities to the Southern part of project area.

5.2.6.2 Baseline Groundwater Conditions

(a) Results from the Previous Surveys and Studies

Sources of Information the following previous studies in the project area are reviewed for the groundwater quality measurements from relevant environmental studies:

- Initial Environmental Examination (IEE) for Dawei Sea Port & Industrial Estate Development (TEAM, 2012a).
- Environmental Impact Assessment (EIA) for Main Road (SEATEC, 2012c).

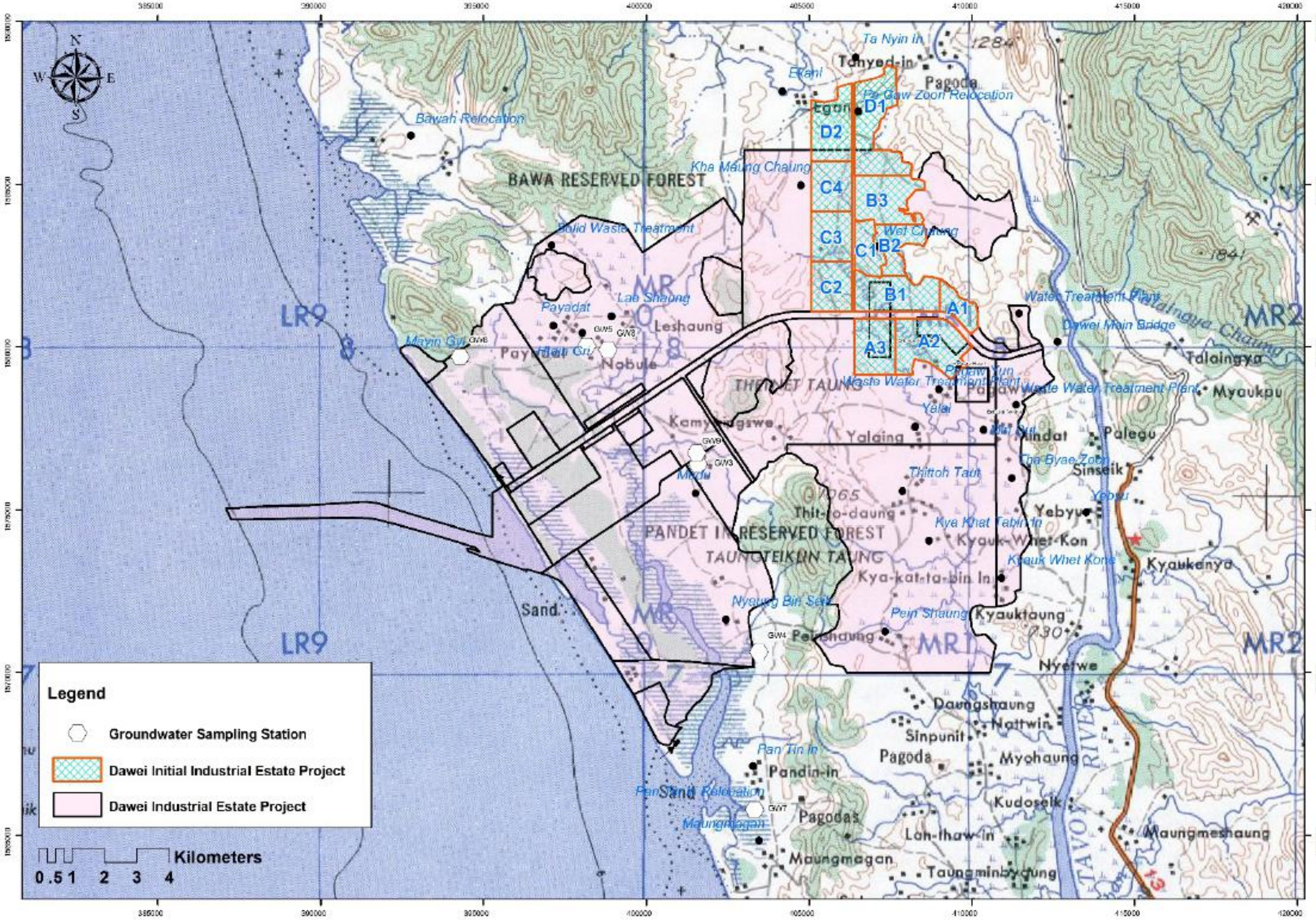
In reference to GW8 and GW9, the results of groundwater quality measurement in dry season and wet season are similar. All pH results show that groundwater in this area are acidic, which are below standards. Suspended solids at station GW4 are much higher than suspended solids at other stations. Cadmium results at GW3-GW7 are exceeding the standard. The concentration of the remaining parameters are similar. (Table 5.2-16 and Figure 5.2-21)

(b) Results from the Study of EIA for Dawei Industrial Estate Project

- Groundwater quality sampling was conducted during December 2012 (after monsoon season) and March 2013 (before monsoon season). The surface water quality will be collected and analyzed at two sampling stations (Figure 5.2-22) :
  - GW1: Pa Ya Dat Village (396,794 E,1,581,009 N)
  - GW2: Pan Din In Village (403,329 E,1,566,970 N)

Groundwater sampling was conducted on 2 December 2012 and 4 March 2013 at Pa Ya Dat (GW1) and Pan Din In village (GW2). From both sampling results, heavy metal was mostly found below detection limit and all complied with standard. Water in both wells were acidic with pH of 4.7 and 5.0, respectively during the first sampling, and 4.8 and 5.2, respectively during the second sampling respectively and below WHO Drinking Water Standard. TCB and E.Coli also were detected with higher value at GW2 during the first sampling but not detected during the second sampling. From observation, people in the village normally had used well water for consumption but boiled before drinking. (Table 5.2-17)

Comparison of results between previous and the study of EIA for Dawei Industrial Estate Project indicated that groundwater quality are quite similar, except for more acidic water and higher number of E.coli noticed in the first sampling of the recent study.



Remark: *Ref. EIA is Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (SEATEC in association with UAE, 2013).

Figure 5.2-21 Reviewed Groundwater Quality Measurement Stations

Table 5.2-16 Results of Groundwater Quality from the Previous Study

Parameter	Unit	14 Oct 11		15 Oct 11		19 Oct 11	Mar 12		May 12		Standard[1/]
		GW3	GW4	GW5	GW6	GW7	GW8	GW9	GW8	GW9	
pH	-	5.5	5.39	4.74	5.57	5.91	6.0	5.5	6.2	5.9	6.5-8.5
Total Hardness as $CaCO_3$	mg/L	20	220	80	40	40	8.0	2.0	7.0	2.0	-
BOD	mg/L	1	1.5	1.5	1	1	-	-	-	-	-
Turbidity	NTU	1.64	0.8	0.77	0.01	0.43	1.0	0.9	1.0	0.8	-
Total Dissolved Solids	mg/L	2720	1720	1970	1010	1240	-	-	-	-	-
Suspended Solids	mg/L	NA	370	40	60	NA	-	-	-	-	50
Bicarbonate	v	20	20	24	40	40	-	-	-	-	-
Sulphate as SO_4	mg/L	0.48	3.92	2.88	2	1.168	-	-	-	-	-
Free Carbonate	mg/L	Nil	Nil	Nil	Nil	Nil	-	-	-	-	-
Iron as Fe	mg/L	0.634	0.14	0.0145	0.049	0.728	0.049	0.03	0.068	0.029	-
Dissolved Oxygen	ppm	7.7	7.3	7.5	7.3	7.2	-	-	-	-	-
Temperature	^oC	26.1	26.3	26.4	25.5	26.1	-	-	-	-	-
Conductivity	µS/cm	21.5	26.2	47.2	16.3	40.3	232	175	216	168	-
Salinity	ppt	Nil	Nil	Nil	Nil	Nil	-	-	-	-	-
Nitrite Nitrogen	mg/L	0.004	0.011	Nil	0.007	0.008	-	-	-	-	50 (Total nitrogen)
Nitrate Nitrogen	mg/L	Nil	Nil	0.007	0.1	0.0009	-	-	-	-	-
Manganese	mg/L	0.3	0.1	Nil	0.3	0.8	0.018	0.018	0.004	0.018	0.5
Zinc	mg/L	0.49	0.95	1	1.25	1.01	<0.001	<0.001	<0.001	<0.001	3
Cyanide	mg/L	Nil	Nil	Nil	Nil	Nil	-	-	-	-	0.07
Arsenic as As	mg/L	ND	ND	ND	ND	ND	-	-	-	-	0.01

Table 5.2-16 Results of Groundwater Quality from the Previous Study (Con't.)

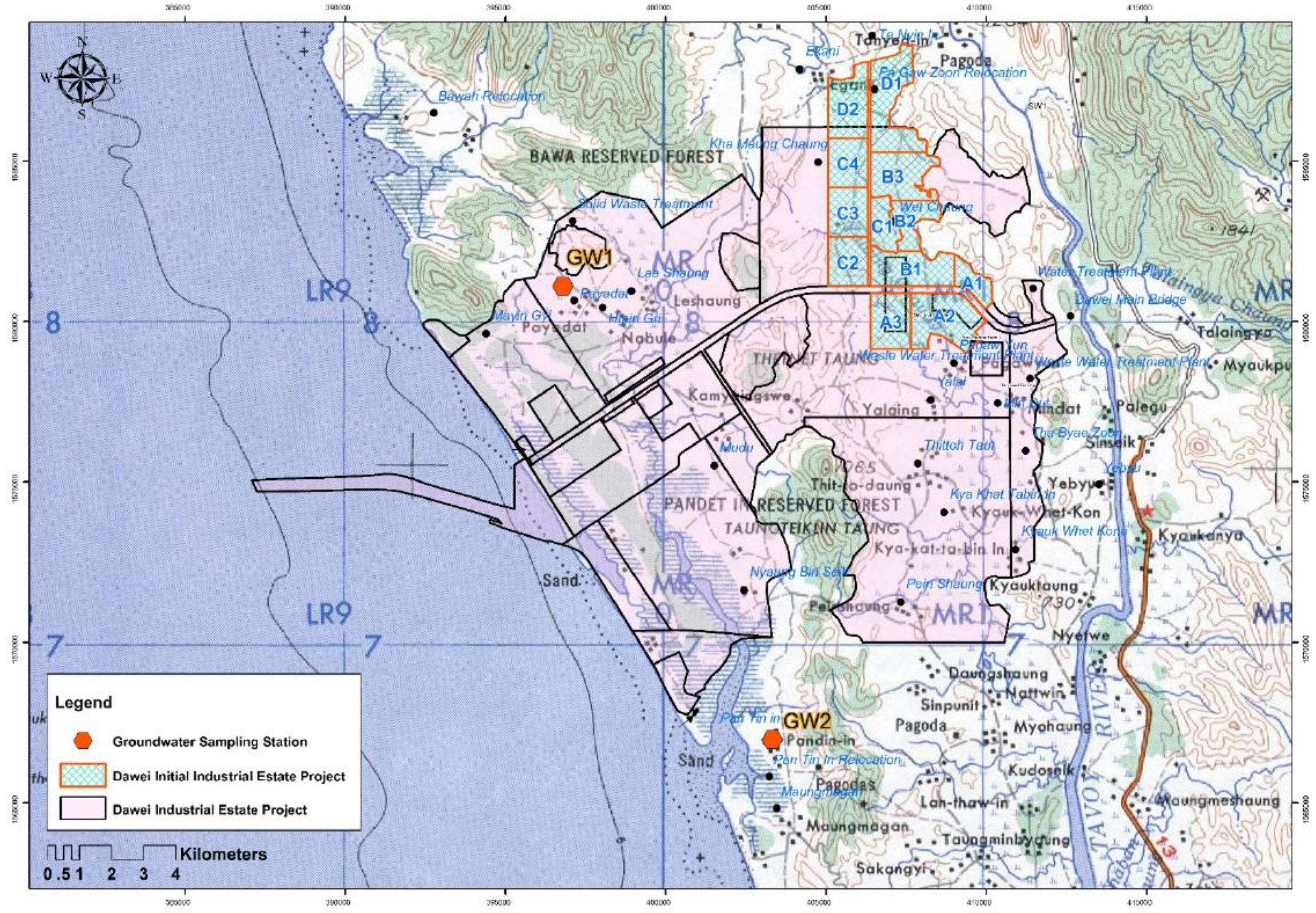
Parameter	Unit	14 Oct 11		15 Oct 11		19 Oct 11	Mar 12		May 12		Standard[1/]
		GW3	GW4	GW5	GW6	GW7	GW8	GW9	GW8	GW9	
Cadmium as Cd	mg/L	0.004	0.005	0.004	0.004	0.005	<0.002	<0.002	<0.002	<0.002	0.003
Copper as Cu	mg/L	ND	ND	ND	ND	ND	0.031	0.005	0.038	0.007	2
Lead as Pb	mg/L	ND	ND	ND	ND	ND	<0.001	<0.001	<0.001	<0.001	0.01
Mercury as Hg	mg/L	ND	ND	ND	ND	ND	<0.0001	<0.0001	<0.0001	<0.0001	0.001
Calcium as Ca	mg/L	3.18	4.29	4.54	4.61	4.35	-	-	-	-	-
Total Solids	mg/L	-	-	-	-	-	136	101	125	94	1000
Total Coliform	MPN/100 ml	-	-	-	-	-	2100	400	390	430	Not Found
E. coli	CFU/ml	-	-	-	-	-	<2	<2	<2	<2	Not Found

Remark: [1/] WHO' Drinking Water Standard, 1993

Nil = No Quantity

ND = Not Detected

NA = No Analysis



Source: Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (2013).

Figure 5.2-22 Groundwater Sampling Stations in December 2012 and March 2013

Table 5.2-17 Result of Groundwater Sampling in December 2012 and March 2013

Parameter	Unit	December 2012		March 2013		Standard 1/
		GW1	GW2	GW1	GW2	
pH	-	4.7*	5.0*	4.8*	5.2 *	6.5-8.5
Turbidity	NTU	0.5	<1.0	1.6	0.5	-
Electrical Conductivity	umho/cm	26 (at 27°C)	75 (at 27°C)	31 (at 29°C)	50 (at 27°C)	-
Total Solids	mg/L	<25	27	30	57	1,000
Suspended Solids	mg/L	<5.0	<5.0	<5.0	<5.0	50
Total Dissolved Solids	mg/L	<25	<25	<25	56	-
Cyanide	mg/L CN^-	<0.005	<0.005	<0.005	<0.005	0.07
Nitrate-Nitrogen	mg/L NO_3-N	0.04	<0.02	0.13	0.09	50 (total Nitrogen)
Total Hardness	mg/L $CaCO_3$	<2.0	5.0	<2.0	6.0	-
Fluoride	mg/L F^-	0.10	0.12	0.28	0.09	-
Sulphate	mg/L SO_4^{2-}	0.4	<0.3	0.9	1.8	-
Non-Carbonate Hardness	mg/L $CaCO_3$	<0	<0	<0	<0	-
Arsenic	mg/L As	<0.0003	<0.0003	0.0024	<0.0003	0.01
Manganese	mg/L Mn	<0.005	<0.005	<0.005	<0.018	0.5
Mercury	mg/L Hg	0.0009	0.0007	<0.0002	<0.0002	0.001
Selenium	mg/L Se	<0.0005	<0.0005	<0.0005	<0.0005	-
Zinc	mg/L Zn	<0.020	<0.020	<0.005	<0.005	3
Candmium	mg/L Cd	<0.002	<0.002	<0.002	<0.002	0.003
Copper	mg/L Cu	<0.003	<0.003	<0.003	<0.003	2
Hexavalent Chromium	mg/L Cr^{6+}	<0.001	<0.001	<0.001	<0.001	-
Lead	mg/L Pb	<0.008	<0.008	<0.008	<0.008	0.01
Nickel	mg/L Ni	<0.005	<0.005	<0.005	<0.005	-
Iron	mg/L Fe	0.068	<0.043	<0.010	0.160	-
Total Coliform Bacteria	MPN/100 mL	2.0*	33*	<1.8	<1.8	not found
E.Coli	MPN/100 mL	2.0*	11*	none	none	not found
Sample condition Water Colour/ Turbid	-	Colurless / Clear	Colurless / Clear	Colurless/ Clear	Colurless/ Clear	-
Sediment	-	-	-	-	-	-

Remark 1/WHO Drinking Water Standard, 1993
*The result did not comply with standard
Source: Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (2013).

(C) Results from the Study of EIA for Dawei SEZ Initial Industrial Estate Project

Groundwater quality study was conducted in March, 2015 which two ground water stations, were sampled and analyzed, consist of BH1 and BH2 that be located at solid waste management site as shown in Figure 5.2-23. The results of parameters analysis is presented in Table 5.2-18 and Annex 5-1 (Ground Water Analysis Report) Ground water sample, namely BH1, had slightly alkaline (pH = 8.3) and 21.9 mg/l as $CaCO_3$ of hardness value. While sample from BH2 were slightly acidic (pH = 6.3) and had more hardness value (41.6 mg/l as as $CaCO_3$). Most analyzed parameters of both stations were below WHO drinking water standard except lead and mercury. Dissolved solids concentration of BH1 and BH2 (40 and 67 mg/l, respectively) were lower than the previous study that had dissolved solids more than 1,000

mg/L. It is recommended that ground water application for drinking water required iron removal process and disinfection unit.

Table 5.2-18 Result of Groundwater Sampling in March 2015

Parameter	Unit	IE-BH01 (March 3, 2015)	IE-BH02 (March 14, 2015)	Standard [1/]
pH	-	8.3	6.5*	6.5-8.5
Turbidity	NTU	650	80.0	-
Electrical Conductivity	umho/cm	42.2	26.8 (at 27°C)	-
Total Solids	mg/L	416	259	1,000
Suspended Solids	mg/L	376	165	50
Total Dissolved Solids	mg/L	40	67	-
Cyanide	mg/L CN^-	ND	ND	0.07
Nitrate-Nitrogen	mg/L NO_3-N	ND	0.02	50 (total Nitrogen)
Total Hardness	mg/L $CaCO_3$	21.9	41.6	-
Fluoride	mg/L F^-	0.14	0.02	-
Sulphate	mg/L SO_4^{2-}	2.8	2.8	-
Non-Carbonate Hardness	mg/L $CaCO_3$	0.2	1.40	-
Arsenic	mg/L As	0.0034	0.0020	0.01
Manganese	mg/L Mn	0.114	0.244	0.5
Mercury	mg/L Hg	0.0022	0.0005	0.001
Selenium	mg/L Se	ND	ND	-
Zinc	mg/L Zn	0.088	0.074	3
Cadmium	mg/L Cd	ND	ND	0.003
Copper	mg/L Cu	<0.003	<0.003	2
Hexavalent Chromium	mg/L Cr^{6+}	ND	ND	-
Lead	mg/L Pb	0.115	0.180	0.01
Nickel	mg/L Ni	ND	<0.005	-
Iron	mg/L Fe	12.8	8.95	-
Total Coliform Bacteria	MPN/100 mL	490	<1.8	not found
E.Coli	MPN/100 mL	None	None	not found
Volatile Organic Compound				
-Benzene	µg/L	ND	ND	-
-Carbon Tetrachloride	µg/L	ND	ND	-
-1,2 Dichloroethane	µg/L	ND	ND	-
-1,1 Dichloroethane	µg/L	ND	ND	-
-cis-1,2 Dichloroethane	µg/L	ND	ND	-
-trans-1,2 Dichloroethane	µg/L	ND	ND	-
-Dichloromethane	µg/L	ND	ND	-

Table 5.2-18 Result of Groundwater Sampling in March 2015 (Con't.)

Parameter	Unit	IE-BH01 (March 3, 2015)	IE-BH02 (March 14, 2015)	Standard [1/]
-Ethylbenzene	μg/L	ND	ND	-
-Styrene	μg/L	ND	ND	-
-Tetrachloroethylene	μg/L	ND	ND	-
-Toluene	μg/L	ND	ND	-
-Tetrachloroethylene	μg/L	ND	ND	-
-1,1,1-Trichloroethane	μg/L	ND	ND	-
-1,1,2-Trichloroethane	μg/L	ND	ND	-
-Total Xylenes	μg/L	ND	ND	-
Sample Condition		Brown / Brown Turbid	Yellow / Brown Turbid	-

Remark [1/] WHO Drinking Water Standard, 1993 - The result did not comply with standard

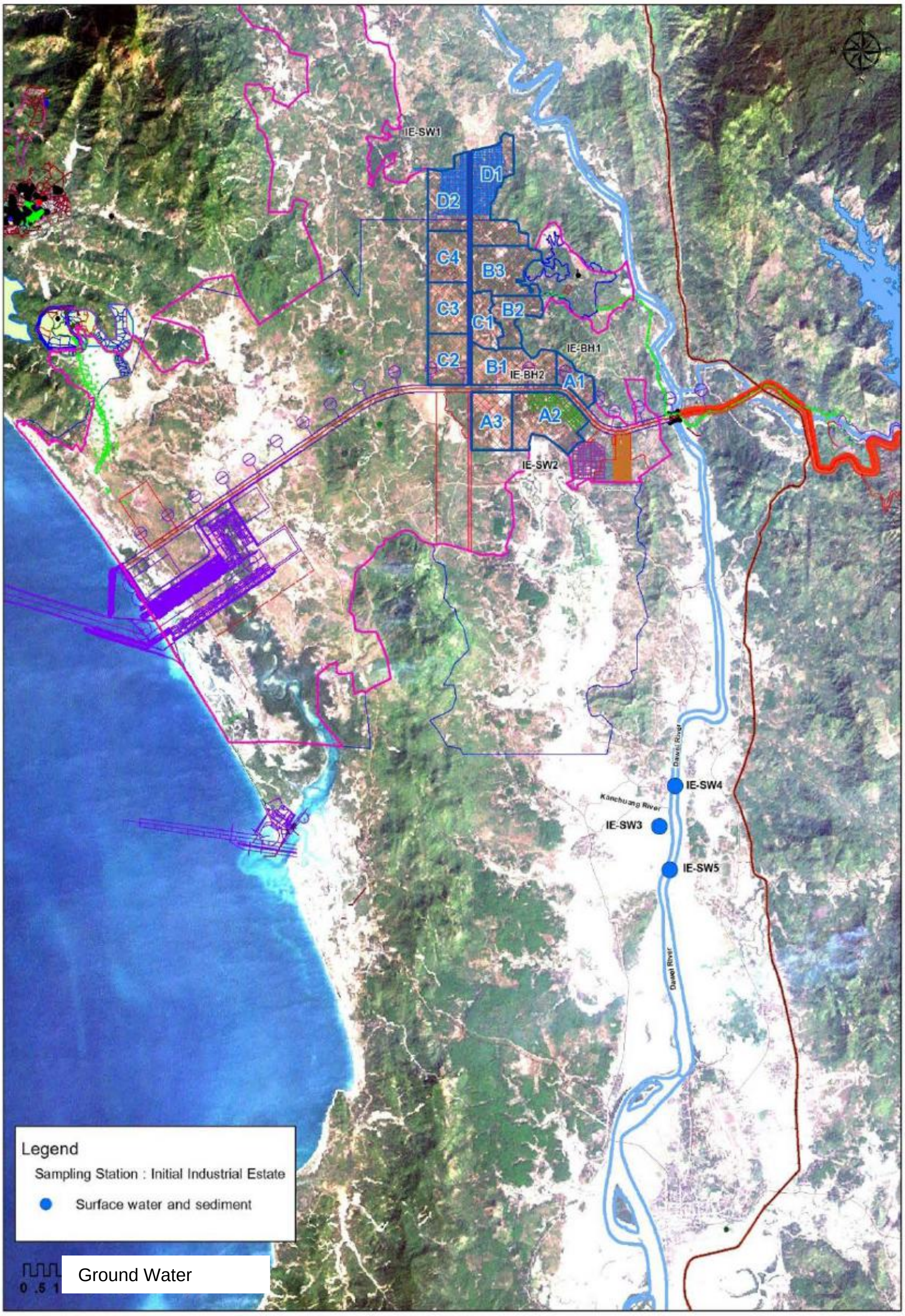


Figure 5.2-23 Sampling Station of Groundwater (this study)

5.2.7 Surface Water and Sediment

5.2.7.1 Study Area

The possible adverse effects that a developing project may have on the quality of the surface water need to be determined prior to the implementation of the project. After reviewing the master plan, the project will discharge treated wastewater from wastewater treatment plants to Dawei and Kunchuang River. Therefore, the study area will cover both upstream and downstream of the proposed discharge points as well as the proposed discharge points.

5.2.7.2 Baseline Surface Water and Sediment Conditions

This section reviews baseline information from available previous studies in the project areas. Additional baseline for surface water has been planned to be conducted in 2015, if needed.

(a) Results from the Previous Surveys and Studies

The main source of Information relevant to surface water and sediment quality relevant to the industrial estate is:

- Environmental Impact Assessment (EIA) for Main Road (SEATEC, 2012c).

Summary of the results of the previous study is summarized below.

- There are four stations (Figure 5.2-24) for surface water and sediment quality measurement during March 2012 (dry season) and May 2012 (wet season) :
  - Station SW12: Dawei River - 300 Meters the Upstream of Proposed Road Centerline (412,709 E, 1,582,539 N)
  - Station SW13: Dawei River – 300 Meters the Downstream of Proposed Road Centerline (412,715 E, 1,579,831 N)
  - Station SW14: Canal in the Project Area at KM 3+000 (398,804 E, 1,577,888 N)
  - Station SW15: Canal in the Project Area at KM 12+000 (406,344 E, 1,581,074 N)

Overall results of surface water quality measurement during the dry season were not significantly different from the wet season, except turbidity, total solids, and COD were a bit different between the seasons. The concentration of water quality for the two stations in Dawei River were higher than the canal in project area, especially considering total solids, COD, and TKN.

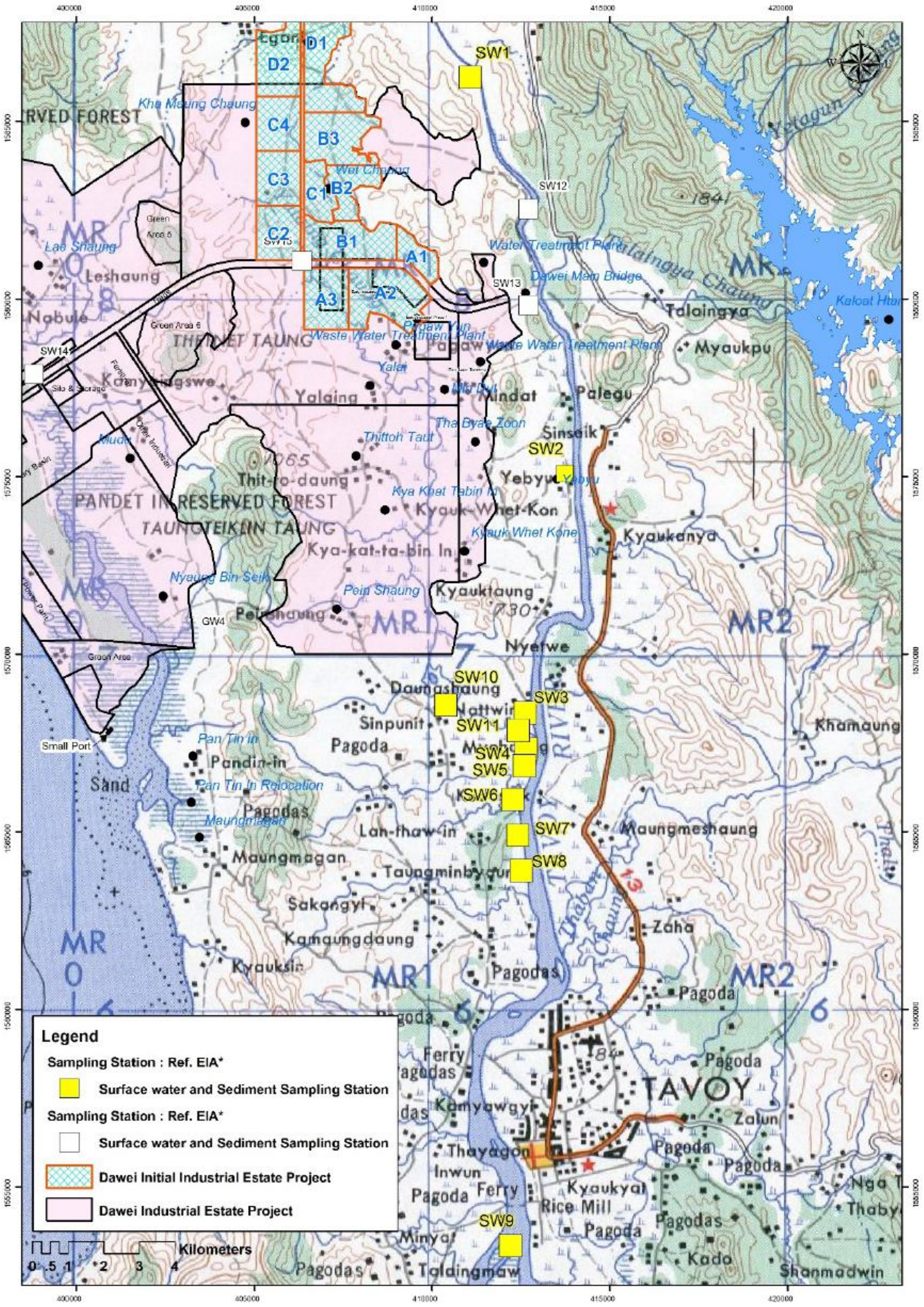
The results of COD in some stations were unusually high (5,929 and 96,595 mg/l), while the BOD at the same stations were not escalated compared with other stations. This was most likely a result of high turbidity and solids in samples rather than contamination of organic pollutions in the water.

The results showed that the physical character of the sediment in the Dawei River 0.3 km. North of the Bridge and canal KM 3+000 was mostly sand, while the sediment at the Dawei River 0.3 km. South of the bridge and canal KM 12+000 was mixed with equal portions of sand, silt, and clay. The quality of the sediment samples find that almost all samples in Dawei River had less concentration of sediment than the samples in the canal within the project area, especially heavy metal; however, all analyzed data are well within sediment quality guidelines.

(b) Results from the Study of EIA for Dawei Industrial Estate Project

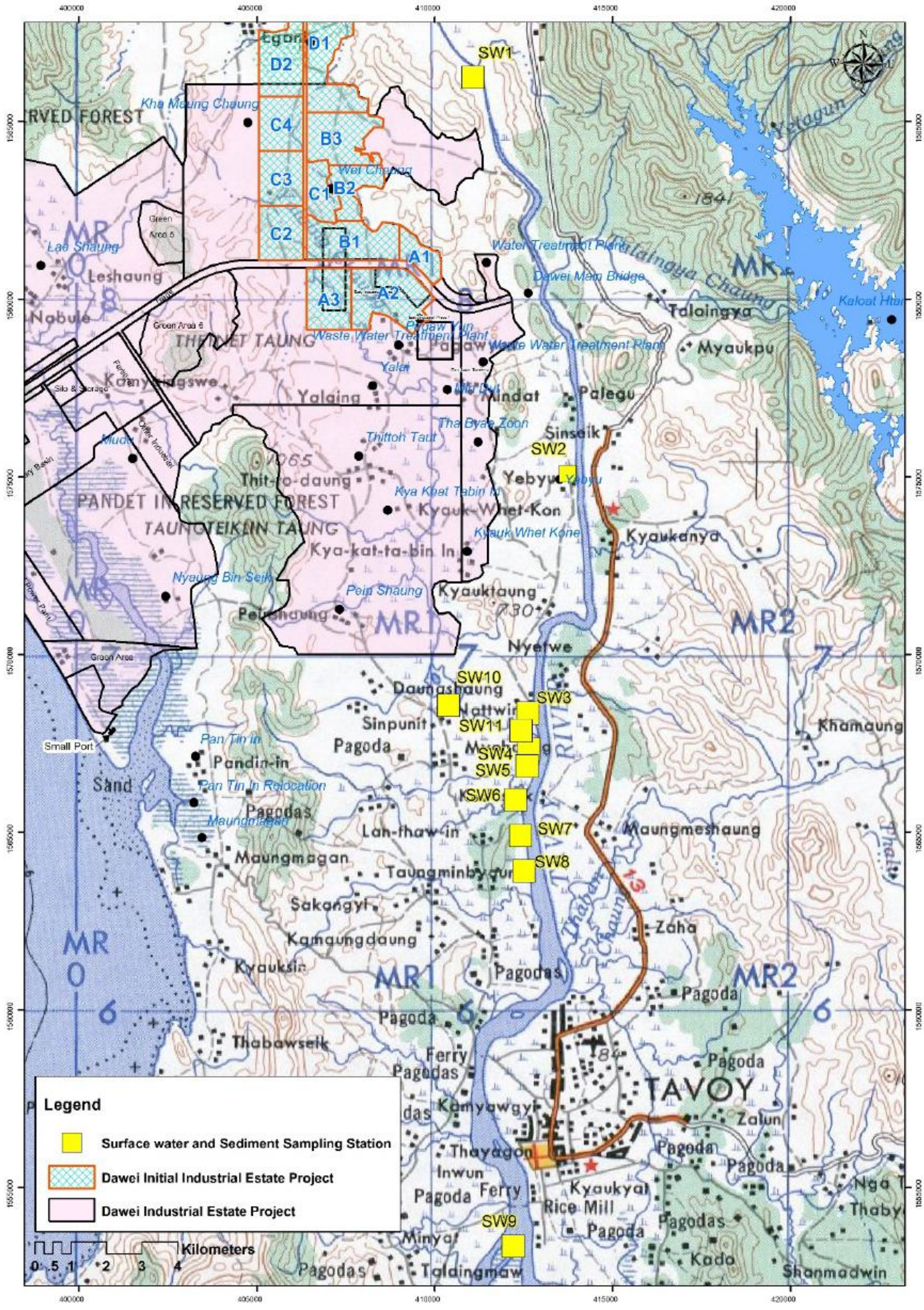
- Surface water quality and sediment samplings were conducted during December 2012 (after monsoon season) and March 2013 (before monsoon season). The surface water and sediment quality samples were collected and analyzed for 11 sampling stations.
- Sampling stations of surface water in the reference study in Figure 5.2-25, EIA for Dawei Industrial Estate Development Project (2013) covered a more extended reach of Dawei river than the previous study reviewed (SW12 and SW13), from upstream from boundary of the project area to south of the Dawei River crossing bridge, Dawei City. Moreover, two sampling stations in Kunchaung River of which wastewater from the project area would be disposed were included in the baseline survey.

The first surface water sampling was conducted on 2-6 December 2012 along Dawei River (SW1-SW9) and Kunchaung River (SW10-SW11). In Dawei River, most of parameters complied with the proposed surface water standard except phenol at SW1-SW8 and manganese at SW9. In Kunchaung River, most of the parameters complied with the proposed standard except phenol at both SW10 and SW11. Various types of industries: oil, coal, metallurgic, chemical production, explosive, dyes, palm oil mill as well as textile, and also degradation of pesticides, and/or natural occurrence may cause phenol contaminations in the surface water (Michalowies and Duda, 2007). Further monitoring in Dawei River and Kunchaung River is needed to monitor changes of phenol concentrations and potential indication of the phenol sources in the area.



Remark: * Ref. EIA is "Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (2013)."

Figure 5.2-24 Reviewed Surface Water and Sediment Quality Measurement Stations



Source: Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (2013)."

Figure 5.2-25 Surface Water and Sediment Quality Sampling Stations in December 2012 and March 2013

At SW9, the manganese concentration (2.08 mg/L) was greater than the standard limit (<1.0 mg/L). The manganese level is commonly low in natural surface water but the source of manganese in the area is possibly from domestic wastewater discharge, industrial waste (iron, steel, acid mine drainage), as well as use of pesticides in the vicinity of Dawei City.

Upstream of the project along Dawei River (boundary of the project area) at SW1, total solids content was rather low, which increased towards downstream especially at SW9 which was close to Dawei City. A similar changes were observed for other parameters such as coliform (TCB, FCB and E.Coli), Nitrate Nitrogen, Total Kjeldahl Nitrogen, zinc, cadmium and iron. However, these parameters are still in compliance with the proposed standard.

The second surface water sampling was conducted on 4-6 March 2013 at the same stations along Dawei River (SW1-SW9) and Kunchaung River (SW10-SW11). Water appeared to be very turbid with much higher level of total solids (about 5 to 20 times higher) than that of the first sampling. Salinity levels were noticeable in most sampling stations, except for SW1 and SW2. For both Dawei River and Kunchaung River, several parameters were not in compliance with the proposed standard, namely: BOD, ammonia-nitrogen, phenols, manganese, and some heavy metals in certain stations. Phenols were also detected in many stations but at lower levels than the first sampling. Moreover, at SW2, the highest total solids and turbidity were observed with some heavy metals (zinc, copper, lead and nickel) were slightly higher than the standard, possibly due to turbidity of water and/or associated resuspended sediments. Heavy metals are often influenced by sediment.

The water quality results of most parameters show better water quality, comparing with the nearby stations from the previous study (SW1 and SW2 of the baseline sampling compared with SW12 and SW13 of the previous study). Even, high manganese concentrations were noticed in the River from the previous study (SW12 of previous study: 3.59 and 0.99 mg/L, for wet and dry seasons, respectively). However, the results of ammonia, nitrate, phenol and bacteria levels in both baseline samples are higher than that of the previous study.

Sediment quality in Dawei River was sampled on 3, 5 and 6 December 2012 and 5-7 March 2013. Physical characteristics of sediments in Dawei River from SW1 to SW7 indicated that the sediments of both first and second sampling period were mostly clay (52.1-66.4% and 55.3-68.9%, respectively). The sediments of SW8 from the first and second samplings were different: mostly clay (58.9%) and sand (38.4%) during the first sampling and combination of sand (43.8%), clay (32.2%) and silt (20.0%) during the second sampling period. For SW9, the sediment was mostly sand from both sampling periods (58.3, and 74.9%, respectively), with a composition of more sand and hardly any clay (0%) from the second sampling. The different physical compositions of sediment from SW9 were probably due to river bank erosion and port activities as observed in the area.

Chemical characteristics of sediments from both sampling events from upstream to downstream were variable. The levels of each parameter tended to be lower at downstream location. Noted that most of heavy metal concentrations detected in sediment were arsenic, zinc, copper, iron, lead, nickel and total chromium, but all results were far below the proposed sediment quality guideline (Table 5.2-19 and Table 5.2-20).

Table 5.2-19 Result of Sediment Sampling in December 2012

Parameter	Unit	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	Standard [1/]
Particle size											
Gravel (>2.00mm.)	%	0	0.3	1	0.1	0.3	0	0	0.4	16	-
Sand (0.063-2.00 mm.)	%	0.9	5.4	3.9	0.8	0.3	1.3	3.9	2.3	58.3	-
Silt (0.002-0.063mm)	%	35.8	29.5	34.9	42.5	47.3	45.0	29.7	38.4	10.6	-
Clay (<0.002mm.)	%	63.3	64.8	60.2	56.6	52.1	53.7	66.4	58.9	15.1	-
Fat, Oil and Grease	mg/kg	345	103	243	286	184	268	589	743	366	-
Arsenic (As)	mg/kg	2.05	2.09	3.01	1.64	2.57	1.79	2.21	1.85	0.980	17.0
Mercury (Hg)	mg/kg	0.163	0.130	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	0.486
Zinc (Zn)	mg/kg	56.3	62.4	52.6	39.7	59.5	33.5	53.0	42.8	12.9	315
Cadmium (Cd)	mg/kg	< 0.600	< 0.600	< 0.600	< 0.600	< 0.600	< 0.600	< 0.600	< 0.600	< 0.600	3.53
Copper (Cu)	mg/kg	10.9	10.1	9.30	7.18	13.8	5.76	10.1	7.72	2.53	197
Iron (Fe)	mg/kg	30,424	34,500	28,363	20,500	28,589	16,263	19,523	21,063	8,253	-
Lead (Pb)	mg/kg	33.7	26.1	39.3	31.5	48.1	27.7	36.7	31.8	4.92	91.3
Nickel	mg/kg	16.9	19.7	14.1	11.8	17.4	9.44	15.1	11.5	5.00	36
Total Chromium (Cr)	mg/kg	18.3	16.1	14.4	10.9	17.8	10.6	12.4	9.18	2.92	90
Sample condition		Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	

Remark [1/] NOAA Screening Quick Reference Table, 1999 accessed from http://archive.orr.noaa.gov on 15 December 2012

Source: Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (2013).

Table 5.2-20 Result of Sediment Sampling in March 2013

Parameter	Unit	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	Standard [1/]
Particle size											
Gravel (>2.00mm.)	%	0	0	0.4	0	0	0	0	4	18.3	-
Sand (0.063-2.00 mm.)	%	1.7	8.2	2.5	13.0	0.9	2.4	2.5	43.8	74.9	-
Silt (0.002-0.063mm)	%	29.4	29.5	31.0	31.4	33.5	33.1	29.2	20.0	6.8	-
Clay (<0.002mm.)	%	68.9	62.3	66.1	55.6	65.6	64.5	68.3	32.2	0	-
Fat, Oil and Grease	mg/kg	291	288	33	196	91	518	263	144	46	-
Arsenic (As)	mg/kg	2.07	2.80	1.13	1.80	2.01	1.89	0.644	1.35	0.139	17.0
Mercury (Hg)	mg/kg	< 0.100	< 0.100	0.193	< 0.100	< 0.100	< 0.100	0.327	< 0.100	< 0.100	0.486
Zinc (Zn)	mg/kg	46.4	53.4	35.0	48.1	46.2	45.8	34.7	30.6	5.51	315
Cadmium (Cd)	mg/kg	< 0.600	< 0.600	< 0.600	< 0.600	< 0.600	< 0.600	< 0.600	< 0.600	< 0.600	3.53
Copper (Cu)	mg/kg	7.64	8.48	5.09	8.28	6.49	5.95	4.92	5.06	0.745	197
Iron (Fe)	mg/kg	23,038	27,562	15,673	23,957	23,108	24,622	16,858	13,724	3,583	-
Lead (Pb)	mg/kg	24.4	17.9	12.0	18.2	15.4	17.1	12.1	18.6	<3.10	91.3
Nickel	mg/kg	10.4	12.0	7.96	10.3	13.0	9.50	7.96	6.27	<2.0	36
Total Chromium (Cr)	mg/kg	13.3	16.0	11.6	16.7	12.4	17.2	10.0	8.35	2.28	90
Sample condition		Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	

Remark [1/] NOAA Screening Quick Reference Table, 1999 accessed from http://archive.orr.noaa.gov on 15 December 2012

Source: Environmental Impact Assessment (EIA) for Dawei Industrial Estate Development Project (2013).

(c) Results from the Study of EIA for Dawei SEZ Initial Industrial Estate Project

- Surface water quality and sediment samplings were conducted during February 2015. The surface water and sediment quality samples were collected and analyzed for 5 sampling stations.
- Sampling stations of surface water and sediment are as follows: Ekani Chaung (SW1), Yalai Chuang Creek (SW2), about 100 m. upstream from Kanchaung River mouth (SW3), about 500 m. upstream in Dawei River from Kanchuang River mouth (SW4), and 500 m. downstream in Dawei River from Kanchuang River mouth as presented in Figure 5.2-26, that be included in the baseline survey.

Clear water sample at SW1 in Ekani River that be located in the north part of the project has 5.8 mg/l of DO, low quantity of solids, 0.0002 mg/l of total mercury. While water sample at SW2 in Yalai Chuang creek, that be located in the south part of the project, found that yellow color and clear in physical characteristic, chemical characteristic analysis results are 4.2 mg/l of DO and low BOD and COD concentration (1.2, 5.2 mg/l, respectively). Both water samples were detected coliform bacteria and E. coli.

Water quality at SW3 station, Kanchuang River mouth, were very high suspended solids concentration (more than 4,000 mg/l) and 4,300 NTU of turbidity. However, 5.0 mg/l of DO, 1.9 mg/l of BOD and low MPN values of coliform bacteria showed that the quality of surface water is in good condition.

Both turbid water samples In Dawei River, had high DO concentration (nearly 6 mg/l) and suspended solids ranged in 1,417 – 1,836 mg/l. Where as coliform bacteria and E. coli were found in both samples.

The water quality results of most parameters show same water quality, comparing with the nearby stations from the previous study, Details of laboratory analysis are presented in Table 5.2-21 and Annex 5-2 (Surface Water Analysis Report)

Both sediments of SW1 and SW2 were mostly sand (54.9 and 44 %, respectively) and some heavy metals quantity were found. For SW3 station, the sediment was mostly clay (58.39%) and high concentration of mercury and iron (0.719 and 26,078 mg/kg, respectively). Physical characteristics of sediments in Dawei River from SW4 and SW5 indicated that the sediments of both stations were mostly clay (47 and 63.7 %, respectively). Noted that most of heavy metal concentrations detected in sediment were arsenic, zinc, copper, iron, lead, nickel and total chromium as shown in Table 5.2-22

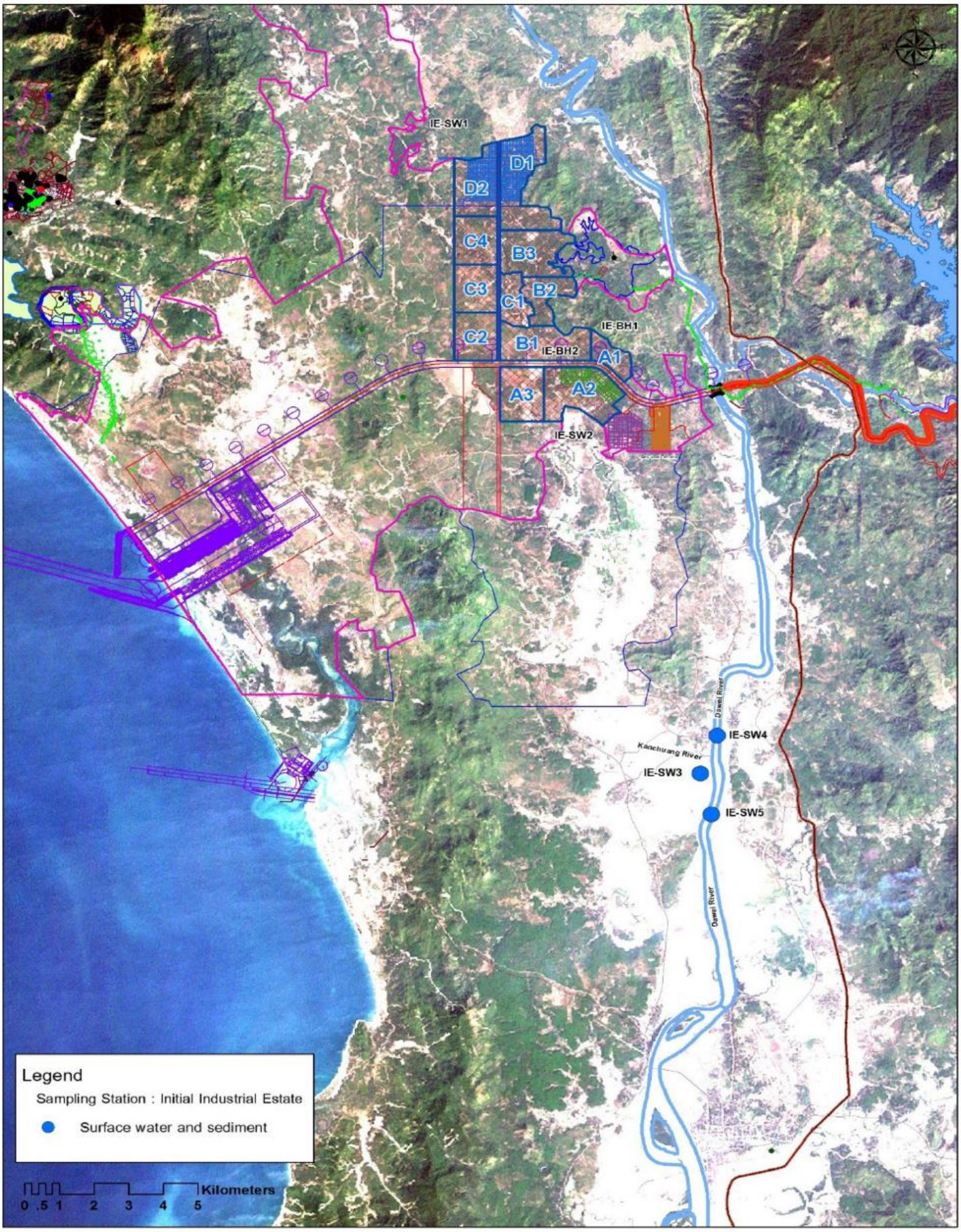


Figure 5.2-26 Sampling Station of Surface Sater and Sediment

Table 5.2-21 Result of Surface Water Sampling in February 2015

Parameter	Unit	IE-SW1	IE-SW2	IE-SW3	IE-SW4	IE-SW5	Standard [1/]
pH	-	6.8	6.4	7.9	7.9	7.7	5.0-9.0
Temperature	^{o}C	30	28	35	28	30	change not over $3^{o}C$
Turbidity	NTU	1.1	4.2	4,300	750	950	-
Electrical Conductivity	umho/cm	11.6	18.0	234	1,400	1,654	-
Salinity	Ppt	0	0	0.1	0.6	0.7	-
DO	mg/L	5.8	4.8	5.0	5.7	5.6	≥ 4
BOD	mg/L	ND	1.2	1.9	ND	1.2	≤ 2
COD	mg/L	ND	5.2	106	15.1	16.3	-
Total Solids	mg/L	28	ND	4,367	1,417	1,836	-
TSS	mg/L	ND	ND	4,018	452	706	-
TDS	mg/L	ND	ND	178	861	905	-
Ammonia-Nitrogen	mg/L NH_3-N	ND	0.04	0.06	ND	ND	≤ 0.5
Cyanide	mg/L CN^-	ND	ND	ND	ND	ND	≤ 0.005
Nitrate-Nitrogen	mg/L NO_3-N	0.03	ND	0.02	0.45	0.41	≤ 5
Phenols	mg/L	0.011	ND	ND	ND	0.007	≤ 0.005
Total Kjeldahl Nitrogen	mg/L	<1.5	<1.5	8.6	<1.5	<1.5	-
Fat, Oil And Grease	mg/L	2	3	2	2	2	-
Arsenic	mg/L As	ND	0.008	0.0224	0.0028	0.0032	≤ 0.1
Manganese	mg/L Mn	<0.005	<0.005	2.54	0.217	0.296	≤ 1
Mercury	mg/L Hg	0.002	ND	0.0019	0.0008	0.007	≤ 0.002
Zinc	mg/L Zn	0.059	0.064	0.304	0.074	0.098	≤ 1
Cadmium	mg/L Cd	ND	ND	ND	ND	ND	≤ 0.005- ≤ 0.05
Copper	mg/L Cu	ND	ND	0.029	<0.003	<0.003	≤ 0.1
Hexavalent Chromium	mg/L Cr^{6+}	ND	ND	ND	ND	ND	≤ 0.5
Lead	mg/L Pb	ND	ND	0.101	ND	ND	≤ 0.5
Nickel	mg/L Ni	ND	ND	0.081	<0.005	<0.005	≤ 0.1
Iron	mg/L Fe	0.126	1.29	116	34.6	42.5	-
TCB	MPN/100 mL	110	230	330	11,000	13,000	≤ 20,000
FCB	MPN/100 mL	79	41	110	11,000	790	≤ 4,000
E. Coli	MPN/100 mL	27	41	79	11,000	790	-
Phosphate-Phosphorus	mg/L PO_4 -P	ND	ND	ND	0.03	0.03	-

Table 5.2-21 Result of Surface Water Sampling in February 2015 (Con't.)

Parameter	Unit	IE-SW1	IE-SW2	IE-SW3	IE-SW4	IE-SW5	Standard [1/]
TPH	mg/L	ND	ND	2	1	2	-
Sample condition							
Water Color/ Turbid	-	Colorless/ Clear	Yellow Brown / Clear	Gray/ Turbid	Yellow Brown/ Turbid	Yellow Brown/ Turbid	-
sediment	-	Yellow Brown	Brown	Brown	Yellow Brown	Yellow Brown	-

Remark [1/] Thailand Surface Water Quality Standard, Class 3

Table 5.2-22 Result of Sediment Sampling in December 2012

Parameter	Unit	IE-SW1	IE-SW2	IE-SW3	IE-SW4	IE-SW5	Standard [1/]
Particle size							
Gravel (>2.00mm.)	%	38.6	21.6	0.0	5.5	0.0	-
Sand (0.063-2.00 mm.)	%	54.9	44.0	13.1	27.2	9.9	-
Silt (0.002-0.063mm)	%	6.5	34.4	29.2	24.3	26.4	-
Clay (<0.002mm.)	%	0.0	0.0	57.7	43.0	63.7	-
Arsenic (As)	mg/kg	0.407	55.2	7.76	6.34	8.06	17.0
Mercury (Hg)	mg/kg	0.334	0.380	0.719	0.933	1.01	0.486
Zinc (Zn)	mg/kg	12.0	13.6	53.8	54.0	69.2	315
Cadmium (Cd)	mg/kg	ND	ND	ND	ND	ND	3.53
Copper (Cu)	mg/kg	1.46	3.76	5.79	6.58	8.28	197
Iron (Fe)	mg/kg	4,817	57,997	26,048	25,660	32,024	-
Lead (Pb)	mg/kg	34.6	9.14	21.1	24.4	37.6	91.3
Nickel	mg/kg	ND	3.70	13.7	15.8	20.4	36
Total Chromium (Cr)	mg/kg	ND	75.8	8.72	14.3	16.3	90
Sample condition		Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	Brown Sediment	

Remark : [1/] NOAA Screening Quick Reference Table, 1999 accessed from http://archive.orr.noaa.gov on 15 December 2012

5.3 BIOLOGICAL COMPONENTS

5.3.1 Surface Water Biology and Fisheries Activities

5.3.1.1 Study Area

The possible adverse effects of a developing project on the surface water biology have to be determined prior to the implementation of the project. After reviewing the master plan, the project will discharge treated wastewater from wastewater treatment plant to Dawei River and Kunchaung River. Therefore, the study area will cover the upstream and downstream of the proposed discharge point.

5.3.1.2 Baseline Surface Water Biology

Results from Study of Environmental Impact Assessment (EIA) for Main Road (SEATEC, 2012c)

Plankton

In the dry season, 12 species of phytoplankton were found. Diatom was dominant, *Coscinodiscus* were the most abundant, the total abundance of phytoplankton were between 162,000 and 1,667,830 cells/cu.m. Nine species of zooplankton were identified. Nauplius of Copepod were the most abundantly found, the total abundance of zooplankton were between 9,170 and 95,113 cells/cu.m.

During the wet season, 32 species of phytoplankton were found and Diatom was dominant. *Coscinodiscus* was the most abundantly found, the total abundance of phytoplankton were between 1,265,400 and 2,652,160 cells/cu.m. while 14 species of zooplankton were identified. Protozoan were the most abundant, the total abundance of zooplankton were between 9,500 and 10,240 cells/cu.m.

Benthos

During the dry season, 2 families of marine segmented worms were found. The total density of benthos were between 33 and 60 orgs/sq.m.

During the wet season, 3 families of marine segmented worms were found. The total density of benthos were 154 orgs/sq.m.in all stations.

Aquatic Flora

5 species of aquatic flora were found: Actinoscirpus grosus; *Coix aquatica*; *Colocasia esculenta; Polygonum tomentosum*; and *Acrositchum auream*.

Fishes

5 species of fishes recorded from the local market near Dawei River: silver barb; yellow catfish; striped catfish; nile tilapia; and snakehead.

5.3.1.3 Fisheries

in Dawei River

Two pushnet boats and two set bag nets were used as the fishing gear by the fishermen during both sampling survey. Moreover, gillnet and lined hook are small fishing gear also being used to catch fishes for household consumption. The fisheries activities in the river were shown in Figure 5.3-1

in Canal near project area

Gillnet, fish trap , dip net, fish net and hook are small fishing gear also being used to catch fishes for household consumpti on in water resource. The list of fisher in the Canal were shown in Table 5.3-1

Fish Trap

Fish Net

Dip Net

Gill Net

Boat and Push Net

Fish Hook

Figure 5.3-1 Fisheries Activity near Water Resource

Table 5.3-1 The Results of Fishes in the Water Resource near the Project Area

Family	Species	Common Name	Result				
			IE-SW1	IE-SW2	IE-SW3	IE-SW4	IE-SW5
Notopteridae	*Notopterus notopterus*	Bronze Featherback	-	1,500 (116.800)	-	-	-
Engraulidae	*Stolephorus* sp.	Anchovy	-	-	-	100 (0.215)	-
Cyprinidae	*Osteochilus vittatus*	Hard-lipped Barb	-	200 (2.240)	-	-	-
	Puntius binotatus	Spotted Barb	-	1,800 (1.040)	-	-	-
	Rasbora spp.	Rasbora	-	400 (1.980)	-	-	-
	Cyclocheilichthys armatus	River Barb	-	500 (0.660)	-	-	-
	Danio albolineatus	Pearl Danio	1,000 (0.110)	-	-	-	-
Nandidae	*Nandus nebulosus*	Bornean Leaffish	200 (0.600)	1,100 (0.270)	-	-	-
	Pristolepis fasciata	Malayan Leaffish	-	200 (2.060)	-	-	-
Osphronemidae	*Trichogaster chuna*	Honey Gourami	-	700 (1.200)	-	-	-
Bagridae	*Mystus gulio*	Long-whiskered Catfish	-	-	-	100 (1.000)	-
Belonidae	*Xenentodon cancilla*	Round-tail Garfish	-	2,400 (17.260)	-	-	-
Hemiramphidae	*Dermogenys pusilla*	Needle Fish	-	-	-	300 (0.145)	-
Tetraodontidae	*Tetraodon biocellatus*	Figure Eight Puffer	-	100 (2.000)	-	-	-
Ambassidae	*Parambassis siamensis*	Siamese Glassfish	-	500 (1.200)	-	-	-
Polynemidae	*Polynemus dubius*	Eastern Paradise Fish	-	-	-	100 (3.250)	150 (4.550)
Sciaenidae	*Johnius (Johnius) coitor*	Coitor Croaker	-	-	400 (358.000)	-	-
	Otalithes biaurites	Tigertooth Croaker	-	-	-	400 (0.270)	450 (0.300)

Table 5.3-1 The Results of Fishes in the Water Resource near the Project Area (Con't)

Family	Species	Common Name	Result				
			IE-SW1	IE-SW2	IE-SW3	IE-SW4	IE-SW5
Gobiidae	*Caragoboides geomys*	Goby	-	-	-	1,950 (2.890)	1,950 (0.910)
	Periopthalmodon schlosseri	Mudskipper	-	-	-	400 (0.380)	100 (0.400)
	Trypuchen vagina	Burrowing Goby	-	-	1,000 (3.000)	1,050 (0.360)	200 (0.055)
Channidae	*Channa lucius*	Splendid Snakehead	-	100 (5.730)	-	-	-
Cobitidae	*Acantopsis choirorhynchos*	Horseface Loach	100 (0.100)	100 (0.010)	-	-	-
Aplocheilidae	*Aplocheilus panchax*	Blue Panchax	100 (0.500)	300 (0.060)	-	-	-
Cynoglossidae	*Cynoglossus bilineatus*	Fourlined Tonguesole	-	-	-	-	300 (0.580)
Total 25 species			**4**	**14**	**2**	**8**	**6**
Total Density (Individuals/Hectare)			**1,400**	**9,900**	**1,400**	**4,400**	**3,150**
Total Abundance (Kg/Hectare)			**1.310**	**152.510**	**364.0**	**8.510**	**6.795**

Results from the Study of EIA for Dawei SEZ Initial Industrial Estate Project

Baseline Survey Methodology

Baseline survey of aquatic biology composition were sampled in February, 2015 (before monsoon season). The phytoplankton, zooplankton, benthic fauna, littoral fauna aquatic flora and fishes were collected and analyzed at 5 sampling stations the sampling locations are shown in Table 5.3-2.

The surface water biology parameters and analysis methods of those parameters are summarized in Table 5.3-3.

Table 5.3-2 Summary Locations of Surface Water Biology Monitoring Stations

Environmental Monitoring	GPS		
	UTMWGS84	Easting (X)	Northing (Y)
IE-SW1 : Ekani Chaung	47P	404239	1588090
IE-SW2 : Yalai Chaung Creek	47P	407810	1578350
IE-SW3: Kunchaung River (About 100 Metres Upstream From Kunchaung River Mouth)	47P	412437	1567850
IE-SW4: Dawei River (About 500 Metres Upstream From Kunchaung River Mouth)	47P	412629	1568350
IE-SW5: Dawei River (About 500 Metres Downstream From Kunchaung River Mouth)	47P	412646	1567330

Table 5.3-3 Sampling Methodology of Surface Water Biology Parameters

Parameters	Method[1/]	Sampling Station
Fishes	Collected by Seining. All samples were separated and preserved in 10 % formation solution and brought back to UAE Laboratory for identification	IE-SW1 : Ekani Chaung IE-SW2 : Yalai Chaung Creek IE-SW3 : Kunchaung River (About 100 Metres Upstream From Kunchaung River Mouth) IE-SW4 : Dawei River (About 500 Metres Upstream From Kunchaung River Mouth) IE-SW5 : Dawei River (About 500 Metres Downstream From Kunchaung River Mouth)
Plankton	Both 20 and 70 micron mesh size. Plankton nets were used to collect phytoplankton and zooplankton samples respectively at each sampling location. In case the river is very shallow, 30 liters of water at about 30 cm. below the surface will be poured through the plankton net. Plankton sample remaining in the net was transferred and kept in a plastic bottle and preserved in 5% formalin solution and brought back to the UAE laboratory for species identification and abundance estimate	
Benthos	A Petersen dredge of 0.25 sq.ft mouth opening was used to collect benthic fauna. Three grab samples were collected at each sampling station. Collected sediment was observed, then washed and sorted through a series of wire sieves. All samples collected were kept in plastic bottle and preserved in 5% formalin solution and brought back to the UAE laboratory for their group identification and number estimate	
Littoral Fauna	A sweep-net method (D-frame net with 30 cm x 20 cm opening) was used to collect the aquatic fauna. The collector stood in the river about 1.5 m. from the water's edge. Working in an upstream direction, the net was swept 10 times near the substratum surface (for one sample) while moving forward Each sweep is about 1 m at right angles to the bank and in water between 1 and 1.5 m. depth. All substrata were collected. The net contents were washed to the bottom of the net, the net was inverted, and the contents were emptied into a bucket, rinsing off any material remaining on the net and empty the bucket to a 0.5 mm. mesh sieve. The contents of the sieve were placed in a sorting tray, adhering material was rinsed off with clean water, and the sample was dispersed in the water. Any animals clinging to the net were picked off and added to the tray. All animals were removed from the sorting tray in the field using forceps and pipettes, and placed into plastic jars containing 70% alcohol. The sample jars were labeled with site name, location code, date, and replicate number then shipped back to the laboratory for specie identification.	
Aquatic Flora	Around each sampling station, aquatic flora were observed and recorded its density was roughly estimated as followed: Abundance (or xxx): occupies 66.67-100.00% in about 500 sq.m. area. Moderate (or xx): occupies 33.34-66.66 % in about 500 sq.m. area. Sparse (or x): occupies 00.00-33.33 % in about 500 sq.m. area.	

Remark: [1/] APHA, AWWA and WEF. Standard Methods For The Examination of Water And Wastewater. 22nd ed. Washington, DC: APHA. 2012.

Surface Water Biology Baseline Survey Results

During the first sampling period in February-March 2015, Phytoplankton samples collected in IE-SW1 to IE-SW5 were identified and tabulated in Table 5.3-4.Total of 6 classes were found, consisting of Cyanophyceae (Blue green algae) with 5 species, Chlorophyceae (Green algae) with 20 species Euglenophyceae (Euglenoids) with 4 species Bacillariophyceae (Diatom) with 26 species) Chrysophyceae (Yellow brown algae) with 1 species and Dinophyceae (Dinoflagellate) with 1 species

28 species of phytoplankton were found in station IE-SW1 (Ekani Chaung) Green Algae and Diatom was the dominant taxa, of which *Mougeotia, Onychonema* and *Pinnularia* were the most abundant in IE-SW1 Total abundance of phytoplankton was 4,313,700 units/cu.m. and diversity index of phytoplankton was 1.48. (Table 5.3-4).

28 species of phytoplankton were found in station IE-SW2 (Yalai Chaung) Green Algae and Diatom was the dominant taxa, of which *Mougeotia, Spondylosium* and *Peridinium* were the most abundant in IE-SW2 Total abundance of phytoplankton was 26,870,000 units/cu.m. and diversity index of phytoplankton was 1.44. (Table 5.3-4)

Range of phytoplankton species in IE-SW3 to IE-SW5 stations (Kunchaung. and Dawei River) were 19-20 species. Green Algae and Diatom was the dominant taxa, of which *Cyclotella, Coscinodiscus* and *Oscillatoria* were the most abundant in all stations. Total abundance of phytoplankton ranged 2,386,200 to 8,297,100 units/cu.m. and diversity index of phytoplankton were 1.03 to 1.28 (Table 5.3-4).

Zooplankton samples collected in IE-SW1to IE-SW5 were identified and tabulated in Table 5.3-4. Total of 3 phyla were found, consisting of Protozoa (Protozoan) with 2 species, Rotifera (Rotifer) with 6 species and Arthropoda (Crustacean) with 3 species

Only 4 species of zooplankton were found in station IE-SW1 (Ekani Chaung) Protozoan and Crustacean were the dominant taxa, of which *Arcella, Difflugia* and Cyclopoid Copepod were the most abundant in IE-SW1. Total abundance of zooplankton was 24,700 units/cu.m. and diversity index of zooplankton was 0.90. (Table 5.3-4)

11 species of zooplankton were found in station IE-SW2 (Yalai Chaung) Rotifer and Crustacean was the dominant taxa, of which Nauplius of Copepod*, Polyarthra* and *Trichocerca* were the most abundant in IE-SW2. Total abundance of zooplankton was 370,000 units/cu.m. and diversity index of zooplankton was 1.87. (Table 5.3-4)

Table 5.3-4 The Results of Aquatic Organisms in the Water Resource near the Project Area

Aquatic Organisms	IE-SW1	IE-SW2	IE-SW3	IE-SW4	IE-SW5
Phytoplankton					
Total Abundance (Units/m^3)	4,313,700	26,869,000	3,377,700	2,386,200	8,297,100
Amount of Species	28	28	20	19	20
Diversity Index	1.48	1.44	1.03	1.28	1.13
Dominant Genera	*Mougeotia*	*Mougeotia*	*Cyclotella*	*Cyclotella*	*Cyclotella*
Zooplankton					
Total Abundance (Units/m^3)	24,700	370,000	23,000	135,300	99,600
Amount of Species	4	11	4	4	3
Diversity Index	0.90	1.87	1.13	0.66	0.47
Dominant Genera/Group	*Arcella*	Nauplius of Copepod	*Difflugia*	Nauplius of Copepod	Nauplius of Copepod
Benthic Fauna					
Total Density (Individuals/m^2)	58	36	36	14	14
Amount of Species	5	3	4	2	1
Dominant Family/Group	Palaemonidae	Libellulidae	Palaemonidae	Palaemonidae	Palaemonidae
Littoral Fauna					
Total Density (Individuals/m^2)	22	64	104	176	64
Amount of Species	3	3	3	3	3
Dominant Family/Group	Palaemonidae	Palaemonidae	Palaemonidae	Palaemonidae	Palaemonidae

Range of zooplankton species in IE-SW3 to IE-SW5 stations (Kunchaung.and Dawei River) were 3-4 species. Protozoan and Crustacean were the dominant taxa, of which *Difflugia,* Nauplius of Copepod and Cyclopoid Copepod were the most abundant in all stations. Total abundance of zooplankton ranged 23,000 to 135,300 units/cu.m. and diversity index of zooplankton were 0.47 to 1.13 (Table 5.3-4).

As indicated by Wilhm and Dorris (1968), the diversity index (H') is related to surface water quality[1]. The diversity index of phytoplankton were 1.03 to 1.48. The diversity index of zooplankton were 0.47 to 1.87 Diversity index results imply that the water quality of water resource near the project area were at moderate conditions and acceptable for aquatic organisms.

[1] H < 1.0 = Bad water quality, not suitable for aquatic organisms
1.0 < H < 3.0 = Moderate water quality, moderately suitable for aquatic organisms
H > 3.0 = Good water quality, very suitable for aquatic organism

Benthic Fauna (Benthos)

Benthos samples collected in IE-SW1 to IE-SW5 were identified and tabulated in Table 5.3-4. Total of 9 families were found, consisting of Crustacea (Shrimp) with 2 families Insecta (Aquatic Insect) with 3 families, and Gastropoda (Snail) with 2 families.

5 families of benthos were found in station IE-SW1 (Ekani Chaung).Shrimp and Insect larva were the dominant taxa, in IE-SW1. Total density of benthos was 58 individuals/sq.m. (Table 5.3-4).

3 families of benthos were found in station IE-SW2 (Yalai Chaung). Insect larva was the dominant taxa in IE-SW2. Total density of benthosn was 36 individuals/sq.m. (Table 5.3-4).

Range of benthos species in IE-SW3 to IE-SW5 stations (Kunchaung.and Dawei River).were 1-4 families. Shrimp was the dominant taxa in all stations. Total density of benthos ranged 14 to 36 individuals/sq.m. (Table 5.3-4).

Littoral Fauna

Littoral Fauna samples collected in IE-SW1 to IE-SW5 were identified and tabulated in Table 5.3-4. Total of 6 families were found, consisting of Crustacea (Shrimp) with 3 families Insecta (Aquatic Insect) with 2 families, and Gastropoda (Snail) with 1 family.

3 families of littoral fauna were found in station IE-SW1 (Ekani Chaung).Shrimp was the dominant taxa in IE-SW1. Total density of littoral fauna was 22 individuals/sq.m. (Table 5.3-4).

3 families of littoral fauna were found in station IE-SW2 (Yalai Chaung). Shrimp was the dominant taxa in IE-SW2. Total density of littoral fauna was 64 individuals/sq.m. (Table 5.3-4).

Range of littoral fauna species in IE-SW3 to IE-SW5 stations (Kunchaung.and Dawei River).was 3 families. Shrimp was the dominant taxa in all stations. Total density of littoral fauna ranged 104 to130 individuals/sq.m. (Table 5.3-5).

Aquatic Flora

Aquatic flora samples collected in IE-SW1 to IE-SW5 were identified and tabulated in Table 5.3-5 and Figure 5.3-2. Total of 14 species were found.

6 species of aquatic flora were found in station IE-SW1 No dominant taxa was in IE-SW1.

8 species of aquatic flora were found in station IE-SW2 (Yalai Chaung). Bladderwort (*Utricularia aurea*) was the dominant taxa in IE-SW2.

Range of aquatic flora species in IE-SW3 to IE-SW5 stations (Kunchaung.and Dawei River).were 5-6 species. Nipa palm (*Nipa fruticans*) and Coarse bulrush (*Actinoscirpus grossus*) were the dominant taxa in all stations (Table 5.3-5).

Table 5.3-5 The Results of Aquatic Flora in The Water Resource near The Project Area

Aquatic Flora	IE-SW1	IE-SW2	IE-SW3	IE-SW4	IE-SW5
Family Poaceae					
Brachiaria mutica	x	x	-	-	-
Leersia hexandra	x	x	-	-	-
Family Menyanthaceae					
Nymphoidessp.	-	xx	-	-	-
Family Cyperaceae					
Actinoscirpus grossus	-	-	x	xx	xx
Family Acanthaceae					
Acanthus ebracteatus	-	-	x	x	x
Family Lentibulariaceae					
Uticularia aurea	-	xxx	-	-	-
Family Cabombaceae					
Cabomba caroliniana	-	xx	-	-	-
Family Araceae					
Cryptocoryne ciliate	-	-	x	xx	xx
Colocasia esculenta	x	x	-	-	-
Lasia spinosa	x	x	-	-	-
Family Asteraceae					
Eclipta prostate	x	x	-	-	-
Family Potamogetonaceae					
Potamogeton malaianus	x	-	-	-	-
Family Rhizophoraceae					
Rhizophora apiculata	-	-	x	x	x
Family Avicenniaceae					
Avicennia alba	-	-	x	x	x
Family Arecaceae					
Nypa fruticans	-	-	xx	xx	xx
Amount of Species	**6**	**8**	**5**	**6**	**6**

IE-SW1 : Ekani Chaung

IE-SW2 : Yalai Chaung Creek

IE-SW3: Kunchaung River (About 100 Metres Upstream From Kunchaung River Mouth)

IE-SW4: Dawei River (About 500 Metres Upstream From Kunchaung River Mouth)

IE-SW5: Dawei River (About 500 Metres Downstream From Kunchaung River Mouth)

Figure 5.3-2 Aquatic Flora of the Water Resource

<u>Fishes</u>

Fishess samples collected in IE-SW1 to IE-SW5 were identified and tabulated in Table 5.3-6 and shown in Figure 5.3-2 Total of 25 species of fiises were found

4 species of fishes were found in station IE-SW1 (Ekani Chaung).Pearl Danio (*Danio albolineatus*) was the dominant taxa in IE- SW1. Total density of fishes was 1,400 individuals/hectar and total abundance of fishes was 1.310 kg/hectare. (Table 5.3-6)

14 species of fishes were found in station IE-SW2 (Yalai Chaung). Round-tailed garfish (*Xenentodon cancila*) was the dominant taxa in IE-SW2. Total density of fishes was 9,900 individuals/hectar and total abundance of fishes was 152.510 kg/hectare. (Table 5.3-6)

Only 2 species of fishes were found in station IE- SW3 (Kunchaung River Mouth). Burrowing goby (*Trypuchen vagina*) was the dominant taxa in IE-SW3. Total density of fishes was 1,400 individuals/hectar and total abundance of fishes was 361.000 kg/hectare. (Table 5.3-6)

Range of fishes species in IE-SW4 to IE-SW5 stations (Dawei River). were 6-8 species. Burrowing goby (*Trypuchen vagina*) and Goby (*Ceragoboides geomys*) taxa in all stations. Total density of fishes ranged 1,400 to 4,400 individuals/hectar and total abundance of fishes ranged 6.795 to 8.510 kg/hectare. (Table 5.3-6).

<u>Fisheries Activities</u>

<u>in Dawei River</u>

Two pushnet boats and two set bag net were used as the fishing gear by the fishermen during both sampling survey. Moreover, gillnet and hook and line are small fishing gear also being used to catch fishes for household consumption. The fisheries activities in the river were shown in Figure 5.3-3.

<u>in Canal near project area</u>

Gillnet, fish trap, dip net, fish net and hook are small fishing gear also being used to catch fishes for household consumption in water resource. The fisheries activities in the river were shown in Figure 5.3-4.

IE-SW1 : Ekani Chaung

IE-SW2 : Yalai Chaung Creek

IE-SW3: Kunchaung River (About 100 Metres Upstream From Kunchaung River Mouth)

IE-SW4: Dawei River (About 500 Metres Upstream From Kunchaung River Mouth)

IE-SW5: Dawei River (About 500 Metres Downstream From Kunchaung River Mouth)

Figure 5.3-3 Parts of Fishes Species in Water Resource

Fish Trap

Fish Net

Dip Net

Gill Net

Boat and Push Net

Fish Hook

Figure 5.3-4 Fishery Activities near Water Resource

Table 5.3-6 The Results of Fishes in The Water Resource near the Project Area

Family	Species	Common Name	Result				
			IE-SW1	IE-SW2	IE-SW3	IE-SW4	IE-SW5
Notopteridae	*Notopterus notopterus*	Bronze Featherback	-	1,500 (116.800)	-	-	-
Engraulidae	*Stolephorus* sp.	Anchovy	-	-	-	100 (0.215)	-
Cyprinidae	*Osteochilus vittatus*	Hard-lipped Barb	-	200 (2.240)	-	-	-
	Puntius binotatus	Spotted Barb	-	1,800 (1.040)	-	-	-
	Rasbora spp.	Rasbora	-	400 (1.980)	-	-	-
	Cyclocheilichthys armatus	River Barb	-	500 (0.660)	-	-	-
	Danio albolineatus	Pearl Danio	1,000 (0.110)	-	-	-	-
Nandidae	*Nandus nebulosus*	Bornean Leaffish	200 (0.600)	1,100 (0.270)	-	-	-
	Pristolepis fasciata	Malayan Leaffish	-	200 (2.060)	-	-	-
Osphronemidae	*Trichogaster chuna*	Honey Gourami	-	700 (1.200)	-	-	-
Bagridae	*Mystus gulio*	Long-whiskered Catfish	-	-	-	100 (1.000)	-
Belonidae	*Xenentodon cancilla*	Round-tail Garfish	-	2,400 (17.260)	-	-	-
Hemiramphidae	*Dermogenys pusilla*	Needle Fish	-	-	-	300 (0.145)	-
Tetraodontidae	*Tetraodon biocellatus*	Figure Eight Puffer	-	100 (2.000)	-	-	-
Ambassidae	*Parambassis siamensis*	Siamese Glassfish	-	500 (1.200)	-	-	-
Polynemidae	*Polynemus dubius*	Eastern Paradise Fish	-	-	-	100 (3.250)	150 (4.550)
Sciaenidae	*Johnius (Johnius) coitor*	Coitor Croaker	-	-	400 (358.000)	-	-
	Otalithes biaurites	Tigertooth Croaker	-	-	-	400 (0.270)	450 (0.300)

Table 5.3-6 The Results of Fishes in The Water Resource near the Project Area (Con't.)

Family	Species	Common Name	Result				
			IE-SW1	IE-SW2	IE-SW3	IE-SW4	IE-SW5
Gobiidae	*Caragoboides geomys*	Goby	-	-	-	1,950 (2.890)	1,950 (0.910)
	Periopthalmodon schlosseri	Mudskipper	-	-	-	400 (0.380)	100 (0.400)
	Trypuchen vagina	Burrowing Goby	-	-	1,000 (3.000)	1,050 (0.360)	200 (0.055)
Channidae	*Channa lucius*	Splendid Snakehead	-	100 (5.730)	-	-	-
Cobitidae	*Acantopsis choirorhynchos*	Horseface Loach	100 (0.100)	100 (0.010)	-	-	-
Aplocheilidae	*Aplocheilus panchax*	Blue Panchax	100 (0.500)	300 (0.060)	-	-	-
Cynoglossidae	*Cynoglossus bilineatus*	Fourlined Tonguesole	-	-	-	-	300 (0.580)
Total 25 species			**4**	**14**	**2**	**8**	**6**
Total Density (Individuals/Hectare)			**1,400**	**9,900**	**1,400**	**4,400**	**3,150**
Total Abundance (Kg/Hectare)			**1.310**	**152.510**	**364.0**	**8.510**	**6.795**

5.3.2 Forests

5.3.2.1 Study Area

The study area will cover the project boundary together with the area potentially impacted by the project activities. For the forest study, the secondary data from the final report of the Dawei Sea Port includes the study of the wildlife and the impact on wildlife resources caused by project implementation.

5.3.2.2 Baseline Forest Conditions

The following information is reviewed for the secondary data and description of the forest conditions in the project area:

- Topographical Map of Tavoy Burma 1:250,000 Series U542, Sheet ND 47-6, Edition 1-AMS, 1957 (USACE, 1957).
- Initial Environmental Examination (IEE) for Dawei Sea Port & Industrial Estate Development (TEAM, 2012a).

A review of secondary data (Figure 5.3-5), regarding forest resources, was conducted at ten plots during 14-21 December 2011. These ten stations were selected to represent areas of natural reserved forestry, within 5 km. from the study of forest temporary sampling plots, forest ecology analysis of the important value index (IVI), and species diversity specific ecosystems.

The types of forest around the project area can be divided into three forest types: mangrove forest, reserved forest, and natural forest (TEAM, 2012a).

Forest characteristics in the project area consisted four forest types: beach forest, mangrove forest; dipterocarp forest; and dry evergreen forest. The situations of the forests were varied depending on the level of disturbance by human.

<u>*Mangrove Forest*</u>

i) Forest composition

In 24 sampling plots (0.54 ha), the total number of species with GBH > 10 cm was 13. The dominant families of tree species were Avicenniaceae (3 species), Rhizophoraceae (3 species), and Fabaceae (2 species). Combretaceae, Euphorbiaceae, Myrsinaceae, Plumbaginaceae, and Verbenaceae had only 1 species respectively. The level of ecological significance of the tree species in the area was ranked by IVI. The tree layer in the study area was dominated by *Avicennia marina* (Forssk.) Vierh., with the highest IVI of 76.09. The second most dominant species was *Excoecaria agallocha* L. (IVI = 57.14), and *Avicennia alba* Blume (IVI = 37.92) was third. The dominant mangrove species in this area were *Avicennia marina* (Forssk.) Vierh., *Excoecaria agallocha* L. and *Avicennia alba* Blume (Initial Environmental Examination (IEE) for Dawei Sea Port & Industrial Estate Development conducted).

The forest structure showed that *Rhizophora apiculata* Bl., *Heritiera littoralis* Dry., *Excoecaria gallocha* Linn., and *Olea maritima* Wall were the dominant species. Other species such as *Bruguiera gymnorrhiza* (L.) Savigny, *Lumnitzera littorea* (Jack) Voigt, and *Lumnitzera racemosa* Willd were sporadically distributed in path areas, particularly the area that saline water cannot easily reach.

The floristic structure showed that the average height of trees were about 3 – 12 m. Diameters at breast height of tree were ranged from 2 to 20 cm. Tree canopy layers were divided into upper and lower layers. The density of trees with diametersof breast height more than 60 cm. was, on average, about one tree/ha. The density of trees with diameters of breast height between 30 to 60 cm. was, on average, about 8 tree/ha. The density of trees with diametersof breast height between 10 to 30 cm. was, on average, about 72 tree/ha. Finally, the density of treeswith diameters at breast height less than 10 cm. was, on average, about 210 tree/ha. 14 species of tree from 12 different families were found. The dominant families of tree species were Rhizophoraceae and Combretaceae (2 species). Euphorbiaceae, Labiatae, Leguminosae Caesal- pinioideae, Leguminosae Papilionoideae, Oleaceae, Pandanaceae, Periplocaceae, Pteridaceae, Rhamnaceae, and Sterculiaceae have only 1 species respectively.

ii) Diversity indices and evenness

Among the different measurement of species diversity indices, the floristic diversity of the mangrove forest was 1.836.

iii) Status for conservation concern

One species found in the Mangrove forests within the study area was on the IUCN Red list: *Ceriops decandra* (Griff.) Ding Hou.

Source: IEE for Dawei Sea Port & Industrial Estate Development (TEAM, 2012a)

Figure 5.3-5 Forest Sampling Stations

Reserved Forest

i) Forest composition

In 5 sampling plots, total number of species with GBH $\geq$ 10 cm. was 21. The dominant families of tree species were Euphorbiaceae (5 species)., Annonaceae, Lauraceae, and Rubiaceae (2 species) (Table 5.3-7 and Table 5.3-8).

The ecological significance of the tree species within the study area was ranked by IVI. The tree study area was dominated by *Dipterocarpus obtusifolius* Teysm., with the highest IVI of 79.06.The second most dominant species was *Aporusa villosa* Bail.(IVI = 60.50) and *Croton joufra* Roxb. (IVI = 42.34) was third. Those species could be considered as the ecological indicator species of the reserved forest. The dominant tree species in this area were *Dipterocarpus obtusifolius* Teysm., *Aporusa villosa* Bail., *Croton joufra* Roxb., *Memecylon plebejum* Kurz, and *Xylia xylocarpa* (Roxb.) Taub. The ground layer was dominated by seedlings and saplings of *Croton joufra* Roxb., *Memecylon plebejum* Kurz, *Spermacoce latifolia* Rubl. And *Kaempferia* sp.

ii) Diversity indices and evenness

According to the results, the diversity indices of individual sample plot and all sample indices were very low. Diversity value for all sample indices was 1.854.

iii) Status for conservation concern

According to the forest reserve's field survey, none of the species in the study area was assessed in the IUCN Red list:

Table 5.3-7 Ranking of Dominant Family by Number of Species Composition

No.	Family Name	No. fo Species
1	Euphorbiaceae	5
2	Annonaceae	2
3	Lauraceae	2
4	Rubiaceae	2
5	Anacardiaceae	1
6	Dilleniaceae	1
7	Dipterocarpaceae	1
8	Fabaceae	1
9	Loganiaceae	1
10	Lythraceae	1
11	Melastomataceae	1
12	Mimosaceae	1
13	Myrtaceae	1
14	Symplocaceae	1
Total		**21**

Table 5.3-8 Ranking of Important Value Index (IVI) in Reserved Forest

No.	Family Name	Scientific Name	RD (%)	RF (%)	RD (%)	IVI (%)
1	Euphorbiaceae	*Aporusa Villosa* Baill	22.68	10.87	37.78	79.06
		Croton joufar Roxb.	19.85	10.87	11.62	42.34
		Suregada multiflora (A.Juss.) Baill	1.03	6.52	0.23	7.79
		Emblica officinalis Gaertn	0.52	4.35	0.11	4.97
		Aporusa dioica (Roxb.) Muell.Arg.	0.26	2.17	0.06	2.49
2	Annonaceae	*Desmos chinensis* Lour	1.03	6.52	0.64	8.19
		Uvaria cordata Schum&Thonn	0.26	2.17	0.28	2.72
3	Lauraceae	*Actinodaphne* sp.	0.26	2.17	0.16	2.59
		Litsea glutinosa (Lour.) C.B.Rob	0.26	2.17	0.11	2.54
4	Rubiaceae	*Randia* sp.	1.55	2.17	1.09	4.81
		Gardenia coronaria Buch-ham	0.26	2.17	0.43	2.87
5	Anacardiaceae	*Lannea Coromandelica* (Houtt.) Merr.	0.77	4.35	0.55	5.67
6	Dilleniaceae	*Dillenia indica* L.	0.26	2.17	0.29	2.73
7	Dipterocarpaceae	*Dipterocarpus obtusifolius* Teysm	30.41	10.87	37.78	79.06
8	Fabaceae	*Dalbergia volubilis* Roxb.	0.52	2.17	0.51	3.20
9	Loganiaceae	*Strychnos* sp.	1.03	2.17	0.71	3.91
10	Lytheaceae	*Lagerstoremia macrocarpa* Kurz	0.26	2.17	0.06	2.49
11	Melastomataceae	*Memecylon plebejum* Kurz	9.79	8.70	10.27	28.76
12	Mimosaceae	*Xylia xylocarpa* (Roxb.) Taub	6.70	8.70	10.27	28.76
13	Myrtaceae	*Syzygium* sp.	1.29	2.17	1.64	5.11
14	Symploaceae	*Symplocos racemose* Roxb.	1.03	4.35	0.90	6.28
Total			**100.00**	**100.00**	**100.00**	**300.00**

Natural Forest

i) Forest composition

In the 19 sampling plots (0.43 ha), the total number of species with GBH ≥ 10 cm. was 98 species. The dominant families of tree species were Euphorbiaceae (13 species), Rubiaceae (8 species), Lauraceae (6 species), Myrtaceae (5 species), and Combretaceae, Lecythidaceae, Lythraceae, and Moraceae (4 species) respectively.

The ecological significance of the tree species within the study area was determined by IVI.. The tree layer in the study area was dominated by *Cratoxylum ligustrinum* Blumewith the highest IVI of 23.76, the second most dominant species was *Duabanga grandiflora* (Roxb. Ex DC.) Walp. (IVI = 17.86) and *Croton joufra* Roxb. (IVI = 16.48) was third. The dominant tree species in this area were *Cratoxylum ligustrinum* Blume, *Duabanga grandiflora* (Roxb. Ex DC.) Walp., *Croton joufra* Roxb., *Aporusa villosa* Bail., and *Aporusa dioica* (Roxb) Muell. Arg. etc. The ground layer is dominated by *Lygodium* sp. (1), *Rhynchospora corymbosa* (L.) Britt. *Spermacoce latifolia* Rubl., *Kaempferia* sp., *Chromolaena*

odorata (L.) R.M. king & H. Robinson, *Helicteres hirtusa* Lour., *Oplismenus composites* (L.) P. Beauv., *Panicum* sp., *Memecylon plebejum* Kurz, *Helicteres angustifolia* L., *Justicia procumbens* L., *Abrus precatirius* L., and *Curcuma* sp.

ii) Diversity indices and evenness

The values of diversity indices and evenness indices of the individual sample plots were relatively high. Diversity value for all sample was 3.4724.

iii) Status for conservation concern

According to the field survey of the reserved forest in the study area, one endangered tree species was *Diospyros crumentata* Thwaites. 2 critically endangered species were *Dipterocarpus kerrii* King and *Dipterocarpus turbinatus* Gaertn. f, and one valuable species is *Hopea odorata* Roxb; all of which founded in the study area.

<u>Beach Forest</u>

i) Forest Composition

Beach forest characteristics indicated that had secondary growth patterns, and were disturbed by the presence of human beings. What was natural land had been turned into a Cashew nut plantation. However, there were some natural trees species that still remain. The forest structure showed that *Casuarina equisetifolia* J.R. & G. Forst., *Syzygium grande* (Wight) Walp. var. grande and *Lannea coromandelica* Merr. were the dominant species. Other species such as *Macaranga tanarius* Muell. Arg., *Memecylon scutellatum* Naudin, *Phyllanthus emblica* Linn., *Suregada multiflorum* Baill. And *Zizyphus oenoplia* Mill. were scattered throughout the path.

The floristic structure showed an average height of trees to be about 2 – 12 m. Diameters at breast height of tree ranged from 3 to 25 cm. Canopy tree layers were divided into upper and lower layers. The density of trees having a diameter, at breast height, more than 60 cm. was on average about 1 trees/ha. The density of trees having a diameter, at breast height, between 30 to 60 cm. was on average about 5 trees/ha. The density of trees having a diameter, at breast height, between 10 to 30 cm. was on average about 60 trees/ha. Finally, the density of trees having a diameter, at breast height, less than 10 cm. was on average about 180 trees/ha. Tree species that were found: 17 species from 10 families including Euphorbiaceae (5 species); Anacardiaceae (2 species); Combretaceae (2 species); Melastomataceae (2 species); Casuarinaceae (1 species); Compositae (1 species); Ceguminosae- Papilionoideae (1 species); Moraceae (1 species); and Myrtaceae (1 species). The numbers of saplings and seedlings were about 280 and 320 trees/ha, respectively. There were few amounts of small trees. The data determined that the natural regeneration of the forest was rather low in quality. The main natural regeneration process of trees, after they had been disturbed or cut down, was to gain nutrients from coppice shoots. Almost all tree species had the ability to make a new shoot by coppicing.

Dry Dipterocarp Forest

i) Forest Composition

Dry Dipterocarp forests in the project area were unique because they were not usually distributed in zones of high precipitation, or close to the sea. It was quite uncommon to find dry dipterocarp forests in areas like the project area, simply because of the presence of moisture. We found that the reason why dry dipterocarp grew in the project area was because of the soil properties of the sand.

The lack of soil nutrition made it limiting for general tree species to grow in the area. These areas are not suitable for agriculture as they used this forest to for firewood. The dominant tree species in this area are: *Dipterovarpus obtusifolius* Teysm; *Aporusa villosa* Baill.; *Crolon joufra* Roxb.; *Memecylon plebejum* Kurz; and *Xylia xylocarpa* (Roxb.) Taub. The ground layer was dominated by seedlings and saplings of *Croton joufra* Roxb., *Memecylon plebejum* Kurz*, Spermacoce latifolia* Rubl., and *Kaempferia* sp.

The floristic structure showed that the height of trees, with Diameters at breast height of tree ranged from 3 to 22 cm., were about 3 – 11 m. Canopy tree layer were divided into upper and lower layers. The density of trees having a diameter, at breast height, more than 60 cm. were, on average, about 2 tree/ha. The density of trees having a diameter, at breast height, between 30 to 60 cm. were, on average, about 9 tree/ha. The density of trees, having a diameter at breast height between 10 to 30 cm., were on average about 69 tree/ha. Finally, the density of trees having a diameter at breast height less than 10 cm. were, on average, about 246 tree/ha. 15 different species from 10 different families were found. The dominant families of tree species were: Euphorbiaceae (3 species); Dipterocarpaceae; Anacardiaceae; and Myrtaceae (2 species) respectively. Rubiaceae, Barringtoniaceae, Combretaceae, Connaraceae, Leguminoceae-Mimosaceae, and Sterculiaceae have only 1 species respectively. The natural regenerations by seed germination and seedling establishment were few and far between. The main process of natural regeneration was coppice from old stumps, particularly from the dominant species, *Dipterovarpus obtusifolius* Teysm.

Dry Evergreen Forest

i) Forest composition

Dry evergreen forests were the main forest types within the project. However, the dry evergreen forests had been disturbed by oil palm plantations, para rubber plantation, cashew nut plantations, Paddy field, and home gardens. The forests were within the same areas as agriculture land. Because of the agricultural land, the composition of the forests were already different from their natural composition. Almost none of the remaining tree species were pioneer species or coppice from the old stump of the mother tree. The remaining trees were small and dense coppicing trees because they were cut and utilized by the rural people. The dominant tree species in this area were: *Cratoxylum ligustrinum* Blume; *Croton joufra* Roxb.; *Barringtonia angusta* Kurz*; Aporusa villosa* Baill.; and *Aporusa dioica* (Roxb.) Muell. Arg. Theground layer was dominated by *Lygodium* sp. (1), *Rhynchospora corymbosa* (L.) Britt. *Spermacoce latifolia* Rubl., *Kaempferia* sp. *Chromolaena odoraa* (L.) R.M. King & H.

Robinson, *Helicteres hirsute* Lour., *Oplismenus composites* (L.) P. Beauv., *Panicum* sp. *Memecylon plebejum* Kurz, *Helicteres angustifolia* L., *Justicia procumbens* L., *Abrus precatorius* L. and *Curcuma* sp.

The floristic structure showed that the average height of trees ranged between 3-15 m. with diameters, at breast height, ranging from 4 to 40 cm. Canopy tree layer were divided into layer as upper and lower layer. The density of trees having a diameter, at breast height, more than 60 cm. was about 3 trees/ha. The density of trees having a diameter, at breast height, between 30 to 60 cm. was about 15 trees/ha. The density of trees having a diameter, at breast height, between 10 to 30 cm. was about 85 trees/ha. Finally, the density of trees having a diameter, at breast height, less than 10 cm. was about 260 trees/ha. 28 different species of trees from 21 different families were found. The dominant families of tree species were: Euphorbiaceae (4 species); Anacardiaceae (2 species); Barringtoniaceae (2 species); Combretaceae (2 species); and Moraceae (2 species) respectively.

5.3.3 Wildlife

5.3.3.1 Study Area

The study area will cover the project boundary together with the area potentially impacted by the project activities. For the wildlife study, the secondary data of the wildlife and investigates the diversity, abundance, distribution, utilization, present day status of wildlife in the Project area, and the impact of project implementation are reviewed.

5.3.3.2 Baseline Wildlife Conditions

Source of Information

- Initial Environmental Examination (IEE) for Dawei Sea Port & Industrial Estate Development (TEAM, 2012a).
- Environmental Impact Assessment (EIA) for Main Road (SEATEC, 2012c).
- Draft Environmental Impact Assessment for Dawei Industrial Estate Project (SEATEC in association with UAE, 2012)

Result of the Studies

According to the study, the diversity of wildlife in and around the study area can be described in four types: reptile; amphibian; avis (Birds); and mammal. Generally, the forest in project site was not fertile and a high population of people was present. Any human activity could affect the living wild animals, so the wildlife was not as diverse. Results of two studies are summarized in Table 5.3-9.

Table 5.3-9 Summary of Wildlife Survey Results from Previous Studies

Type	TEAM Study (2012a)	SEATEC Study (2012c)
Reptiles Species	A total of eight reptiles species were recorded during the surveyed period. Out of the recorded species, the Burmese python (*Python molurus bivittatus*) is an endangered species listed in the IUCN Red-list. The species *Python molurus bivittatus*, *Ptyas korros*, *Naja kaouthia* are listed under Appendix II of the CITES list. The Burmese python (*Python molurus bivittatus*) and Green tree viper (*Trimeresurus gramineus*) were noted as forest dwellers and the remaining reptile species were recorded to inhabit other habitats. Garden fence lizard (*Calotes versicolor*) and Many-lined sun skink (*Mabuya multifasciata*) were found as common reptile species distributing in all habitats of the studied area.	A total of 20 reptile species were recorded during the survey period. The recorded species were not included in any lists. The species of reptile were classified to two orders consisting of Chelonia and Squamata, and ten families consisting of Testudinidae (one species), Gokkonidae (four species), Agamidae Scincidae (four species), Uromastycidae (three species), Varanidae (one species), Pythonidae (one species), Pythonidae (one species), Colubridae (three species), Elapidae (one species) and Viperidae (one species). Almost all reptiles that were found in the project area were living in a terrestrial forest, such as dry diptercarp forest and under growth of the dry evergreen forest, except the Water Monitor Lizard (*Varanus salvator*) which lives in the river bank area. All of reptiles that were found in the project area are known as common reptile species that are distributed in all habitats of the study area. The study area is only livable to adaptable species, because the project site has been constantly disturbed by people.
Amphibians Species	Seven amphibian species were recorded during the survey period. Among these recorded species, the Paddy frog (*Rana limnocharis*) is listed as an endemic species in Myanmar. The frogs and toads recorded are common in the study area, and large populations were observed in the paddy fields and grassland. The species *Rana limnocharis* and *Rana limnocharis* were observed in large population within the paddy field. The common toad *(Bufo melanostatus)* was observed particularly in human habitation areas. *Rana* species are more active during the monsoon season.	A total of thirteen other amphibian species were recorded during the surveyed period. Four families of amphibians, consisting of Bufonidae (four species), Ranidae (five species), Rhacophoridae (one species) and Microhylidae (three species) belong to the *Anura* family. Among these recorded species, the Common Black-Spinned Toad (*Bufo melanostictus*), Malayan Giant Toad (*Bufo asper*), Pearl-tripped Pustiled Puddle Frog, (*Occidozyga magnapustulosus*) Marten's Puddle Frog (*Occidozyga martensii*), Marsh Frog (*Fejervarya limnocharis*) and Malayan Giant Frog (*Rana blythii*) were observed within the riverbank area or paddy fields. Others species, including Flat-Headed Toad (*Bufo macrotis*), Dawf Toad (*Bufo parvis*), Common Tree frog (*Rhacophorus leucomystax*), Striped Spadefoot Frog (*Calluella guttulata*), Common Burrowing Frog (*Microhyla pulchra*), and Ornated Chorus Frog (*Microhyla ornata*) were normally found in the under growth of dry dipterocap forest and dry evergreen forest. The common toad (*Bufo melamostatus*) was observed particularly in human habitation areas. All amphibian species are more active during the monsoon season.

Table 5.3-9 Summary of Wildlife Survey Results from Previous Studies (Con't.)

Type	TEAM Study (2012a)	SEATEC Study (2012c)
Mammals Species	A total of fourteen mammal species were recorded during the survey period. Among the recorded species, the East Asian Porcupine (*Hystrix brachyuran*) and Long-tail Goat (*Naemorhedus caudatus*) were listed under vulnerable species in the IUCN Red-list. The Slow Loris (*Nycticebus coucang*) The Asiatic Black Bear (*Ursus thibetanus*), The Jungle Cat (*Felis chaus*) and The Sund Pangolin (*Manis javanica*) were listed under Appendix II of the CITES list, while the Long-tail Goat (*Naemorhedus caudatus*) was listed under Appendix I. The two squirrel species, Palla's Squirrel (*Callosciurus erythraeus*) and Variable Squirrel (*Callosciurus finlaysonii*) were observed as common species residing in orchards and human habitation areas. The Asiatic Black Bear (*Ursus thibetanus*) was recorded as relatively rare in the proposed project area.	A total of sixteen mammal species were recorded during the survey period; however, they were not recorded in any lists. The species of mammals were classified in to five orders: Insectivora; Chiroptera; Primates; Carnivora; and Rodentia. They were classified in to seven families: Tupaidae (one species); Pteropodidae (one species); Cercopithecidae (two species); Viverridae (two species); Herpestidae (one species); Sciuridae (three species); and Muridae (six species). Most of the mammals that were in the project area were living in a terrestrial forest such as the dry diptercarp forest and the under growth of the dry evergreen forest, except The Water Small Asian. Mongoose (*Herpestes javanicus*) which live in river bank area. The three squirrel species, Variable Squirrrel (*Callosciurus finlaysonii*), Indochinese Ground Squirrel (*Menetes berdmorei*) and Himalayan striped Squirrel (*Tamiops macclellandi*) were observed as common species living in orchards and human habitation areas. All of the mammals were found in the project area however, the common mammal species were adapting to all habitats in the study area. Because of all the destruction brought on by human activity, only small adaptable mammals remain.
Avis (Bird) Species	A total of thirty-seven bird species were recorded during the survey period. Members of the family Ardeidae, Little egret (*Egretta garzetta*) Cattle egret (*Bubulcus ibis*) Indian pond heron (*Ardeola grayii*) and Chinese pond heron (*Ardeola bacchus*) are found near the water and are listed as water bird species. Apart from the species Family Ardeidae, four other water bird species were also observed: Little grebe (*Tachybaptus ruficollis*); Red-watted lapwing (*Vanellus indicus*); and the common sand piper (*Actilis hypoleucos*) were also noted as water bird species. The bird of prey species were: Oriental Honey-buzzard (*Pernis ptilorhynchus*); Shikra (*Accipiter badius*) and the Black Kite (*Milvus migrans*). The Barn swallow (*Hirundo rustica*) and the common myna (*Acridotheres tristis*) were recorded as common species in the proposed project area. Threatened species were not observed in the area.	A total of sixty-seven bird species were recorded during the survey period. All of the bird species were common species that could be found in general areas. Threatened species were not observed in the area; however, the species of bird were very diverse in order, family, and species level. It may be caused by the project area consisting of various ecosystem types from mountainous to beach. The species of birds that were found in the project area were classified to tweleve different orders: Pelecaniformes (one family); Anseriformes (one family); Ciconiiformes (one family); Falconiformes (one family); Charadriiformes (one family); Columbiformes (one family); Cuculiformes (one family); Strigiformes (one family); Apodiformes (two families); Coraciiformes (four families); Piciformes (one family); and Passeriformes (fifteen families). The habitats of avis were different depending on bird species; however, it could be divided into three main zones: swamp and beach area; grassland and paddy field area; and under growth and forest area. Among the avis family, Phalacrocoracidae, Anatidae, Ardeidae, Charadriidae, and Aicedinidae preferred to use swamp and beach area in beach forest and mangrove forest. Family Accipitridae, Columbidae, Cuculidae, Meropidae, Coraciidae, Bucerotidae, Megalaimldae, Megalaimldae, Pycnonotidae, Dicruridae, Oriolidae, Corvidae, Timaliidae, Turdidae, Muscicapidae, Dicaeidae, Sturnidae, and Estrildidae preferred to use under growth area of dry dipterocarp forest and dry evergreen forest. Additionally, Strigidae, Apodidae, Hemiprocnidae, Hirundinidae, Alaudidae, Motacillidae, and Sylviidae preferred to use grassland and paddy field areas.

Table 5.3-9 Summary of Wildlife Survey Results from Previous Studies (Con't.)

Type	TEAM Study (2012a)	SEATEC Study (2012c)
Status for conservation concern	According to IUCN (2008), only one specie of the one hundred forty-three wildlife species on location is considered an endanger species. Two of the mammal species in the proposed project area are considered as valuable species. In addition, there are two species of mammals considered near threatened species.	The list of wildlife species shows that only the common species live in the undergrowth of the area that is disturbed by humans. The total amount of wildlife: one hundred sixty-seven species: fifty-one families; and twenty orders. All of the species found in the project area were not on any conservation lists. The species found were common species and could adapt to living general area.

5.4 SOCIO – ECONOMIC COMPONENTS

5.4.1 Industries Development

5.4.1.1 Study Area

Myanmar is still in the stage of developing the manufacturing sectors. Major industries in Myanmar are agriculture and mining. Dawei Industrial Estate will bring in industries that have not existed in the area near the city of Dawei.

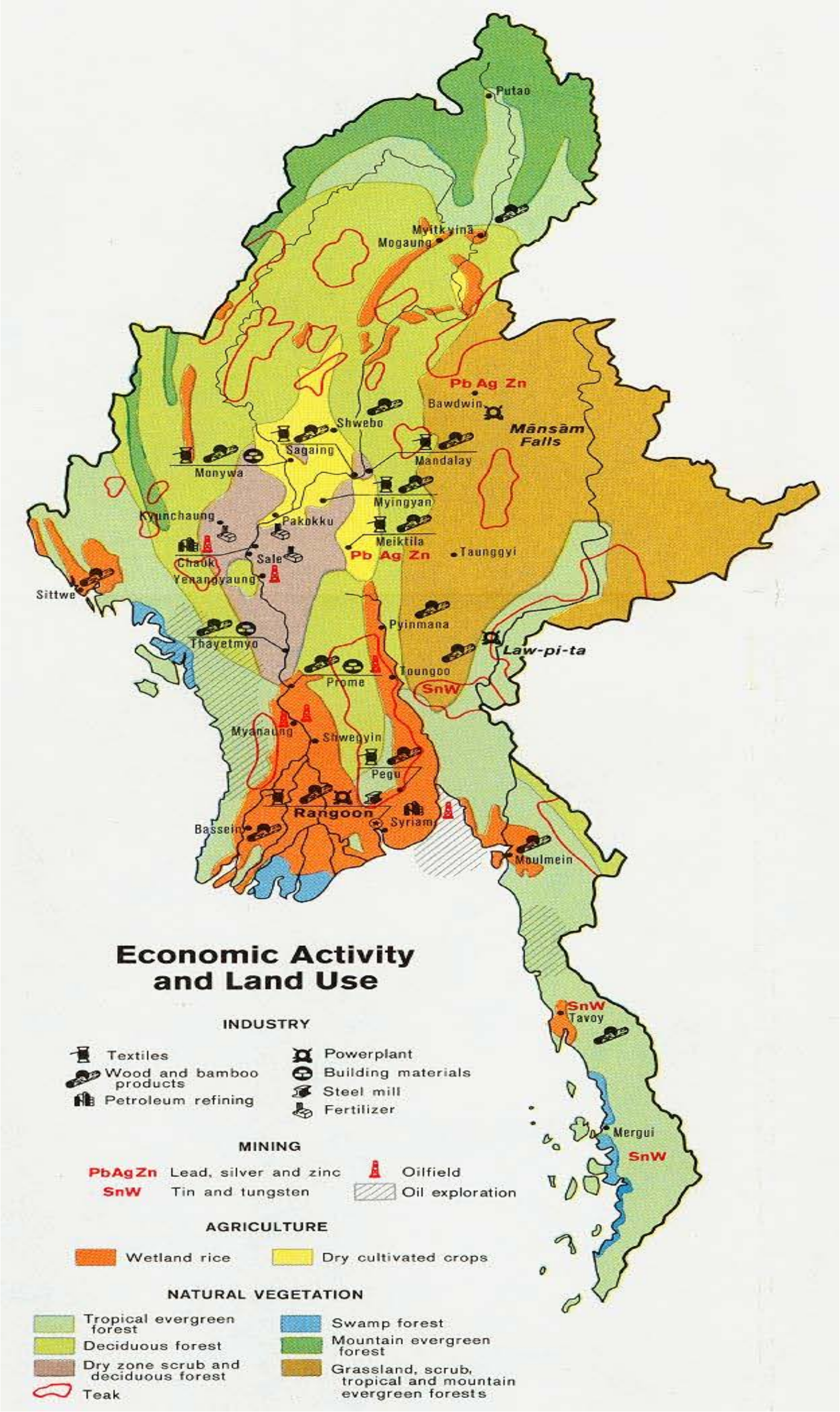
5.4.1.2 Baseline Township Development Conditions

Generic information of types of industries in Myanmar was extracted from the following document:

- Economic Activity and Land Use Map (U.S. CIA, 1972)

There were seven types of major industries in Myanmar: textiles; power plants; wood and bamboo products; petroleum refining; building materials; steel mill; and fertilizer. Most of the industries were located in the central part of Myanmar (Figure 5.4-1).

For the area around Dawei city and the project vicinity, there were 2 types of industry: wood and bamboo product; and tin and tungsten mining.



Source: http://www.mapcruzin.com/free-maps-burma-myanmar/burma_econ_1972.jpg accessed on 8 November 2012

Figure 5.4-1 Type of Industries in Myanmar

5.4.2 Studied Villages

5.4.2.1 Communities and Population

(a) Settlement Pattern and Age of Community

According to the village survey, the settlement pattern of most villages is lining along the road. Only 3 villages; Payadat, Lae Shaung, and Kha Maung Chaung are settled in cluster form. The age of most of communities is 200 years and the average age of 18 villages is 177 years (Table 5.4-1).

(b) Community Administration

Most villages have the administrative structure, which mixes traditional customary laws with governmental attributes and structures. The village heads rule the villages according to existing laws regulated by the government authorities in the Township but at the same time the elderly persons are appointed as advisors or the judicial body according to the local traditions. The village committees are formed and are also involved in the village' s administrative body. Three to seven villages will belong to a village' s administrative tracts, and the combination of village tracts becomes a Township (Dawei Project Watch, 2012).

Table 5.4-1 Settlement Pattern and Age of Community of 18 Villages

Village	Settlement Pattern	Age of Community (years)
Mayin Gyi	Line along the road	200
Payadat	Cluster	200
Htain Gyi	Line along the road	200
Lae Shaung	Cluster	200
Kha Maung Chaung	Cluster	200
Yalai	Line along the road	200
Min Dut	Line along the road	200
Wet Chaung	Line along the road	200
Pagaw Zoon	Line along the road	200
Nyaung Bin Seik	Line along the river	150
Mudu	Line along the road	150
Thit Toh Taut	Line along the road	200
Kyauk Whet Kone	Line along the road	200
Pein Shaung	Line along the road	200
Tha Byae Zoon	Line along the road	150
Kya Khat Tabin In	Line along the road	200
Bawah existing	Line along the road	150
Pan Din In	Line along the road	180
Average		**177**

(c) Number of Population

The village survey found that there are 5,834 households in 18 villages. The total number of population is 35,443; divided into 16,628 males and 18,805 females. The highest population is at Pagaw Zoon village (7,700) while the lowest population is at Nyaung Bin Seik village (328). Table 5.4-2 shows number of households, populations, males, and females in affected villages.

(d) Population Change

According to the community leaders' interview, in 2012 average number of birth is 15 people while average number of death is 6 people. Number of birth and death of each village during 2012 is shown in Table 5.4-3. The regarding migration, the survey reveals that some people in all 18 villages work outside the village all year. This finding is consistent with TEAM report (2012b) which stated that large numbers of people in all affected villages have migrated regularly for employment in Thailand.

Both male and female emigrants are employee. The average wage/day of male emigrants is 8,556 Kyat while the average way/day of female emigrants is 6,778 Kyat. The emigrants from Thit Toh Taut and Kyauk Whet Kone Village obtain the highest wages (Table 5.4-4).

(e) Ethnic Group

According to the literature review, there are some ethic groups in Dawei. Few of them are Kayin. here are the Karen communities in the eastern part of Dawei Special Economic Zone. They have a slightly different administration from the majority of the Tavoyan and Mon people in coastal area. These areas are conflicted with opposing administration areas, some parts the government orlocal Burmese Army has taken hold, while in other areas the main Karen armed opposition, Karen National Union (KNU) has some influences with the Karen village heads (Dawei Project Watch, 2012).

However, there is no data about ethnic group in 18 affected villages due to REM's village survey in 2013.

Table 5.4-2 Number of Households, Populations, Males, and Females in Affected Villages

Village	Number of Households		Number of Population[2]	Number of Male[2]	Number of Female[2]
	ITD Data[1]	REM Survey[2]			
In the project area					
Mayin Gyi	136	193	821	425	396
Payadat	321	333	1,662	795	867
Htain Gyi	415	415	2,253	1,080	1,173
Lae Shaung	610	626	3,337	1,650	1,687
Kha Maung Chaung	249	341	1,450	725	725
Yalai	321	398	1,547	749	798
Min Dut	87	132	510	250	260
Wet Chaung	78	99	453	241	212

Table 5.4-2 Number of Households, Populations, Males, and Females in Affected Villages (Con't.)

Village	Number of Households		Number of Population[2]	Number of Male[2]	Number of Female[2]
	ITD Data[1]	REM Survey[2]			
Pagaw Zoon	389	404	7,700	3,000	4,700
Nyaung Bin Seik	52	52	328	154	174
Mudu	343	347	2,029	986	1,043
Thit Toh Taut	363	411	2,199	1,107	1,092
Kyauk Whet Kone	185	205	838	410	428
Pein Shaung	336	378	2,097	1,022	1,075
Tha Byae Zoon	149	169	751	365	386
Kya Khat Tabin In	241	333	1,524	763	761
Host for Resettlement					
Bawah existing	55	198	796	355	441
Pan Din In	799	800	5,138	2,551	2,587
TOTAL	**5,129**	**5,834**	**35,433**	**16,628**	**18,805**

Source: [1] Italian Thai Development (11-12-2012 Project Layout with Bawah)
[2] SEATEC in association with UAE (2013)

Table 5.4-3 Number of Birth and Death in 18 Villages in 2012

Village	Number of Birth	Number of Death
Mayin Gyi	8	2
Payadat	10	3
Htein Gyi	5	3
Lae Shaung	20	7
Kha Maung Chaung	6	3
Yalai	20	8
Min Dut	10	5
Wet Chaung	10	0
Pagaw Zoon	34	10
Nyaung Bin Seik	0	0
Mudu	30	10
Thit Toh Taut	22	10
Kyauk Whet Kone	8	10
Pein Shaung	14	2
Tha Byae Zoon	8	10
Kya Khat Tabin In	17	10
Bawah existing	6	2
Pan Din In	40	10
Average	15	6

Source: SEATEC in association with UAE (2013)

Table 5.4-4 Type of Emigrant's Work and Wage per Day

Village	Type of Emigrant's Work		Wage/Day (Kyat)	
	Male	Female	Male	Female
Mayin Gyi	Employee	Employee	8,000	6,000
Payadat	Employee	Employee	8,000	6,000
Htain Gyi	Employee	Employee	8,000	6,000
Lae Shaung	Employee	Employee	8,000	6,000
Kha Maung Chaung	Employee	Employee	8,000	6,000
Yalai	Employee	Employee	8,000	6,000
Min Dut	Employee	Employee	8,000	6,000
Wet Chaung	Employee	Employee	8,000	6,000
Pagaw Zoon	Employee	Employee	9,000	8,000
Nyaung Bin Seik	Employee	Employee	8,000	6,000
Mudu	Employee	Employee	9,000	8,000
Thit Toh Taut	Employee	Employee	10,000	9,000
Kyauk Whet Kone	Employee	Employee	10,000	8,000
Pein Shaung	Employee	Employee	9,000	9,000
Tha Byae Zoon	Employee	Employee	9,000	8,000
Kya Khat Tabin In	Employee	Employee	9,000	6,000
Bawah existing	Employee	Employee	8,000	6,000
Pan Din In	Employee	Employee	9,000	6,000
Average			**8,556**	**6,778**

Source: SEATEC in association with UAE (2013)

5.4.2.2 Education Facilities

The education system in Myanmar is divided into 4 levels; pre-school education, primary education, secondary education, and higher education (UNESCO, 2011). The primary education is free and compulsory (Myanmar Ministry of Education, 2012).

Before 1886, the literacy rate of Myanmar was 85%. But the literacy rate dramatically fell to 35% in the colonial period. In 1973, the Ministry of Education introduced adult literacy program of 3Rs (Read, Write and Arithmetic) program for the illiterates throughout the nation. Since 1996, summer literacy programs and 3Rs classes have been opened. Every summer, literacy programs are undertaken in the Regions and States including border areas, and as a result, the literacy rate of Myanmar renged from 79.7 percent in 1998 to 95.01 percent in 2011 as shown in Table 5.4-5 (Myanmar Ministry of Education, 2012).

Table 5.4-5 Basic Education Indicator of Myanmar (1998 and 2011)

No.	Indicator	1998	2011	Increase (%)
1	Net Intake Rate (NIR) of age 5+ in kindergarten	67.13	98.37	31.24
2	Net Enrollment Rate (NER)			
	Primary level age (5-9)	74.70	84.61	9.91
	Middle school level age (10-13)	23.60	47.16	23.56
	High school level age (14-15)	10.10	30.01	19.91
3	Completion Rate by Level (2009 – 2010)			
	Primary level age (5-9)	24.80	81.20	56.40
	Middle school level age (10-13)	47.10	71.70	24.60
	High school level age (14-15)	29.32	30.83	1.51
4	Transition Rate (2009 – 2010)			
	Primary level to middle school level	45.60	80.18	34.58
	Middle school level to high school level	53.70	90.57	36.87
5	Teacher – Student Ratio	1.43	1.29	
6	Adult Literacy Rate (2011)	79.7	95.01	15.31

Source: Myanmar Ministry of Education (2012)

According to REM field survey (2013), each village has one school except Kya Khat Tabin In village which has 2 schools. The total number of schools in the project area is 19 (Table 5.4-6).

Table 5.4-6 Number of Schools in the affected Villages

Village	Number of Schools
Mayin Gyi	1
Payadat	1
Htain Gyi	1
Lae Shaung	1
Kha Maung Chaung	1
Yalai	1
Min Dut	1
Wet Chaung	1
Pagaw Zoon	1
Nyaung Bin Seik	1
Mudu	1
Thit Toh Taut	1
Kyauk Whet Kone	1
Pein Shaung	1

Table 5.4-6 Number of Schools in the affected Villages (Cont.)

Village	Number of Schools
Tha Byae Zoon	1
Kya Khat Tabin In	2
Bawah existing	1
Pan Din In	1
TOTAL	**19**

Source: SEATEC in association with UAE (2013)

5.4.3 Economic Profile

5.4.3.1 Land Use and Land Holding

Dawei is a completely agrarian society. The region constitutes a long pristine coast line with the enrichment of marine and mineral resources. The towns of Kanpauk, Heinda and Hamyingi in Dawei District have long been home to several mines which produce tin and tungsten, essential metals useful in steel industry. Off the Dawei coastline, the region is close to a large natural gas reserve in the Andaman Sea. In the vast hinterland, the region is green with paddy fields and plantations of rubber, beetle nut, cashew nut, and durian, the major livelihoods of the local people. Also, the local villagers rely on fishing in the Maungmagan coastline and Nipa (locally known as Dani) palm forests along Dawei River (Aung, 2011).

Regarding the land use of 2 townships that have been affected by the project, Yebyu and Laung Lone still have a large area unoccupied, which are mostly of forest, virgin land and uncultivated land. The majority of occupied area is agricultural land. Hence, agriculture is the primary occupation in this area. Rice is grown mostly for household consumption. The soil fertility can be indicated by cultivation of various types of plantations such as rubber, cashew nut, bamboo, oil palm, coconut, betel, and various fruit trees (TEAM, 2012b).

Land use in Yebyu and Laung Lone Townships is described as follows;

Yebyu Township

Yebyu township is bounded by Ye township to the north, Laung Lone township to the south, Kaleinaung township to the east, and Andaman Sea to the west. It covers an area of 604,663 acres (2,446.98 km^2). According to the data from Land Records Department of Dawei District (2011), the area is still mostly unoccupied as only about 12 percent are active agricultural land while about two-third are forest land, and the remaining are not fully utilized (Table 5.4-7).

Table 5.4-7 Type of Land Utilization in Yebyu Township

No.	Type of Land Use	Area		Percentage
		Acres	Km^2	
1	Forest Land	201,012	813.5	33.24
2	Uncultivated Land	146,728.7	593.8	24.27
3	Cultivatable Waste Land	131,450.2	532	21.74
4	Agricultural Land	72,703.3	294.2	12.02
5	Virgin Land*	52,655.7	213	8.71
6	Fallow Land	113	0.5	0.02
Total Land		**604,663**	**2,447**	**100**

* Land which has not yet been cultivated or used
Source: Land Records Department, Dawei District (2011)

Laung Lone Township

Laung Lone Township is bounded by Yebyu in the north, Andaman Sea to the west, Dawei Township to the east, and Thayetchaung Township to the south in Thaninharyi Region, southern part of Myanmar. Its size is much smaller than Yebyu (227,787 acres or 921.8 km^2). About one-third of total area is utilized for agricultural purposes while nearly two-third of the area is not utilized (combination of forest, virgin, uncultivated land, etc) as shown in Table 5.4-8.

Table 5.4-8 Type of Land Utilization in Laung Lone Township

No.	Type of Land Use	Area		Percentage
		Acres	Km^2	
1	Forest Land	78,255.8	316.69	34.35
2	Uncultivated Land	68,806	278.45	30.21
3	Cultivatable Waste Land	40,815.1	165.2	17.92
4	Agricultural Land	33,345.1	165.1	14.64
5	Virgin Land*	6,553.2	26.5	2.88
6	Fallow Land	12	0.05	0.01
Total Land		**227,787**	**921.8**	**100**

* Land which has not yet been cultivated or used
Source: Land Records Department, Dawei District (2011)

According to the village profile survey in 18 affected villages, the average land holding per one household is 5.33 acres. The highest average land holding per household is in Kha Maung Chaung Village (15 acres/household) while the lowest average land holding per household is in Mu Du and Pan Din In Village (1 acres/household).

The land use for residential area of 18 villages is only 0.83 acres/ household. The residential land use per household of most villages is 1 acre while the residential land use of 6 villages (Mayin Gyi, Yalai, Pagaw Zoon, Mudu, Thit Toh Taut, and Pan Din In) is 0.5 acres per household.

Most of land use in 18 villages is for agricultural purpose (average 6.33 acres/household). Kha Maung Chaung Village has the highest average land use for agricultural area (15 acres/ household), followed by Min Dut Village (12 acres/household), Payadat Village, Htain Gyi Village, and Wet Chaung Village (10 acres/household). Mudu village has the smallest average land use for agricultural area (only 2 acres/household). Table 5.4-9 shows average land holding and land use per household.

Table 5.4-9 Average Land Holding and Land Use

Village	Average Land Holding (Acres/ Household)	Average Land Use (Acres/ Household)	
		Residential Area	Agricultural Area
Mayin Gyi	5	0.5	5
Payadat	10	1	10
Htain Gyi	5	1	10
Lae Shaung	5	1	5
Kha Maung Chaung	15	1	15
Yalai	7	0.5	7
Min Dut	10	1	12
Wet Chaung	10	1	10
Pagaw Zoon	3	0.5	3
Nyaung Bin Seik	2	1	5
Mudu	1	0.5	2
Thit Toh Taut	3	0.5	4
Kyauk Whet Kone	3	1	5
Pein Shaung	5	1	5
Tha Byae Zoon	4	1	5
Kya Khat Tabin In	3	1	3
Bawah existing	4	1	5
Pan Din In	1	0.5	3
Average (18 villages)	**5.33**	**0.83**	**6.33**

Source: SEATEC in association with UAE (2013)

Regarding land issue, most of villages indicate that they have land rights; except Nyaung Bin Seik Village that does not obtain land rights document. The average land price of village area, paddy field, and orchard (garden) is 3,093,750 kyats/acres, 900,000 kyats/acre and 2,000,000 kyats/acre; respectively. However, the land price data of 2 villages: Wet Chaung and Nyaung Bin Seik is not available. Table 5.4-10 shows land rights and average land price of village area, paddy field, and orchard area.

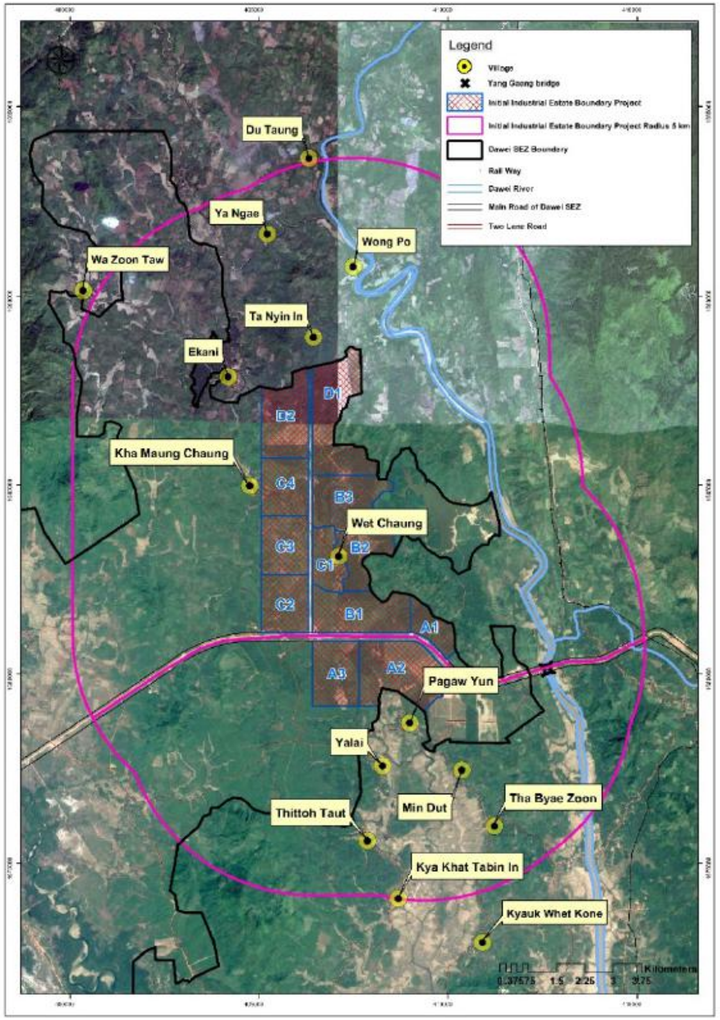
Table 5.4-10 Land Rights and Average Land Price

Village	Land Rights	Land Price (kyat/acre)		
		Village area	Paddy field	Orchard/ Garden
Mayin Gyi	Yes	3,000,000	1,000,000	1,200,000
Payadat	Yes	3,000,000	1,000,000	1,500,000
Htain Gyi	Yes	3,000,000	1,000,000	1,000,000
Lae Shaung	Yes	4,000,000	1,000,000	1,000,000
Kha Maung Chaung	Yes	2,000,000	500,000	1,500,000
Yalai	Yes	3,000,000	1,000,000	2,000,000
Min Dut	Yes	500,000	300,000	800,000
Wet Chaung	Yes	n/a*	n/a*	n/a*
Pagaw Zoon	Yes	2,000,000	500,000	1,000,000
Nyaung Bin Seik	No	n/a*	n/a*	n/a*
Mudu	Yes	5,000,000	1,000,000	1,000,000
Thit Toh Taut	Yes	3,000,000	1,000,000	3,000,000
Kyauk Whet Kone	Yes	5,000,000	1,000,000	4,000,000
Pein Shaung	Yes	5,000,000	2,000,000	3,000,000
Tha Byae Zoon	Yes	2,000,000	600,000	1,000,000
Kya Khat Tabin In	Yes	3,000,000	1,000,000	4,000,000
Bawah existing	Yes	1,000,000	500,000	1,000,000
Pan Din In	Yes	5,000,000	1,000,000	5,000,000
Average Land Price of 16 villages (excluding Wet Chaung and Nyaung Bin Seik which data are not available)		3,093,750	900,000	2,000,000

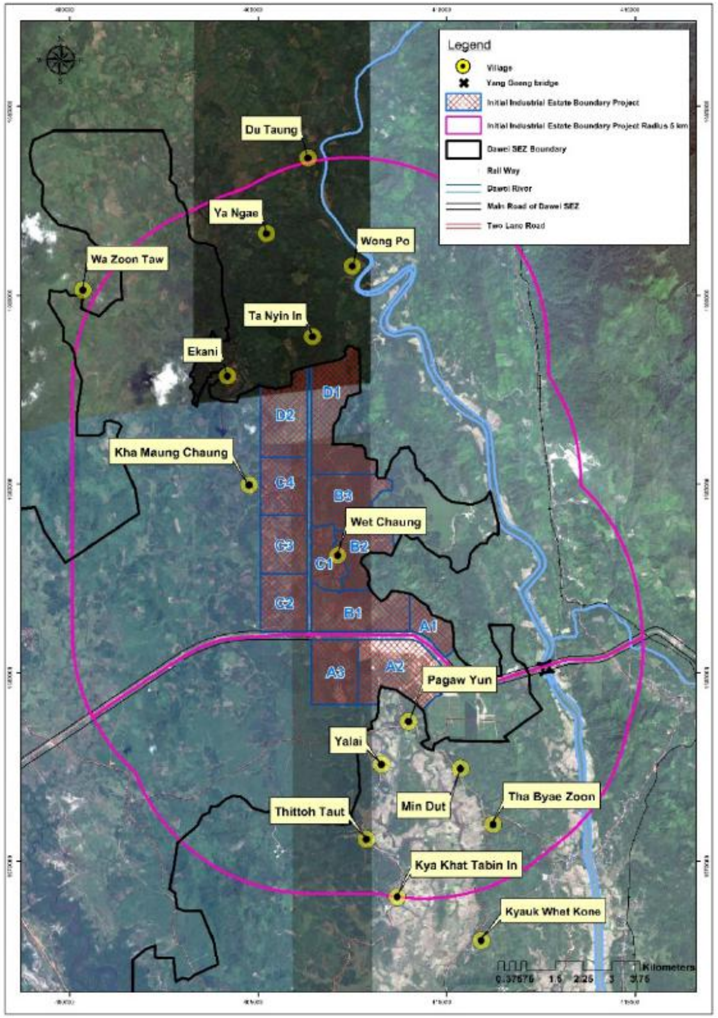
Source: SEATEC in association with UAE (2013)
Remark: n/a = data is not available

Land use in Project Area

In the past, the most of landuse in the project area were agriculture purpose e.g. palm plantation of Myanmar's Government and betel palm and crops and tree plantation of villages. The palm plantation is up to 40% of the study area. In the present, the palm plantation are clearcut for project development. Comparison of the project area in year 2013 (Before Clearcutting) and in year 2016 (After Clearcutting) are shown in Figure 5.4-2.



Year 2013



Year 2016

Source:www.goggle.com

Figure 5.4-2 The Comparison of Landuse of Project Area in Year 2013 between to Year 2016

5.4.4 Health Profile

5.4.4.1 Study Area

The area of study focuses on division level (Thanintharyi), district level (Dawei), and precisely in the village level. According to Transnational Institute (2012), 32,274 people (3,977 households) in 18 villages in Laung Lone and Yebyu townships of Dawei District will be affected by the relocation. These 18 villages are the direct targets of this study.

As a result of the industrial estate development, 4 villages have to be relocated. The host area for resettlement includes 3 villages: Bawah existing; Pagaw Zoon; and Pan Din In. The migrants from 4 villages may have to adapt themselves to the new environment and to change the way of life. Local people in the host villages may be also affected by the conflict with migrants and competition to access public resources. The number of population and households in these 19 affected villages.

5.4.4.2 Scope and Methodology

The aim of this study is to evaluate the potential impacts of project development on public health and occupational health. The proposed scope of work will at least cover the following concerns:

- Data collection on public health and epidemic, including public hygiene problems, environmental sanitary use, diseases-endemic, seasonal epidemics, and other contagious diseases of local people living downstream and those relocated to provided residence.
- Nutrition condition: a comparison between the local people and the neighborhood.
- Identification of ecological conditions susceptible to an increase in the parasitic condition of aquatic carriers such as fishes and mosquitoes (as carriers of malaria, dengue, i.e.).
- Evaluation of existing data of health and sanitary condition of people in the community near the project site.
- Assessment of obtained data focusing on an induction of the project development on an increasing of health determinants stressors and other occupational or environmental illness of local people living downstream.
- Investigation of public health problems due to diseases enhanced by the project existence.
- Suggestion on mitigation measures.

5.4.4.3 Sources of Information

Sources of data include primary and secondary information. For primary data collection, the socio-economic survey was conducted on 11 – 18 February 2013 by Myanmese Consultant (REM). The socio-economic survey covers 371 households in 18 affected villages (16 villages in the industrial estate area and 2 villages for resettlement area). The secondary data sources include previous EIA study, academic journals and official websites which are:

- Environmental Impact Assessment (EIA) for the Dawei Sea Port (TEAM, 2013).
- Environmental Impact Assessment (EIA) for Main Road (SEATEC, 2012c).
- IEE Environmental Studies for Dawei Sea Port & Industrial Estate Development Project (TEAM, 2012a).
- 2011 Socio-Economic Data (Dawei Township Office, 2012 (in Burmese)).

Public health and occupational health impact assessment is the process of evaluating the potential impact caused by project activities, which likely affect the determinants of health. This topic presents the condition of existing health determinants which have the potential to be influencedby project activities. The identified data are incorporated into the health impact assessment process, as discussed in Chapter 6 of this report (Impact Assessment). The sources of baseline data included in this chapter are as shown in Table 5.4-11.

Table 5.4-11 Baseline Data Classified by Health Determinants and Sources of Data

Baseline Data for Health Impact Assessment	Primary	Secondary
1) Physical Environment	✓	
2) Social Environment	✓	✓
3) Economic Characteristic		✓
4) Health Status		✓
5) Accident and Public Safety	✓	✓
6) Sufficiency and Capacity of Health Service Facilities	✓	✓
7) Person’s Individual Characteristic/ Behaviors		✓
8) Infrastructure and Public Service	✓	✓

5.4.4.4 Baseline Findings

The determinants of health to evaluate the health impacts of project activities:

(a) Physical Environment

The physical environment, e.g. air quality, noise and vibration, may lead to public health impact as presented Chapter 6. According to the social attitude survey, the existing physical environment problems are water supply, solid and waste water management, dust and noise from construction, bad odor, etc. as shown in Chapter 8 Public Involvement and Disclosure

(b) Social Environment

Information of the social environment, including political structure, population characteristic, and social status is shown in Section 3.4.4 Socio-economic conditions

(c) Economic Environment

The economic environment including population income, household income, and expenditure is shown in section 5.4 Socio-economic components

(d) Health Status

The health status of the Thanintharyi region can be considered from the morbidity rate, mortality rate, and public health service capacity which have been collected from the Ministry of Health:

Morbidity Rate

The most 5 common diseases in Thanintharyi region are malaria, diarrhea, tuberculosis, dysentery and liver cirrhosis. Malaria has been the most widespread disease with more than 13,000 cases treated in 2011 however no casualties due to the diseases are reported. In community level, malaria is also the most common disease and can be found in almost every month as shown in Table 5.4-12, Table 5.4-13 and Figure 5.4-3, respectively.

Table 5.4-12 Widespread Disease

Township / Subtownship	Disease (visit) in 2011									
	Malaria		Diarrhea		Tuberculosis		Dysentery		Liver cirrhosis	
	Sick	Death	Sick	Death	Sick	Death	Sick	Death	Sick	Death
Dawei	4,292	0	1,263	0	124	0	454	0	0	0
Yebyu	288	0	59	0	14	0	3	0	0	0
Laung Lone	7,201	0	1496	0	0	0	546	0	0	0
Thayetchaung	593	0	173	0	23	0	50	0	0	0
Mitta (subtownship)	463	0	142	0	0	0	43	0	0	0
Ka Lain Aung (subtownship)	200	0	16	0	2	0	11	0	0	0
Total	13,174	0	3,149	0	163	0	1,097	0	0	0

Reference : Dawei Township Office. 2012.2011 Socio-Economic Data (in Burmese)

Remark : (Number) = the number of treat. One patient can be treated more than one time.

Table 5.4-13 Common Diseases in Villages

Sr.	Name of Disease	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
1	Malaria	79	70	55	45	29	25	48	21	31	20	26	0	449
2	Diarrhea	26	40	21	26	16	18	21	9	16	12	14	0	219
3	Dysentery	7	10	7	7	8	8	13	6	9	2	8	0	85
4	A.R.I	9	10	7	6	7	8	20	16	18	15	11	0	129
5	Tuberculosis	1	1	4	0	2	0	1	3	0	6	7	3	28

Source: Leshaung Village, Rural Health Care

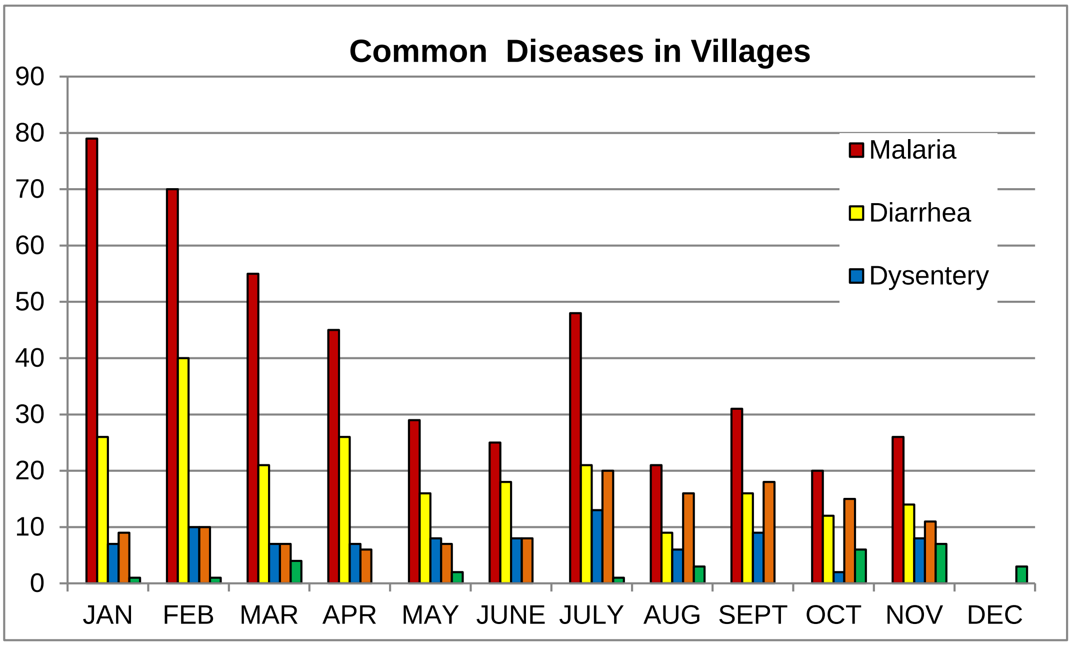


Figure 5.4-3 Common Diseases in Villages

Mortality Rate

The Ministry of Health reports that the Thanintharyi region has a mortality rate for under 5 years old children of 93.63 per one thousand live birth and a maternal mortality rate of 3.07 per one thousand live birth as shown in Figure 5.4-4 and Figure 5.4-5 respectively. In addition, the miscarriage rate is high in Yebyu while the mortality rate of Laung Loune is highest as presented in Table 5.4-14. These data indicate that the health care facilities as well as health education in the region is quite poor compared with other areas of the country.

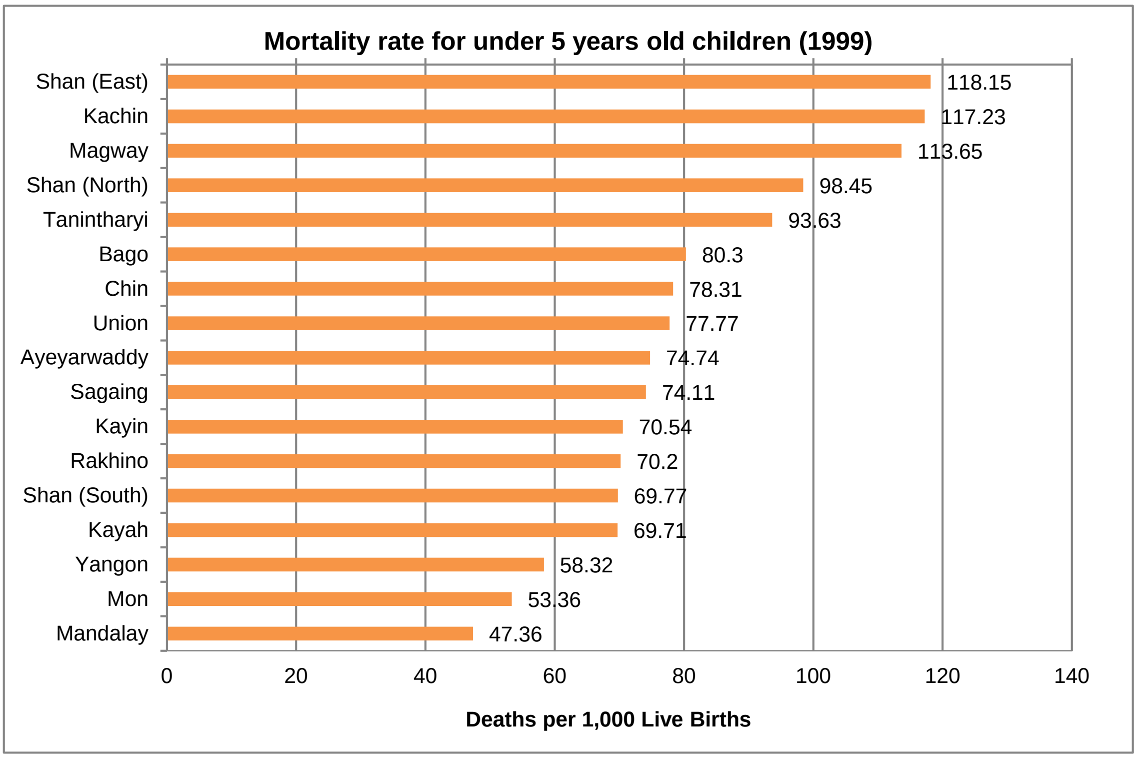


Figure 5.4-4 Mortality rate for under 5 years old children (1999)

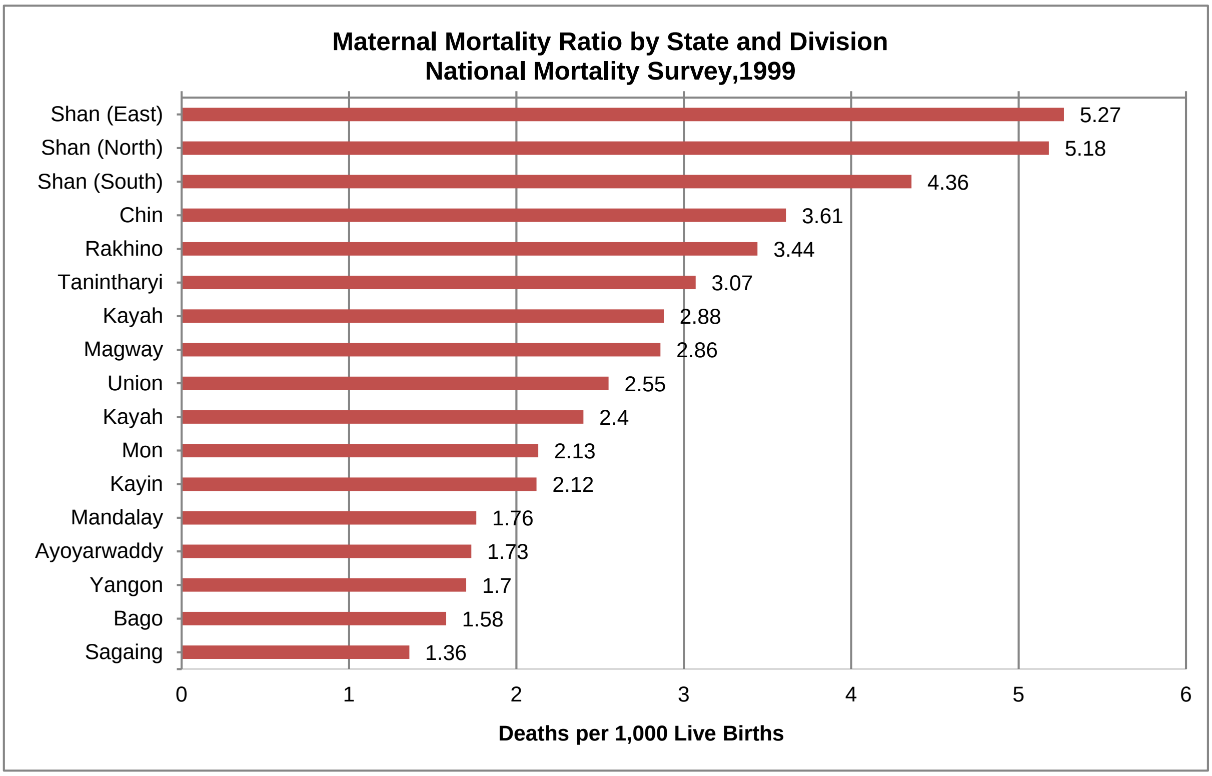


Figure 5.4-5 Maternal Mortality Rate

Table 5.4-14 Birth and Mortality per 1000 People

Township / Subtownship	Rate per 1000 persons		
	Birth	Mortality	Miscarriage
Dawei	20.4	2.5	0.4
Yebyu	7.1	2.2	15.2
Laung Loune	11.7	5.6	3.1
Thayetchaung	10.9	3.6	5.2
Mitta (subtownship)	0	0	0
Ka Lain Aung (subtownship)	0	0	0

Reference: Dawei Township Office. 2012.2011 Socio-Economic Data (inBurmese)

<u>Health Problems and Treatment</u>

In the project area, the most common non communicable disease is hypertension whereas the most common communicable disease is malaria.

In addition, the communities have given their opinion regarding to sickness. Most of the respondents did not have any sickness in the previous year (30.2%). The major sickness of most respondents included cough, stroke, and gaiter disease (22.6%), followed by communicable disease (18.3%) and heart and cardiovascular disease (12.7%). Most of the respondents went to see the doctor at hospital to cure their sickness (71.2%) while 11.6 percent of the respondents did not do anything to cure their sickness.

(e) Accident and Public Safety

Excluding the unidentified cases, the primary cause involving with public safety is car and motor bike accidents during 2010-2011. The number of cases due to burglar and thieves in 2011 is higher than in 2010 as shown in Table 5.4-15.

Table 5.4-15 Thieves and Accident Cases

Type	2010				2011			
	No. of Cases	No. of Lawsuit	Lawsuit Suspended	Not going to court	No. of Cases	No. of Lawsuit	Lawsuit Suspended	Not going to court
Burglar / Thieves	12	7	4	1	15	10	4	1
Normal accidents	11	10	0	1	18	18	0	0
Car and motorbike accidents	40	32	3	5	62	56	5	1
Others	62	54	1	7	88	87	1	0
Total	125	103	8	14	183	171	10	2

Reference: Dawei Township Office. 2012.2011 Socio-Economic Data (in Burmese)

(f) Sufficiency and Capacity of Health Service Facilities

Health Service Provider

Health service providers in this project area include 34 health service facilities that belong to the Government, and eight of private health service facilities. There is one large hospital located at Dawei, three of medium size hospitals located at Yebyu, Laung Lone and Thayetchaungas well as six specific medical clinic dealing with leprosy, malaria and tuberculosis located at Dawei, Yebyu, Laung Lone and Thayetchaung as shown in Table 5.4-16.

Table 5.4-16 Number of Health Service Provider

Township / Subtownship	Hospital				Clinic				
	Government			Private	Government				Private
	Small <16 beds	Medium >25 beds	Large (100 beds)		Village	Leprosy	Malaria	TB	
Dawei	0	0	1	4	4	1	1	1	4
Yebyu	1	1	0	0	3	0	0	1	0
Laung Lone	2	1	0	0	6	0	0	1	0
Thayetchaung	1	1	0	0	4	0	0	1	0
Mitta (subtownship)	1	0	0	0	0	0	0	0	0
Ka Lain Aung (subtownship)	1	0	0	0	1	0	0	0	0
Total	6	3	1	4	18	1	1	4	4

Reference: Dawei Township Office. 2012.2011 Socio-Economic Data (inBurmese)

<u>Public Health Professionals and Facilities</u>

According to the ministry of health, there are 11 medical doctors per 100,000 populations in the Thanintharyi region in 2007. In comparison, the overall country is 17 while of the Yangon Region is 46 doctors per 100,000 populations. Additionally, there are 22 nurses per 100,000 people and 22 midwifes per 100,000 populations in 2009 as shown in Figure 5.4-6 and Figure 5.4-7.

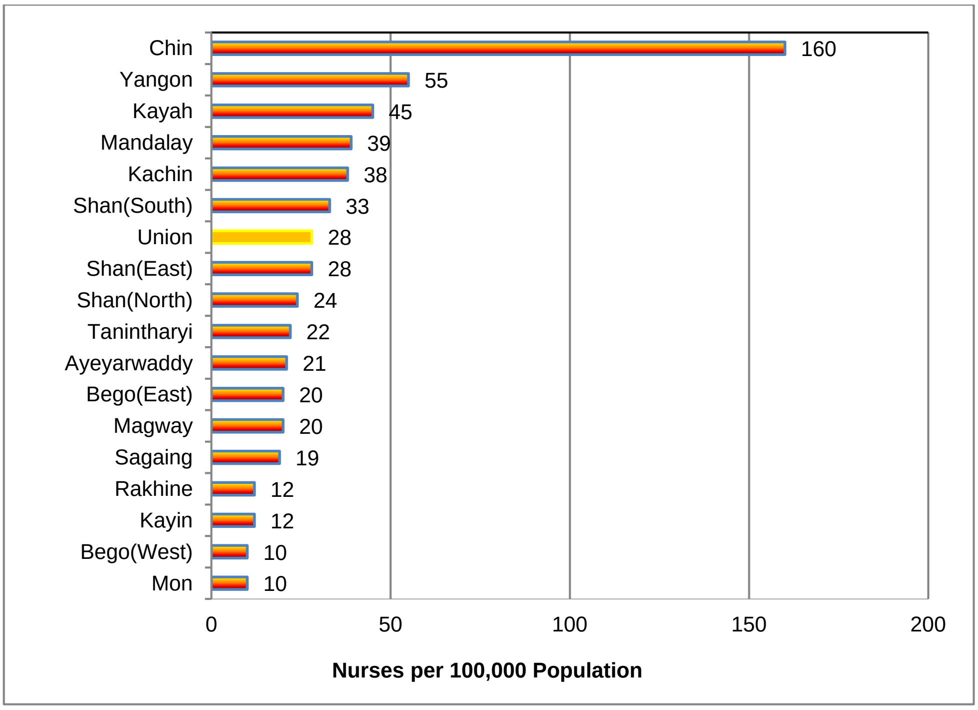


Figure 5.4-6 Availability of Nurses

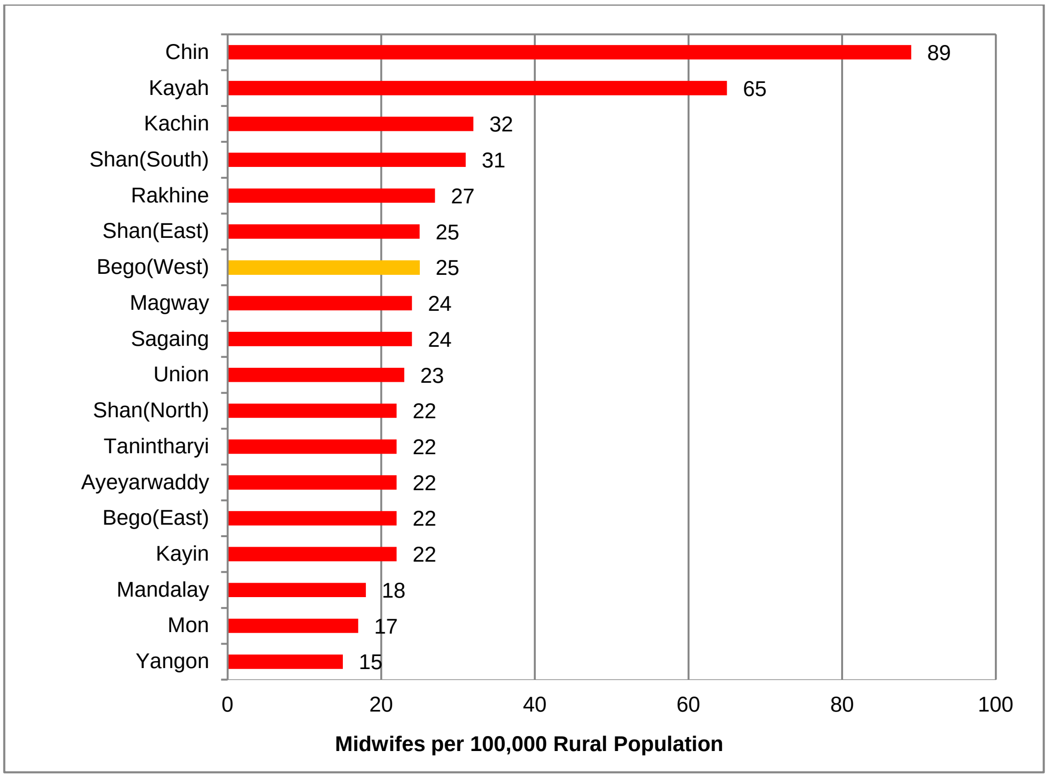


Figure 5.4-7 Availability of Midwifes

In the study area, there are 20 doctors, 68 nurses and 22 nurse assistant, most of them working in Dawei, Laung Lone and Thayetchaung as presented in Table 5.4-17.

Table 5.4-17 Medical Staff

Township / Subtownship	Population	Doctors		Nurses		Nurse Assistants	
		Number of Doctors	Ratio	Number of Nurses	Ratio	Number of Nurse Assistants	Ratio
Dawei	204,280	6	34,046	10	20,428	7	29,182
Yebyu	145,321	3	48,440	10	14,532	2	72,660
Laung Loune	211,920	5	43,984	18	13,217	6	36,653
Thayetchaung	181,870	4	45,467	19	9,572	4	45,467
Mitta (subtownship)	22,329	1	22,329	6	37,215	2	11,164
Ka Lain Aung (subtownship)	18,052	1	18,052	5	3,610	1	18,052
Total	791,772	20	39,588	68	11,643	22	32,726

Reference: Dawei Township Office. 2012.2011 Socio-Economic Data (inBurmese)

Health Care Centre and Manpower

There are 2 rural health centers with health assistance and a senior blue nurse (LHV Lady Health Assistance) in Lae Shaung and Pan Din In village (Figure 5.4-8). Most of the people around the study area visit these clinics for treatment of minor illness such as common cold, cough, headache and dizziness. Most villagers depend on a public drug store and health assistance to solve their health problems. If they suffer serious illness, they are admitted to Dawei hospital because of better health care equipments and services.

Most people in this area have hypertension. Thus, they should regularly check their blood pressure at a rural health center. For the people who are diagnosed with hypertension, they are referred to the closet health center; i.e., Maungmagan Sub-township Hospital or General Hospital of Dawei.

Availability of and Accessibility to Healthcare Services

Development of the project, both construction and operational phases, may cause an increase of morbidity and mortality rate which may pressure on public health resources including the number of service facilities, number of health professions, medical equipments, and devices. From field survey conducted during 11 – 18 February 2013, they stated that the most distance between some village to health center is about 23 Km and ten villages have helath volunteers (as shown in Table 5.4-18).Half of the respondents said that the number of physician and nurse was sufficient (50.7%) while the other half (49.3%) said that the physician and nurse were insufficient. However, most of the respondents (92.5%) reported that the specialist physicians such as surgeon, environmental and occupational medicine were insufficient. Regarding the location of public health service, 44.7 percent of the respondents said that they were convenient to access the public health service while 53.9 percent of the respondents indicated that the location of public health service was too far and inconvenient. Most of the respondents (95.1%) reported that they had to pay for medical charge while 3.5 percent of the respondents got the government supports.

Table 5.4-18 Number of Hospital and Health Center in Project Area

Village	Number of Hospital	Number of Health Center	Distance from Major Health Service (km)	Health Volunteer
Mayin Gyi	0	0	3.0	No
Payadat	0	0	23.0	No
Htain Gyi	0	0	23.0	No
Lae Shaung	0	1	22.0	Yes
Kha Maung Chaung	0	0	9.0	Yes
Yalai	0	0	5.0	Yes
Min Dut	0	0	0.5	No
Wet Chaung	0	0	0.5	No
Pagaw Zoon	0	0	4.5	Yes
Nyaung Bin Seik	0	0	3.0	No
Mudu	0	0	20.0	Yes
Thit Toh Taut	0	0	6.0	Yes
Kyauk Whet Kone	0	0	12.0	Yes
Pein Shaung	0	0	8.0	Yes
Tha Byae Zoon	0	0	1.5	No
Kya Khat Tabin In	0	0	2.0	No
Bawah existing	0	0	2.0	Yes
Pan Din In	0	1	1.0	Yes
Summary	**Total = 0**	**Total = 2**	**Average = 8.1 km**	**Yes = 10** **No =8**

Source: SEATEC in association with UAE (2013)

Health Care Centre (Lae shaung Village)

Health Care Centre (Pan Din In Village)

Figure 5.4-8 Health Care Centers in the Project Area

(g) Person's Individual Characteristic/ Behaviors

The results of the survey indicated that 70.8% of people have smoke tobacco and 12% of people drink alcohol regularly (Figure 5.4-9). Drinking alcohol and Smoking can cause many kinds of diseases including hypertension, heart disease, lung disease, and cancer.

(h) Source of Food

From the result of filed survey, main source of food of the respondents was from the self-plantation (84.72%) followed by buying from market (9.94%), and natural resources/ fishery/ forest/ river (5.56%). Some villages for example, Mayin Gyi, Min Dut, Nyaung Bin Seik and Pan Din In are closed to the sea therefore the source of food for people come from sea. The details was shown in Table 5.4-19.

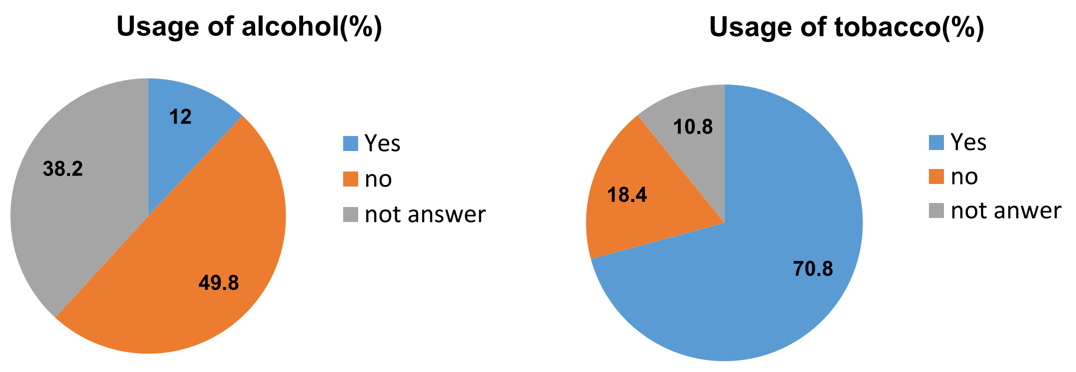


Figure 5.4-9 Usage of Alcohol and Tobacco

Table 5.4-19 Percentage of Source of Food

Village	Source of Food (%)			
	Garden/Farm	**Forest**	**Sea**	**Market**
Mayin Gyi	80	0	10	10
Payadat	80	0	0	20
Htain Gyi	90	0	0	10
Lae Shaung	90	0	0	10
Kha Maung Chaung	90	0	0	10
Yalai	90	0	0	10
Min Dut	85	0	5	10
Wet Chaung	90	0	0	10
Pagaw Zoon	90	0	0	10
Nyaung Bin Seik	95	0	5	0
Mudu	90	0	0	10

Table 5.4-19 Percentage of Source of Food (Con't.)

Village	Source of Food (%)			
	Garden/Farm	Forest	Sea	Market
Thit Toh Taut	95	0	0	5
Kyauk Whet Kone	90	0	0	10
Pein Shaung	90	0	0	10
Tha Byae Zoon	90	0	0	5
Kya Khat Tabin In	90	0	0	10
Bawah existing	90	0	0	10
Pan Din In	10	0	80	10
Average Percentage	**84.72**	**0**	**5.56**	**9.44**

Source: SEATEC in association with UAE (2013)

(i) Infrastructure and Public Service

The details of infrastructure and public service within the study area, such as the water supply, waste management, electricity, etc. are displayed below.

Water supply

The primary source of domestic water supply, in the study area, is the shallow well. Other sources of water, for local villages, are from artesian wells and rain fall. Normally, there are one or two shallow wells that supply water among one village. For the project site, the water supply for local agricultural purposes is primarily from the Dawei River. There are four rivers: Nabule River; Dawei River; Kunchaung River; and Pan Din In Chaung River near and within the project site. However, the water supply is not adequate during the dry season.

In the project development area, artesian wells are a source of water during the construction phase.

Most households, in the affected villages, have good water source from shallow wells and streams in the Bawah village. Pan Din In has limited water resources, and often experiences water shortages in the dry season. In this village, some households have to share wells with the others, and some have to pay a fee to well owners due to limited water availability, especially in the dry season. In general, the water quality is good for consumption (Figure 5.4-10).

Figure 5.4-10 Domestic Water Supply

Drinking water quality is in good condition around the project area. More than 50% of the villagers use the filter treatment and 26.5% boil water before consumption (Figure 5.4-11).

Figure 5.4-11 Drinking Water

Most of the interviewed respondents use groundwater (93.8%) as source of drinking water, followed by tap water (3.5%) and river/ canal (0.3%).

<u>Electricity</u>

In the nearby area of the project site, local villagers have no electricity supply system. Only some households generate electricity from small generators; e.g., main generator (400 kV) and 7-10 kV of generators which the household members share cost for diesel fuel (Table 5.4-20).

In the project development area, the main generators are used for electricity generation during construction. The electricity in the project area was turned off during 12.00-13.00 and 22.00-03.00. There is no electricity system supported either by the government or by private companies in these villages. Some villagers possess small generators and generate electricity to share so that their neighbors can have power at night time; however, they have to pay in terms of their utilization (Figure 5.4-12).

Figure 5.4-12 Electricity Supply

Table 5.4-20 Electricity supply

Township / Subtownship	Demand (kW)	Government Generation (kW)	Private Generation (kW)	
			No. of Generators	Generation Capacity (kW)
Dawei	8,800	3,800	2	3,800
Yebyu	1,000	170	2	170
Laung Lone	1,670	480	3	500
Thayetchaung	1,360	180	1	180
Mitta (subtownship)	350	26	1	26
Ka Lain Aung (subtownship)	410	70	1	70
Total	13,590	4,746	10	4,746

Reference: Dawei Township Office. 2012.2011 Socio-Economic Data (in Burmese)

Environmental Sanitary: Solid Waste Management and Wastewater System

In the Dawei area, environmental sanitation, such as solid waste and wastewater treatment system, is inadequate, resulting in poor environmental sanitation. Presently, Dawei does not have proper management on solid waste and sanitation. The solid waste is collected and disposed of by open dumping or open burning within their household (**Figure 5.4-13**). For organic waste, most of villager feed to their pig and cow. Tough toilet systems are relatively available in Htain Gyi, Lae Shuang, Mudu and Payadat. Provision of both solid waste and wastewater systems are rather limited in all villages.

During the construction phase, the solid wastes in the project site are: domestic waste; (plastic bag and food waste) and waste from construction activities (Steel scrap, etc.) The domestic waste is collected in the garbage bins which are set at all camp sites and canteens. Then, the waste is collected everyday and dumped in the landfill within project area. When the domestic waste inside landfill is full, the landfill is covered by soil. The waste from construction activities is collected in the storage area for reuse.

The results of field survey also indicate that public health services in local communities are quite limited. For household wastewater management, most of the respondents discharge wastewater to the ground (82.2%), followed by discharge to public drainage system (5.9%), discharge into the garden (5.1%), and discharge to the public river (4%).

Regarding to solid waste disposal, most of the respondents manage by open burn (93.8%), followed by pile up outside the house (2.7%), landfill (2.2%), and throw away to pubic area (0.8%). Only 0.3 percent of the respondents make fertilizer from solid waste.

Figure 5.4-13 Domestic Solid Waste Disposal

Road

The roads in the project site and local villages are unpaved surface about 4 m wide (Figure 5.4-14). Most of the roads can be accessed year round, but the condition is relatively poor, especially in the wet season.

In addition, the results from the attitude survey show that the most common problem related to infrastructure/ public services are a shortage of drinking/ consumption water, shortage of electricity, inconvenient transportation, flood, and solid waste management.

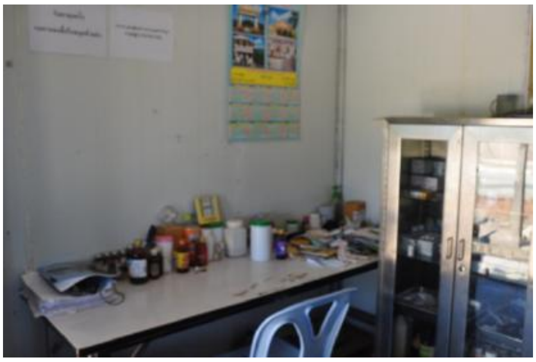
Figure 5.4-14 Road Condition

(j) Health Service in Camp Site

IID has provided health service at the camp site (Figure 5.4-15) with the physician at all time. Three common illnesses are respiratory disease, skin disease and gastrointestinal disease. Malaria is also found with small number of incident (Table 5.4-21 and Figure 5.4-16). The ambulance car is always in use for transfer the serious case to Dawei hospital. Health education is also performed.

Health Care Service in Camp Site

Medicines for Medical Treatment



Health Care Service in Camp Site

Campaign to Prevent and Control Disease

Figure 5.4-15 Health Service in Camp Site

Table 5.4-21 Summary of the Patient per Month in 2012

Disease	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mararia Disease	2	1	5	0	9	2	3	7	3
Respiratory Disease	129	83	81	71	80	139	236	255	309
Gastrointestinal Disease	39	48	45	54	53	87	48	91	83
Musculoskeletal Diseases	59	38	44	50	41	50	37	139	78
Skin Diseases ; Other	71	58	102	84	132	174	139	105	171
Total	**300**	**228**	**277**	**259**	**315**	**452**	**463**	**597**	**644**

Source: Presence Sheet, J.1790 Dawei Sea Port & Industrial Estate Development Project (Dawei)

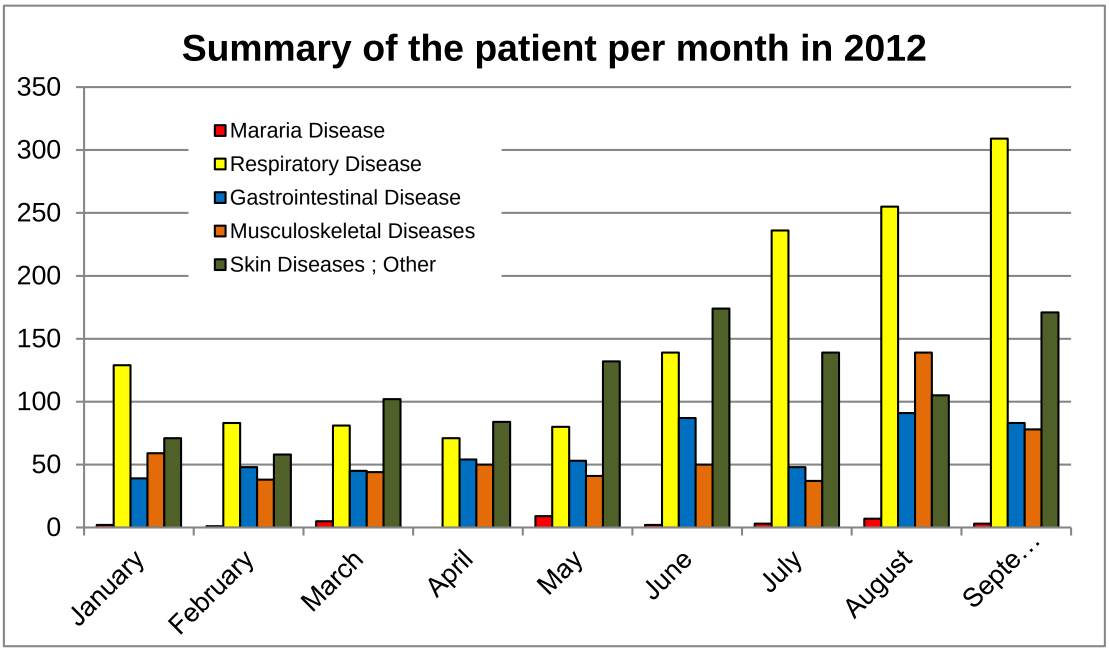


Figure 5.4-16 Summary of the Patient per Month in 2012

5.4.5 Infrastructure Facilities

<u>Study Area</u>

Infrastructure facilities, such as water supply, waste management, electricity, and communication facilities are inadequate in Myanmar. Therefore, the Dawei Industrial Estate, will have to generate all of its infrastructures onsite. The project influence area (impact zone) of the Dawei Industrial Estate was determined as the infrastructure in the vicinity of project area and infrastructure in the project area.

Baseline Infrastructure Facility Conditions

The conditions of baseline infrastructure facilities have been surveyed in the previous studies. The source of information in this section was:

- Environmental Impact Assessment (EIA) for the Dawei Sea Port (TEAM, 2013).

Water Supply

The primary source of domestic water supply in the study area was the shallow groundwater wells. Other sources of water for local villages were from artesian wells and rainwater. Normally, there were one or two shallow wells to supply water among one village. For the project site, the water supply for local agricultural purpose was primarily from Dawei River. There were four rivers, namely Nabule River, Dawei River, Kunchaung River and Pan din in chaung River near and within the project site; however, the water supply is not adequate during the dry season.

Electricity

In nearby area of project site, local villagers had no electricity grids. Only some households were able to generate electricity via small generators; e.g., main generator (400 kV) and 7-10 kV of generators which the household members shared cost for diesel fuel. In other larger villages, generators were located in the village's temple with small distribution system connecting the generators with the households which the villagers shared the cost of fuel and maintenance.

Solid Waste Management

Presently, Dawei does not have proper management on solid waste and sanitation. The solid waste was collected and disposed of by open dumping or open burning within their households. While organic waste, most villagers feed the waste to their pigs and cows.

5.4.6 Traffic and Transportation

Study Area

Around and inside the project area, there were only local roads in poor conditions. There were no transportation routes in the project site. When Dawei Industrial Estate is developed, the internal access roads will be constructed for supplying the construction materials within project area. Therefore, the traffic is expected to be increased in the surrounding area. The project influence area (impact zone) is considered to be the nearby communities and households within the project area.

Baseline Traffic and Transportation Conditions

Baseline traffic and transportation has been surveyed in the previous relevant studies. These are:

- Environmental Impact Assessment (EIA) for Main Road (SEATEC, 2012c).
- IEE Environmental Studies for Dawei Sea Port & Industrial Estate Development Project (TEAM, 2012a).

The studies include survey of traffic volume on the main local roads. The results of the studies can be summarized below.

Land Transportation

There was only one main road within a five km. of radius from the industrial estate: Highway no. 8; which is a two lane, paved road, with no shoulder and under poor condition. The other secondary roads for transporting between villages were dirt roads.

The road condition at the project site and local village is laterite surface, about 4.0 m. wide. Most of the roads can be accessed all year round, but conditions are relatively poor, especially in the wet season.

The traffic survey was reviewed at Kamyawkin point, located at North Latitude 14.0942^{o} and East Longitude 98.1795^{o} in the Northwest of Dawei city on the Dawei-Nabule Road. Recorded vehicles included express buses, mini buses, trucks, vans, and pickup trucks. The largest amount of passenger cars were found at the Dawei-Thayetchaung and the Dawei-Kyauknimaw routes. Most of the cars on these routes were express buses, minibuses, and pickup trucks (Table 5.4-22). Yangon-Dawei-Myeik and Mawlamyine-Dawei-Myeik routes also pass through the project area. There are seven cars daily from the Yangon-Dawei-Myeik route. Most of the cars and buses are running on the local road network.

Table 5.4-22 Passenger Cars Recorded Around Project Area

Trips	Number of Cars per day
Dawei-Thayetchaung	40
Dawei-Kyauknimaw	24
Dawei-Yebyu	19
Dawei-Laung Lone	17
Dawei-Maungmagan	14
Dawei-Ashaytaw	9
Yangon-Dawei/Myeik	7
Dawei-Kanpauk	4
Dawei-Pulaw	3
Mawlamyine-Dawei-Myeik	3
Dawei-Yay	2
Dawei-Shinmotehti	1

Source: TEAM (2012a)

In 2011, the highest traffic volume was observed during August. The traffic volume observed at Kamyawkin point in August was 8,384 vehicles. Total traffic volume during April and September is 47,508 vehicles (Table 5.4-23). The highest numbers of vehicles were express buses and mini buses.

Table 5.4-23 Passenger Cars Recorded at Kamyawkin Point

Months	Number of Vehicles				Total
	Above 5 tons	3-5 tons	1-3 tons	Below 1 ton	
April	296	1,048	58	6,264	7,666
May	310	930	62	6,696	7,998
June	300	900	60	6,480	7,740
July	300	1,080	60	6,420	7,860
August	320	1,152	64	6,848	8,384
September	300	1,080	60	6,420	7,860
Total	**1,826**	**6,190**	**364**	**39,128**	**47,508**

Source: TEAM (2012a)

The volume of vehicles at Kamyawkin point was recorded (Dawei-Nabule Road) during 1-2 October, 2011 as shown in Table 5.4-24. The dominant type of vehicles was motorcycle with the highest volume during 10.00 a.m. - 02.00 p.m.

Table 5.4-24 Volume of Vehicles at the Kamyawkin Point

Time Account	<1 ton (Motorcycle)	1-3 tons (Light Truck)	3-5 tons (Light Bus)	>5 tons (Heavy Truck)	Total
1/10/2011					
0:00-6:00 hrs	38	6	5	2	51
6:00-10:00 hrs	390	46	10	8	454
10.00:14:00 hrs	445	68	20	4	537
14:00-18:00 hrs	209	38	14	6	267
18:00-0:00 hrs	18	4	6	2	30
1/10/2011					
0:00-6:00 hrs	40	7	4	2	53
6:00-10:00 hrs	400	36	12	8	456
10.00:14:00 hrs	500	24	24	2	550
14:00-18:00 hrs	300	28	10	6	344
18:00-0:00 hrs	15	3	4	1	23
Grand Total	**2,355**	**260**	**109**	**42**	**2,765**

Source: TEAM (2012a)

Each category of vehicles has its own Passenger Car Unit (PCU) which can be calculated in form of Passenger Car Equivalents (PCE), with conversion factor in Table 5.4-25.

Table 5.4-25 Passenger Cars Equivalent Factor of each Vehicles

Type of vehicle	Passenger Car Equivalents Factor (PCE)
Passenger Car and Taxi	1.00
Light Bus	1.25
Heavy Bus	2.00
Light Truck	1.50
Medium Truck	1.75
Heavy Truck	2.00
Motorcycle	0.33
Bicycle, Tri-cycle	0.20

Source: 1. Puopong Ninjunpansri, 1997. Highway Engineering Department of Civil Engineering, Faculty of Engineering. Rachamongkol Technology Institute, 312 p.
2. Department of Highway, 2001. Highway Traffic Report

The result of traffic volume in terms of PCU/hour at Kamyawkin point (Figure 5.4-17) can be described in Table 5.4-26, which showed that PCU/hour for working hours (estimate 10 hours) in Kamyawkin point was 69.45. The obtained V/C Ratio will be used for comparison with the standard values for future traffic condition with assumptions and the calculated V/C ratio of the existing condition was shown in Table 5.4-27.

The V/C ratio of the existing condition can be calculated as shown in Table 5.4-28. The result showed that the traffic condition is very high traffic flow.

Table 5.4-26 The PCU/Day Result of Vehicles on the Kamyawkin Point

Types of Vehicle	Average Number of Vehicle During 1-2 October 2011 (No./day)	PCU/day	PCU/hr[1/]
< 1 ton (Motorcycle)	1178	388.74	38.87
1-3 tons (Light Truck)	130	195	19.5
3-5 tons (Light Bus)	55	68.75	6.88
>5 tons (Heavy Truck)	21	42	4.2
Total	1384	694.49	69.45

Source: [1/] Estimate working hours (TEAM, 2012a)

Table 5.4-27 Standard Values (Range of V/C Ratio) for Traffic Condition Classification in the Future

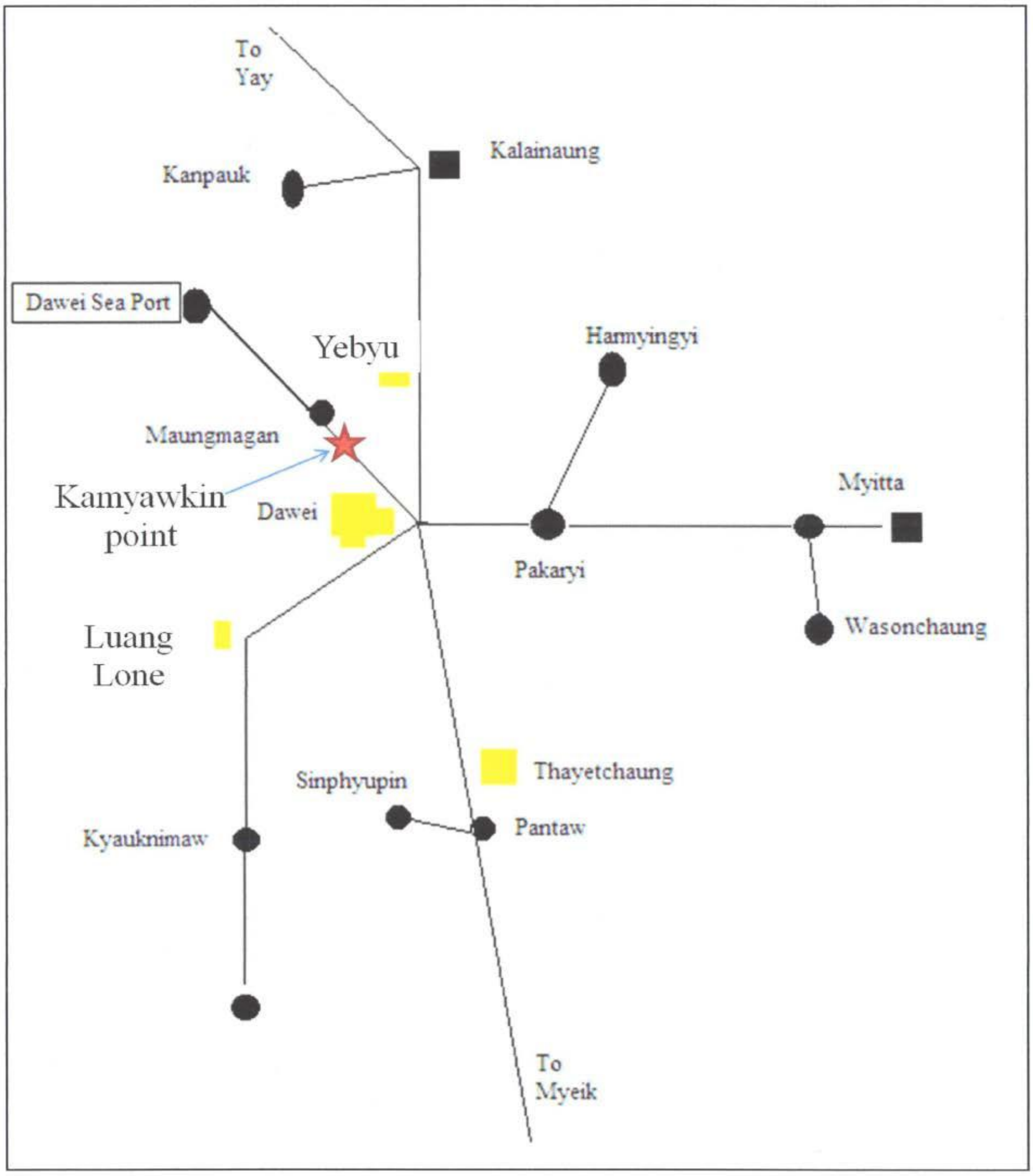
Range of V/C Ratio Value	Classification of Traffic Condition
0.88-1.00	Severe traffic congestion
0.67-0.88	Heavy traffic congestion
0.52-0.67	Satisfactory traffic flow
0.36-0.52	Good traffic flow
0.22-0.36	Very high traffic flow

Source: 1. Puopong Ninjunpansri, 1997. Highway Engineering Department of Civil Engineering, Faculty of Engineering. Rachamongkol Technology Institute, 312 p.

Table 5.4-28 Standard Values (Range of V/C Ratio) for Traffic Condition Classification in the Present Time

Information	Average
Traffic volume: 10 hrs of working hour (PCU/hour)	69.45
Carrying capacity (C) (PCU/hour)	2000
V/C ratio for the working hour	0.035
Traffic condition	Very high traffic flow

Source: 1. Puopong Ninjunpansri, 1997. Highway Engineering Department of Civil Engineering, Faculty of Engineering. Rachamongkol Technology Institute, 312 p.



Source : TEAM (2012a)

Figure 5.4-17 Map of Traffic survey Location (Kamyawkin Point)

Air Transportation

There is a local airport at Dawei. All international flights are operated by Myanmar Airways International. Air Mandalay, Air Kanbawza, Asian Winds, Air Bagan and Yangon Airways are for domestic passengers. Flight time from Yangon to Dawei is about one hour.

Railways

Dawei- Yay railroad is running through Yebyu Township in the North- South direction parallel to the Dawei – Yay Highway. Dawei-Yebyu railroad section was completed on 30 May 1995 and Yebyu – Kaleinaung railroad was opened on 1st July, 1996. It was totally completed and opened on 26th May, 1998. The length of railroad from Dawei to Yay is about 166. 0 km.

From Dawei to Yebyu, it is about 17.0 km. There are 22 stations between Dawei and Yay stations. At present, from Dawei to Mawlamyine, Myanmar Railways provide transport service with three diesel locomotives, five carriages, and one wagon. The train leaves Dawei at 5:15 am. and reaches Mawlamyein at 9:15 pm.

Water Transportation

Only cargo boats utilize the Dawei jetty. Passengers to Yangon, Myeik and Kawthang use speed boats from Thayetchaung jetty. There are two speed boats for passenger services.

5.4.7 Land Use

5.4.7.1 Study Area

The proposed project altered existing land use in the project area. A high portion of the project area and nearby areas was used for agricultural purposes. A number of villages was also located within the project boundary. This section describes the existing land use prior to development of Dawei Industrial Estate.

5.4.7.2 Baseline Land Use Conditions

A. Baseline Land Use Condition

The source of information on the land use conditions in the project area included:

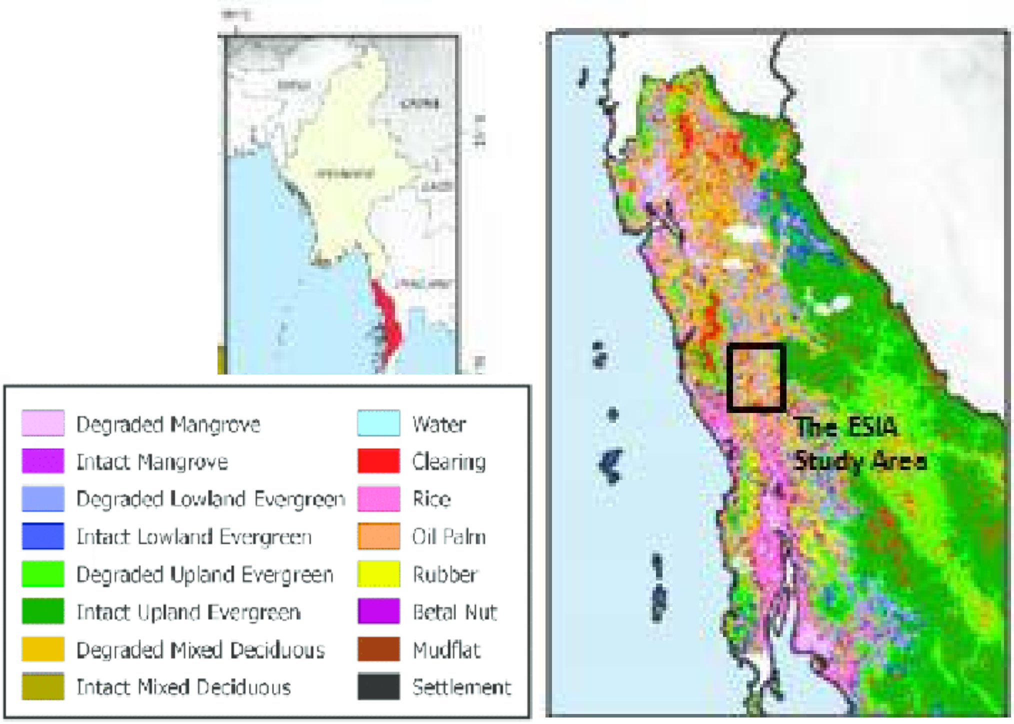
- The Geology of Burma (Myanmar): An Annotated Bibliography of Burma's Geology (Hadden R.L., 2008)
- Land use survey map from MIE (MIE, 2015)
- Classification of Land Uses by Remote Sensing in Tanintharyi region, Myanmar. (Connette et.al., 2016)

The study area is relatively flat surrounded by mountain range trending parallel the coastline of southern Myanmar. Some parts of the ESIA study area cover by undulated terrain and low ridges with slope dipping into seaward. Drainage and channels are well developed, which form the Dawei River basin and floodplains in southern part of the upper Tanintharyi region.

Regional Land Use

As published in "The Mapping Distinct Forest Types Improves Overall Forest Identification Based on Multi-Spectral Landsat Imagery for Myanmar's Tanintharyi Region" in Journal of Remote Sensing reveals that forest land is extensively degraded. Land uses over the Tanintharyi Region covers by unique type and classes of forest and human settlement.

Western side of the ESIA study area (Figure 5.4-18) is extensively degraded especially in northwestern the study area is noticeable cleared (in red). Spreading along the coastal still dominates with mangrove forest (in light purple).



Source: ESIA Study Team

Figure 5.4-18 Classification of Regional Land Uses in Tanintharyi Region

In the southeast and eastern sides of the ESIA study area still covers by canopies of upland evergreen (in dark green) and deciduous forest (in brown and pale brown).

In central and near by the study area, land is almost utilized for agricultural purposes and human settlement. Majority of the land is for oil palm plantation (pale pink) and discriminates with rubber plantation (yellow) and intact low land evergreen. Supporting land use data from Dawei districts is summarized in Table 5.4-29.

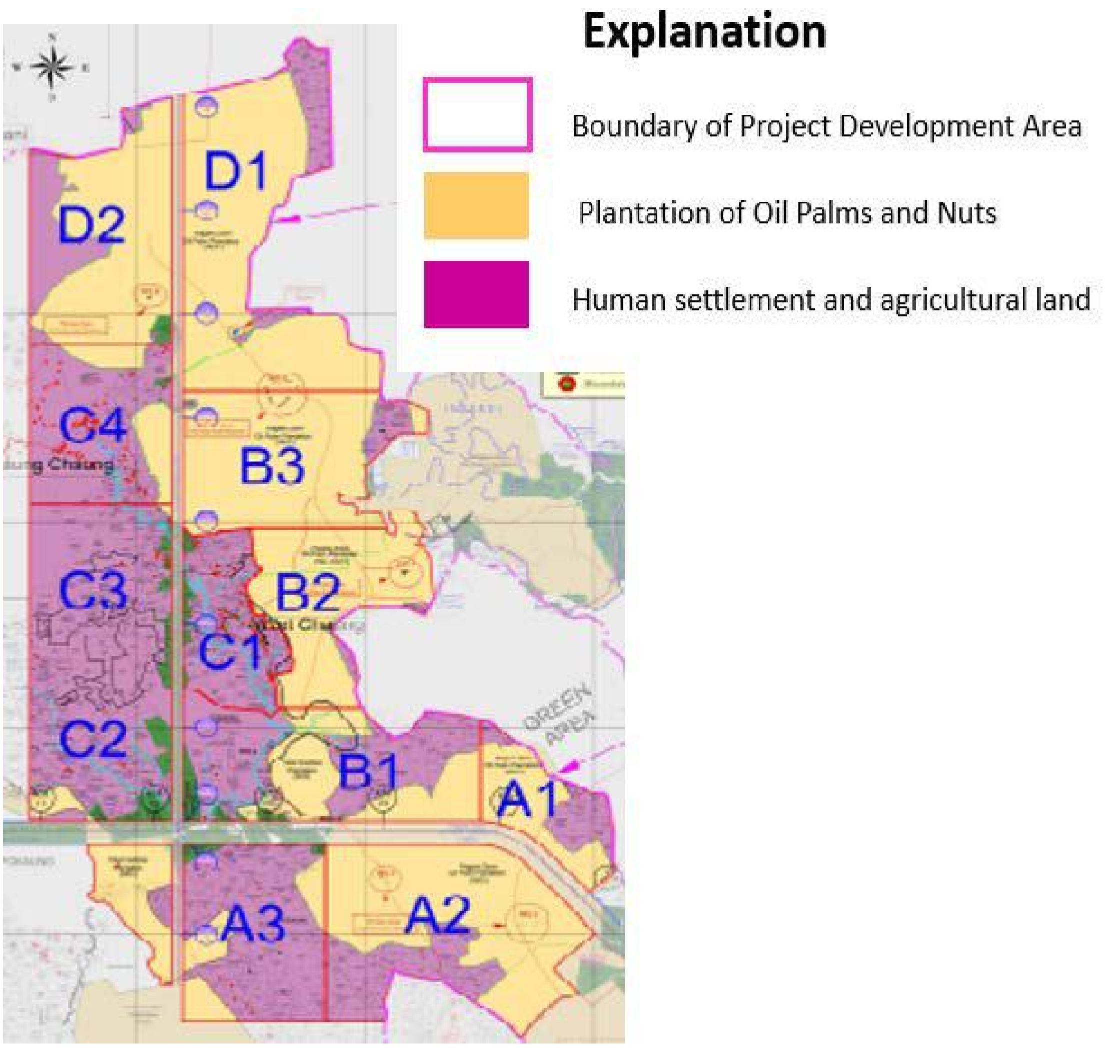
Table 5.4-29 Land Use of Yebyu and Laung Lone Townships

Land Category	Yebyu		Laung Lone	
	Acres	%	Acres	%
Forest Land	201,012	33.24	78,256	34.35
Agricultural Land	72,703	12.02	33,345	14.64
Others Land	330,948	54.74	116,186	51.01

Source: Land Resource Department, Dawei District (2011)

<u>Local Land Use In The Study Area</u>

Surveys by the Project Proponent, most of the land is used for plantation (in egg's shell color) by Minister of Industry in production of palm oils and some nuts i.e. betel and cashew nuts. The other land type (purple color) is settlement of the villages including their agricultural and farmland areas.



Source: MIE (2015)

Figure 5.4-19 Land uses in the Project Development Area (within the black line borders) and surrounding areas

The Project development area can be categorized into three major types:

- Agricultural land
- Developed land
- Rural settlement

Most of agricultural land is flat and cultivated with crops and paddy fields. Plantations are also found on the quite altitudes and foot of the hills and the ridges. Major types of plantations are oil palm, cashew nut, rubber whereas minor are coconut and betel palm. Some parts of the Project areas are developed and cleared (Figure 5.4-20) such as in Zone A. Rural settlement are four (4) villages consisting of Kha Maung Chung, Wat Chung, Yalai and Pagaw Zoon. Table 5.4-2 presents land use and land holding per household of the villages. See details of their economic profile in in Section 5.4.4.

Source: The ESIA Study Team

Figure 5.4-20 Characteristics of Forest and Agricultural land

Table 5.4-30 Average land holding and land use

No.	Villages	Land Holding (Acres / Household)	Land Use (Acres / Household)	
			Residential	Agricultural
1.	Kha Maung Chaung	15	1	15
2.	Yalai	7	0.5	7
3.	Wet Chaung	10	1	10
4.	Pagaw Zoon	3	0.5	3

Source: SEATEC in association with UAE (2013)

5.5 CULTURAL COMPONENTS

5.5.1 Historical and archeological sites

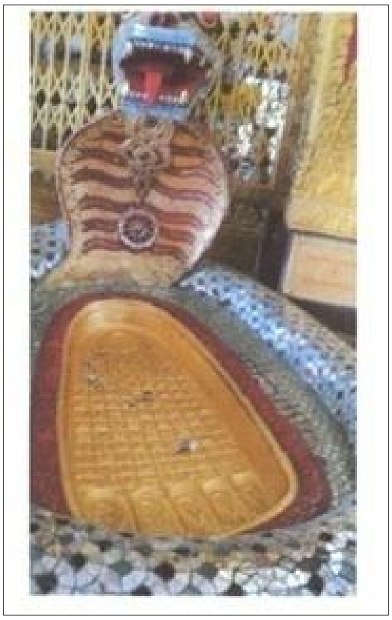
According to local legends, there were 17 towns that had been established by different kings during the 15th Century until the 18th Century until the British occupied lower Burma in the first Anglo-Burmese War. The local Tavoyan people are very proud of Buddhism and their cultures, because they believe that the Lord Buddha visited their region. The Tavoyan dance of carrying water with pots (made of mud) was a well-known dance inthe communities. Many communities have various Buddhist heritages exemplified in their monasteries and have preserved and maintained this religious and cultural value from generation to generation (Dawei Project Watch, 2012). This information is supported by Moore (2011) who stated that Dawei community remains a strong element of present Dawei culture. This can be seen in the local dialect, songs and the neighborhood-village public role in important festivals in Dawei town and surrounding pagodas. The founding story of many of these is woven into the founding story of Thagara involving a prince, Maung Nwa (Mr. Bull) who becomes a hermit. From the union of the hermit and a Nakoma fish, the first dynasty of Thagara emerged. As noted above, on the Weidi side of the Dawei River, place names are traditionally seen to refer to the Buddha's previous life as a buffalo king versus his life as a royal peacock on the Dawei side of the river.

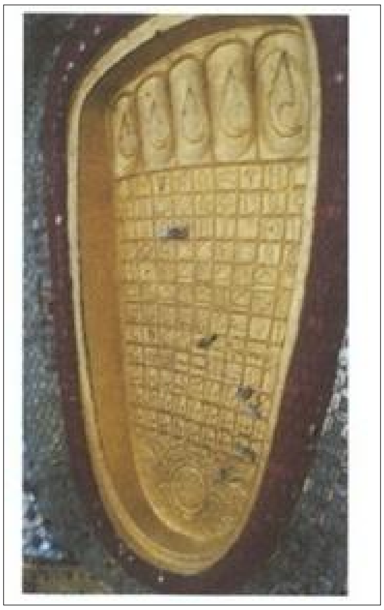
The village profile survey by REM (2013) found "Foot Print of Buffalo Pagoda" in Payadat Village and "Nabule Settawyar or Buddha Foot Print" in Lae Shaung Village. Moreover, there is one monastery in Mudu Village and two pagodas (one in Min dut and the other in Pan Din In Village). The historical and archeological places in the project area are listed in Table 5.5-1. Pictures of the historical and archeological places are shown in Figure 5.5-1.

Table 5.5-1 Historical and Archeological Places in the Project Area

Village	Historical/ archeological places
Payadat	Foot Print of King of Buffalo Pagoda (Buddha)
Lae Shaung	Nabule Settawyar (Buddha Foot Print)
Min Dut	Pagoda
Mudu	Monastery and Spirit (Nat) Animism
Pan Din In	Pagoda

Source: SEATEC in association with UAE (2013)





Nabule Settawyar or Buddha Foot Print in Lae Shaung

Spirit (Nat) Animism (Mudu Village)

Monastery (Mudu Village)

Pagoda (Min Dut Village)

Pagoda (Pan Din In Village)

Figure 5.5-1 Historical and Archeological Sites in the EIA study area

CHAPTER 6
IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES

6.1 INTRODUCTION

This chapter provides impacts and risk assessment to the environment due to project activities as described in Chapter 4. The assessment of potential impacts is conducted on key physical resources, ecological resources, economic development and social and cultural aspects, using quantitative approach wherever possible. Some mitigation measures are discussed in this chapter and will be further prescribed in **Chapter 8** Environmental Management Plan (EMP).

6.2 CONSTRUCTION PHASE

6.2.1 Physical Components

6.2.1.1 Air Quality

(a) Dust

Potential impact to air quality during construction activities are from dust that will be generated from the following sources:

- Transportation routes, which are unpaved, and transported materials;
- Construction site, quarry, and cleared land;

Road construction and site clearing are main activities generated fugitive dust during this period. The other activities are such as burning of vegetation. So, Total Suspended Particulates Concentration (TSP), which is common dust parameter, will be assessed in this section.

Quantity of heavy dust or Total Suspended Particulates (TSP) can be evaluated by "*application of emission factor in construction area at 1.2 ton/acre/month*" (US. EPA, 2005). An approximately 1 square kilometer (247 acres) of construction area will be calculated at once. Hence 1.235 ton of dust will be emitted in a day for 8 hours working per day.

Dispersion of dust can be estimated with Box Model based on Hanna, Briggs and Hosker (1987) by the following formula:

$$C = Q / (d \times w \times m)$$

Where: C = Concentration of dust; mg/m^3

Q = Quantity of disperse dust; = 1.235 ton/d = 343,056 mg/s

d = Width of construction area from perpendicular with wind;

= 1,000 m

w = Average wind speed; = 1.5 m/s* (TEAM, 2012)

m = Average mixing height; = 1,837 m* (TEAM, 2012)

Concentration of TSP from the calculation is 0.124 mg/m^3 or 124 µg/m^3 and when combined with ambient TSP concentration of 120 µg/m^3 (measured in March 2013), sum of the TSP concentration is 224 µg/m^3. This TSP level is still not exceed maximum value, 230 µg/m^3, of the World Bank ambient air quality standard. Extend of the impact will be local due to suspended particles potentially settle down near source, in the construction area. The impact will occur temporary, only during the construction period.

Dust suppression methods, such as water spray and cover up trucks are effective ways to mitigate the impacts. Especially, the water spray is recommended by US. EPA, can reduce up to 50 % of fugitive dust.Therefore, dispersion of TSP from construction activities is predicted to be 62 µg/m^3 after applied the water spray and when combined with ambient TSP concentration of 120 µg/m^3, the impact to air quality in 24 hours shall be reduced to 182 µg/m^3. This level of TSP is still within the World Bank ambient air quality standard.

Although dust can be easily settle down on ground in construction area, some villages nearby the Project development may sometimes get adverse effect on health from re-dispersion. It is responsibility of the Project Proponent to implement mitigation measures in order to minimize the impact to air quality so that recommended mitigating measures are as follows:

- At the entrance of construction site and in construction area must be water sprayed during dry season, at least two times per day in the morning and in the afternoon.
- Haulage truck must be covered during transportation or/and sprayed with water before loading or unloading.
- Covered construction materials such as sand, gravel and cement by canvas.
- Buffer construction zone with vegetation such as foliage plants or shrubs. These plants are good in reducing dust, especially area adjacent to local communities. The plants shall be grown at the beginning of the construction phase.
- Open burning of solid waste or any materials shall not be permitted in construction area. However, in case necessity where the other methods are not practical, burning i.e. vegetation from land clearing shall be limited and/or the materials have to be piled and burned in area away from sensitive receptors such as communities and work camps.
- Exhausts from construction vehicles are acceptable. However, all equipment and vehicles will need to be maintained in good mechanical conditions.

6.2.1.2 Noise and Vibration

Major source of noise and vibration during construction phase is from working of equipment and construction activities. The equivalent sound level (L_{Aeq}) is one of parameter that will be used in noise assessment. L_{Aeq} depends on the fraction of time that the equipment is operated over the time period of construction. This section provides information on typical levels of noise and vibration generated by various construction equipment and assessment of potential impacts due to their operation during construction.

(a) Noise

The noise levels created by construction equipment will greatly vary depending on factors such the type of equipment, the specific model, the operation being performed, and the condition of the equipment. The source of noise from most construction equipment is the engine, usually a diesel engine, without sufficient muffling. Some construction process can be generated noise also, i.e. impact pile driving or pavement breaking.

Construction equipment can be considered to operate in two modes, stationary and mobile. Stationary equipment operates in one or more days at a time, with either a fixed power operation (i.e. compressors and generators) or a variable noise operation (i.e. pile drivers) or to and from the site (trucks). Variation in power imposes additional complexity in characterizing the noise source level from a piece of equipment. This is handled by describing the noise at a reference distance from operating at full power and adjusting it based on the duty cycle of the activity to determine the (LAeq) of the operation. Typical noise levels from representative pieces of equipment are listed in Table 6.2-1

Table 6.2-1 Stationary Equipment and Noise Emission Levels

Equipment	Typical Noise Level (dBA) 50 ft (15 m) from Source
Air Compressor	81
Backhoe	80
Ballast Equalizer	82
Ballast Tamper	83
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane, Derrick	88
Crane, Mobile	83
Dozer	85
Generator	81
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	85
Paver	89
Pile-driver (Impact)	101
Pile-driver (Sonic)	96
Pneumatic Tool	85
Pump	76
Rail Saw	90
Rock Drill	98
Roller	74
Saw	76
Scarifier	83
Scraper	89
Shovel	82
Spike Driver	77
Tie Cutter	84
Tie Handler	80
Tie Inserter	85
Truck	88

Source: USEPA (1971)

Not only the levels of noise is assessed, but also the duration of the noise. The L_{Aeq} of each phase is determined by combining the contributions from each piece of equipment used in that phase. A construction noise assessment is performed by comparing the predicted noise levels with criteria established for the project. The recommended method for predicting construction noise impact is suggested by the Federal Highway Administration (FHWA).

$$L_{Aeq}\,(equip) = E.L. + 10\log(U.F.) - 20\log(D/50) - 10G\log(D/50)$$

Where:

- L (equip) is the L at a receiver resulting from the operation of a single piece of equipment over a specified time period

- E.L. is the noise emission level of the particular piece of equipment at the reference distance of 50 feet
- G is a constant that accounts for topography and ground effects, for hard ground G = 0
- D is the distance from the receiver to the piece of equipment
- U.F. is a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

The following assumptions are adequate for a general assessment of each phase of construction:

- Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period. Therefore, U.F. = 1, and 10 log (U.F.) = 0.
- Hard field conditions are assumed and ground effects are ignored. Consequently, G = 0.
- Emission level at 50 feet, E.L
- All pieces of equipment are assumed to operate at the center of the project.
- The predictions include only the two noisiest pieces of equipment expected to be used in each construction phase.

The predicted noise levels in the distance of 100 ft (33 m) to 3300 ft (1000 m) from construction equipment sources are estimated as shown in Table 6.2-2. The selected noise source emission levels range from 85 to 101 dB(A) which covers all the noise emission from construction equipment.

Table 6.2-2 Estimated Noise Levels from Various Equipment at 100 ft to 3,300 ft

E.L. (dBA)	L_{eq}, equip (dBA)				
	D=100 ft.	**D=330 ft.**	**D=660 ft.**	**D=1650 ft.**	**D=3300 ft.**
Loader (85 dBA)	79.0	68.6	62.6	54.6	48.6
Jack Hammer (88 dBA)	82.0	71.6	65.6	57.6	51.6
Paver (89 dBA)	83.0	72.6	70.6	58.6	52.6
Pile-driver (Sonic) (96 dBA)	90.0	79.6	73.6	65.6	59.6
Rock Drill (98 dBA)	92.0	81.6	75.6	67.6	61.6
Pile-driver (Impact) (101 dBA)	95.0	84.6	70.1	70.6	64.6

Source: ESIA Study Team

The highest noise source is 101 dB(A) from pile-driver (impact type) and the estimated noise level is 70.6 dB(A) at 1650 ft (500m). Therefore, any noise source lower than 101 dB(A) will result in noise level lower than 70 dB(A) at 500 m. However, the community in the distance of less the 500 m may be affected from noise. Construction within 500 m from the any sensitive receptors such as communities therefore have to be controlled either by restricting the construction to day-time only, or an agreement has to be made with the nearby villagers should extended working hours are needed.

The noise impact criteria in Table 6.2-3 are based on comparison of the existing outdoor noise levels and the future outdoor noise levels from the proposed project. The noise criteria and descriptors depends on land use, as defined in Table 6.2-4.

Table 6.2-3 Noise Levels Defining Impact for Transit Projects

Existing Noise Exposure* L_{Aeq}(h) or L_{Adn} (dBA)	Project Noise Impact Exposure,* L_{Aeq}(h) or L_{Adn} (dBA)					
	Category 1 or 2 Sites			Category 3 Sites		
	No Impact	Moderate	Severe Impact	No Impact	Moderate	Severe Impact
<43	<Ambient+10	Ambient + 10 to 15	>Ambient+15	<Ambient+15	Ambient + 15 to 20	>Ambient+20
43	<52	52-58	>58	<57	57-63	>63
44	<52	52-58	>58	<57	57-63	>63
45	<52	52-58	>58	<57	57-63	>63
46	<53	53-59	>59	<58	58-64	>64
47	<53	53-59	>59	<58	58-64	>64
48	<53	53-59	>59	<58	58-64	>64
49	<54	54-59	>59	>59	59-64	>64
50	<54	54-59	>59	>59	59-64	>64
51	<54	54-60	>60	>59	59-65	>65
52	<55	55-60	>60	<60	60-65	>65
53	<55	55-60	>60	<60	60-65	>65
54	<55	55-61	>61	<60	60-66	>66
55	<56	56-61	>61	>61	61-66	>66
56	<56	56-62	>62	>61	61-67	>67
57	<57	57-62	>62	<62	62-67	>67
58	<57	57-62	>62	<62	62-67	>67
59	<58	58-63	>63	<63	63-68	>68
60	<58	58-63	>63	<63	63-68	>68
61	<59	59-64	>64	<64	64-69	>69
62	<59	59-64	>64	<64	64-69	>69
63	<60	60-65	>65	<65	65-70	>70
64	<61	61-65	>65	<66	66-70	>70
65	<61	61-66	>66	<66	66-71	>71
66	<62	62-67	>67	<67	67-72	>72
67	<63	63-67	>67	<68	68-72	>72
68	<63	63-68	>68	<68	68-73	>73
69	<64	64-69	>69	<69	69-74	>74
70	<65	65-69	>69	<70	70-74	>74
71	<66	66-70	>70	<71	71-75	>75
72	<66	66-71	>71	<71	71-76	>76
73	<66	66-71	>71	<71	71-76	>76
74	<66	66-72	>72	<71	71-77	>77
75	<66	66-73	>73	<71	71-78	>78
76	<66	66-74	>74	<71	71-79	>79
77	<66	66-74	>74	<71	71-79	>79
>77	<66	66-75	>75	<71	71-80	>80

Remarks: * L_{dn} is used for land use where night time sensitivity is a factor; L_{eq} during the hour of maximum transit noise exposure is used for land use involving only daytime activities.

Table 6.2-4 Land Use Categories and Metrics for Transit Noise Impact Criteria

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor L_{Aeq} (h)*	Tracts of land where quietness is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor L_{Adn}	Residences and buildings where people normally sleep. This category includes homes, hospitals and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor L_{Aeq} (h)*	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds and recreational facilities can also be considered to be in this category. Certain historical sites and parks are also included.

Remarks: * L_{Aeq} for the noisiest hour of transit-related activity during hours of noise sensitivity.
Source: ESIA Study Team

As indicated in Table 6.2-4, the noise impact criteria and descriptors depend on land use, designated either Category 1, Category 2, or Category 3. Category 1 includes uses where quietness is an essential element in their intended purpose, such as indoor concert halls or outdoor concert pavilions or National Historic Landmarks where outdoor interpretation routinely takes place. Category 2 includes residences and buildings where people sleep, while Category 3 includes institutional land uses with primarily daytime and evening use such as schools, places of worship and libraries.

Should there be any of the structures or facilities of these categories within the range of distances from the construction equipment and the comparison shows that noise level generated from the equipment may exceed the recommended noise levels; construction activities should be limited to the time that is least disturbing to the receptors. The mitigating measures recommended for the noise impact are as follows:

- Regularly maintain engines, equipment machines and vehicles in good condition
- Speed of vehicle (40 km/hr) must be limited to minimize the noise of vehicle
- Consider alternatives of construction method to reduce noise
- Construction and haulage activities to be limited to daytime
- Contractor must use equipment and machines that generate low noise levels
- Install temporary noise barriers, if necessary
- Construction workers exposed to noise levels of 80 dBA or more shall be provided with adequate hearing protection.

(b) Vibration

Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods employed. Operation of construction equipment causes ground vibrations that spread through the ground and diminish in strength with distance. Buildings founded on the soil in the vicinity of the construction site respond to these vibrations, with varying results ranging from no perceptible effects at the lowest levels, low rumbling sounds and perceptible vibrations at moderate levels, and slight damage at the highest levels.

Ground vibrations from construction activities do not often reach the levels that can damage structures, but they can achieve the audible and feelable ranges in buildings very close to the site. In this case where prolonged annoyance or damages from construction vibrations are not expected, a qualitative assessment is appropriate.

Construction vibration may be generated from blasting, pile-driving, vibratory compaction, demolition, and drilling or excavation in close proximity to sensitive structures. The existing conditions of the area do not have any high-rise buildings or structures that may be sensitive to vibration. Some religious places, such as pagodas and temples, exist, but presumably these places will be relocated before the construction activities can commence close to them. Overall impacts due to vibration from construction equipment are expected to be negligible.

Notwithstanding, should a quantitative assessment of vibration impacts from construction is needed in the future, the guidance below can be used.

<u>Damage Assessment</u>

Select the equipment and associated vibration source levels at a reference distance of 25 feet from Table 6.2-5. Make the propagation adjustment according to the following formula (this formula is based on point sources with normal propagation conditions):

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$$

where:

- PPV (equip) is the peak particle velocity in in/sec of the equipment adjusted for distance
- PPV (ref) is the reference vibration level in in/sec at 25 feet from Table 6.2-5
- D is the distance from the equipment to the receiver.

Vibration Source Levels from Construction Equipment

A major concern with regard to construction vibration is building damage. Construction vibration is generally assessed in terms of peak particle velocity (PPV). Various types of construction equipment have been measured under a wide variety of construction activities with an average of source levels reported in terms of velocity as shown in Table 6.2-5. The table gives one level for each piece of equipment, it should be noted that there is a considerable variation in reported ground vibration levels from construction activities. The data provide a reasonable estimate for a wide range of soil conditions.

Construction Vibration Criteria

The primary concern regarding construction vibration relates to potential damage effects Table 6.2-5. Guideline vibration damage criteria are described in Table 6.2-6 for various structural categories.

Table 6.2-5 Vibration Source Levels for Construction Equipment (From Measured Data.)

Equipment		PPV at 25 ft (in/sec)	PPV at 25 ft (mm/sec)
Pile Driver (impact)	upper range	1.518	38.5572
	typical	0.644	16.3576
Pile Driver (sonic)	upper range	0.734	18.6436
	typical	0.170	4.318
Clam shovel drop (slurry wall)		0.202	5.1308
Hydromill (slurry wall)	in soil	0.008	0.2032
	in rock	0.017	0.4318
Vibratory Roller		0.210	5.334
Hoe Ram		0.089	2.2606
Large bulldozer		0.089	2.2606
Caisson drilling		0.089	2.2606
Loaded trucks		0.076	1.9304
Jackhammer		0.035	0.889
Small bulldozer		0.003	0.0762

Source: ESIA Study Team

Table 6.2-6 Summary of Building Damage criteria in DIN 4150-3:1999

Type of structure	Short-term vibration				Long-term vibration
	PPV at the foundation at a frequency of			PPV at horizontal plane of highest floor (mm/s)	PPV at horizontal plane of highest floor (mm/s)
	1 - 10Hz (mm/s)	1 – 50 Hz (mm/s)	50 - 100 Hz (mm/s)		
Commercial/Industrial	20	20 – 40	40 – 50	40	10
Residential/School	5	5 – 15	15 – 20	15	5
Historic or sensitive structures	3	3 – 8	8 – 10	8	2.5

Source: ESIA Study Team

6.2.1.3 Topography and Soil

Construction of the project involves large amount of earth moving. Most of the materials obtained from the excavation will be used for backfilling of the low areas of the project.

During operation phase, the operating areas of factories and manufacturers are expected to be either compacted or paved. Soil contamination may occur due to inappropriate handling of chemicals or spills.

The project area is a relatively flat basin surrounded by mountain ranges on the north, Dawei river on the east, coastal area on the west, and flat land on the south. Mountains and highlands within and surrounding the project area are either excluded from the project boundary or will be preserved as green area and, therefore, will not be disturbed by the construction activities. The area can be divided into Dawei river basin to the east and Andaman basin to the west.

However, the area, as a flat basin that is subjected to occasional flood, has to be filled up to +6 m Chart datum (CD) to be above the recorded flood level. Additionally, some rolling hills within the basins will need to be leveled. Excavated materials from leveling of higher area will be used for filling and elevating these low-lying lands.

Changes and impacts to the topography during the construction are expected to be quite large and unavoidable. Practices on sourcing material from nearby area will limit transferring soil material across different basins. Top soils will be preserved wherever possible and reused when earthworks are completed, which will help preserving fertile soil.

6.2.1.4 Surface Water and Sediment

This section contains surface water and sediment evaluation of potential impact during construction and operation periods.

Two waterways will be receiving treated wastewater from the industrial estate area:

- Kunchaung River (Kyaning Chaung), which is located at the southeastern part of the project boundary. It is a combination of many canals in the north: Sin Pu Nit Chaung; Pein Chaung; and Ya Laing Chaung, flowing from north to southeast and into Dawei River. Kunchuang River will be the primary receiving water, where wastewater starts flowing into is the Southern part with the distance of 5 kilometers before flowing rapidly into Dawei River, the secondary receiving water.

- Dawei River, which is the main river in the area flowing from north to south at the foothills of Thanintharyi mountain range and entering into the Andaman Sea at the Thanintharyi Coast Region. The Dawei River is situated at the project boundary to the east.

Water quality results from various studies indicated that existing water quality prior to the project implementation in Dawei River and Kunchaung River are generally suitable for agricultural purpose, and, to an extent, consumption with pretreatment (refer to Chapter 5 for more detail). However, high levels of suspended solid and turbidity were observed during the dry season, and in some sampling locations, certain pollutants were higher than the levels expected in natural water, such as zinc, copper, lead, and nickel. Additional water quality monitoring in Dawei River before the full phase project implementation is recommended so that a longer term water quality data are available, and attempt should be made to identify possible sources of these contaminants, potentially from upstream of the project area.

Source of pollutants that may impact water quality during construction period include: domestic wastewater from workers and sediment from runoff, particularly in the land development activities where vegetation clearing is needed.

The land development of the initial industrial estate area may result in increased sediments in surface water from surface runoff during rainy season. Control of sediments from the construction sites will be required during this period to reduce sediment releasing to the waterways. Vegetation clearing will only be conducted to the area that is needed for construction activities. Control measures such as sedimentation pond and silt fence will need to be constructed to reduce sediment loading to the natural waterways. Potential impacts due to sediment during construction will be limited to only the construction period. Local villagers rely on surface water for agricultural purpose, and water for consumption is sourced from shallow groundwater well. Therefore, impacts to the use of water are expected to be quite limited and short-term.

Domestic wastewater generated from the construction work camps are another source of pollutants to the natural waterways. Approximately 96 m^3/ day of domestic wastewater from the main construction camp is estimated, based on an assumption that the wastewater is generated at the rate of 80 liters/person with a total numbers of 1,200 staffs in the site and labor camp. This volume of untreated wastewater can deteriorate quality of natural water resource and also coliform bacteria can be contaminated into ground water well. Septic tank must have detention time at least 3 days for killing pathogenic microbes, Wastewater from bathing and washing must be collected to treat with aerobic biological process, that can

reduce BOD of wastewater to be less than 20 mg/l before discharge into receiving water source (seepage tank is not recommended for this area due to it cannot work during rainy season that be high water content in soil). It is necessary to limit and control unexpected labor camps sub-contractors.

Other concerns may be contaminated wastewater and used oil from equipment maintenance and workshops. Used oil need to be controlled and accounted for. It is recommended that the used oil are kept temporarily on site in a proper storage area until appropriate oil disposal facilities are identified locally or until the waste management facilities of the industrial estate is constructed and operated. Storage of oil and chemicals used during the construction period needs to be properly constructed with secondary containment to reduce the impact in case of leakage or spills.

In summary, construction activities show that be low level of significant impact to surface water and sediment. However, project owner must act and control the operating of recommended mitigation measures as follows:

- Consider alternatives for treated wastewater recycling such as watering trees
- Provide sedimentation pond for sediments quantity reduction before run off water flow into surface water
- Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course and ground are banned

6.2.1.5 Groundwater

Ground water, especially shallow wells are the main water supply source for local people in surrounding communities of Dawei SEZ. The ground water quality of observe well at zone A1 showed that most parameters are in standard of ground water for drinking except ferrous concentration and total coliform bacteria.

Ground water can get worse in quality due to proper treating of generated wastewater is neglected. In addition, ground water has been applied by most villagers in nearby communities that are not fully relocated and be insufficient during dry season. Whereas 120 m^3/day of tap water will be produced from ground water source at site camp which may have ground water supply crisis. Thus, treating of toilets and lavatories in labor camp and the other wastewater from various activities of workers by proper treatment units shall be prevented ground water contamination. In the absence of sewage treatment unit, septic tank and/or pit latrine is unaccepted. It is expected that level of impact is low with good performance of mitigation.

The mitigating measures recommended for the above impact are as follows:

- Saving water sanitary wares such as faucet, flush toilet must be applied
- water is worth it " need to be reminded all workers/sectors forward water saving
- Pipeline of water supply must be regularly checked and immediately repaired for preventing of water leakage

- In case of insufficient ground water supply, the project must use other water source for tap water production to avoid water supply conflict
- Provide sufficient number of toilet and bathing facilities for labors, the contractors/subcontractors must not be allowed to establish worker camps outside ITD labor camp.

6.2.1.6 Geology and Seismology

According to the review of baseline information (Chapter 5), the project area located in Zone I, minor damage, which is the range of ground acceleration less than 0.075 g, which is equivalent to MMI class V and less. Also, the seismic records indicated that none of earthquake situation in Dawei and project area. Although the risk is considered low, the project may consider cooperating with the local authority in updating and exchange of the seismological information. It results in no effect during construction and operation phase.

6.2.2 Biological Components

6.2.2.1 Surface Water Biology

The project development will change the existing ecological conditions including loss natural forest and vegetation. The surface runoff will increase sediment into surface water resources. This will result in increased levels of turbidity and suspended solids affecting photosynthesis of phytoplankton and productivity of water resources. Mitigation measures controlling release of sediment from construction sites need to be implemented to limit the amount of sediment being released to the environment.

Wastewater from construction labor camps, if not controlled, may result in degradation of water quality and dissolved oxygen, particularly in smaller streams, resulting in loss of or reduced aquatic animals and fish stock. Appropriate primary treatment of domestic wastewater and sewage is required to prevent this impact. Use of seepage tanks and selection of location of the tanks away from the streams will help reduce the potential impacts.

Similar to impact to water quality due to construction activities, the impacts are expected to be temporary only during rainy seasons during the construction phases. Potential impacts can be moderate without implementation of the measures. From site survey and observation, the local population consumes more marine fish than fresh water fish. Effect of construction of the industrial estate on fisheries resources for local population is expected to be minimal.

6.2.3 Economic Development

6.2.3.1 Infrastructure Facilities

Infrastructure facilities include water supply, wastewater treatment, drainage and flood control and solid waste management systems in the area and if these facilities will be affected by the project activities during construction and operation phases. Local villagers rely on shallow groundwater wells as source of water for general use and consumption. Wastewater from households still is low treatment technology and no drainage and flood control system. Hence, they need to be concerned. Solid waste management system is not

well established in the area yet and open burn or dumping is still being used. Project owner including contractor, subcontractor should take people's concerns seriously and work towards sustainable development by improving the livelihood security of the local communities and environmental sustainability.

(a) Water supply

During construction, tap water by ITD water supply system will be the source of water for construction camps. About 120 m^3/day of clear water will be produced in the site to supply total number of 1,200 workers in the construction period, which ground water well at construction camp will be raw water source. Moreover local people take water from shallow well for living. Therefore, impact to surrounding communities is no significant if nearby villages are fully relocated before the construction is started. However, mitigation measures that recommended for surface water and ground water must be strictly conducted during construction period.

(b) Wastewater treatment

Mainly generated wastewater from routine activities of 1,200 staffs including labor in the site will have average BOD concentration of 200 mg/l with 96 m3 in quantity which calculated to be 115 kg of organic loading. Unless it is treated, these loads can have effects on bad odors, eyesore conditions, worsen surface water and ground water quality and also global warming caused by methane gas generated from anaerobic condition. Consequently wastewater treatment system must be provided to get the treated wastewater having BOD less than 20 mg/l before discharged to natural water course. Grease trap is also recommended to treat kitchen and canteen wastewater, large amounts of fat oil and grease (FOG) can cause sewer line to clog, floating oil in the surface water course inhibit oxygen dissolve capability that affect living of aquatic animals such as fish, shrimp, planktons.. However, there is no impact on infrastructure facilities of communities. However, mitigation measures that recommended for surface water and ground water must be strictly conducted during construction period.

(c) Solid waste management

As there is no adequate solid waste management system in Dawei or near project area. Solid waste in quantity of 1,200 kg is expected to be generated per day from activities of workers, that having 360 liters in volume (density of solid waste = 1,000 kg / 300 liter). This few solid waste will be sorted at site, which be classified into general waste, recycling waste and hazardous waste. Three colors of plastic garbage containers will be provided for solid waste separation. Some portion of generated solid waste such as paper, glass, plastic, metal, can be reused and recycled, that need storage area for short time. For hazardous waste: dry battery, light bulb, paint bucket, spray paint canister, need to be stored temporarily until the waste management facilities are operated. Disposal site for general solid waste that be non-hazardous waste needs to be established. Although there is no affect to waste disposal of local nearby villages, project owner must do the recommended mitigating measure as follows:

- Sorting waste must be regularly operated at construction site and labor camp
- Solid waste must not be thrown away to surface water course or directly dumped on ground
- Reuse and recycle waste buyers in Myanmar must be contacted in construction period and provide lists to factories
- solid waste is worth " must be promoted for labor awareness
- Landfill units need to design and operate as US EPA guidelines
- Hazardous waste disposal in or off the construction site is strictly prohibited
- Project owner must have a strict control system for construction waste disposal

6.2.3.2 Traffic and Transportation

Issues related to volume and management of traffic and transportation are mainly covered under EIAs for Main Road and Two Lanes Road. However, there is one aspect that may need to be addressed within the scope of this EIA, the existing use of local roads through the project area by local villagers.

The existing villages inside the project area rely on 2 main roads traversing the project area in a north-south direction. One road is on the west side of the project area connecting the area to the north of the project (i.e. Bawah) to the south (i.e. Maungmagan). This road crosses the Main Road at about Km+4.000. Another route is on the east part of the project area starting from Yebyu on the southeast of the project area to the north and crosses the Main Road at approximately Km +15.000.

Transportation of construction materials within the project area is the main traffic volume during this stage. Transportation of construction materials such as cement, rebar, and other materials that cannot be sourced from within Myanmar will be imported from Thailand. The main transportation route from the Small Port connects with the Main Road at approximately Km +3.000 and does not cross any permanent villages.

However, the volume of traffic from smaller vehicles, such as pick-up trucks, is expected to be higher than the period before the project, thus increased risk of accident between the vehicles used in the project and motorcycles, which is the most common transportation mean of the local villagers.

To reduce the risk of accidents, the project will install sign boards along the roads that most frequently used by the project's vehicles. Ling of sight and curvature of the road will be progressively improved.

6.2.3.3 Land Use

Major concerns related to land use during construction period include:

- Forest encroachment by relocated villagers.
- Temporary services for constructions their crews will initially formed and later turn into uncontrolled settlement, forest encroachment.

When construction starts, there will be a large number of personnel moving in. The majority will be construction crews with low wages. They will likely depends in part on the locals to provide certain low cost basic services, such as food, cleaning, transportation and especially those entertainment or relaxation not allowed on the official construction camps. Naturally there will be temporary structures set up to provide such services at the place most convenient to the clients, predictably nearest to the main route, crew camps and the entrance to the site, due to the limited mobility and road access of the crews. These squatted temporary settlements will overtime take more permanent forms but not necessary are tidy, safe, or sanitary. While designated township zone is already provided under the proposed plan, the legitimate area for labor services may not be located according to the zone due to convenient distance to the camps and construction sites. In terms of land use, it is important such temporary service activities and structures set up for workers' needs be planned out monitored regularly. Relocation may be needed in intervals as appropriate so that eventually most or all services for project personnel will not be allowed to scatter outside the designated township zone.

6.2.3.4 Power and Transmission

Electricity in the camps will be generated either by diesel generators or the LNG power plant installed during construction period. No impact to the existing use and electricity generation of the local villagers is expected.

6.2.4 Social and Cultural Components

6.2.4.1 Socio-Economic Conditions

Occupations of the local villagers are farmers with basic education from local schools. The concerns of the villagers collected during public consultation activities, include:

- Lack of knowledge of project activities and planning; and
- Concerns on potential employment in the future industrial estate due to lack of education and appropriate skills.

Another social aspect that needs to be considered is potential conflict between the local populations and immigrant workers particularly due to different culture, language, way of life, and way of thinking.

Influx of construction workers from different cultures and nationalities will start from this construction phase. These immigrant workers may unknowingly offend social norms and customs. Potential impacts due to this issue can range from slight to possible widespread

creating conflicts between different nationalities inside the project area. To minimize the potential impacts, foreign workers need to receive orientation regarding appropriate / inappropriate actions. A guide, in form of booklet, may be provided to each of the new workers.

Lack of knowledge of project activity and planning is one of the key concerns received from the public consultation activities. This may lead to negative rumors and misconception of the project. The project will need to be proactive and engage the local villagers routinely throughout the preparation and construction phase to ensure that the information is sufficiently disseminated to the villagers. This will also help promote the relationship and trust between the project and the villagers. Concerns of the public can also be collected and addressed during this routine engagement.

Dawei Special Economic Zone Law requires that the factories employ Myanmese at a certain percentage of all workforces every year. Despite this requirement, if the knowledge and skills of local villagers do not meet the requirements of the industries, the industries will have to employ Myanmese from other regions such as from Yangon resulting in lost opportunity for the local populations. Career training and workshop aiming to improve skills of local populations need to be established to prepare them for future employment in the industrial estate since the construction phase.

6.2.4.2 Sites of Historical and Cultural Importance

Buddhism is the religion of the majority of the populations in the project area. Each of the villages has at least 1 temple. The temple is the center of the community and the senior monks are highly respected by the villagers. Pagodas have been observed to be scattered in various places in the project area, and sometimes in the middle of paddy fields. There are three sites of high historical and cultural values to the local villagers, which are Nabule Settawyar or Buddha Foot Print (Lae Shaung Village). These sites are within the project area and will require careful planning as to how they are maintained or relocated.

Religious places are highly important in Myanmar and potential impacts due to mishandling of these sites and insufficient engagement and acceptance with local villagers and authorities are considered high. Sites of cultural and historical importance have to be surveyed, recorded, and clearly marked on project maps. Construction activities that may generate vibration such as pile driving may need to be avoided close to the site unless permission from the local villagers is granted.

Relocation of temples from the existing villages subject to resettlement is also required based on the feedback from public consultation meetings. Apart from completion of new housing and utilities in the resettlement area, the new temples need to be completed prior to relocation of the communities.

Procedure when the construction crews encounter a potential site with historical and cultural values not surveyed or included in the list needs to be established. The construction activities at the site will need to be temporarily suspended, and authorities will be contacted for direction. Demolition or removal of any religious places will need to be agreed upon by the local villagers.

6.2.4.3 Public and Occupational Health

Public and occupation health impact assessment is prepared for the following objectives.

1) To identify health hazards of both workers and communities relating to the major activities of the construction and operation phases of Dawei Industrial Estate Project;
2) To anticipate existing of measures and preparedness for hazards caused by the project; and
3) To propose mitigation measures and monitoring programs in order to minimize or prevent the adverse effects possibly caused by the project.

Potential sources of impact to public and occupational health conditions during construction phase can be identified as follow:

- Construction activities usually consist of civil works, mechanical and electrical services, and support services. Accidents and injuries are frequently occurred during these activities.

- The construction materials, such as concrete, structural steel, pipe, machinery and other associated infrastructure items, are to be delivered to the site by trucks and vans via temporary unpaved roads. An increasing of transportations may increase accidents and injuries.

- The influx of workforces and the employment of foreign labors, including skilled and unskilled labors. Moreover, growth of other supporting industries and surrounding areas would create pressure on adequacy of infrastructure amenities and services, public health facilities as well as sanitation.

- Increase of accommodation for workers.

- Emission of air pollution, noise, wastewater, and solid waste into environment inappropriately will contaminate ambient environment and may affect health and living conditions of communities.

- Chemicals, chemical and hazardous waste, in case of accidents, may create major hazards such as fire, explosion or chemical leakages.

Potential impacts during construction phase under each important aspect are discussed below:

(a) Occupational Health and Safety

Accidents and Injuries:

During the construction phase, accidents and injuries will be notable for workers, especially among untrained ones. The wide range of injuries may be found from minor or medical aid required only to serious cases, disabling injuries and/or death. Faulty electrical devices, blunt injuries, cut wounds, falling, as well as eye irritation and burns are common, however, broken limbs, trauma and or serious injuries can also occur. Besides,

increased number of traffic accidents can be expected. Therefore, the prevention and mitigation measures need to be provided.

Occupational, Sexual Transmission and Communicable Diseases:

Potential respiratory diseases may be aggravated, due to pollutants exposure in the workplace, such as dust, exhaust gas, chemicals or solvents. Underlying chronic diseases: asthma, allergy, peptic ulcer, or mental disorder, can be exacerbated by the exposure of hazardous/ chemical wastes. Moreover, noise vibration and workplace temperature are likely to be expected. Workers will experience new jobs, hard work and an unfamiliar environment. Hence, they may encounter stress, anxiety, and hypertension. Being away from home, workers easily turn to drink more alcoholic beverages, smoking and/ or substance abuse.

Moreover, unhygienic habits, poor personal hygiene and environmental sanitation, may possibly increase diarrhea, hepatitis and communicable diseases. Malaria and dengue fever and local disease from the affected area, can be easily spread. Sexually transmitted disease and HIVs are also expected and needed to be seriously concerned to designate prevention and control measures.

Emergency Response and First–Aid:

Fire may occur from ignition of flammable materials or other reactive chemicals which can lead to accident and injuries as well as loss of properties. Thus, emergency response plan dealing with fire, explosion and chemicals leaks should be established.

Project owner, has provided the first- aid unit in the campsite at all times. However, when the construction phase is at full scale with some activities at remote sites, additional first- aid units with comprehensive and appropriate equipment should be provided as appropriate. The qualified first- aid units should also be established to ensure that can properly handle with serious or trauma cases. Patients should be taken care and transferred to appropriate medical facilities in time.

(b) Community Health

The project activities during the construction phase possibly have certain impacts beyond the project boundaries. Communities around the project area may be affected in various issues.

Housing and Sanitation:

Even though project owner has provided adequate accommodations for the construction workforce, increasing of numbers of workers and also growth of other supporting industries and surrounding areas, possibly numerous accommodations will be constructed outside the estate. This will create pressure on public health services, public health facilities, and sanitation. Currently the public health services provided by local authorities are rather limited. Improper management of sewage, wastewater and solid waste may generate sources

of diseases. Therefore, the sufficient infrastructure amenities and services should be provided, e.g. solid waste disposal, to mitigate the impact.

Environmental/Communicable Diseases:

According to construction activities and transportations, communities will be exposed to excessive dust and noise that can lead to increase of respiratory diseases and nuisances.

Due to mobility of workforce, sexually transmitted diseases, such as HIV/AIDS, will be the most concerned communicable diseases. These diseases can be spread widely. Increasing of malaria, dengue fever, dysentery, hepatitis, pneumonia, and tuberculosis is also expected due to the poor sanitation.

The migrated workers may bring emerging diseases to the project area. If this happens, local villagers will be likely exposed to new strains of diseases. Common cold and flu as well as respiratory tract infection caused by probably new strains are also possible. An increase of alcoholic drinking, smoking and substance abuse and increasing of migrated labors, violence and social disturbance are expected as well. Appropriate mitigation measures should be implemented to reduce these impacts that may occur.

Accident/Fire/Chemical Leaks:

Unsafe vehicle transport with poor road conditions can trigger vehicle accidents and injuries, particularly among young adults. Accidents may occur while transporting construction materials and supplies including chemicals such as gasoline, solvents or lubricants. These accidents will lead to releases of hazardous materials that may result in fire, explosion and/or toxic chemical leaks into the environment. Thus, the emergency response plan should be established.

Adequacy and Readiness of Healthcare Services:

Local healthcare services and healthcare personnel, in quantitative and potentiality dimension are quite limited at present. However, the injuries and illness will be increased in term of quantity and complexity. The mitigation measures should be, therefore, provided to reduce pressure on the healthcare facilities.

6.3 OPERATIONAL PHASE

6.3.1 Physical Components

6.3.1.1 Air Quality

(a) Air Pollutants

During operation period, air pollution are generated from various sources, in the production process and from the stacks. Air pollutants of concerns and their major sources from the activities expected to take place in the industrial estate include:

- Particulate matters particularly those smaller than 10 micron (PM_{10}) may be generated from combustion processing, which include fuel combustion in manufacturing, coal-fired power plants, and vehicle exhaust.
- Sulfur dioxide (SO_2) is generated from combustion of fossil fuels, which contain sulfur, in boilers, power plants.
- Nitrogen oxide (NO_x), which is a result of reaction between oxygen and nitrogen in air in combustion process.
- Volatile Organic Carbon Compounds (VOCs) are generated from electronic manufacturing industries.
- Dioxin may be generated from waste incinerators.

Various technologies are available to control the release of important air pollutants above. Particulate matters can be controlled by using dry and wet dust collection technologies such as Bag house, Electrostatic Precipitators, and Scrubbers. Sulfur dioxide can be reduced by use of low sulfur fuels or coal and use of SO_x removal technologies. Low NO_x burners are becoming standard in control of release of nitrogen oxide. VOCs need to be recovered, wherever possible, and removed from emission by such method as wet scrubber, whereas Dioxin formation can be minimized temperature control in the combustion chamber of incinerator.

Potential impacts from the above air pollutants are mostly focused on human health, particularly to those living in the vicinity of the sources, in this case – around the industrial estate. Since there are various potential sources within the industrial estate, the most appropriate approach to understand how the release from the sources within the industrial estate may disperse to the surrounding area is by using numerical model. The objective of the numerical model is to predict the maximum concentrations of air pollutants in the area outside the industrial estate area, and limit concentrations to not to exceed the relevant international standards by providing the pollutant loadings that can be released from the estate area.

Emission loading of air pollutants by AERMOD model calculation reported in the EIA report of Dawei Industrial Estate Project (SEATEC and UAE,2014) which the model expert applied the air pollutants loading in worst case situation (maximum load). Hence, we can apply the recommended emission load of PM10, NO_2 and SO_2 as the emission load control for this initial phase. The emission rate of PM10, NO_2 and SO_2 shall be no greater than 0.0025,

0.003125 and 0.0075 kg/ha/day, respectively, must be strictly controlled_to protect health status of nearby people and also preventing the problem of industrial estate development to surrounding communities.

However, particulate matter less than 2.5 micron (PM2.5) or fine particulate that is concerned pollutant by WHO due to it can pass through respiratory system into alveoli. Long-term exposure to $PM_{2.5}$ is associated with an increase in the long-term risk of cardiopulmonary mortality by 6 – 13 % per 10 µg/m3 of $PM_{2.5}$. Generally, $PM_{2.5}$ is equal to 50% of PM_{10} concentration which can be generated from both fuel combustion engines and vehicles. It is recommended additional parameter for monitoring of this project especially stack of waste incinerators.

Furthermore, another air pollutant that need to concern for this project is dioxin which be generated from waste incinerator. Dioxin is known as persistent environment pollutant and be accumulated in the food chain. It is obvious that dioxin formation occurred at temperatures above 450 Degree Celsius (°C) and was reduced significantly at temperatures above 850 Degree Celsius (°C) . The reaction occurring in an incinerator is extremely complex, and there are many factors in addition to combustion temperature influencing dioxin formation. Selection of manufacturing process and incinerator with low dioxin emission are recommended to reduce formation of dioxin.

Methane gas, one of greenhouse gas group, generated from landfill sites and leachate treatment by anaerobic process is also concerned. Gas flaring must be provided to cope with this methane gas for reduction of emitted greenhouse gas quantity. that from Thai industries data , Food industries release greenhouse 0.38 ton (O_2 eq/ton of product) that equal to 34.34 M.ton (million ton) , Chemicals industries release greenhouse 0.35 ton (O_2 eq/ton of product) that equal to 19.07 M.ton , Textiles industries release greenhouse 0.27 ton (O_2 eq/ton of product) that equal to 5.25 M.ton , Glass and ceramic industries release greenhouse 0.88 and 0.20 ton (O_2 eq/ton of product), respectively.

Overall it is expected that activities during operation period will have low level of impact in ambient air quality.

The mitigating measures recommended for the above impact are as follows:

- Regularly check and maintenance various equipment, machines, and vehicles in good condition to minimize the exhaust emission
- Plant trees around the project site boundaries and empty land shall be provide in order to increase green area.
- Consider cleaner technology for alternative of production process
- Promote awareness that fuel combustion caused global warming, energy saving is a rule
- provision of air pollution loading control system such as emitted pollutant loading and its control of each factory is necessary for industrial estate operator
- Control emission loads of main air pollutants as mentioned

- Provide continuous emission monitoring system (CEMs) for power plant and waste incinerators
- Control air quality emitted from stacks of power plant and waste incinerators are well within the standard
- Measure air quality emitted from stacks regularly by ISO/IEC 17025 qualified laboratory (twice a year, dry and wet season)
- Continual collect data from the industries and update the numerical model when data from the CEMS is available or at the 3rd year of the operation, whichever comes first. Then runs updated model every year afterwards based on the actual measured data.

(b) Greenhouse Gases

As an international concerned issue increasing of greenhouse gases (GHGs) will result in global warming and climate changes. It consequences now are devastation for environment such as raising of temperature, sea level change, impacts to ecosystem and biota. Although, the Republic Union of Myanmar is not in Annex I (non-Annex I) countries and no need to commit with targets emission of GHGs, according to the Kyoto Protocol (1995), the union has been aware of the threatening and plan to join activities of the United Nations Framework Convention on Climate Change (UNFCC) in the near future. So far, GHG emission is advised by the MONREC (official comment on 11th March 2015 and 2nd February 2016 meeting) to instigate Eco-industrial or Green park for all new establishment.

Only CO_2, CH_4, and NO_2 are major GHGs that will be emphasized in this ESIA report due to they are common GHGs in relevant manufactures in the DSEZ Initial Industrial Estate. The others GHGs e.g. HFCs, PFCs, SF_6 and NF_3 are quite specific to coolant manufacture, aluminum smelter, rubber production/insulator and electronics/semi-conductors, respectively, which are probably small portion of the target industry for DSEZ Initial Industrial Estate. In general, emission of these GHGs shall be minimized and in narrow uses of GHG materials. GHG policy shall be in details mentioned in each own factory's EIA/ESIA reports. Amount of GHGs emitted from any industrial activities can be broadly categorized into 3 major sources:

- Manufacturing processes
- Energy input
- Waste Treatment Facilities
- Transportation

Manufacturing processes

Processing of manufacture is one of the most important factor that will set amount of GHG emission. As reported by IPPC (2006), type of industries that will establish in the DSEZ Initial Industrial Estate will play significant role in contribution of GHG impact.

Table 6.3-1 Estimated CO_2 (Kilogram per Tonnage of Product) emitted from target manufacture in DSEZ Initial Industrial Estate

Code	IPCC	Target DSEZ Manufacture	Tonnage CO2/year/tons of product*
2A1	Cement Production	Construction Materials	0.51
2A2	Lime Production		0.47
2A3	Glass Production		0.20
2B1	Ammonia Production	Agriculture	0.39
2B10	Rubber Production	Rubbers	0.25
2E1	Integrated Circuit of Semiconductor	Auto parts, Home appliances and Electronics	CF groups
2E2	TFT Flat Panel Display		
2G1	Electronic Equipment		
2G3	Pharmaceutical products	Pharmaceutical products	-
2H2	Food and Beverage	Food and Beverage, Cannery and Frozen Food	0.38
*	Not in the industrial list	Garment and Textiles	0.27

Source: IPCC (2006)

As presented in Table 6.3-1, construction materials production including cement, lime and glass production rank the heaviest industries, which will emit GHG while garment and textiles are not considered to emit significance amount of GHG according to the IPCC list. Therefore, low emission of GHG's industries shall be promoted.

<u>Fuels</u>

Type of energy input or fuels using in the manufacturing processes is another important factor that will contribute the amount of GHG emission. As in a certain manufacturing e.g. boiling in food processing or combustion in cement kiln including combustion due to mobile vehicles in transportation of products or raw materials can emit GHG. Carbon dioxide is main GHG and Methane and Nitrogen dioxide are minor greenhouse gases. Different types of conventional fuels used in the processes and their GHG emission factor are presented in Table 6.3-2.

Table 6.3-2 GHGs generate from combustion of different fuels from immobile sources (in factories) in Tier1*

No.	Type of Fuels (TJ)	Emission Factor (Kg of GHG / TJ)		
		CO2	CH4	NO2
1.	Landfill Gas	54,600	1	0.1
2.	Natural Gas	56,000	1	0.1
3.	Liquefied Petroleum Gases (LPG)	63,100	1	0.1
4.	Biodiesels	70,800	3	0.6
5.	Diesel Oil	74,100	3	0.6
6.	Municipal waste	91,700	30	4

7.	Bituminous Coal	94,600	10	1.5
8.	Lignite	101,000	10	1.5
9.	Coke	107,000	10	1.5
10.	Wood	112,000	30	4
11.	Industrial waste	14,3000	30	4

Remarks: IPCC 2006, * Teir 1: Default emission factor according to IPCC for National or International data

Table 6.3-3 GHGs generate from combustion of different fuels from mobile sources (vehicles) in Tier1*

No.	Type of Fuels (TJ)	Emission Factor (Kg of GHG / TJ)		
		CO2	**CH4**	**NO2**
1	Compressed Natural Gas	56,100	92	3
2	Liquefied Petroleum Gases (LPG)	63,100	62	0.2
3	Motor gasoline	69,300	3.8-33	3.2-8.0
4	Diesel oil	74,100	3.9	3.9
5	Ethanol truck	N/A	260	41
6	Ethanol cars	N/A	18	N/A

Remarks: * Teir 1: Default emission factor according to IPCC for National or International data
Source: IPCC (2006)

Gases phases fuels trend to emit lower amount of GHGs than liquid fuels and solid fuels, which rank the highest amount of GHGs such as lignite, coke and wood. Thus, clean fuels alternatives or low emission of GHG fuels and technologies that will establish in the DSEZ Initial Industrial Estate shall be promoted.

As for energy conservation, recovery of heat or power efficient consumption have been successfully achieved and already implemented in many plants and some Industrial Estates in Thailand, in order to reduce GHG in the carbon footprint incentive program. Therefore, this issue are recommended in GHG mitigation measure or as alternative options for manufacturing in the future full phases development of the Initial Industrial Estate.

Waste Treatment Facilities

Waste Management Facilities in the Project are the Solid Waste Disposal System and Wastewater Treatment System. Sources of GHGs can be summarized as follow:

Table 6.3-4 GHGs from each type of waste management facilities

System and Facility	Activities	CO_2	CH_4	N_2O
Solid Waste Disposal				
Landfills	Landfill biogas	✓		
Incinerators	Biogas combustion	✓		
Composing operation??	Composing biogas	✓	✓	✓
Treatment unit	Biogases	✓		
Wastewater Treatment System				
Wastewater Treatment Processes	Biogases	✓	✓	✓
Sludge digester	Biogases	✓		

Remarks : US 40CFR Part 98, subparts HH and TT
Source: ESIA Study Team

Operation of both system will generate a certain amount of GHGs. Within a confined period amount of GHGs such as CO_2, CH_4 and N_2O can be predicted. Global Warming Potential factor in 100-years time horizon is 1 for CO_2, 21 for CH_4 and 310 for N_2O.

Considering the amount of GHGs may calculated from Solid Waste Management System will depend on type of waste disposals (landfill or incinerator). Amount of GHGs emission by disposal in landfills will rely on biodegradable rate which are function of climate (dry, moderate, wet), soils and type of waste materials as presented in Table 6.3-5.

Table 6.3-5 Carbon emission under altered climates.

Waste Model/Waste Type	DOC (weight fraction, wet basis)	k [dry climate[b]] (yr^{-1})	k [moderate climate[b]] (yr^{-1})	k [wet climate[b]] (yr^{-1})
MSW Landfills—Bulk Waste Option				
All waste materials	0.2028	0.02	0.038	0.057
MSW Landfills—Bulk MSW Option				
Bulk MSW	0.30	0.02	0.038	0.057
Construction and demolition waste	0.08	0.02	0.03	0.04
Inert waste (glass, metal, plastic)	0.0	0.0	0.0	0.0
MSW Landfills—Waste-Specific Option				
Food waste	0.15	0.06 [c]	–[c]	0.185 [c]
Garden waste	0.20	0.05 [c]	–[c]	0.10 [c]
Paper waste	0.40	0.04 [c]	–[c]	0.06 [c]
Wood and straw waste	0.43	0.02 [c]	–[c]	0.03 [c]
Textile waste	0.24	0.04 [c]	–[c]	0.06 [c]
Diapers	0.24	0.05 [c]	–[c]	0.10 [c]
Sewage sludge	0.05	0.06 [c]	–[c]	0.185 [c]
Inert waste (glass, metal, plastic)	0.0	0.0	0.0	0.0
Industrial Waste Landfills				
Food processing industry	0.22	0.06	0.12	0.18
Pulp and paper industry	0.20	0.02	0.03	0.04
Wood and wood products	0.43	0.02	0.03	0.04
Construction and demolition waste	0.08	0.02	0.03	0.04
Inert waste (glass, metal, plastic)	0	0	0	0
Other industrial solid waste (not otherwise listed)	0.20	0.02	0.04	0.06

Remarks : US 40CFR Part 98, subparts HH and TT
Source: ESIA Study Team

Installation of gas collective facility is another contributor i.e passive or active gas collection system or have none as presented in Table 6.3-6

Table 6.3-6 Default landfill gas collection efficiency

Description	Landfill Gas Collection Efficiency
A1: Area with no waste in-place	Not applicable; do not use this area in the calculation
A2: Area without active gas collection, regardless of cover type.	CE2: 0%
A3: Area with daily soil cover and active gas collection	CE3: 60%
A4: Area with an intermediate soil cover, or a final sold cover not meeting the criteria for A5 below, and active gas collection	CE4: 75%
A5: Area with a final soil cover of 3 feet or thicker of clay and/or geomembrane cover system and active gas collection	CE5: 95%
Area weighted average collection efficiency for landfills.	CEave1 = (A2*CE2 + A3*CE3 + A4*CE4 + A5*CE5)/(A2+A3+A4+A5)

Remarks : US 40CFR Part 98, subparts HH and TT
Source: ESIA Study Team

As mentioned in Chapter 4, capacity of the 9 landfills for non-hazardous waste (sanitary landfills) and hazardous waste (secure landfills) are only designed or 8 years. Afterward, the waste will dispose in separate non-hazardous waste incinerator and hazardous waste incinerator for the remain period of operation.

Amount of GHGs emission from wastewater treatment system will depend on specification of the activated sludge tank such as BOD_5 and TNK of the influent, efficient of the facilities i.e. aerated tank (>95%), size and operation hours of the tank.

Table 6.3-7 Default values for Methane collection and biomass yield for wastewater treatment system

Treatment System	MCF[a]	λ
Wastewater Treatment Processes		
Aerated treatment process (e.g., activated sludge system), well managed	0	0.65 [b]
Aerated treatment process, overloaded (anoxic areas)	0.3	0.45 [b,c]
Anaerobic treatment process (e.g., anaerobic reactor)	0.8	0.1 [c,d]
Facultative lagoon, shallow (< 2 m deep)	0.2	0
Facultative lagoon, deep (≥ 2 m deep)	0.8	0
Sludge Treatment Processes		
Aerobic sludge digestion	0	Use λ from wastewater treatment process
Anaerobic sludge digestion	0.8	

Remarks : US 40CFR Part 98, subparts HH and TT
Source: ESIA Study Team

Transportation

Transportation is another source of GHGs including Carbon monoxide (CO), Non-Methane (CH_4), Organic compounds (VOCs), Oxides of nitrate (NOx) and Sulphur dioxide (SO_2). Five types of transportation are considered, Civil aviation, Road, Railways, Navigation and other transportation. Estimated rate of CO_2 emission and the other non-CO_2 are presented in Table 6.3-8

Table 6.3-8 Estimated carbon emission factors from CO_2 and Non-CO_2 groups in transportation

Type of Fuels			CO_2 Carbon Emission Factor (tC/TJ)	Non-CO_2 Carbon Emission Factor (tC/TJ)
1.	NGV	Gases	17	15.3
2.	LPG		17	17.2
3.	Ron 91	Engine Oils	19	18.9
4.	Ron 95		19	
5.	E 10		19	19.3
6.	E 20		19	
7.	E 85		19	
8.	Jet Fuel	Jet Fuel	20	19.5
9.	HSD	Diesels	20	20.2
10.	LSD		*	
11.	Palm diesel	Biodiesels	*	19.3
12.	B5		20	
13.	Kerosene	Fuel Oil	20	21.1

Remark: * No data
Source: ESIA Study Team

6.3.1.2 Noise and Vibration

Noise sources in the operation phase vary depending on the production processes of each facility. Control of noise at source is the most effective approach to control impact to the receptors outside the boundary of the facility. Equipment that generates high level of noise is usually installed in enclosed building. Noise level in the fence line of each manufacturing facility need to be routinely monitored so that the Leq24hr does not exceed 70 dB(A). Effects from noise to the receptors outside the initial phase of industrial estate area are negligible. Nevertheless it is necessary for each factory to provide ear plugs and/ or ear muffs for employees or workers who work in place that having noise level exceed 80 dB(A).

- Equipment and machine that generate high level of noise shall be installed in an enclosed building so that, when operated, noise level at the fence line of the industries do not exceed 70 dB(A).

6.3.1.3 Topography and Soil

During operation phase, impacts to topographic conditions are expected to be very small, limited to each plot of the land where individual manufacturer or factory may adjust the elevation and level of their land plot.

Potential impact to soil quality due to contamination of chemicals used in the operation may happen due to inappropriate handling of chemicals and spills. Integrated waste management facility is another area where potential soil contamination may occur.

The project will require that each individual manufacturer and factory have appropriate chemical storage area with secondary containment on impervious ground. Industries with higher risk of chemicals release, such as garment and textiles also electronics industries, will need to conduct specific Environmental Impact Assessment that will include identifying risk of spill and preventive measures. The project will also develop spill and emergency response plan. Potential contamination of soil can be limited through these measures.

6.3.1.4 Surface Water and Sediment

An evaluation of potential impacts during the operation period includes wastewater from domestic consumption and industrial usage.

The operation of initial phase development will produce various types of waste. If not properly handled, the above by-products can contaminate to water and sediment quality in Kunchaung and Dawei Rivers. All industrial wastewater from each zone will be treated by the wastewater treatment plants. Wastewater from industries area will be collected and transferred to the central treatment plant, designed with appropriated treatment techniques.

The wastewater from industries will be pretreated to meet the requirements according to Industrial Estate Authority of Thailand (IEAT) or other relevant/designated requirements. The pretreated wastewater will then be combined and transferred in to wastewater treatment located in each zone. The treated wastewater from all wastewater treatment plants will have to comply with Effluent Standards for Factories and Industrial Estates or other relevant/designated requirements. The treated wastewater is then transferred through drainage system, and discharged into Kunchaung River, finally flow to Dawei River.

Dissolved Oxygen (DO) Sag Curve Analysis

1) DO sag curve analysis in Kanchuang river

Approximately 21,597 cubic meter per day or 0.21 cubic meter per second of treated wastewater (BOD 20 mg/L) from initial phase industries (only factory locate in zone A) will be discharged into Kanchuang river. DO sag curve analysis results as presented in Figure 6.3-1 and DO concentration analysis in Kanchuang river was shown in Table 6.3-9. It showed that treated wastewater discharging of 20 mg/L BOD do not affect Kanchuang River quality during Zone A development. Dissolved oxygen in Kanchuang river will become to be more than 4 mg/l, that be same level at the upstream point.

For scenario 2, no treating of wastewater (BOD 500 mg/L) from zone A was given, increasing of loadings has affect DO concentration in the river that reduce to be 0 mg/l at 1,000 m. Distance after discharged point (Figure 6.3-2).

Scenario 3, treated wastewater from township zone was also discharged into Kanchuang river, DO concentration will having lowest concentration (1.33 mg/l) at 3,000 m. Distance which this condition could be accepted (Figure 6.3-3).

Thus, it could conclude that discharged treated wastewater from various activities during operation phase of Dawei SEZ Initial Industrial Estate has medium significant impact to Kanchuang river

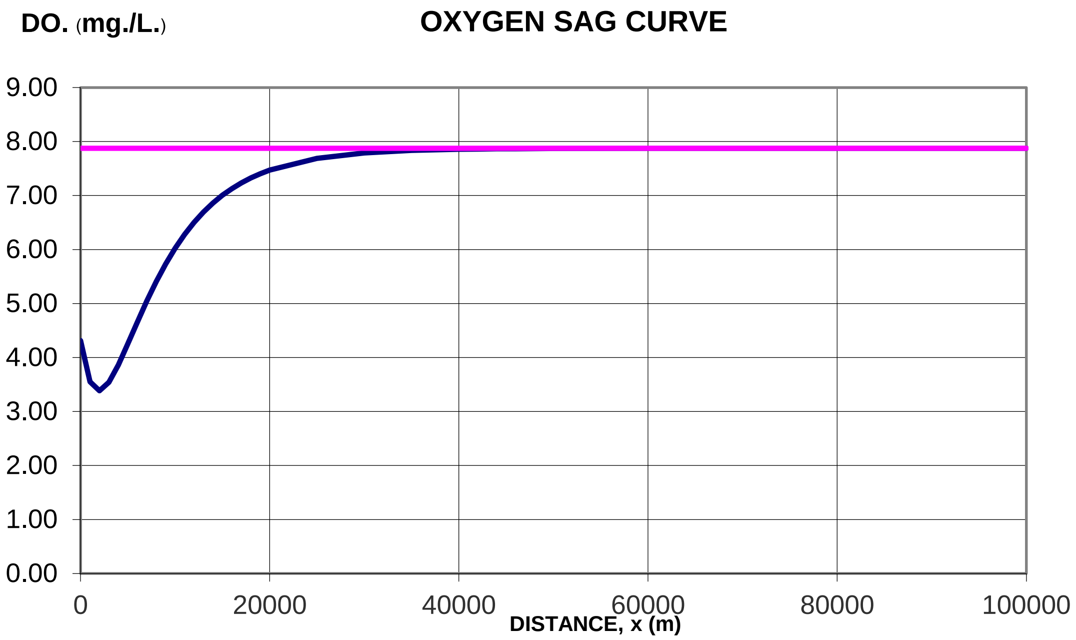


Figure 6.3-1 DO sag curve in Kanchuang river in case discharging of 21,597 m^3/d of treated wastewater from zone A with BOD 20 mg/L

Table 6.3-9 DO Sag Curve Analysis in Kanchuang river

Scenario	Condition	Flow Rate (m3/s)	Effluent BOD (mg/l)	DO (mg/l)										
				0 m	1,000 m	2,000 m	3,000 m	4,000 m	5,000 m	6,000 m	7,000 m	8,000 m	9,000 m	10,000 m
1	Zone A	0.21	20	4.38	3.73	3.61	3.78	4.10	4.47	4.85	5.22	5.56	5.87	6.14
2	Zone A (No treatment)	0.25	20	4.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Zone A + TS (BOD 20)	0.41	32	4.06	2.09	1.36	1.33	1.66	2.18	2.77	3.36	3.92	4.43	4.89

Source: ESIA Study Team

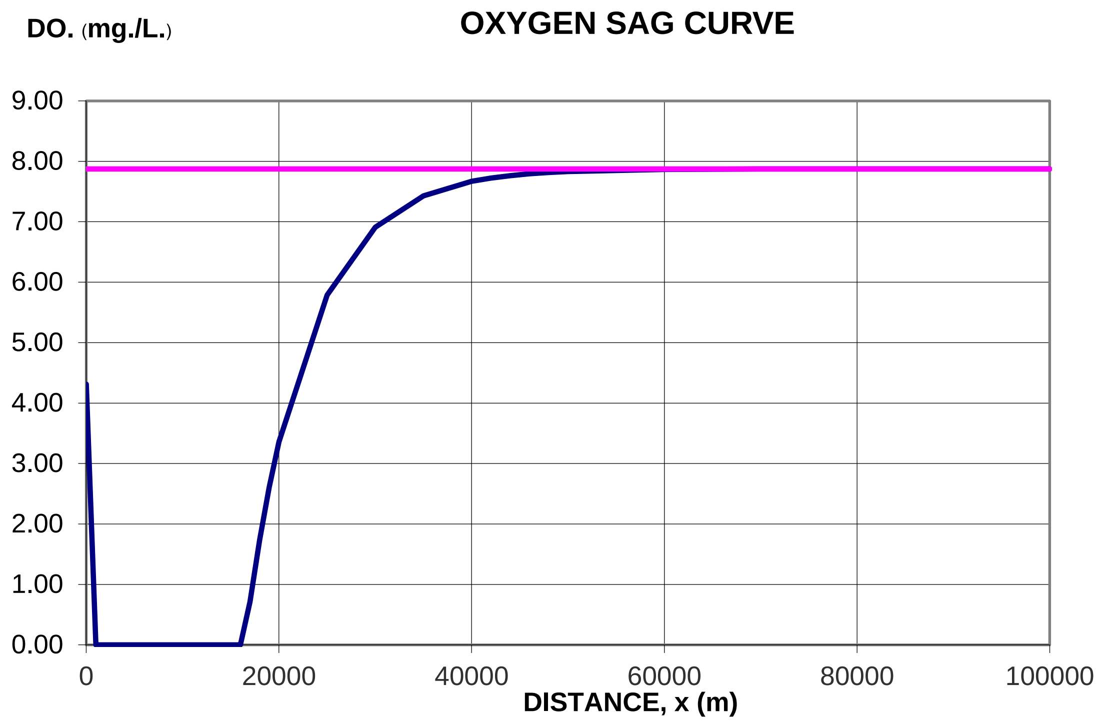


Figure 6.3-2 DO sag curve in Kanchuang river in case discharging of 21,597 m^3/d of treated wastewater from zone A with BOD 500 mg/L (No treatment of wastewater)

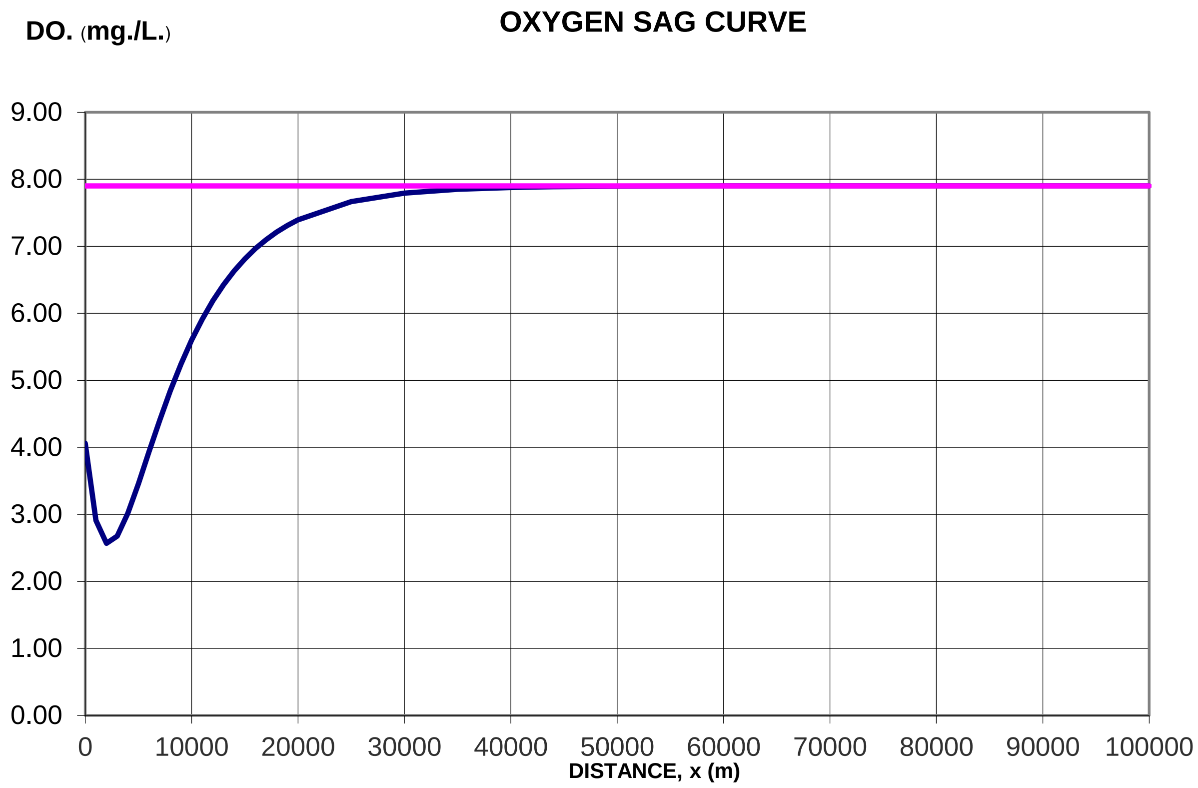


Figure 6.3-3 DO sag curve in Kanchuang river in case discharging of 21,597 m^3/d of treated wastewater from zone A with BOD 20 mg/L and 14,052 m3/d of treated wastewater from township with BOD 20 mg/L

2) DO sag curve analysis in Dawei river

When industries in zone B, C, and D were development, the treated wastewater will be directly discharged into Dawei river for conservation of water quality in Kanchuang river to be suit for local people usage. DO sag curve analysis was studied for 8 scenarios DO sag curve analysis results were presented in Figure 6.3-4 to Figure 6.3-11 and DO concentration analysis in Dawei river of all scenario were shown in Table 6.3-10 as following ;

Scenario 1 : Approximately 26,061 cubic meter per day or 0.3 cubic meter per second of treated wastewater (BOD 20 mg/L) from industries in zone B be discharged into Dawei river. It showed that treated wastewater discharging will not affect Dawei River quality during this development. Dissolved oxygen in Dawei river will be more than 4 mg/l, that be same level at the upstream point (Figure 6.3-4).

Scenario 2: when zone B and C operated it was expected to have 52,139 cubic meter per day or 0.6 cubic meter per second of treated wastewater (BOD 20 mg/L) discharged into Dawei river. It found that treated wastewater discharging will not affect Dawei River quality during this development (Figure 6.3-5).

Scenario 3 : when zone B, C and D were developed it was expected to have 75,429 cubic meter per day or 0.87 cubic meter per second of treated wastewater (BOD 20 mg/L) discharged into Dawei river. It found that treated wastewater discharging will not affect Dawei River quality during this development period (Figure 6.3-6).

Scenario 4 : treated wastewater from township activities (1,824 cubic meter per day will be more than it was expected to have 75,429 cubic meter per day or 0.87 cubic meter per second of treated wastewater (BOD 20 mg/L) discharged into Dawei river. It found that treated wastewater will not affect Dawei River quality during this development period (Figure 6.3-7).

Scenario 5 : no treating of wastewater (BOD 500 mg/L) from zone B was given, increasing of loadings has affect DO concentration in the river will be decreased to be lower than 4 mg/l at 5,000 m. distance after discharged point (Figure 6.3-8).

Scenario 6 : no treating of wastewater (BOD 500 mg/L) from zone B and C was given, increasing of loadings has affect DO concentration in the river decreased to to be lower than 4 mg/l at 2,000 m. distance after discharged point (Figure 6.3-9).

Scenario 7 : no treating of wastewater (BOD 500 mg/L) from zone B,C and D was given, increasing of organic loadings has affect DO concentration in the river decreased to to be lower than 4 mg/l at 2,000 m. distance and also expected to be zero at 10,000 m. after discharged point (Figure 6.3-10).

Scenario 8 : during initial development period, wastewater from township zone will be discharged into Dawei river combined with untreated wastewater from zone B, C and D (BOD 500 mg/L), DO concentration will having lowest concentration (0.00 mg/l) at 10,000 m. distance which this condition could be took place for 10 Km. along the river (Figure 6.3-11).

Thus, it could conclude that discharged treated wastewater from various activities during operation phase of Dawei SEZ Initial Industrial Estate has low significant impact to Dawei river. In the other hand untreated wastewater will have significant affects.

The mitigating measures recommended for the impact are as follows:

- Regularly maintain equipment and machines of wastewater treatment plant in good condition
- Provide stand by aerators and diesel engine generator at the plant for emergency case
- Discharged of treated wastewater to surface water must meet effluent standard of IEAT
- Consider alternatives for treated wastewater reusing and recycling such as watering trees, raw water for some production process
- Directly drain raw wastewater and/ or used chemicals/ oils/ lubricants to surface water course are banned
- Laboratory analysis of influent and effluent of central wastewater treatment plant should be regularly conducted
- Recycling of wastewater should be promoted. Treated effluent should be used in the industrial estate wherever possible, such as for watering the green areas.

Table 6.3-10 DO Sag Curve Analysis in Dawei river

Scenario	Condition	Flow Rate (m^3/s)	Effluent BOD (mg/l)	DO (mg/l)										
				0 m	1,000 m	2,000 m	3,000 m	4,000 m	5,000 m	6,000 m	7,000 m	8,000 m	9,000 m	10,000 m
1	Zone B	0.3	20	4.97	4.97	4.98	4.99	5.02	5.04	5.08	5.11	5.15	5.20	5.24
2	Zone B+C	0.6	20	4.94	4.93	4.93	4.94	4.95	4.97	5.00	5.03	5.07	5.11	5.16
3	Zone B+C+D	0.87	20	4.91	4.89	4.88	4.88	4.89	4.90	4.93	4.96	5.00	5.04	5.08
4	Zone B+C+D+TS	0.89	20	4.91	4.89	4.88	4.88	4.89	4.90	4.93	4.96	4.99	5.03	5.07
5	Zone B (No treatment)	0.3	500	4.97	4.66	4.40	4.18	4.00	3.84	3.72	3.63	3.56	3.51	3.48
6	Zone B+C (No treatment)	0.6	500	4.94	4.32	3.78	3.32	2.93	2.60	2.32	2.09	1.91	1.76	1.65
7	Zone B+C+D (No treatment)	0.87	500	4.91	4.02	3.23	2.56	1.98	1.49	1.07	0.73	0.73	0.44	0.21
8	Zone B+C+D+TS (No treatment)	0.89	500	4.91	3.99	3.19	2.50	1.91	1.41	0.98	0.63	0.33	0.10	0.00

Source: ESIA Study Team

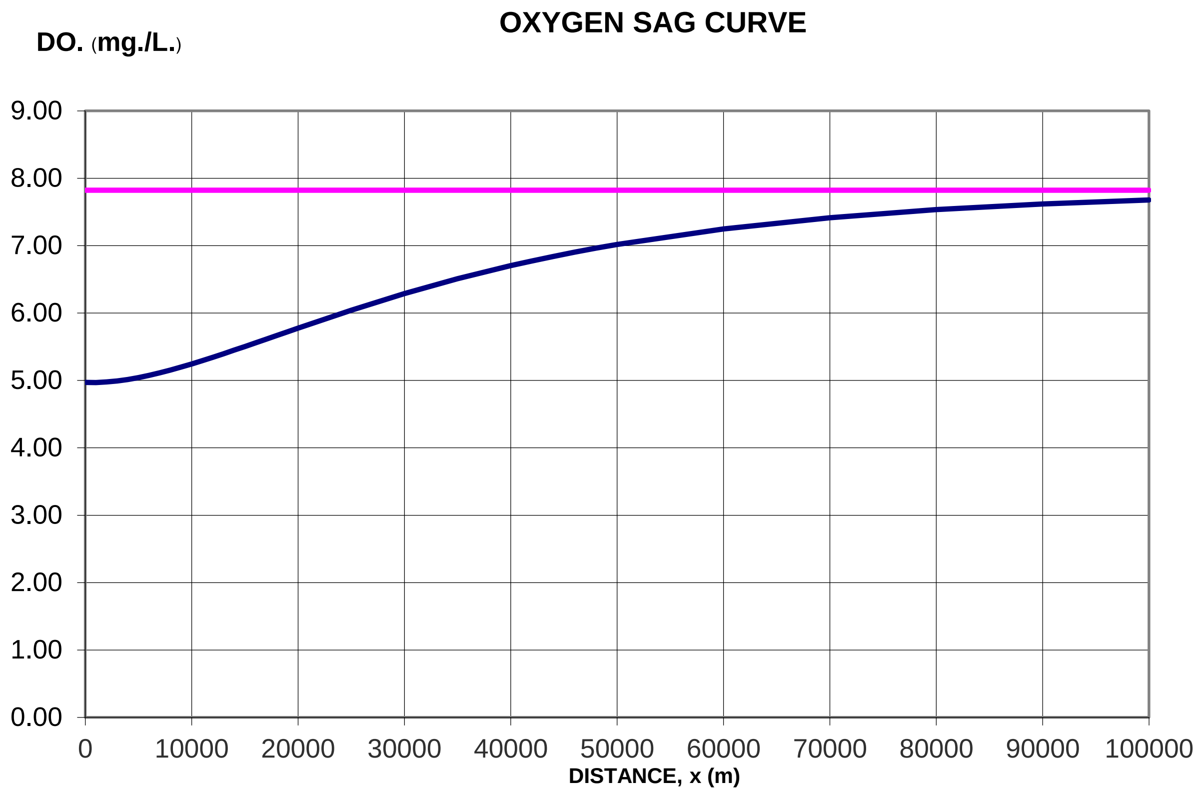


Figure 6.3-4 DO sag curve in Dawei river in case discharging of 26,061 m3/d of treated wastewater from zone B with BOD 20 mg/L

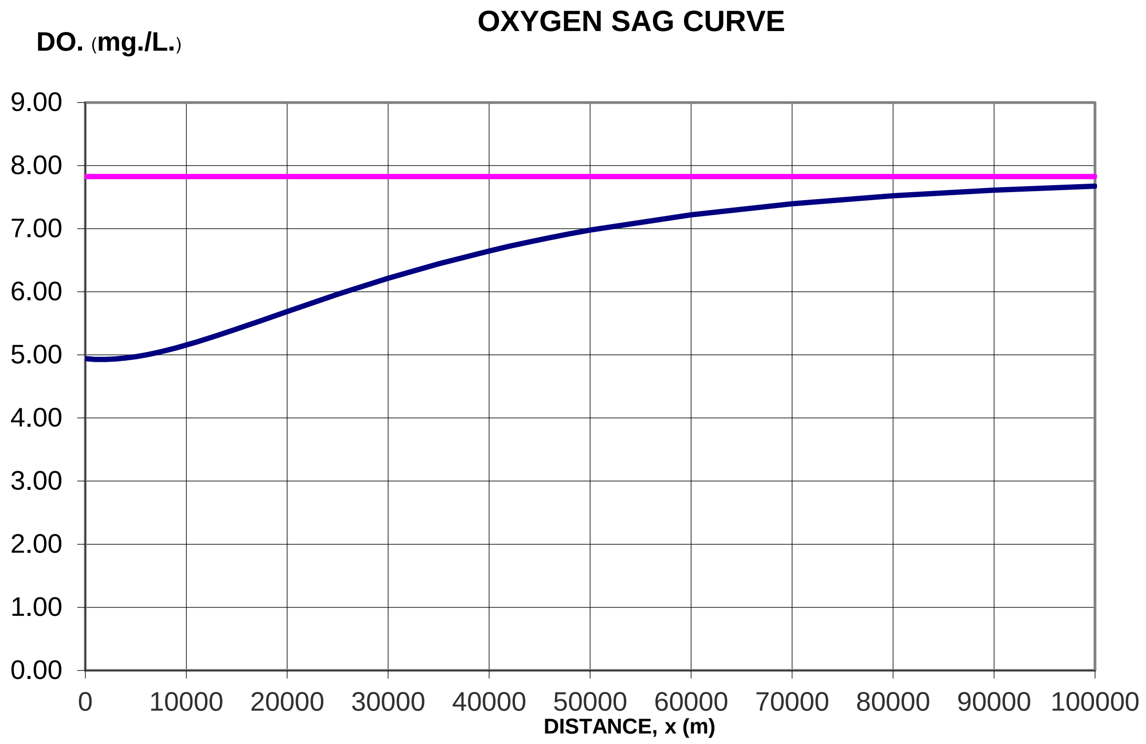


Figure 6.3-5 DO sag curve in Dawei river in case discharging of 52,139 m^3/d of treated wastewater from zone B and C with BOD 20 mg/L

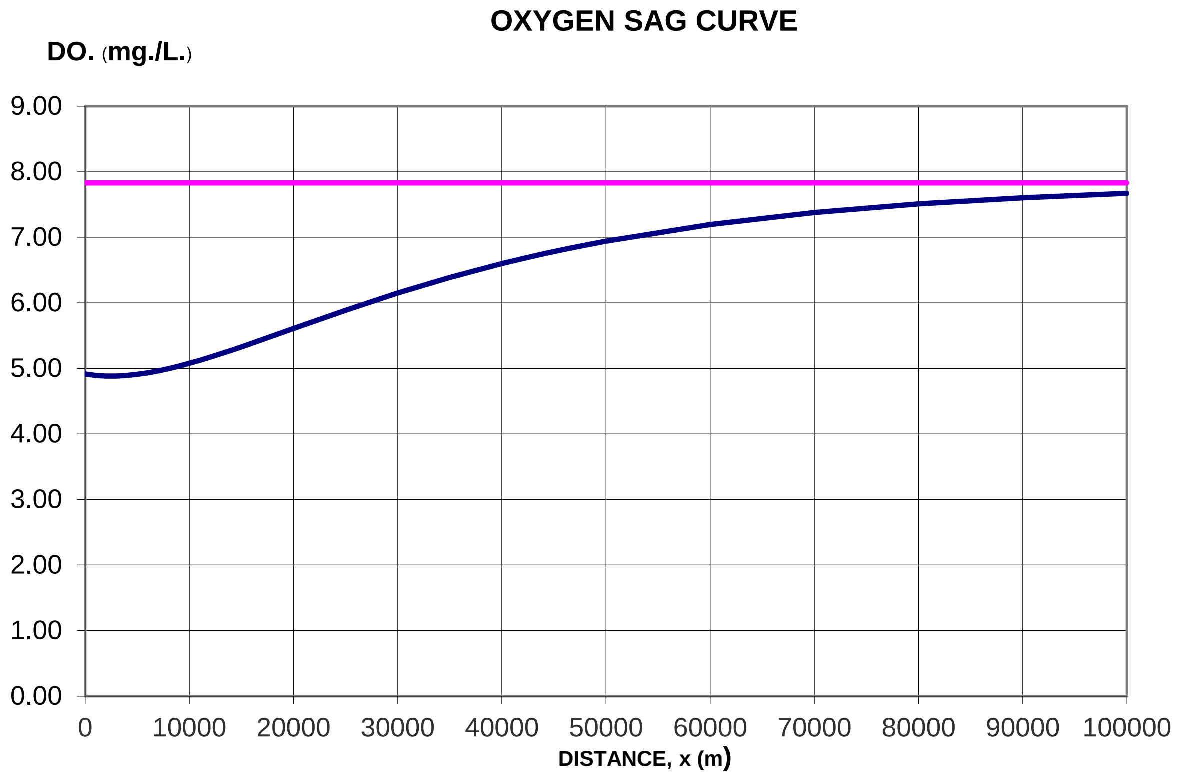


Figure 6.3-6 DO sag curve in Dawei river in case discharging of 75,429 m^3/d of treated wastewater from zone B ,C and D with BOD 20 mg/L

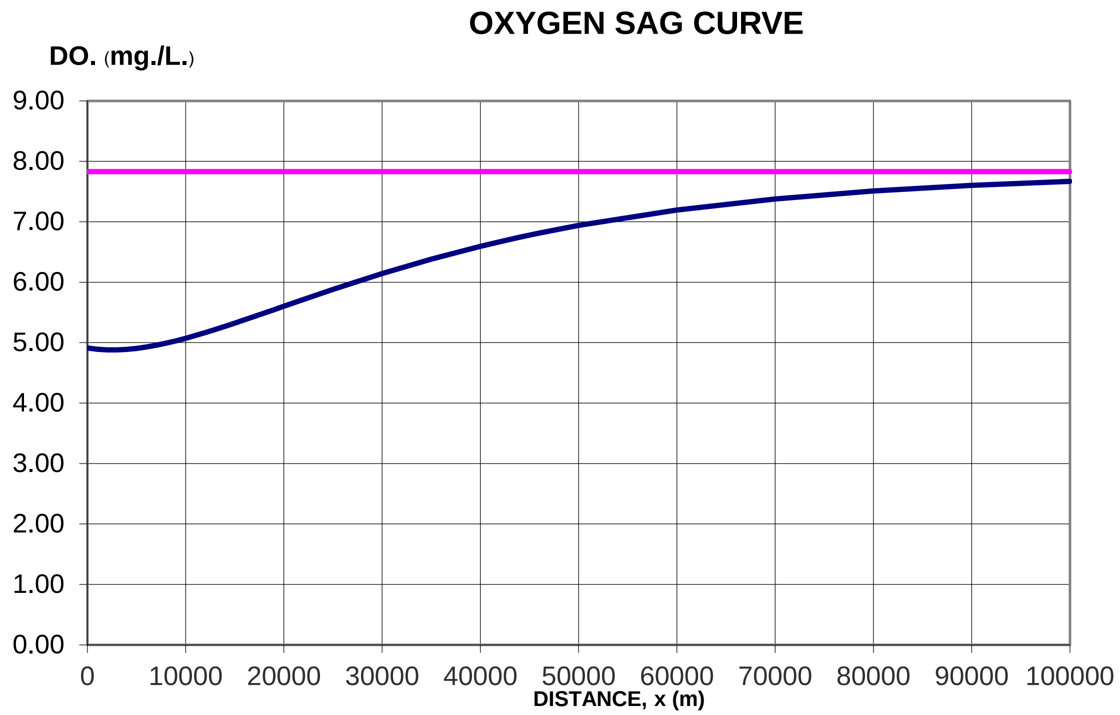


Figure 6.3-7 DO sag curve in Dawei river in case discharging of 75,429 m^3/d of treated wastewater from zone B, C, D with BOD 20 mg/L and 1,824 m3/d of treated wastewater from township with BOD 20 mg/L

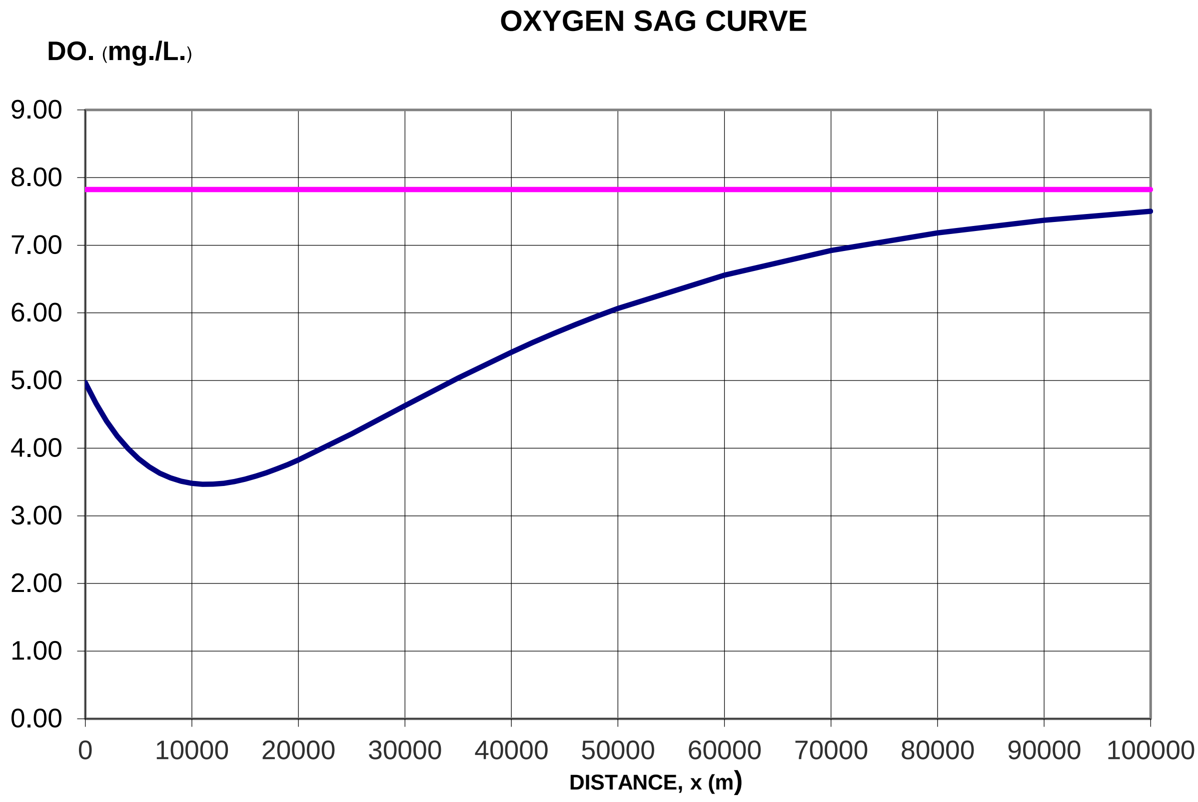


Figure 6.3-8 DO sag curve in Dawei river in case discharging of 26,061 m^3/d of treated wastewater from zone B with BOD 500 mg/L (No treatment)

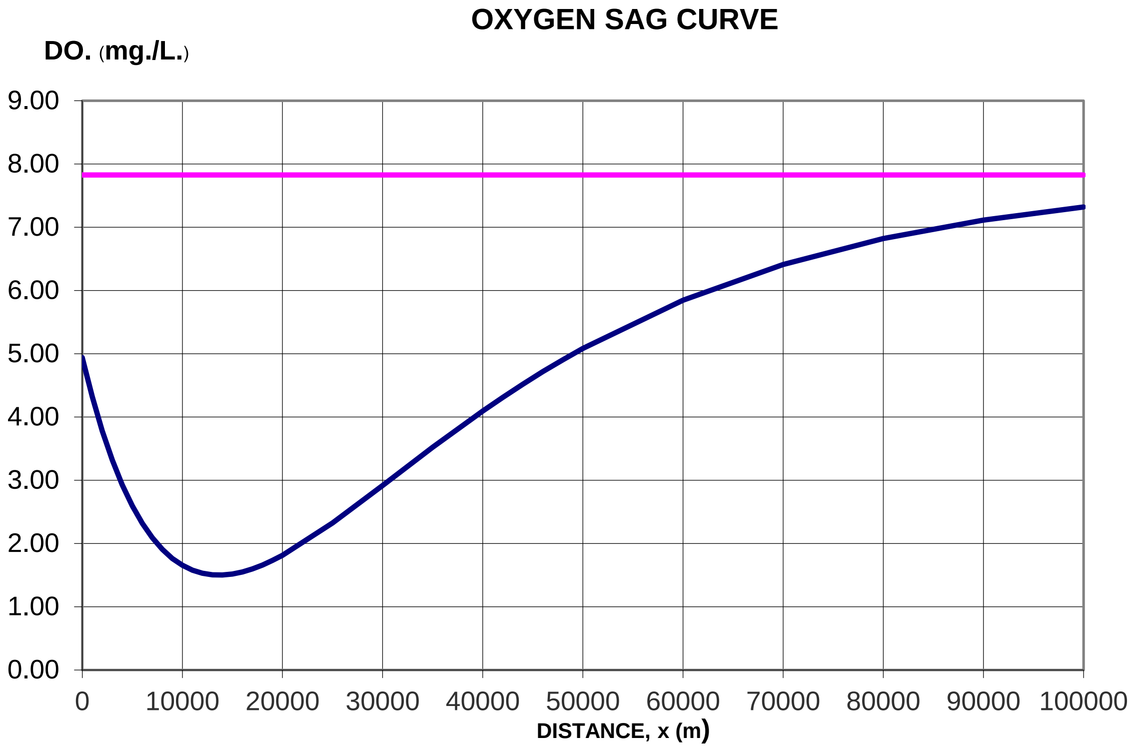


Figure 6.3-9 DO sag curve in Dawei river in case discharging of 52,139 m^3/d of treated wastewater from zone B and C with BOD 500 mg/L (No treatment)

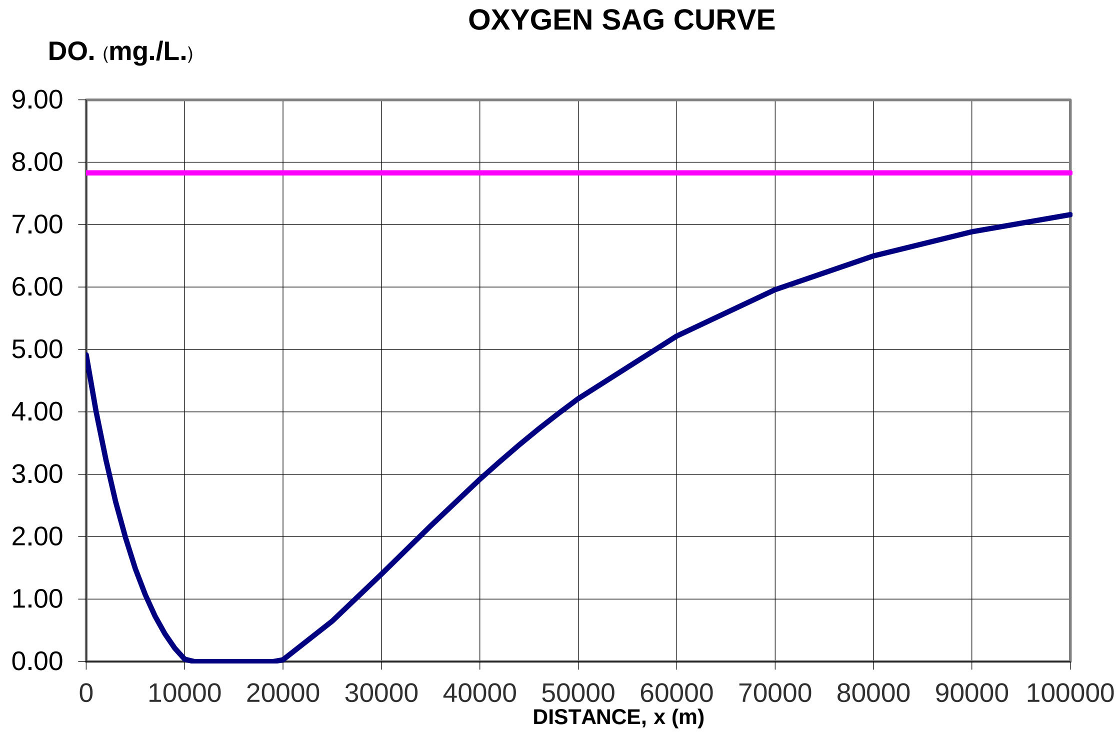


Figure 6.3-10 DO sag curve in Dawei river in case discharging of 75,429 m3/d of treated wastewater from zone B ,C and D with BOD 500 mg/L (No treatment)

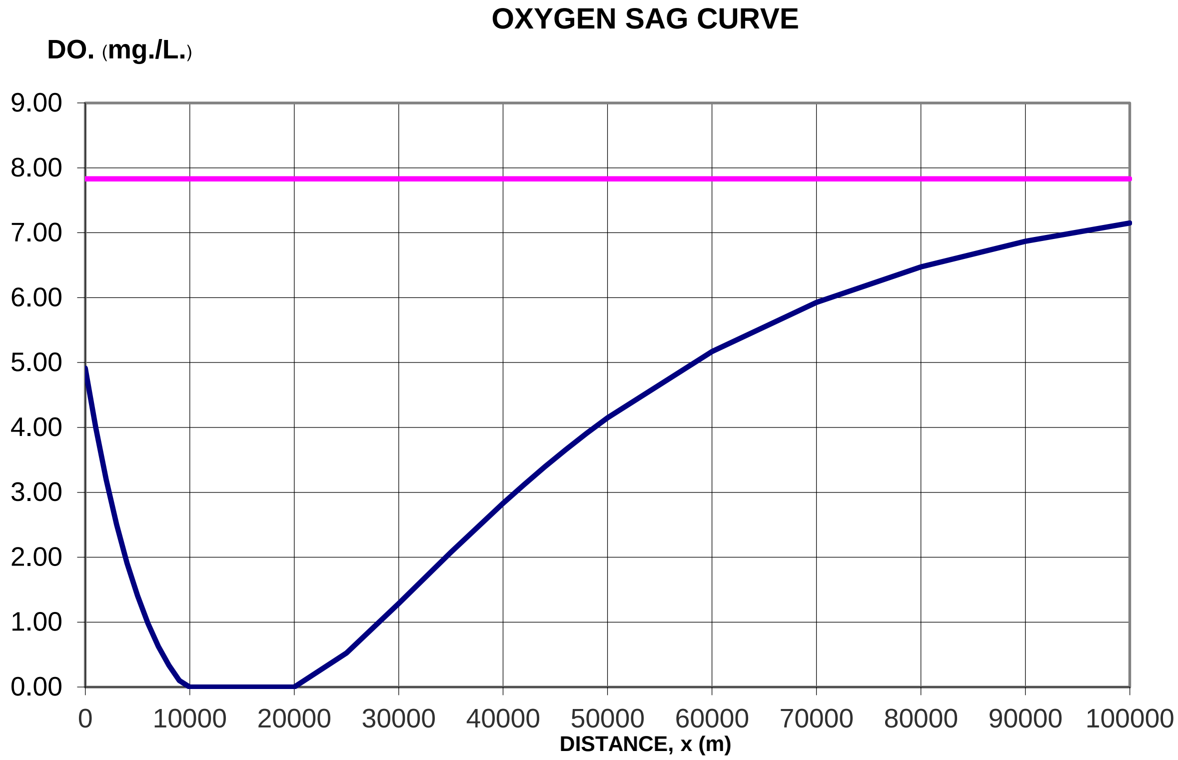


Figure 6.3-11 DO sag curve in Dawei river in case discharging of 75,429 m^3/d of treated wastewater from zone B, C, D with BOD 500 mg/L and 1,824 m^3/d of treated wastewater from township with BOD 500 mg/L (No treatment)

6.3.2 Groundwater

The central wastewater treatment plants were operated to treat wastewater from industries. Wastewater Effluent shall be well within the standard, discharged to river, no untreated wastewater is allowed to seep into groundwater source.

The project activity that might impact to groundwater quality is the waste management facilities where sanitary landfill and secure landfill sites are located. Groundwater monitoring program will be required particularly for the waste management facilities. Considering that the project location is a low-lying land surrounded by mountain ranges and that the hydro-geological gradient is likely to be drained into the coastal area and is unlikely to be connected with groundwater system of the resettled communities, when the project is fully developed, the impact of groundwater use is considered an appropriate limits. However, monitoring programs of existing groundwater wells that are being used by local populations in the area surrounding the industrial estates and also inside the initial industrial estates area should be followed up, due to the existing communities are not fully relocated when the operation of some of the industries starts.

Good design and construction practices of industries and manufacturing facilities can prevent contamination of groundwater through using of impervious material for drainage system and tanks. However, it is recommended that systematic groundwater monitoring program should be established to monitor overall contaminants that may be released to groundwater due to project activities. A conceptual hydro-geologic setting of the area should be formulated in order to propose monitoring program in the long term program. This will be one of the feasible tools in preventing the future groundwater contamination from the developed industrial zones. Thus, impact of project on ground water quality and quantity is expected to be low.

The mitigating measures recommended for the impact are as follows:

- Directly drain raw wastewater and/or used chemicals/oils/lubricants to ground are forbidden.
- Raw wastewater must be discharged to wastewater collection system for treating
- Groundwater application of factories to be water supply in factories is prohibited

6.3.3 Biological Resources

6.3.3.1 Surface Water Biology

Fresh water biology can be affected mainly from discharging of wastewater into the receiving waterways. Wastewater from the industries, if not properly treated, is expected to contain mainly organic matters, which will affect the living organisms and also the quality of their habitats.

To minimize the potential impact, the project requires that the industries located within the initial industrial estate project have to pre-treat their wastewater to meet the receiving requirement of the central wastewater treatment plants. Chemical treatment such as chemical

precipitation will be required for those industries that may have heavy metals in their wastewater stream prior to sending to the central wastewater treatment systems of the industrial estate. Oil and grease, which will be one of the main pollutants from food and cannery industries, also need to be removed from the raw wastewater prior to transferring the wastewater through the collection system to the wastewater treatment plants. The central wastewater treatment systems are designed with expected quantity and characteristics of wastewater from each zone. The design and effluent criteria of the central wastewater treatment will well within either IEAT requirements or Myanmar standard

The effect of the industrial estate operation is expected to be small, if the release is properly controlled as planned.

6.3.4 Economic Development

6.3.4.1 Infrastructure Facilities

(a) *Water supply*

During operation phase, sources of raw water will be from Ta Laing Gya Weir. Pa Yain Byu reservoir will be temporary used during development of zone A. The raw water will be treated to meet WHO water quality guidelines before distributed to the initial industrial estate area.

In the early period of development, 18,000 m^3/day of water was planned to produce for industries/factories of zone A that raw water pumped from Pa Yain Byu reservoir. Since volume of the reservoir is approximately 1,000,000 m^3 which can supply raw water for about 2 months of water production, this will not affect to water usage of nearby communities. However, high volume of product water at 180,000 m^3/day, when full phase developed, for supply all activities, buildings, industries/factories in the Dawei SEZ Initial Industrial Estate. Hence, project owner must provide raw water from surface water source nearby the project to fulfil Pa Yain Byu reservoir that need to compromise with local people for this water usage.

Not only rain water that fall in the project area and treated wastewater which having good quality are options to be raw water source for water supply treatment plant and/or watering green areas of the project . But also water quantity reduction by water saving equipments or machines or processes applications and re-usage of some water such as cooling water in the industries/factories must be practiced.

The mitigating measures recommended for the impact are as follows:

- Directly drain raw wastewater and/or used chemicals/oils/lubricants to groundwater or surface water course are forbidden
- Groundwater application of factories to be water supply in factories is prohibited
- Saving water sanitary wares such as faucet, flush toilet must be applied
- “ *Water is worth it* “ need to be reminded all workers/sectors forward water saving industries

- Pipeline of water supply must be regularly checked and immediately repaired for preventing of water leakage
- Cleaner technology for production processes especially water saving machines/equipment must be first alternative for investors
- Reusing and recycling of treated wastewater must be promoted and awarded
- Application of raw water source must be accepted by local communities to avoid water supply conflict and project ban
- Laboratory analysis of product water or tap water should be conducted every S of Trihalomethane compounds in product water or tap water is recommended
- Transportation of chlorine gas and other chemicals must be under UN recommendation on the transport of dangerous goods and ASEAN Framework Agreement on Facilitation of Goods in Transit
- Chemicals storage safety OSHA requirements should be conducted.

(b) *Wastewater treatment*

Wastewater treatment plant # 1 will be operated for treatment of discharged wastewater from industries in zone A1 and A2 that having capacity for treating flow rate of wastewater at 12,712 m^3/ d. Some solids in partial mixed aerated lagoon are kept in suspension that require another treatment unit for solid settling unless supernatant do not meet the effluent standard. Therefore, inspection pond # 1 will be assessed that allowing solid settling to occur. Since the volume of the pond about 24,852 m^3 is enough to have 2 days retention time that also can limit algae growth to control suspended solid increasing. It means that inspection pond # 2 will act as effluent holding pond for assuring that discharged effluent meet the standard all time.For more confident, installation of online monitoring system for flow measurement of both influent and effluent and BOD concentration of the effluent are recommended.

In case characteristic of effluent higher than requirements, the project must provide an empty pond that has at least 2 days storage capacity to retain the undesired effluent. Then pump it back to aerated lagoon for retreating that may require more oxygen to add in or special techniques in treatment process to get the better effluent.

However, improper treatment of wastewater operation and maintenance may have adverse affected in bad odor, water course contamination and other nuisances to surrounding communities. The recommended measures for mitigation of the impact on surface water must be conducted.

(c) *Solid waste management*

A waste management facility is planned to construct in Dawei SEZ Initial Industrial Estate Project. The waste management facility will be capable of handling both hazardous and non-hazardous waste. Environmental monitoring program will be in place at

the waste management facility to monitor if the environmental protection measures at the site is efficient.

Reusable and recycle wastes include; paper, glass, plastic, steel, aluminum etc, will be collected at each factory for selling to involved person or company. This can help to reduce quantity of solid waste to landfill site. Composting is a good technique to cope with the food waste, methane gas and stabilized organic matters are useful product for locals. Methane gas can be used to produce electrical and/or as fuel for cooking. Stabilized organic matter can be soil conditioner or soil filling in the green and required low-lying area.

There are 2 main types of solid wastes: municipal and industrial solid waste, which classified into non-hazardous and hazardous waste. During development or first stage of solid waste management development for this project, project owner has planned to bury non-hazardous municipal and industrial waste in sanitary landfills, whereas hazardous waste was planned to store in the proper building. It will be stabilized, solidified and buried in the secure landfill site later. Methane gas from biodegradation of solid waste must be collected and burnt to reduce greenhouse gas released to the atmosphere layers, methane application for cooking is another way for sustainable development.

In the second stage of development, incinerator that having capacity of 200 ton/day will be applied for non-hazardous waste disposal, while hazardous waste also being burnt by another incinerator is planned for installation in the future. Dioxin, a group of chemically-related compounds that are persistent environmental pollutants (POPs), is normal generated from waste incineration. It can accumulate in the food chain mainly in fatty tissue of animal. Dioxin is known as highly toxic substance and can cause reproductive and developmental problems, damage the immune system, interfere with hormones and also cause cancer. Prevention or reduction of human exposure is best done via source-directed measures, i.e. strict control of industrial processes to reduce formation of dioxin. Hence, project owner need to select the incinerator with low dioxin formation and control temperature in the burning chamber more than 850 Degree Celsius including monitoring of dioxin from stack and ambient air at nearby communities.

Overall, it is expected that there will be no impacts from the project to the existing infrastructure facilities of the local communities.

Determination of Potential Impacts of the landfill site

Identify and describe all potential major environmental impacts from the development which will be significant over the long-term. Describe as a minimum the environmental consequences from:

- leachate emanating to surroundings through leakage in the proposed liner system; including estimates of quantity and quality of a potential leachate leakage and the consequences to groundwater and receiving surface water
- impact to neighborhoods along direct haul routes from increased traffic (primarily noise, dust, litter, odor, and vibrations), and including economic

development due to improvements in roadways and trade from refuse haulage personnel

- estimate impacts to surrounding neighborhoods near the landfill from noise, odor, gaseous emissions, dust, air-borne pathogenic micro-organisms, and wind blow litter potentially related to landfill construction

In order to protect local communities and environment and boost public confidence in landfills as a component of a workable integrated waste management system, the mitigation measures need to conduct are as follows;

- landfill site selection and design must comply with U.S. EPA Technical Manual for Solid Waste Disposal Facility
- landfill site must be above the recorded flood level
- project owner/operator must set up a program to detect and prevent disposal of hazardous waste
- project owner/operator must cover disposed solid waste with at least 6 inches of earthen material at the end of each operating day to control vectors, fires, odors, blowing litters and scavenging. An alternative cover material or temporary cover sheet is allowed, if local climate conditions make such a requirement impractical.
- Open burning of waste is not permitted
- Project owner/operator is responsible for controlling vector populations. Vectors include any rodents, flies, mosquitoes, or animals or insects capable of transmitting disease to humans
- project owner/operator must control public access to prevent illegal dumping
- project owner/operator must build and maintain a control system designed to prevent surface water run-off and storm waters from running on the active part of the landfill

6.3.4.2 Traffic and Transportation

When the industrial estate is fully developed, control of access of vehicles to the industrial estate will be limited. This will result in blockage of the existing roads that connects the areas north and south of the project area, particularly the one on the west side of the project. This is potentially significant impact to the local populations if they want to travel across the industrial estate.

There are a number of potential solutions to this issue. The secondary road inside the industrial estate that has similar alignment to the existing road can be opened to general public or only people living the settlement areas to use. However, this approach may jeopardize the site safety and security. To maintain the integrity of site safety and security and at the same time allow local populations to travel to use a secondary road to trespass the project area, the special pass issued for resettlement community or a specific secondary road may need to be constructed with an appropriate way to cross the Main Road.

6.3.4.3 Land Use

The major concern during operation period includes:

- Scattered temporary shops, stalls and workers accommodations settled in undesignated areas, endangering efficiency, safety and security of the industrial estate area and the squatters themselves. Town of Dawei may be uncontrolled growth condition.

The project area is lying on the relatively flat land along the shore on the west side, with steep hill ranges on the east, north, and south. Geographically, there is not much flat land left outside the project border in the adjacent areas. Learning from the past incidents regarding future land use conflicts in and around the industrial estate projects in the regions such as Thailand. One of the major concerns is the unplanned land uses that will naturally change to accommodate the livelihood and convenience of those working in the project. While the proposed land use zoning of the project has allotted the narrow eastern strip of the site.

The practice of land use planning in Myanmar is at a very beginning stage. At present, the government has near absolute authority on land use designation though land use planning practice is still rare. Realizing the need for planning practice, there are efforts from international organization in assistance for expertise.

Potential negative impacts on land use are predicted to affect the town of Dawei also. As the project is in operation, there will be needs for services other than those day-to-day services that can be provided within the township zone. Naturally, it can be predicted that the town of Dawei, with certain level of infrastructure and social services, will rapidly grow to accommodate requirements of project personals such as, residences for the supervisors or consultants who prefer not to stay within the industrial estate, business clients and guests who visit the project estate shortly for specific purposes, or other workers who perform services to the project personnel but are not allowed to stay in the township zone. Dawei will also provide entertainment activities for the workforces when off-duty on the weekend. These sometimes undesirable uses are not allowed in the township zone of the project but will find their places in the town. Zoning and control for such entertainment district should be laid out ahead of time for the town of Dawei.

In conclusion, the major negative impact due to land use changes around the estate is the problem of uncontrollable uses. Beginning at the stage of project preparation and construction, it is highly likely that those locals whose agricultural land were confiscated will thrive for livelihood by providing food and services and even temporary shelters for construction crews. These squatters, in time, will grow larger and become more permanent. Without proper control, at the time of the project operation, these shanty towns will become permanent communities over time at the location unfitted and even endangering both efficient and safe operations of the project and also the squatters themselves.

6.3.4.4 Power source and transmission

Electricity in the initial industrial estate area will be generated by 450 MW power plant. No impact to the existing use and electricity generation of the local villagers is expected.

6.3.5 Social and Cultural Resources

6.3.5.1 Socio-Economic Conditions

Issues related to the socio- economic and social issues during operation phase are similar to the construction phase.

6.3.5.2 Sites of Historical and Cultural Importance

Potential sources of impact to public and occupational health conditions during operation phase can be identified as follow

- There will be diversified industries in the industrial estate. Each type of industry will have different environmental, health and safety risks. Working environment and safety including accidents may become the significant causes of injuries and fatalities for both of workers and communities.
- Most of industries are labor intensive; therefore, numerous workers, including foreign/migrated and untrained workers, are expected.
- Project owner has set a plan to provide a township consists of hospital, school and other infrastructure amenities located inside the industrial estate boundary.
- Materials, machinery and associated infrastructure items are required therefore volume of transportations may escalate significantly and may lead to an increase of road accidents and injuries.
- Increase of accommodation and growth of supporting industries in the surrounding areas will create pressure on adequacy of infrastructure amenities, public health services, public health facilities as well as sanitation, especially around the project area.
- Pollutions due to emission from all industries to the environment may affect health and living condition of communities, especially long-term effects. Chemicals and hazardous waste, under emergency situation, may be the sources of fire, explosion or chemical leakages.
- Major hazards, fire explosions and toxic chemical leaks, from crucial industries particularly oil refinery, steel mills, coal fired-power plant, and petrochemicals plants may occur.

Potential impacts during operation phase under each important aspect are discussed below:

(a) Occupational Health and Safety

Accident and Injuries:

During the operation phase, reckless work and accidents may become the significant causes of injuries and fatalities of workers, particularly among the unskilled workers. Depending on types of industries, accidents may be caused by various activities for example electrical machines/ devices, rotating and moving equipment, working at height, high temperature working condition, confined space and traffic at the site. The wide range of injuries may be found from minor and medical aid only to disabling injuries and/or death. Besides, the accident may occur outside the project boundary due to routine transportation for workers or materials. Therefore, the prevention and mitigation measures need to be provided.

Occupational, Sexual Transmission and Communicable Diseases:

Related occupational health problems and work hazards remain throughout during the operation phase of the industrial estate. Chemical, Biological and Physicals Hazards may cause illness or injury. Acute and chronic diseases, e.g. allergy, respiratory symptom, nervous system, systemic disorder and cancer, may be as a result of the exposure of chemicals or hazardous wastes in the working environments. Noise, Vibration and Workplace Temperature including repetitive works and improper ergonomics are likely to be expected. Psycho-social disorders may increase among workers with hard work, unfamiliar environment and being away from home. Among others, stress, anxiety, insomnia, substance abuse, violence, smoking, alcohol drinking and mental illnesses will be found more often.

Sexual transmission diseases and vector-borne infection are mostly related to poor personal hygiene and poor sanitation. Foreign or migrated workers are possibly exposed to local diseases, malaria and dengue fever. Strict prevention and control measures as well as occupational health surveillance should be established in accordance with each type of the industry.

The industrial estate has provided the accommodations for their workforces by establishing the township located near the industrial Zone A. It is likely to have impacts from the industries nearby; therefore, the buffer strip is definitely needed to separate the township from industrial zone.

Fire, Explosion, Chemical Leaks and Major Hazards

Various industries use chemicals that pose flammable, reactive or toxic properties. Releasing of these chemicals may cause significant adverse impacts including fire, explosion and toxic gases. The preventive and control are necessary.

Major hazard, fire explosion and toxic chemical leaks may occur from crucial industries particularly oil refinery, steel mills, coal fired-power plant, and petrochemicals plants resulting in the large scale of adverse effects including loss of properties, injuries, disabilities and death. The comprehensive emergency preparedness and response are needed.

Adequacy and Readiness of Healthcare Services:

Regarding the significant numbers of workers in the project area, a hospital/healthcare facility located in the project township will be established. This newly established healthcare facility should be the comprehensive one, in term of adequacy, capability, and accessibility since at present public health facilities and services provided by local authorities are quite limited.

Community Health

(1) Sanitation:

Increasing of supporting industries and surrounding areas will have pressure on adequacy of infrastructure amenities and services, as well as public health facilities. Improper management of sewage, wastewater and solid waste may lead to poor sanitation and environmental health stresses. Currently, public health services of the local authorities are limited therefore the project owner should closely collaborate with the local authorities to create the mitigation measures to prevent the consequences that may occur.

(2) Environmental, Communicable/Non-Communicable Diseases:

Industrial and gas emission from industries including power plant, may cause direct impacts: increasing pollution level of SO_2, NO_2, PM_{10} and volatile organic compounds into surrounding ambient. Disposal of waste, hazardous waste and effluent discharge will cause certain impacts on the local environment, including soil and water, resulting in deterioration of the community health status. Appropriate mitigation measures and strict implementation are needed.

The increase of foreign labor may lead to the emerging various diseases possibly spread to the local residents, especially in the area with poor hygiene practices. Sexual transmission diseases, HIV/AIDs, and communicable diseases are associated with mobility of workers.

Higher public incomes may result in unhealthy habits e.g., low nutritious food, alcohol drinking and less exercise, which may cause chronic health problems: hypertension, diabetes, heart disease, stroke and cancers. More alcohol consumptions and smoking will be normally found. Disputes among workers and the public, including violence and social disturbance are expected. In fact, these non-communicable diseases will be serious problems, and need a sophisticated approach for the solution.

(3) Accident/Fire/Chemical Leaks:

Numerous transportations of industrial materials, such as gasoline, solvents or lubricants are expected. Unsafe transport vehicles can trigger vehicle accidents and injuries. Moreover, these accidents may lead to possible releases of hazardous materials which may result in fire, explosion and/or toxic chemical leaks into the environment. The emergency preparedness and response plans should be created by collaborating with the

local authority to ensure that the plan can cope with all types of possibly scenarios of fire, explosion and chemical spills.

(4) Adequacy and Readiness of Healthcare Services:

Qualified healthcare services are needed due to an increase of illness, injuries, accidents and fatalities. The wide range of injuries and disabilities will create an excessive burden of health services. Death and serious injuries from accidents will be increased. Moreover, the complexity of illness from long term and multi exposures of health hazards are expected. Consequently, the effective health surveillance system is needed.

The potential impacts of worker and public during construction and operation phases can be concluded as shown in Table 6.3-11 and Table 6.3-12

Table 6.3-11 Types of Negative Impacts on Project staff/workers

No.	Construction Phase	No	Operation Phase
1.	Accidents/Injuries	1.	Accidents/Injuries
2.	Occupational, Sexual Transmission and Communicable Diseases	2	Occupational, Sexual Transmission and Communicable Diseases
3.	Emergency Response and First-Aid	3..	Fire/Explosion/Chemical Leaks and Major Hazards
		4.	Adequacy and Readiness of Healthcare Services

Source: ESIA Study Team

Table 6.3-12 Types of Negative Impacts on Communities

No.	Construction Phase	No.	Operation Phase
1.	Housing and Sanitation	1.	Sanitation
2.	Environmental and Communicable diseases	2.	Environmental/ and Communicable/Non-Communicable Diseases
3.	Accidents/Fire/Chemical Leaks	3.	Accidents/Fire/Chemical Leaks
4.	Adequacy and Readiness of Healthcare Services	4.	Adequacy and Readiness of Healthcare Services.

Source: ESIA Study Team

6.3.6 Natural Disaster

Lately, frequent natural disaster, cyclone, flooding, fire and earthquake have been reported, which raise a concern for new establishment in order to protect people life and properties in accordance with Myanmar Action Plan on Disaster Risk Reduction (MAPDRR). Disaster assessment and Emergency Response Plan is required in ESIA. The issue is mentioned by 2nd and 3rd of MONREC comments. Thus, three threatening disaster in the Project region are assessed in this section.

6.3.6.1 Flooding

Base on physical resource in Chapter 5, *Section 5.2*, location of the Project is in monsoon and in warm and humid climate. In accord with flooding map with return period of 100 years, annual flood may not often expose the Project to flooding because the Project is located in upstream area, not regular flooding area, downstream of both Kun Chuang and Dawei Rivers (See Figure 4.2-48).

Periodical cyclone, has started frequent occurring for the past decades and recently impacted Myanmar many times, especially in Ayeyarwaddy river delta region. As location of the Project in Tanintharyi region that is not in direction of the cyclone, so, it is situated in low risk area. However, the storm is regional meteorological condition, the Project area may still be under the storm influence. Heavy and continuous rainfall may expose risk of rapid flooding in local including cumulative flooding in regional area. Thus, the Project has designed the Flood Controlling System (Chapter 4, *Section 4.2.4*) that can effectively drain runoff and can insist up to 140 mm/hour of rainfall or approximately 4 hours of flood retention times.

To ensure that the Project will be minimal impacted by storm and flood hazards, the Project shall follow the Flood Emergency Response Procedure as prescribed in *Section 4.3.3.*

6.3.6.2 Earthquake and Tsunami

Base on physical resource in Chapter 5, *Section 5.2,* Location of the Project (See Figure 5.2.7) is in active zone of earthquake, around 500 km from subduction or collision boundary between Indian and Eurasian Plate margins. However, this is a deep earthquake, around 150 to 200 km below the ground and may not expose damages to the Project unless, a regional to global scale of earthquake will occur, which will be consequently an unavoidable disaster.

In the contrary, attention shall pay to intra- plate movement, active fault. "*The Sagain Fault* " is the major fault that cause severe damages and ruins, as recorded in long history of the Union of Myanmar (See Figure 5.2.8 and Table 5.2-1) due to the fault is still active, shallow earthquake (less than 50 km), frequent occur and expose on land in northern Myanmar in population area.

The Sagaing Fault is N-S trending, from Sagaing region downward to Yangon region before submerges under the Andaman sea. Location of the Project is around 300 km east from the trend and overlays on passive earth, detritus sediments/sedimentary rocks of Quaternary, the Project shall be expose low risk. However, the Project may associate earthquake for a level depending on scale and magnitude of regional earthquake, the scale may ranging from feelable to some damages on structure. According to, seismic zoning map prepared by Tint Lwin Swe (2012) suggested that earthquake impact to the Project area shall be small, less than the other area in Myanmar, as presented in Figure 5.2-7.

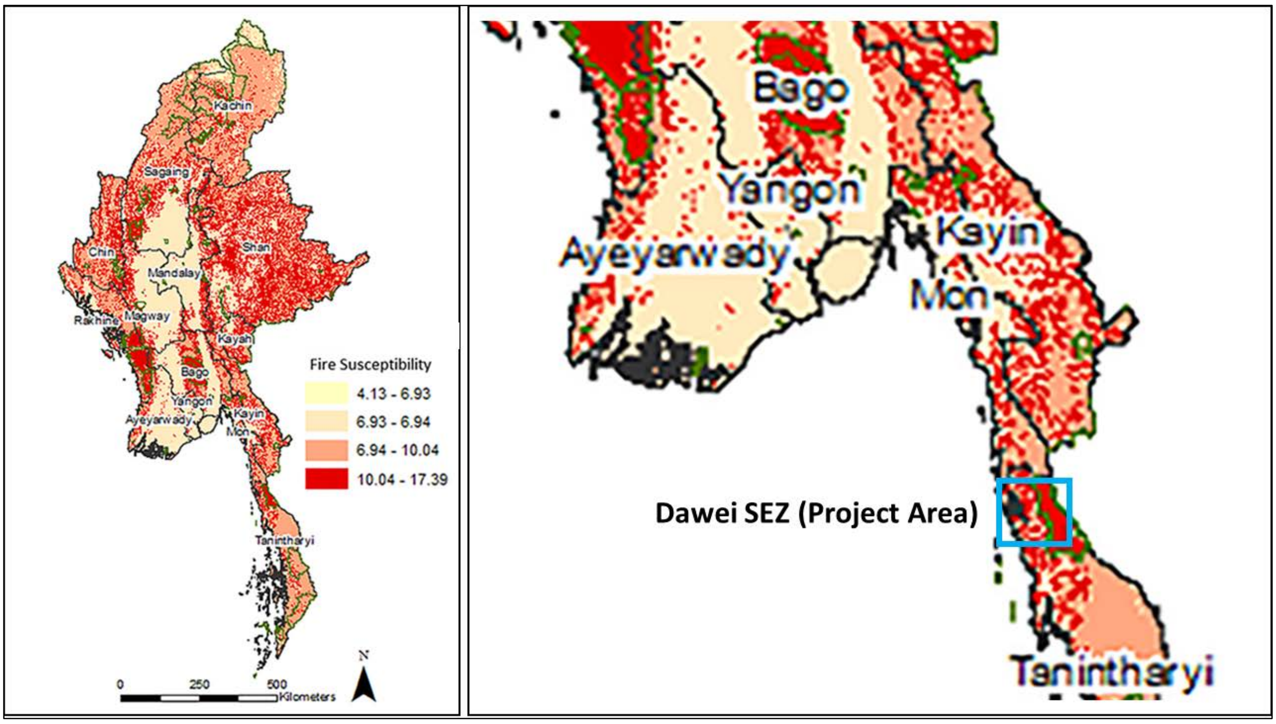
Despite, the Sagain fault is strike slip style and in sub-marine proximal to the Project location, it movement may sub-sequentially cause another disaster, Tsunami. The Project may associate tsunami for a level depending on scale and magnitude of the sub-marine earthquakes that originates in Indian Ocean. However, due to setting of the Project location is not on shoreline, which is Tsunamic impact zone. At least 10 km further in landward, the Project shall not be directly wiped off by this scale of Tsunami (Refer to the worst Tsunami case hit the Andaman shoreline in December 2004). The Project shall expose to low risk.

In this EIA report, ERP will not include the earthquake and tsunami emergency because likelihood of occurrence is low and temporary. In case unavoidable disaster i.e. regional or global scale, the Project and related people shall follow general procedure for evacuation and safety guideline in responding to Earthquake and Tsunami; *http://www.earthquakecountry.org/downloads/LivingonShakyGround_NorthCoast.pdf* (Appendix 6-1).

6.3.6.3 Fire Vegetation

A fire prone research, probabilistic frequency ratio analysis of fire vegetation, by Biswas et.al. (2015) *http://journals.plos.org/plosone/article?id=10.1371/journal.pone.*0124346 reveals that anthropogenic sources contributes fire risk factor rather than biophysical factor e.g. vegetation, elevation and temperature. Area in vicinity of the Project, around 20-50 km in radius of the Project central, has high exposure to fire vegetation, as presented in Figure 6.3-12.

Fire vegetation in Project area likely causes by agricultural burns including shifting burns of land and/or crops. Northeast of the Project area, is protected forest, has also high risk of fire due to type of vegetation and elevation. Forest can be source of fire vegetation from fire spreading. Especially, in dry month between November and April, fire is more prone by winds and fuels in the forest rather than in wet month when humidity is limited ignition of fire. For this reason, the Project is located in high fire hazard areas due to it surrounded with settlement of people and protected forests. Thus, the impact from fire vegetation is medium.



Source: Biswas et.al. (2015)

Figure 6.3-12 Fire risk map

To ensure that the Project will be minimal impacted by fire vegetation, the Project shall follow the Fire Emergency Response Procedure as prescribed in *Section 4.3.2* and mitigation measures as follow:

- Prepare prevention plan and rehearsal of Fire Emergency Response Plan.
- Maintenance of Fire Fighting Equipment/apparatus
- Manage fire defending space surround the Industrial Estate i.e. location connect to plantation of villagers or rice field
- Vegetation for buffer zone shall not be ignitable plant species e.g. Eucalyptus are among flammable plants.
- Manage vegetation, weeds, organics rubbish by other mechanical ways instead of burning. In case necessity, open burning must not leave over or ignorance. The burning must be controllable.
- Engage community, to acknowledge them about hazards of fire vegetation e.g. reduce burning and fire prevention plan.

6.4 RISK ASSESSMENT

6.4.1 Conceptual Framework

(a) Concept and Definition of Environmental Risk

In most document on environmental risk assessment, environmental risk is narrowly defined to focus on a hazard from an environmental event which could affect receptors though an environmental pathway. For example:

- Environmental event: disposal of toxic and hazardous wastes on Land causing soil contamination which could pollute groundwater
- Environmental pathway: groundwater
- Consequences on receptors: health impacts on communities nearby the disposal site that rely on groundwater for domestic use and consumption

In these environmental risk assessment documents, impacts are easily confused with risk if the risk context is not clearly established. In the above example, if toxic and hazardous wastes are not properly disposed off in the site, soil will be contaminated and pollutants could reach the aquifer. If the disposal site is on the aquifer used by the communities, it is certain that the groundwater will be polluted causing adverse consequences on the communities. In this respect, groundwater pollution is certain and the issue needs to be investigated in the context of EIA not environmental risk assessment. On the contrary, if the wastes are properly disposed in engineered landfill, there still is a concern that the liner may possibly leak. This concern is a risk that should be investigated in the context of environmental risk management and will have to be managed to minimize the possibility of leak.

The Consultant considers environmental risk within the context and framework of project risk management as environmental risk one of several categories of project risks, such as technical risk, financial risk, legal risk, and market risk. Environmental risk will need to be managed as part of project risk management, which is an integral part of project management, during the construction phase and operational phase of a project in parallel with other categories of project risks.

A project risk is variously defined in risk management documents but all definitions share three key words: event, likelihood of occurrence of the event, and consequence of the event, if occurred, on the project. The Consultant defines a project risk in general as:

"A project risk is an undesirable event which may or may not occur, but if it occurs it will have negative consequences on the achievement of the Project's environmental management objectives."

In investigating environmental risk of this Project, the Consultant, based on the above definition of a project risk, treats an environmental risk as:

"An event which may or may not occur, but if it occurs it will have negative consequences on the achievement of the Project's environmental management objectives, i.e. compliance with environmental performance requirements prescribed by MONREC and other authorities, and as agreed or committed with the stakeholders, particularly the surrounding communities."

(b) Objectives of Environmental Risk Assessment

In line with the objectives of EIA, the objectives of environmental risk assessment (ERA) are to: (i) identify and assess environmental risks during the construction and operational phases of the Project; and (ii) prepare an environmental risk management plan (ERMP) for the Project covering the construction phase (CERMP) and the operational phase (OERMP). The ERMP will be part of the project risk management plan (PRMP) to be implemented as part of project management.

(c) Environmental Risk Management Planning Process

The ERM planning process is similar in principle to the project risk management planning process, and the planning process for the construction phase is similar to that for the operational phase. The project risk management planning is different from the environmental risk management planning in scope and risk management context.

The ERM planning process adopted for this Project, in general, consists of the following steps:

(1) Establish the Environmental Risk Management Context

The establishment of environmental risk management context is to gain a clear understanding of the following subjects: (i) project management arrangements, especially project risk management; (ii) arrangements for environmental management of the Project during the construction phase; (iii) responsibilities of contractors, project owner, project management team, and project risk management, and between environmental risk management and environmental management.

Information on the Project implementation and its environmental impacts will be the basis for forming judgmental views on the potential uncertain events which constitute risks, likelihood of occurrence of the events, and their impacts on the environmental management objectives of the Project.

(2) Risk Identification

Risk identification is to identify various concerns related to possible events that, if occur, could result in the Project being unable to comply with environmental requirements prescribed by MONREC and other authorities and as agreed or committed with the key stakeholders. Such events would consist of external events and internal events.

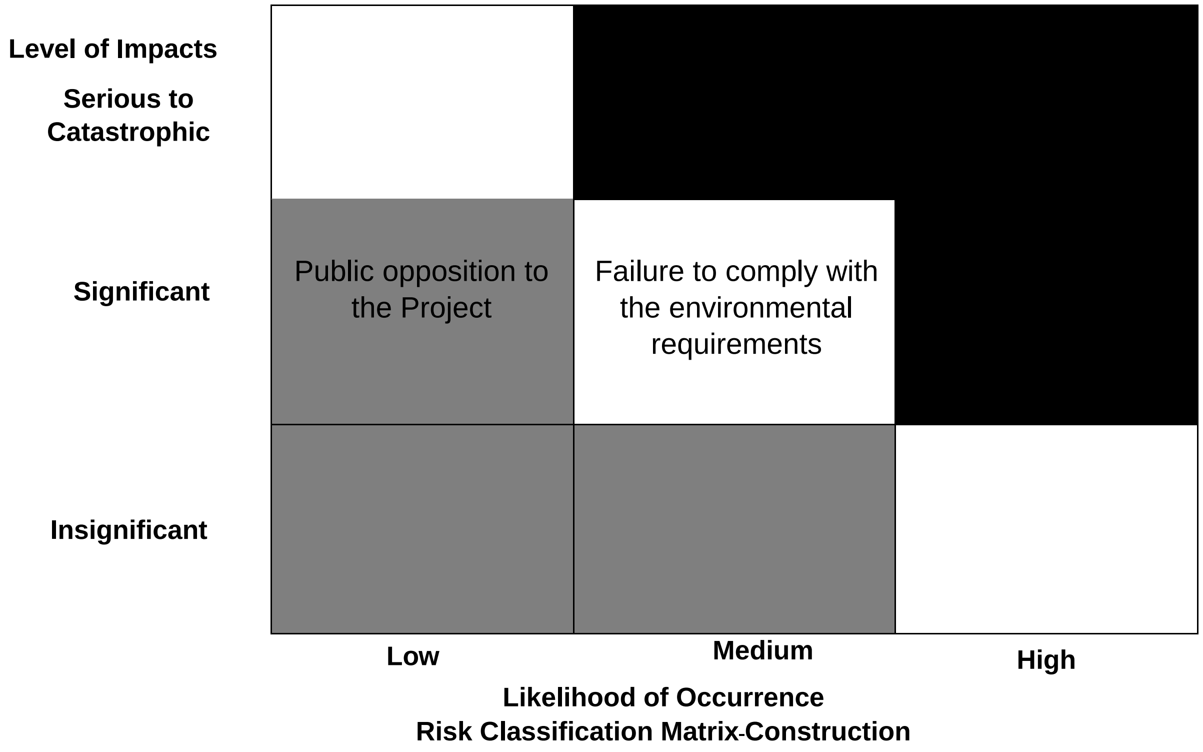
(3) Risk Analysis

In this step, each identified event will be analyzed to come up with a rational conclusion on its likelihood of occurrence (high medium low), its impacts on the achievement of the Project's environmental management objectives and direct and indirect on-site and off-site costs, and causative factors related to the occurrence of the event.

(4) Risk Classification

The results of risk analysis are used to prepare a risk classification matrix based on the likelihood of occurrence and the magnitude of impact. **Figure 6.4-1** shows an example of simple risk classification matrix. In this example, risks are classified into minor, moderate and major risk.

- Minor risks are characterized by low impact and low likelihood of occurrence. Minor risks can be accepted or ignored.
- Moderate risks are characterized by high impact and low likelihood of occurrence or by low impact and high likelihood of occurrence. Moderate risks will need treatment.
- Major risks are characterized by high impact and high likelihood of occurrence. Major risks will need close attention of the management and significant levels of treatment.



Source: ESIA Study Team

Figure 6.4-1 Simple Risk Matrix

- A risk profile should be prepared for each risk to be managed. The risk profile should include:
- A description of the risk;
- Potential cause of the risk;
- Likelihood of the risk occurring;
- Potential effect or consequences of the risk;
- Ranking or severity of the risk; and
- The evaluation of the acceptability of the risk.

(5) Formulation of Cost Effective Risk Treatment or Mitigation Measures

For a risk related to uncontrollable external event, such as flooding, risk mitigation measures will either aim at protection or minimizing the impacts or both.

For a risk related to internal event, the risk mitigation measure to be adopted could be designed to reduce the likelihood of occurrence, reduce consequences if the event occurs; avoid the event by not taking actions that have risks; and transfer the risk. A minor risk would be accepted if mitigation measure is not financially justified. Designing a cost effective mitigation measure needs to consider the root cause of the event constituting the risk.

(6) Arrangements for Implementing and Managing the Risk Mitigation Measures

This step will propose arrangements for implementing the proposed risk mitigation measures, including: (i) responsible person for each risk; (ii) organization for environmental risk management; (iii) risk monitoring and evaluation; and (iv) reporting and corrective actions.

The environmental risk management plan will need to be linked with the environmental management plan as well as the project risk management plan to ensure that any dependencies or potential resource conflicts between project and environmental management tasks and environmental risk mitigation are identified and resolved. Managing environmental risk is essentially an element of project risk management. For example, the individual environmental risks will need to be included in the project risk registration process.

Where appropriate, the environmental risk management plan should also be linked to other business plans within the industrial estate management entity such as the corporate risk management plan.

6.4.2 Environmental Risk Management-Construction Phase

(a) Environmental Risk Management Context

For this Project, the IE contractor would be contractually responsible for: (i) preparation of detailed designs and specification of all equipment and facilities; (ii) procurement and construction; and (iii) testing and commissioning the industrial estate and associated facilities before handling over to the Project Proponent. The environmental performance requirements of the Project construction and operation will need to be adequately incorporated in the designs, specifications, and construction. All environmental mitigation measures recommended in this Final EIA Report and accepted by the Project Proponent and MONREC will be implemented by the IE contractor and his subcontractors under the supervision of construction supervision consultants of the Project Proponent. Monitoring of the environmental performance of the IE contractor will be carried out by the project management team of the Project Proponent.

The environmental risk management will be carried out by the project management team as part of the overall project risk management. The environmental risk mitigation measures will be implemented by the project management team within the scope of and procedures for project risk management.

(b) Risk Identification

During the construction phase, two uncertain events or two environmental risks would be of concern to the project proponent:

- The project may not be able to comply with environmental requirements prescribed by MONREC or other concerned authorities.
- The project may be opposed to by stakeholders, especially the nearby communities.

These two uncertain events could have the following consequences on the project:

- The authorities may order the project to suspend the construction or in the worst case they may revoke the construction permit.
- Public complaints could be filed against the project and could lead to litigation.
- Bad publicity to the project.
- Physical damages or body damages on-site or off-site with cost to be incurred by the project.

(c) Risk Analysis

The two identified risk events could be cause by the following:

Risk 1-Failure to comply with the environmental requirements

Potential causes:

- The IE contractor and subcontractor have inadequate understanding of the environmental performance requirements of the Project.
- The IE contractor and subcontractor unintentionally omit the environmental requirements due to ambiguity of the environmental requirements in the contract.
- Inadequate supervision and monitoring of environmental mitigation activities of the IE contractor and subcontractors.
- Changes in designs or construction methods without revising the originally proposed mitigation measures.
- Changes in the environmental requirements during the construction without the revision of the originally proposed mitigation measures.

Risk 2-Public opposition to the Project

Potential causes:

- Misunderstanding or misinformed of the nature, severity and extent of impacts of the Project.
- Rough relationship between the Project and the surrounding communities.

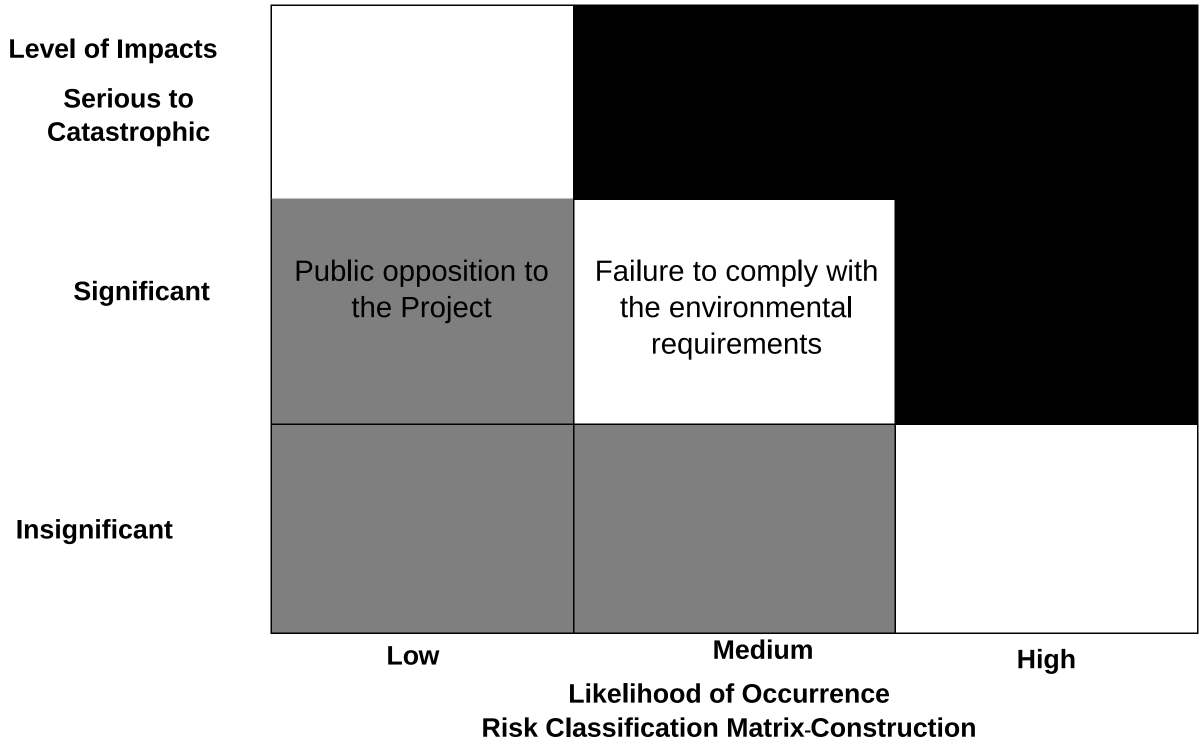
(d) Risk Classification

Figure 6.4-2 shows a risk matrix for the construction phase.

Risk 1 is considered major risk as it would have a high level of likelihood of occurrence and a high level of impacts.

Risk 2 is considered minor risk as it would have a law level of likelihood occurrence and a high level of impacts.

Risk 2 is considered minor risk as it would have a law level of likelihood of occurrence and a high level of impacts.



Source: ESIA Study Team

Figure 6.4-2 Risk Matrix for the Construction Phase

(e) Risk Mitigation Measures

Risk mitigation measures need to address the identified causes of the risk. Mitigation measures for the two identified risks correspond to the identified causes are presented in Table 6.4-1 The measures will be implemented through contractual arrangements and stakeholder engagement.

Table 6.4-1 MITIGATION MEASURES FOR ENVIRONMENTAL RISK MANAGEMENT DURING CONSTRUCTION PHASE

Cause	Mitigation Measures
IE contractor and subcontractor have inadequate understanding of the environmental performance requirements of the Project	1. Require the IE contractor to: - Prepare a CEMP based on the EIA report and the associated CEMP, detailed design and construction plan and schedule. The CEMP must clearly define: - The project's environmental requirements and obligations - Physical measures that are needed to comply with the requirements and obligations - Construction measures that are needed to comply with the requirements and obligations - Assignment of responsibilities to each subcontractors 2. Require the IE contractor to clearly incorporate environment requirements and mitigation measures in the Project Understanding, the Statement of Criteria, and the Basis of Designs-these three documents would be required by the Project Proponent as part of the design risk management.
Ambiguity of environmental requirements in the IE contract	1. TOR for procurement of the IE contract must clearly state the Project's environmental requirements during the construction phase that the IE contractor must ensure that the Project construction will meet the requirements. 2. The IE contract must clearly prescribes environmental management responsibility of the IE contractor
Inadequate supervision and monitoring of environmental mitigation activities of the IE contractor and subcontractor.	1. The supervision consultant will be required to submit a supervision and monitoring plan that clearly indicates the environmental tasks to be supervised and monitored. This supervision and monitoring plan for the implementation of the environmental mitigation measures would be part of an overall project supervision and monitoring plan. 2. Weekly and monthly reviews of the IE Contractors environmental performance. 3. Close supervision of truck operations especially during the site filling period.
Changes in designs or construction methods without revising the originally proposed mitigation measures accordingly	Changes in designs or construction methods may be initiated by the IE contractor or the Project Proponent. The request for changes must be subject to the change procedure in project management. The request for changes must be accommodated by an analysis of environmental implications and revised mitigation measures.
Change in the environmental requirements during the construction without revising the originally proposed mitigation measures.	Change in the environmental requirements may be initiated by MONREC the Project Proponent with approval of MONREC. The changes must be subject to the change procedure in project management. The IE contractor will analyze environmental implication of the changes and revise the originally proposed mitigation measures accordingly.

Table 6.4-1 MITIGATION MEASURES FOR ENVIRONMENTAL RISK MANAGEMENT DURING CONSTRUCTION PHASE (Cont.)

Cause	Mitigation Measures
Misunderstanding or misinformed of the natural, severity and extent of impacts of the Project	1. Pay attention to the clarity and adequacy of the information on impacts of the project using non-technical language that could be easily understood by villagers. Information in audio visual forms should also be prepared.
Misunderstanding or misinformed of the natural, severity and extent of impacts of the Project (Cont.)	2. Design an effective public information program to ensure the intended information reaches the target groups. 3. Ensure that the tripartite committee proposed in the CEMP has a clear understanding of the Project's impacts. 4. Organize a study tour to other similar industrial estates in Myanmar or some neighboring.
Rough relationship between the Project and the surrounding communities	1. CSR activities should be initiated as soon as possible in the construction phase. 2. The Project management team should visit as often as possible the villages located within the area of influence of the Project.

Source: ESIA Study Team

(f) Implementation Arrangements

(1) Responsible Persons and Organization

Environmental risk management needs to be an integral element of environmental management of the Project. Therefore, the organization for environmental management proposed in the CEMP will also implement the environmental risk mitigation measures in cooperation with the construction supervision manager.

(2) Risk Monitoring and Evaluation

Risk monitoring involves periodic monitoring of risk triggers. A risk trigger is an event which could lead to the occurrence of the risk event. For example, a risk trigger for a flood risk is the intensity and frequency of rain falls in the catchment area. The rainfall data will be analyzed to evaluate the likelihood of occurrence of the flood

Risk monitoring and evaluation in environmental risk management will be carried out as part of the environmental monitoring program for environmental management. Some data could serve both risk monitoring environmental monitoring.

Risk 1-Failure to comply with the environmental requirements

The monitoring and evaluation should cover the following risk triggers:

- Inadequacies of the CEMP prepared by the IE contractor and the timeliness in correcting deficiencies in the CEMP found by the project management team;

- Trend of the IE contractor and subcontractors not conform with the construction requirements related to the CEMP; and
- Response of the IE contractor to the instructions of the supervision engineers and the EHS manager regarding the implementation of environment impact mitigation measures and monitoring of the environmental management performance.

Risk 2-Public opposition to the Project

The monitoring and evaluation should cover the following risk triggers:

- Trend of public complaints-the increasing trend would suggest the increasing likelihood of occurrence of the risk event; and
- Periodically surveys of public views and opinions on the Project-the frequency of surveys would be reduced if the public opinions are positive.

(3) Reporting and Corrective Actions

The process for reporting and corrective actions in environmental management will also be applied to the environmental risk management.

6.4.3 Environmental Risk Management-Operational Phase

(a) Environmental Risk Management Context

During the operational phase, the industrial estate operational team will routinely implement, as part of the industrial estate operation, all environmental mitigation measures recommended in this Final EIA Report and accepted by the Project Proponent and MONREC. It is essential that the environmental performance requirements of the operational phase will need to be adequately incorporated in the designs, specifications, and construction. Monitoring of the environmental performance of the industrial estate operation will be carried out by the industrial estate team as discussed in the OEMP section in **Chapter 8.**

The environmental risk management during the operation phase will be carried out by the EHS unit as part of the overall industrial estate risk management. The environmental risk mitigation measures will be implemented by the industrial estate management team within the scope of and procedures for the industrial estate risk management.

(b) Risk Identification

(1) Operation Risks

During the commissioning and operational phases, the major concerns are on possible hazardous events which, if occur, would seriously damage the industrial estate and could cause injuries and fatalities to operational personnel and people in the nearest communities. The hazards in the industrial estates are generally well understood resulting in

numerous standards and codes of practice to cover the design, construction, installation, testing, commissioning, operation and maintenance of the industrial estate facilities.

(2) Pollution Control Risks

No special risk mitigation measures will be required. Careful selection of the CEMS and the low NOx burner will be adequate to minimize the risk. Other possible causes of the risks will be minimized by efficient environmental management.

(c) Risk Analysis

(1) Operational Risks

Consequences

If a serious accident occurs, the damages would be contained within the Industrial estate site as the nearest community is about 5 km away.

Underlying Causes

Several studies of failures of industrial estate traced the Incidents to the following root causes or underlying causes: (i) faulty designs; (ii) defective equipment and improper equipment installation and construction; (iii) inadequate and/or improper operation and maintenance procedures; and (iv) human error in the operations and maintenance.

Likelihood of Occurrence

The likelihood of occurrence of the operational risks would be low if: (i) technical specifications and performance requirements are clearly prescribed in the contract; (ii) equipment suppliers have good track records in safety; (iii) close supervision and quality control of the installation and construction; (iv) rigorous training of operators; (v) clear and adequate operational procedures for all operations and maintenance; and (vi) efficient plant management.

(2) Gaseous Emission Control Risks

Consequences

The Project's industrial estate will generate only very small amounts of NOx and SO2. Therefore, non- compliance with the emission standards and monitoring requirements, if occurs, will not create a significant impact on local air quality. Nevertheless, the non-compliance, when detected, will need to be rectified as soon as Possible.

Underlying Causes

Non-compliance with the gaseous emission control requirements may be caused by the following:

- The CEMS may malfunction, thus being unable to collect emission Data to meet the monitoring requirement;

- The actual efficiency of the installed low NOx burner is lower than 30% level used the calculation of emission standard;

Likelihood of Occurrence

Considering the above possible causes, the likelihood of occurrence of the non-compliance with the gaseous emission control requirements would be low.

(3) Wastewater Control Risk

Consequences

The wastewater generated in the industrial estate operation, even without treatment, will contribute some amounts of non-toxic pollutants into the river. Therefore, non-compliance with the treated effluent standards and monitoring requirements, if occurs, will not result in a serious degradation of the water quality. Nevertheless, the non-compliance, when detected, will need to be rectified as soon as possible.

Underlying Causes

Non-compliance with the wastewater control requirements may be caused by the following:

- Inadequate operational management of the wastewater collection and treatment facilities resulting in a part of wastewater bypassing the treatment facilities, poor performance of the treatment facilities, and negligence of monitoring tasks;
- Inadequate maintenance of the collection and treatment facilities;

Likelihood of Occurrence

Considering the possible causes, the likelihood of occurrence of the non-compliance with wastewater control requirements would be medium.

(d) Risk Classification

(1) Operational Risks

Although the operational risks could have serious consequences on the industrial estate, their likelihood of occurrence is low. Therefore, they are classified as moderate risks.

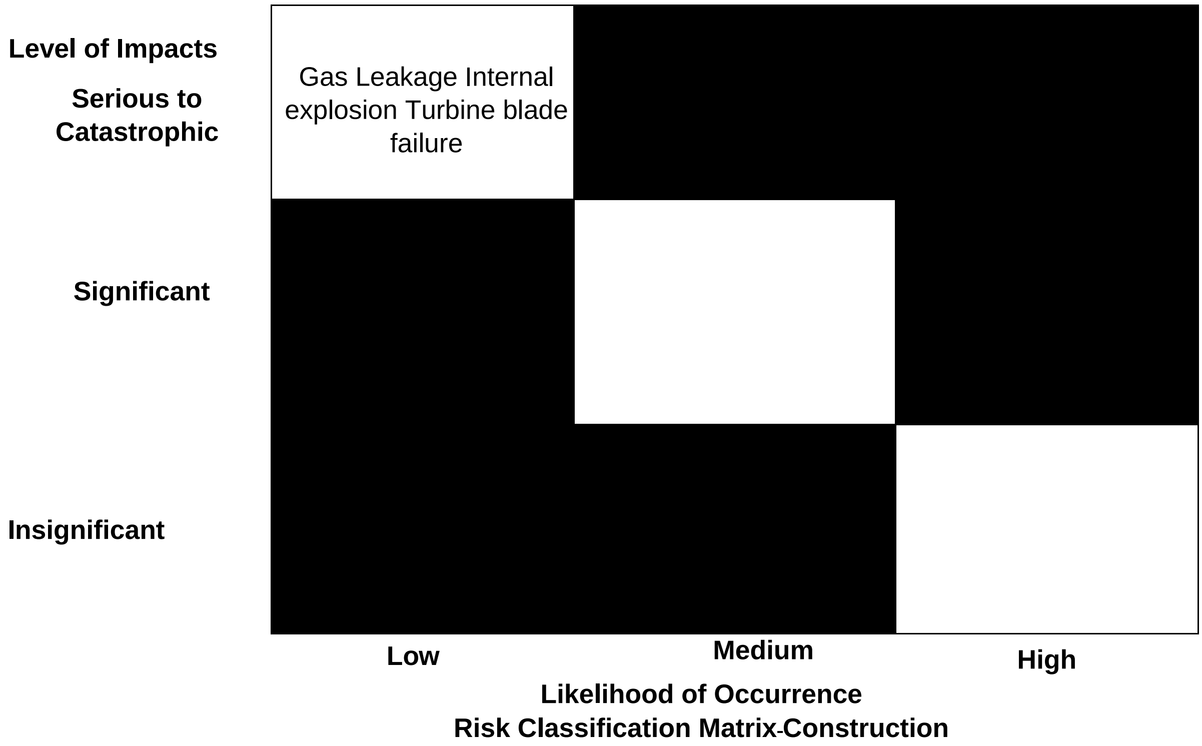
(2) Pollution Control Risks

Gaseous Emission Control

The risk related to the compliance with the gaseous emission control requirements is rated as minor or insignificant risk.

Wastewater Control

The risk related to the wastewater control requirement could also be rated as minor risk. A simple risk matrix for the operational phase is shown in **Figure 6.4-3**



Source: ESIA Study Team

Figure 6.4-3 Risk Classification Matrix-Operation Phase

(e) Risk Mitigation Measures

<u>(1) Operational Risks</u>

Measures for managing the operational risks will be divided into two groups. The first group will aim minimizing the possibility of faulty design and defects in the equipment, equipment installation, and construction. The second group will aim at minimizing inadequacies in the operation and maintenance procedures, and human error in the operations and maintenance. The first group of measures will be mainly related to the IE contractor and his design consultant and subcontractors. The second group of measures will be related to both the IE control and the power plant operational team.

Measures for Addressing Faulty design and defects in the Equipment, Equipment Installation, and Construction

- The IE contractor should be required to the RAMS process In the design and construction of the industrial estate and its associated facilities.

The IE contractor will ensure that the design, selection of equipment, installation and construction will follow the health and safety guidelines, as well as applicable supplementary guidelines or standards of other recognized

technical Organizations such as the American society of Mechanical Engineers (ASME), the American Gas Association (AGA), the us National Fire Protection Association (NFPA), and the American Society of Testing Materials (ASTM).10

- The IE contractor will be required to clearly incorporate operational risk management requirements and proposed designs of mitigation measures in the project understanding, the Statement of Criteria, and the Basis of Designs- these three documents would be required by the Project Proponent as part of the design risk management.

- A safety review of the design, proposed equipment, methods of installation and construction should be conducted by the project management team of the Project Proponent.

- The IE contractor will be required to submit a detailed quality control system for the design, equipment installation and construction. The quality control system will need to clearly show the interaction between the IE contractor and the design consultant and the subcontractors.

- Conduct a detailed hazard and operability study (HAZOP) after the detailed design and specifications are completed. Results of the HAZOP study would support the safety review suggested above.

Measures for Addressing Inadequacies in the Operation and Maintenance Procedures, and Human Error in the Operations and Maintenance

The Project Proponent will, as part of the contract, require the IE contractor to carry out the following tasks:

- Submit a detailed plan for testing and commissioning of the industrial estate. Fire and Explosion Prevention during operation must be strictly observed. The IE contractor must prepare a procedure for review by the Project Proponent and conduct a training of personnel to ensure correct implementation of procedure.

- Submit detailed working procedures for the operation and maintenance of various units or facilities of the industrial estate. The procedures will include safety aspect of high risk areas of operation such as flare system, boilers, and steam generators. The working procedures must be certified by qualified engineers with extensive experience in plants. The work procedures will be included in the safety review of the Project Proponent.

- Organize and conduct training of the industrial estate operational team to be nominated by the Project Proponent in operation and maintenance and risk management of the Project industrial estate. The training will use the work procedures prepared by the IE contractor. The IE contractor will submit a detailed training program and implement the training not later than two weeks before commencing the testing and commissioning of the industrial estate. After the training, the IE contractor will conduct a rigorous test of the trainees to evaluate their technical competencies required for efficient and safe operation and maintenance of the industrial estate.

In addition, the Project Proponent would also adopt a risk transfer measure through taking an insurance against the cost of damages to properties, injuries and fatalities, and loss of revenue should the operational risk events occur.

In addition to the insurance, the Project Proponent should require the IE contractor to prepare an emergency response plan to enable the industrial estate operational team to promptly cope with the consequences if the operational risk events occur. The content of such plan should include, but be limited to the following:

- Background and Purpose of the Emergency Response plan
- Types, Nature and Locations of Emergencies (on-site and off-site)
- Emergency Response Organization
- Emergency Response Process and Work Procedures
- Notification Procedures and Communication Systems
- Damage Assessment Process
- Process and Procedures for Returning to Normal Operations
- Emergency Equipment and Facilities Available
- Regular Tests of Emergency Organization and Procedures
- Review of Plans and Updates
- Detailed Operating Manuals

(2) Pollution Control Risks

No special risk mitigation measures will be required. Careful selection of the CEMs and the low NOx burner will be adequate to minimize the risk. Other possible causes of the risks will be minimized by efficient environmental management.

(f) Implementation Arrangements

(1) Responsible Persons and Organization

Environmental risk management needs to be an integral element of environmental management and risk management of the operational phase. Therefore, the organization for environmental management proposed in the CEMP will also be responsible for environmental risk management.

However, the proposed measures for managing the operational risks will need to be implemented by project management team during the design and construction phase and by the industrial estate management team starting from the testing and commissioning through the operational phase.

The industrial estate management organization should have a risk management committee to be chaired by the industrial estate manager and participated by the operational manager and the EHS manager. Other members of the safety management committee would be head of various units of sections of the industrial estate. These unit heads will be responsible for the operation and maintenance of the units in strict adherence to the applicable work procedures. The risk committee will be involved in operational and environmental risks, including safety aspect. The risk committee will consistently review and evaluate the operational risks of the industrial estate, and recommend necessary improvements of the work procedures to ensure the risks are minimized or avoided.

(2) Risk Monitoring and Evaluation

Operational Risks

For the operation risks, the following risk triggers should be considered for routine monitoring and evaluation:

- Number of reported incidents of emission and its trend;
- Response time to address the reported emission and its trend; and
- Number of reported incidents of non-conformance with the work procedures and its trend.

The incidents should be decreasing and the response to the reported leakage should be prompt and effective. The opposite trend suggests increasing of the likelihood of occurrence of operational risk events.

The monitoring and evaluation of the risk triggers should be the responsibility of the EHS unit.

Pollution Control Risks

The monitoring and evaluation should cover the following risk triggers:

- Number of CEMS malfunction incidents and the period of down number of non-compliance of the effluent standards and the compliance trend; and
- Number of non-compliance with the effluent quality standards of the treated effluent and the compliance trend.

(3) Reporting and Corrective Actions.

The process for reporting and corrective actions in environmental management will also be applied to the environmental risk management. The monitoring and evaluation results will be reviewed by the risk management committee for taking corrective actions.

CHAPTER 7
CUMULATIVE IMPACT ASSESSMENT

7.1 INTRODUCTION

Cumulative impacts are the result from incremental changes caused by other past, present, or reasonably foreseeable actions together with the project. The reasonable foreseeable actions are usually obtained from available government policy, town planning and/or development plans that are applicable to the area of interest.

Dawei SEZ Initial Industrial Estate Project and associated components are by far the single largest development plan in this region of Myanmar. No other town planning or development plans have been identified during the study period. Myanmar also lacks overall economic development planning, which hinders prediction of future cumulative impacts. It is therefore assumed that the future scenario will include expansion of villages and townships surrounding the project area due to expanded local economy and immigrated workers.

Past and present development and impacts to the area are from smaller scale human development mainly from agriculture (paddy fields, and orchards) and communities. Mining is one of the key industries in Myanmar, but mines are generally located in the mountain ranges further away from the project area.

Present environmental qualities which can be used to represent past and present impacts, from the baseline and existing environmental surveys in several studies of the project, are in acceptably good conditions except for surface water quality in major rivers, where some parameters such as phenol and COD may occasionally exceed the referenced standard levels. The surveys show that groundwater quality have evidence of being contaminated with wastewater and sewage from communities due to escalated level of coliform bacteria. Terrestrial ecology in the project area has been changed from natural conditions to agricultural lands and communities. The area on the west bank of Dawei river has evidence of being encroached by local populations based on site observation.

It is therefore believed that the current activities in the area have already put stress on some of the environmental aspects, particularly on surface water quality, groundwater quality, and terrestrial ecology, in the project area. The present water quality impacts are most likely from lack of sanitary system in the communities within and surrounding the project.

A simple matrix can be used to identify and evaluate cumulative impacts due to project development and other past, present, reasonably foreseeable activities against elements of environment or sensitive receptors. The levels of potential impacts are assessed qualitatively based on available information from the above sections and the best professional judgment. Table 7.1-1 shows the results of the evaluation.

Table 7.1-1 Cumulative Impact Evaluation Matrix

Potential Impacts Area	Proposed Action	Past Actions	Other Present Actions	Future Actions	Cumulative Impacts
Physical Resources					
Air Quality	**			*	**
Noise and Vibration	*				*
Surface Water and Sediment	**	*	*	**	**
Groundwater	*	*	*	*	*
Geology and Seismology					
Biological Resources					
Surface Water Biology	*				
Economic Development					
Infrastructure Facilities	+				+
Traffic and Transportation	*			**	**
Land Use	***			**	***
Social and Cultural Resources					
Socio-Economic Conditions	+			+	+
Sites of Historical and Cultural Importance	**				**
Public and Occupational Health	*	*	*	**	**

Remarks: * - low adverse impact ** - moderate adverse impact *** - high adverse impact
+ - beneficial impacts

Source: ESIA Study Team

Beneficial cumulative impacts are identified in two areas: infrastructure facilities and socio-economic conditions. Although, initially, the project will only install power plant sufficient to sustain the project operation, the project may expand the grids to cover the adjacent communities in the future. This will provide a more stable and reliable electricity source to the current system in the communities that relies on diesel generator. The project will also have its own water treatment system, waste management facilities and wastewater treatment system and thus will not create impacts to the infrastructure outside the project.

Adverse cumulative impacts on land use are of the most concern. Although the project area has already been encroached and largely used by local populations, expansion of the communities and population as an indirect impact of the project may increase demand of lands and wildlife products, which will lead into further encroachment into forest area and increased wildlife poachers. Lack of land use and town planning, as discussed in the previous sections, may worsen the situation surrounding the project area.

Moderate impacts are identified for air quality, surface water and sediment, traffic and transportation, and sites of historical and cultural importance.

The project will be the largest source of air and wastewater emission in the area. Future emission may be from vehicle exhausts which are less important than the former.

Surface water and groundwater quality, as discussed earlier, already show signs of impacts due to the past and present human activities. Wastewater from households and agricultural areas are discharged into receiving waterways, which end up in Dawei river. Only basic sewage treatment system, such as septic and seepage tanks, exists in a few places. Most of the households still use open pits for disposal of sewage. This leads to contamination of groundwater wells, which are being used for consumption. The project has less potential to impact groundwater quality but discharge of treated wastewater will be made to Dawei river. Without improvement to the sanitation system within the communities, which are expected to be expanded in the future, cumulative effects on the quality of surface and groundwater are foreseeable.

The project has been designed with road network that have sufficient capacity to handle expected traffic volumes inside the project area. However, the local road network outside the project is small and in deteriorated conditions. Expansion of the local road networks will be needed to alleviate the potential impacts in the future.

Impacts to the site of historical and cultural importance will occur mostly due to project activities during construction. Removal, relocation, or preservation of the sites will need to be done during the period. No impacts from other human activities are expected.

The project has been planned for building its own healthcare facilities. This will reduce stress to the public healthcare facilities outside the project that are already in deficiency, based on the baseline conditions discussed in Chapter 4. However, an increase of population in local communities is expected, and it is likely that the local healthcare facilities may not be developed quickly enough to cope with the increased in population.

The project has established EMP to address some of these concerns, such as for land use issue. However, many of the cumulative impacts and possible mitigation measures are considered to be beyond the scope and capability of the project to implement. Close cooperation with local and national government agencies will be required to address these concerns and to ensure that the potential impacts are predicted and appropriate measures are planned and implemented.

CHAPTER 8
ENVIRONMENTAL MANAGEMENT PLANS

For each of the potential environmental impacts described in the previous chapter, measures are suggested either to prevent those impacts and/or to mitigate their effects. The various preventative mitigation measures proposed for different types of impacts, implementation parties, the responsible authorities, location of usual construction or operation activities, estimated cost and duration are prescribed in this Chapter.

The key organizations responsible for implementation of the mitigation measures include: the Governing Bodies of the Government of Myanmar, the Project Proponent, the Construction Contractor and Sub-Contractors (during construction phase), and the Investors/Tenants. Definition and responsibility of each party are described in *Section 8.8* Institutional Arrangment.

8.1 ENVIRONMENTAL MANANGMENT ACTION PLANS

As enacted in the EIA Procedure, 2015. The two EMPs during construction phase and operation phase are defined as follows:

"***Construction Phase EMP*** *means a detailed and comprehensive Environmental Management Plan (EMP) for the construction phase of a Project. Such plan shall present all relevant commitments, Emission Limit Values, Environmental Quality Standards and other environmental requirements and include a description of the construction works, present an overview of Adverse Impacts, present mitigation measures and monitoring programs together with time schedules, overview maps, images, aerial photos, sattlelite image, site layout plans, cross sections, transects, environmental management and monitoring sub-plans for each construction site, thematic sub-plans, and management procedures as appropriate*".

"***Operation Phase EMP*** *mean a detailed and comprehensive EMP for the operational phase of a Project. Such plan shall present all relevant commitments, Emission Limit Values, Environmental Quality Standards and other environmental requirements and include a description of the construction works, present an overview of Adverse Impacts, present mitigation measures and monitoring programs together with time schedules, overview maps, images, aerial photos, sattlelite image, site layout plans, cross sections, transects, environmental management and monitoring sub-plans for each construction site, thematic sub-plans, and management procedures as appropriate*".

The above definitions make clear that the two EMPs required by MONREC will need to be comprehensive and have more details than very brief EMPs presented in EIA reports of the past. This requirement of MONREC is in line with current ESIA practices in developed countries. It should be noted that the two EMPs prepared as part of this ESIA study are invariably framework plans as they are based on outline designs of the Project. They are

therefore intended to provide framework and prescribe requirements for the preparation of detailed CEMP and OEMP by the appointed EPC contractor (Contractor). Consequently, they could be considered and reffered to as the Project Proponent's or Owner's EMPs to distinguish them from the Contractor's EMP after the ESIA during project implementation.

8.2 ACTION PLANS FOR CONSTRUCTION PHASE (CEMP)

As discussed in Chapter 6, the Project is not expected to have major environmental impacts during construction apart from environmental disturbances normally experienced in Initial Industrial Estate construction. Nevertheless, the Project Propernent will ensue that the Contractor will make best efforts to minimize the impacts during the construction phase despite their insignificant levels. In this regard, the Project Proponent will ensure that the Contractor-CEMP will incorporate all mitigation measures as prescribed in the Owner-CEMP in preparing detailed designs of the Initial Industrial Estate and its associated facilities, construction methods, and specifications. CEMP is present as below:

8.2.1 Air Emission and Noise Action Plan

(a) Principle and Rational

One of the main potential impacts to air quality during construction activities is fugitive dust generated from the construction areas and unpaved roads. Other sources include exhaust from machineries used in the construction activities. Construction machineries also generate noise which may affect nearby communities and receptors.

(b) Objectives

To reduce and control dispersion of dust and noise due to construction activity and to reduce air pollution emission and noise from construction machinery equipment. To reduce air pollution and noise impact on community nearby the area.

(c) Project Area

Project construction area

(d) Description of Environmental Mitigation Measures

MIE shall formally notify CC and enforce the following measures to reduce emission of air pollutants and noise during construction activities.

- Exhaust gas from construction vehicles are acceptable. However, all equipments and vehicles will need to be maintained in good mechanical conditions;
- Stationary noise sources (such as generators, batching plants etc.) shall be sited as far as possible from villages, construction camps and resettlement areas;

- Construction works within the distance of 500 m from villages and resettlement areas will be carried out between 06:00 to 18:00;
- Dump trucks with loads that may generate dust will be covered when travelling through communities;
- Water spraying at least twice a day in the construction areas and unpaved roads is required in the following conditions:
  - On the section of unpaved transportation routes that pass through communities or construction work camps;
  - When dust generating activities are being carried out within 100 m of a village or construction work camp;
  - When visual inspection indicates excessive dust generation in the construction areas and unpaved roads used for material transportation;
- Burning of waste materials including waste vegetation from site clearing will be allowed under the following conditions:
  - The materials that are allowed to be burned are general garbage and vegetation waste. No burning of materials that may generate toxic gases is allowed;
  - A trained fire protection officer with appropriate fire fighting equipments has to be present near the burning areas;
  - Burning is not allowed during severe wind conditions;
  - Burning is carried out at a safe distance from vegetated areas and not within 2 km from a village, a construction work camp, or resettlement areas on the upwind direction;
- Avoid impact pile-driving where possible in vibration-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver causes lower vibration levels where the geological conditions permit their use.
- Construction workers exposed to noise levels of 80 dBA or more shall be provided with adequate hearing protection.

(e) Description of Environmental Monitoring Program

MIE is responsible for monitoring that the CC is complying with the measures mentioned above. The monitoring program can be described as follow:

- Each construction machineries are inspected at least every 6 months with a written certificate / maintenance records of each machinery provided by qualified mechanics of the CC;

- Inspect that the dust suppression measures are implemented according to the mitigation measures and the burning of waste materials are conducted according to the relevant mitigation measures;
- Monitor the Community Grievance Record related to dust and noise and ensure that the complaints are responded to and closed appropriately according to the relevant mitigation measures.

Additionally, it is recommended that the project continue sampling of ambient air quality in industrial area and nearby villages every 6 months, dry and rainy season. A total of 2 sampling stations is recommended, which details of the stations and parameters are provided in Table 8.2-1 and Figure 8.2-1.

Table 8.2-1 Analysis Methods of Ambient Air Quality Parameters and Sampling Stations During Construction Period

Parameters	Analysis Method[1/]	Sampling Station
Ambient air quality		Yalai Village (if still exist) and Ekani Village (during zone D construction period)
TSP 24 hours	Gravitric – High Volume	
PM 10	Gravitric – High Volume or equivalent to USEPA	
Wind speed and direction	Wind speed / direction metering Device	
Temperature	Thermometer	
Noise level		
Leq 24 hours	IEC 616721-1 / 616721-2	
Ldn	IEC 616721	
Lmax	IEC 616721	
L90	IEC 616721	

Source: ESIA Study Team

(f) Work Plan (Duration)

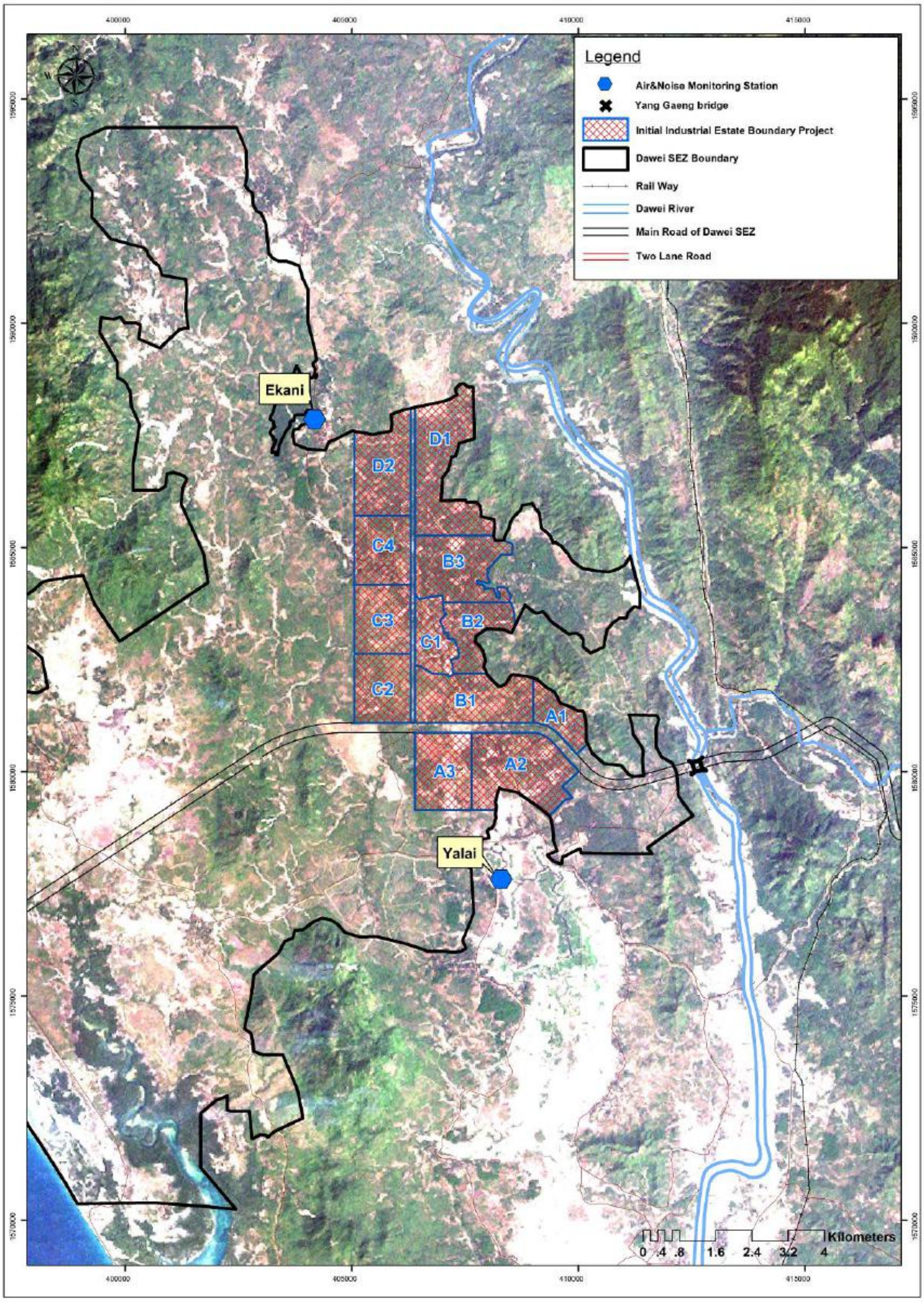
During construction phase of the industrial estate.

(g) Responsible Organizations or Agency

MIE shall ensure that the mitigation measures were distributed to and acknowledged by CC. CC shall implement the mitigation measures under supervision of MIE.MIE shall report the results of implementation for audit every 6 months.

(h) Budget

Approximately 6,000 USD/Year.



Source: ESIA Study Team

Figure 8.2-1 Sampling Locations for Air Quality and Noise Monitoring in Construction Phase

8.2.2 Groundwater Quality Action Plan

(a) Principle and Rational

Release of pollutants from construction activities, work camps, workshops, and chemical storage to the environment may affect quality of ground water. Control of release is necessary to limit the potential impacts caused by such activities.

(b) Objectives

To reduce pollution from construction activities into groundwater resources

(c) Project Area

Project construction area

(d) Description of Mitigation Measures

The following mitigation measures need to be implemented by MIE and CC:

- Prepare and implement the measures for Ground Water Control.
- Saving water sanitary wares such as faucet, flush toilet must be applied
- “ water is worth it “ need to be reminded all workers/sectors forward water saving
- Pipeline of water supply must be regularly checked and immediately repaired for preventing of water leakage
- In case of insufficient ground water supply, the project must use other water source for tap water production to avoid water supply conflict
- Provide sufficient number of toilet and bathing facilities for labors, the contractors/subcontractors must not be allowed to establish worker camps outside ITD labor camp

(e) Description of Monitoring Program

Integrate monitoring program for inspection of mitigation measure implementation with relevant plans.

Additionally, it is recommended that the project continue sampling of ambient air quality in industrial area and nearby villages every 6 months, dry and rainy season.

A total of 4 sampling stations is recommended, which details of the stations and parameters are provided in Table 8.2-2.

Table 8.2-2 Analysis Methods of Ground Water Parameters and Sampling Stations During Construction Period

Parameters	Analysis Method[1/]	Sampling Station
pH	Electrometric Method	2 well at landfill unit , 1 well at Yalai village 1 well at Ekani village
Electrical Conductivity	Electrical Conductivity Method	
Turbidity	Nephelometric Method	
Total Suspended Solids (TSS)	Total Suspended Solids Dried At 103-105 ºC	
Total Dissolved Solids (TDS)	Total Dissolved Solids Dried At 180 ºC	
Total Solids (TS)	Total Solids Dried At 103-105 ºC	
Total Hardness		
Iron	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Manganese	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cadmium	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Hexavalent Chromium	Extraction and Direct Air Acetylene Flame Method	
Lead	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Zinc	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Nickel	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Copper	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cyanide Arsenic Total Mercury	Distillation,Pyridine-barbituric acid Method Hydride Generation AAS Method Cold Vapour AAS Method	
Total Coliform Bacteria (TCB)	Multiple Tube Fermentation Technique	
Faecal Coliform Bacteria (FCB)	Multiple Tube Fermentation Technique	
E.Coli	Multiple Tube Fermentation Technique	

Source: ESIA Study Team

(f) Work Plan (Duration)

Throughout the construction phase

(g) Responsible Organizations or Agency

MIE shall ensure that the mitigation measures were distributed to and acknowledged by CC.

CC shall implement the mitigation measures under supervision of MIE.

MIE shall prepare the report with the results of implementation for audit every 6 months

(h) Budget

Approximately 30,000 USD/Year.

8.2.3 Erosion and Sedimentation Control Action Plan

(a) Principle and Rational

Construction and large earth-moving activities accelerate erosion mainly by exposing large areas of soil to rain and running water. If this runoff is not properly controlled, the result is often serious siltation of nearby watercourses. The consequences are degradation or destruction of fish and wildlife habitats, and water being less useful for fresh water supplies.

(b) Objectives

To prevent change in soil quality and fertility as well as to prevent soil erosion in the construction site into water resource and area nearby.

(c) Project Area

Project construction area

(d) Description of Mitigation Measures

CC shall prepare an *Erosion and Sediment Control Plan* for construction activities and submit to MIE for approval prior to commencement of construction activities in the area. The major effort at construction sites will focus on the management of erosion of excavated surfaces, especially during the wet season when the volume of runoff is expected to be high. The plan shall have the following components:

- An assessment of the potential for contamination of natural waterways. Basic principles include the size of the disturbed area, site drainage, and waterways receiving stormwater from the disturbed area;
- Plans for water management during construction shall be established and include adequate drainage system to manage runoff;
- Sedimentation controls shall be implemented in the form of silt trap fences and sedimentation basins where be suit, and all runoff from the disturbed area shall be directed to the sediment controls;
- Measures to be taken to collect, store and treat stormwater prior to discharge from the site considering options for water re-use onsite;

- Management of material storage area – Stockpile and spoil disposal area shall not be located on drainage line;
- Control of erosion and sedimentation shall be constructed progressively prior to commencement of each stage of earthworks until the permanent protection is established.

(e) Description of Monitoring Program

MIE shall develop a monitoring program to include inspections of drainage works, sediment traps, and other structures designed to treat water to meet an acceptable quality before discharge into natural and/or constructed watercourses meet the appropriate standard. The monitoring program for erosion and sediment control include:

- Inspect that erosion and sediment controls are in place prior to rainy season;
- Inspect that the drainage system and sediment controls are functional during rainy season;
- The sediment basins have a capacity of reducing the suspended solid from stormwater by fifty percent (50%); and
- Designate water quality monitoring plan to include locations of sampling upstream and downstream of the entry points of surface water runoff from construction area; frequency and methods of testing, and applicable standards for suspended solid.

(f) Work plan (Duration)

During construction period

(g) Responsible Organizations or Agency

CC under supervision by MIE shall develop and implement *Erosion and Sediment Control Plan* according to the site condition and progress of construction work.

MIE shall review and approve the *Erosion and Sediment Control Plan* before the construction in the area can be commenced, then inspect and monitor the implementation of *Erosion and Sediment Control Plan* according to the monitoring program.

MIE shall prepare the report with the result of the implementation for audit every 6 months.

(h) Budget

Included in construction budget.

8.2.4 Surface Water and Sediment Quality Action Plan

(a) Principle and Rational

Release of pollutants from construction activities, work camps, workshops, and chemical storage to the environment may affect quality of freshwater, coastal water, and sediment. Control of release is necessary to limit the potential impacts caused by such activities.

(b) Objectives

(1) To prevent soil erosion and wastewater runoff into natural water resources.
(2) To prevent wastewater contamination from campsite

(c) Project Area

Project construction area.

(d) Description of Mitigation Measures

The following mitigation measures need to be implemented by MIE and CC:

- Prepare and implement the measures for Erosion and Sediment Control.
- Prepare and implement the measures for Waste Management.
- Prepare and implement the measures for Construction Work Camps.
- Release of oil and grease from workshop facilities is prohibited. Used oil need to be stored separately and managed as per *Waste Management Plan*.
- Stock yards; gasoline, oil, lubricant and hydraulic oil storage areas; and machines/vehicles cleaning areas should be located at least 100 meter away from natural waterways.

(e) Description of Monitoring Program

Integrate monitoring program for inspection of mitigation measure implementation with relevant plans.

Additionally, it is recommended that the project continue sampling of surface water quality in Dawei and Kunchaug Rivers every 6 months, dry and rainy season, during the construction period for another 3 years so that the project has a more complete and continual baseline surface water quality before commencement of the industrial areas.

A total of 10 sampling stations is recommended, which details of the stations and parameters are provided in Table 8.2-3 and Figure 8.2-2

Table 8.2-3 Analysis Methods of Surface Water and Sediment Quality Parameters and Sampling Stations During Construction Period

Parameters	Analysis Method[1/]	Sampling Station
Surface Water		
Water Level/Depth/Width	Depth Meter	SWK1: about 100 m upstream before flow into boundary of project SWK2: discharged point of the effluent into Ya Liang Chaung SWK3: 2,000 m downstream after discharged point of the effluent SWK4: 4,000 m downstream after discharged point of the effluent SWK5: about 100 m before Kunchuang River mouth SWD1: about 500 m upstream before flow pass through boundary of project SWD2: Discharged point of the effluent into DAWEI River SWD3: 2,000 m.downstream after discharged point of the effluent into DAWEI River SWD4: 4,000 m. downstream after discharged point of the effluent into DAWEI River SWD5: 500 m downstream before Kunchuang River mouth
Temperature	Thermometer	
Flow Rate	Flow Meter	
pH	Electrometric Method	
Salinity	Electrical conductivity Method	
Electrical Conductivity	Electrical Conductivity Method	
DO	Membrane Electrode Method	
BOD	Membrane Electrode Method	
Turbidity	Nephelometric Method	
COD	Open Reflux Method	
TSS	TSS Dried At 103-105 ^oC	
TDS	TDS Dried At 180 ^oC	
Total Solids (TS)	TS Dried At 103-105 ^oC	
Nitrate-Nitrogen	Cadmium Reduction Method	
Ammonia-Nitrogen	Phenate Method	
Phosphate -Phosphorus	Ascorbic Acid Method	
TKN	Kjeldahl Method	
Oil&Grease	Soxhlet Extraction Method	

Table 8.2-3 Analysis Methods of Surface Water and Sediment Quality Parameters and Sampling Stations During Construction Period (Cont.)

Parameters	Analysis Method[1/]	Sampling Station
Phenol	Distillation, 4-aminoantipyrine Method	
Iron	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Manganese	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cadmium	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Hexavalent Chromium	Extraction and Direct Air Acetylene Flame Method	
Lead	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Zinc	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Nickel	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Copper	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cyanide	Distillation,Pyridine-barbituric acid Method	
Arsenic	Hydride Generation AAS Method	
Total Mercury Total Coliform Bacteria (TCB) Faecal Coliform Bacteria (FCB) E.Coli Sediment [2/] Particle size	Cold Vapour AAS Method MPN Technique MPN Technique MPN Technique Sieve Analysis and Hydrometer Test[3/]	
Oil and Grease	Soxhlet Extraction Method	
Iron	Acid Digestion and Flame AAS Method	
Arsenic	Acid Digestion and Hydride Generation AAS Method	
Cadmium	Acid Digestion and Flame AAS Method	
Total Chromium	Acid Digestion and Flame AAS Method	
Copper	Acid Digestion and Flame AAS Method	
Mercury	Acid Digestion and Cold Vapour AAS Method	
Nickel	Acid Digestion and Flame AAS Method	

Table 8.2-3 Analysis Methods of Surface Water and Sediment Quality Parameters and Sampling Stations During Construction Period (Cont.)

Parameters	Analysis Method[1/]	Sampling Station
Lead	Acid Digestion and Flame AAS Method	
Zinc	Acid Digestion and Flame AAS Method	

Remarks:

[1/] APHA, AWWA and WEF. Standard Methods For The Examination of Water And Wastewater. 22nd ed. Washington, DC: APHA. 2012.

[2/] United States Environmental Protection Agency. SW-846 Method.

Source: ESIA Study Team

(f) Work plan (Duration)

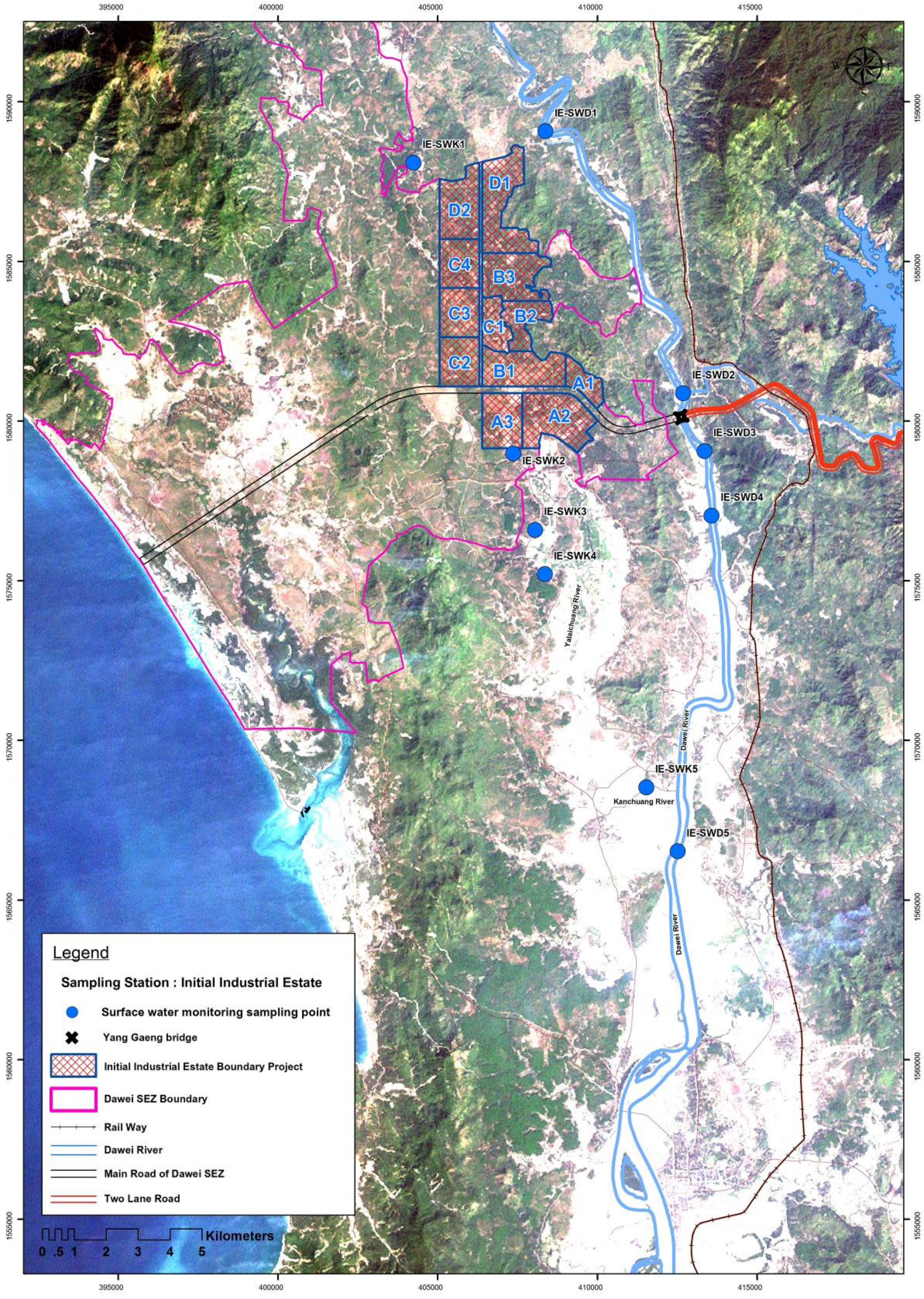
Throughout the construction phase.

(g) Responsible Organizations or Agency

MIE shall ensure that the mitigation measures were distributed to and acknowledged by CC. CC shall implement the mitigation measures under supervision of MIE. MIE shall prepare the report with the results of implementation for audit every 6 months

(h) Budget

Approximately 50,000 USD/Year.



Source: ESIA Study Team

Figure 8.2-2 Sampling Locations for Surface Water and Sediment Monitoring in Construction Phase

8.2.5 Terrestrial Biology Action Plan

(a) Principle and Rational

Although the much of the project area has been encroached by local villagers and used as farmland and residential areas, natural forests remains in some part of the area, and some endangered plant species were identified. Attempts should be made to conserve the native plant species and minimize disturbance to sensitive environment such as mangrove area.

(b) Objectives

To prevent a natural forests , endangered plant species ,native plant species and minimize disturbance to sensitive environment such as mangrove area.

(c) Project Area

Project construction area.

(d) Description of Mitigation Measures

MIE needs to coordinate with CC to ensure that the measures below are incorporated in their construction plan.

- Only clear the area needed for construction of infrastructure and utility system. Avoid disturbance of beach forest and mangrove as much as possible.
- Wherever possible, identify the endangered species and transfer them to safe locations prior to clearing the vegetation.
- Hunting of wildlife is prohibited.
- Disturbance of forest areas outside the project area by CC and their subContractor is prohibited.

(e) Description of Monitoring Program

MIE will be monitoring the progress of construction work and vegetation clearing. Excessive vegetation clearing particularly prior to rainy season has to be minimized. Natural forests and mangrove areas that can be conserved throughout the construction phase has to be identified and signposted.

(f) Work Plan (Duration)

Vegetation clearing plan and detailed survey of endangered species has to be conducted before an area is cleared. The plan can be revisited throughout the construction period.

(g) Responsible Organizations or Agency

MIE is responsible to identify the area where natural forest can be conserved. MIE needs to consider further survey of endangered plant species identified in baseline environmental survey to map out their locations and numbers. MIE shall communicate the plan to CC for action.

(h) Budget

Included in construction budget.

8.2.6 Waste Management Action Plan

(a) Principle and Rational

A number of elements of the construction activities have the potential to generate waste that can have adverse effects on the surrounding environment in terms of water quality, soil quality, air quality (odor and pollutants) and human health. Waste can be both non-hazardous and hazardous waste. These wastes require different management methods. Lack of appropriate waste management facilities in the vicinity of the project area requires that the project needs to manage the waste generated from the construction activities by themselves.

(b) Objectives

(1) To prevent and resolve waste and solid waste impact from the project.
(2) To minimize waste and provide guideline for solid waste management according to the law and regulation and appropriate method.
(3) To prevent and resolve impact from remaining solid waste. To get rid of bleeding area in solid waste storage location.

(c) Project Area

Project construction area.

(d) Description of Mitigation Measures

MIE shall develop *Waste Management Plan* that will be applicable to all Contractor and sub contractors in the project. The *Waste Management Plan* shall include the following components:

- Identify classification of waste. The minimum waste classification shall be non-hazardous and hazardous waste;
- Identify the size and location of the temporary hazardous waste storage area and non-hazardous waste disposal site for the construction phase of the industrial estate;
- A mechanism for coordination between MIE and CC in waste separation, waste transfer, record of waste quantity.

- Non hazardous waste and construction waste such as glass, plastic, paper, wood shall be separated at the site for reusing and recycling. Unusable waste shall be disposed at sanitary landfill site.
- Hazardous waste in construction period shall include, but not limited to, the following waste materials. Any mixed waste stream that contains any of the hazardous waste shall be categorized as hazardous waste:
  - Alkalis and caustic waste;
  - Batteries;
  - Empty containers which held chemicals, paints, oil and solvents;
  - Oil contaminated waste including oily rags, oil filters, used gloves;
  - Used oil, hydraulic fluids, chemicals, and solvents;
  - First aid and medical waste;
  - Spill clean-up waste;
  - Waste from grease trap
- Hazardous waste shall be stored in appropriate temporary hazardous waste storage areas until the permanent hazardous waste management facilities for the operation phase is functional. Minimum requirements of the temporary hazardous waste storage areas include:
  - Impervious floor without cracks or spaces that may allow spills to perforate into the ground;
  - Surrounded by secondary containment bunds. The secondary containment bunds shall be at least 0.5 m high with a volume large enough to contain the spill of the largest container expected in the storage area;
  - Designate storage area for liquids or materials that are not allowed to be mixed, such as acids and alkalis;
  - Equipped with spill response kits;
  - Consider providing the area with roofing and temporary walls with a provision that the temporary hazardous waste storage area will have to be in use for at least 3 years until the permanent hazardous waste management facilities of the industrial estate are functional.
  - Type and quantity of hazardous waste in the storage area shall be recorded and kept current.
- Burning of the following non-hazardous waste is allowed: cardboard, pallets, papers, and wood/vegetation waste. The waste burning site shall be designated in the *Waste Management Plan* and shall be at least 2 km from any villages, construction work camps, or resettlement areas.

- Other non-hazardous waste shall be transferred to non-hazardous waste disposal site to be used during construction phase shall meet the following minimum requirements:
  - The disposal site shall be on higher ground not subject to flood.
  - The disposal site shall be at least 2 km from any groundwater well that is being used by workers or local villagers.
  - The disposal site shall be in the area where no excavation is planned. It shall be delineated with clear sign boards.
  - The waste shall be covered with soil on daily basis.
  - The location of all disposal sites during construction period shall be recorded as expanded appendices to the *Waste Management Plan*.
- Establish a training program for workers related to waste classification, storage, and disposal.
- The *Waste Management Plan* may be expanded to cover recyclable waste and compostable waste in the future.

(e) Description of Monitoring Program

MIE is responsible for monitoring that the CC is complying with the measures mentioned above. The monitoring program is described below.

- Inspect that appropriate containers for type of waste as categorized in the *Waste Management Plan* are provided for construction work camps, workshops, construction sites, and other supporting facilities;
- Weekly inspection of waste segregation at the construction facilities and at the hazardous waste storage and non-hazardous waste disposal site;
- Weekly inspection of hazardous waste storage area and record of hazardous waste inventory.
- The location of waste burning area is designated and no waste burning is conducted outside the area;
- Waste management training record;

(f) Work Plan (Duration)

During construction phase of the industrial estate.

(g) Responsible Organizations or Agency

MIE shall develop the *Waste Management Plan* to be implemented by both MIE and CC during construction phase.

MIE shall operate the temporary hazardous waste storage area and waste disposal site. MIE shall keep record of types and quantity of waste received to the temporary hazardous waste storage area and non-hazardous waste disposal site. MIE shall provide and keep record of waste management training program. MIE shall report the implementation of *Waste Management Plan* for audit every 6 months.

CC shall collect, separate, and transport the waste to the appropriate waste handling facility.

(h) Budget

Included in construction budget.

8.2.7 Quarry Management Action Plan

(a) Principle and Rational

One limestone quarry is identified to the north of the industrial estate area. The quarry will supply aggregates and rip-rap rocks for construction of the industrial estate and the port and jetty. Activities at the quarry include site clearing, rock blasting, crushing plant, stockpile and transportation of materials. Activities at the quarry may results in various impacts to the environment including erosion and sedimentation, noise, dust, and visual impacts.

(b) Objectives

To control results of activities at the quarry including erosion and sedimentation, noise, dust, and visual impacts

(c) Project Area

Project construction area.

(d) Description of Mitigation Measures

MIE operates the quarry as a main source of construction materials for the construction of the industrial estate and other facilities. Operation of a quarry needs to be managed so that the potential impacts to the environment and communities surrounding it is reduced and controlled. MIE shall establish *Quarry Management Plan* that has the following components:

- Extent of the quarry, estimated quantity of material, and rock blasting safety zone around the quarry. The safety zone has to be barricaded and entrance by unauthorized persons shall be prohibited;
- Explosives shall be properly stored in secured, explosion-proof storage room. The storage room shall be guarded at all time. Procurement and use of explosives shall be in accordance with local regulations;

- *Erosion and Sedimentation Control Plan* for the quarry site has to be established according to the mitigation measures for erosion and sedimentation control;
- Dust suppression measures for the quarry, crushing plant, and stockpile area will be implemented on exposed areas during windy conditions, or when visual inspection indicates excessive dust generation;
- Blasting activities within a distance of 2 km from villages or construction camps will be carried out between 06.00 and 18.00. Blasting in all other areas may be undertaken 24 hours a day subject to suitable safety and lighting measures being implemented;
- Quarry closure method needs to be planned to minimize the visual effects after the operation is complete.

(e) Description of Monitoring Program

MIE is responsible for monitoring the quarry operation for compliance with the measures mentioned above. The monitoring program can be described as follow:

- All measures as stipulated in the *Quarry Management Plan* are implemented;
- Monitor the Community Grievance Record related to quarry operation and ensure that the complaints are responded to and closed appropriately according to the relevant mitigation measures.

(f) Work Plan (Duration)

During the operation of quarry.

(g) Responsible Organizations or Agency

MIE as the operator of the quarry shall ensure that the *Quarry Management Plan* is established and implemented.

MIE shall prepare the report wiyh the results of the implementation for audit every 6 months.

(h) Budget

Included in construction budget.

8.2.8 On-site Traffic and Access Management Action Plan

(a) Principle and Rational

Access roads used for transportation of construction materials and for traveling between construction sites overlap with the existing roads used by local villagers inside the

project area. Roads are currently unpaved and have blind spots. Improvement of road safety conditions will be required.

(b) Objectives

To control using for transportation of construction materials and for traveling between construction sites .

(c) Project Area

Project construction area.

(d) Description of Mitigation Measures

MIE as the project owner shall be responsible and instruct relevant CC to implement the following measures to improve access road safety conditions.

- All access roads in the construction area shall be signposted with the following information in Myanmese and English:
  - Speed limit;
  - Construction activities and machinery;
  - Roadside borrow pits and material stockpiles;
  - Any applicable load limit, particularly for temporary bridges; and
  - Road features that may affect driving conditions such as curves, hidden accesses etc.
- A speed limit of 40 km/hr shall be applied in village areas and construction camps. Drivers shall be trained and notified of such limit;
- Consider building speed humps before and after each village, where appropriate;
- Route for heavy vehicles used for transportation of construction materials shall be designated. Route with least number of villages and residential area is most preferable;
- Survey of the access roads to identify blind spots need to be regularly conducted. Improvement to the blind spots such as removal of obstructing objects when necessary; and
- Access road used for the construction activities shall be maintained in good conditions.

(e) Description of Monitoring Program

MIE is responsible for monitoring if the above measures are implemented by all parties. MIE shall coordinate with CC in selection of the most appropriate transportation routes that will contribute to least impact to the locals using the road for their daily travel.

(f) Work Plan (Duration)

During construction phase of the industrial estate, until the permanent roads are completed.

(g) Responsible Organizations or Agency

CC responsible for construction and maintenance of the access roads shall be responsible for implementing the measures relevant to signposts and road improvement.

MIE and CC are responsible for using the designate routes for transportation of construction materials and traveling between construction sites. Speed limit needs to be respected and punishment system should be in place in case of violation.

(h) Budget

Included in construction budget.

8.2.9 Construction Work Camps Action Plan

(a) Principle and Rational

Construction work camps can be sources of wastewater pollution and health impacts. Thousands of workers are expected during the construction period, and proper management of the camps will be required to ensure that the potential impacts are controlled.

(b) Objectives

To control sources of wastewater pollution and health impacts from work camps.

(c) Project Area

Project construction area.

(d) Description of Mitigation Measures

It is assumed that MIE, CC, and sub contractors will have their own compounds and camp management bodies. The following measures will be required for each of the worker camps in the project area:

- Camp rules shall be established and informed to all residences. The rules should contain the following components:
  - Policy on alcohol and substance abuse;

- Safety measures and emergency response particularly in case of fire;
- Waste management requirements;
- Other measures to prevent dissemination of vectors and transmissible disease including STDs and HIV/AIDs;

- General areas of the camp shall be kept clean and tidy. Waste shall be collected regularly to avoid accumulation of waste in the camp;
- Toilets shall be provided at a ratio of 1 toilet per 15 workers. All toilets shall be equipped with septic and treatment tanks of adequate size. The toilets need to be at least 100 m from any natural waterways. Sludge from tank cleaning shall be stabilized by adding lime (pH = 12 for 30 minutes) and disposed of in designated pit for sludge disposal. The pit shall be at least 1 km from any groundwater wells and is higher than groundwater table;
- Proper drainage has to be provided. Improve areas with stagnant water as much as possible; and
- Pest control measures shall be planned and implemented. All bedrooms need to be equipped with mosquito protection.

(e) Description of Monitoring Program

MIE shall be the party inspecting the camps periodically to ensure that all the implementation are made.

(f) Work Plan (Duration)

Since the start of any construction work camp until end of its use.

(g) Responsible Organizations or Agency

All parties are responsible for managing their own camps in line with the above mitigation measures.

(h) Budget

Included in construction budget.

8.2.10 Historical and Cultural Resources Action Plan

(a) Principle and Rational

There are a number of sites with historical and cultural values in the project area. Each village also has at least one temple. Pagodas are observed in many places within the project area. Construction activities may disturb and damage these structures. Removal or relocation of these sites will be eventually required when the project is fully developed. If not handled properly, this matter will create significant conflict between local populations and the project.

(b) Objectives

To reduce disturbing and damaging historical and cultural values in the project area.

(c) Project Area

Project construction area.

(d) Description of Mitigation Measures

MIE as the project owner will need to take ultimate responsibility in handling the matter and ensure that CC understand the risk and follow the procedures and measures described below to reduce potential impacts with the communities.

- Sites with historical and cultural values shall be identified, recorded and located in the map. This information shall be agreed upon by the local authorities and villagers.
- If construction activities have to be carried out within 50 m from these sites, the leaders of the communities that the sites belong to need to be notified at least 1 week prior to commencement of the activities.
- Establish a plan and communication channel in case an unidentified site is encountered during the construction work to avoid damage to the site.
- Removal and relocation method and destination shall be a mutual agreement between MIE, local authorities, and the leader of the communities that the site belongs to.

(e) Description of Monitoring Program

MIE needs to keep record and map up to date and make them available to all parties including CC and their subcontractor. MIE needs to monitor the construction work progress with the locations of known sites so that timely action can be taken is the sites will be subject to disturbance by construction activities.

(f) Work Plan (Duration)

Throughout the construction phase.

(g) Responsible Organizations or Agency

MIE as the project owner is ultimately responsible for this matter.

(h) Budget

Included in construction budget .

8.2.11 Public and Occupational Health Action Plan

(a) Principle and Rational

Construction activities can directly and indirectly affect the conditions of public and occupational health. Potential impacts include accidents, injuries, communicable diseases, increase in stress to the existing public health facilities etc. Mitigation measures related to each aspect of public and occupational health are described below.

(b) Objectives

To reduce accidents, injuries, communicable diseases, increase in stress to the existing public health facilities .

(c) Project Area

Project construction area.

(d) Description of Mitigation Measures

<u>Occupational Health and Safety:</u>

During the construction phase, MIE as the project owner and CC as the implementer should establish the preventive and protective measures to mitigate the potential occupational health impacts as follows:

Accidents and Injuries

- Establish occupational and safety management plan and program for the construction should be established to assess and manage EHS impacts and risks. Project or activity-specific plans or procedures should be prepared and the basic site rules of work should be included.
- Perform occupational accidents and disease recording and reporting, and investigate all incidents to understand the cause of accident and to identify measures necessary to prevent a recurrence.
- Provide Contractor and sub contractor management plan to ensure that the Contractor and sub contractor will have safety performances and procedures to protect their employee. Supervise and monitor Contractor and sub contractor performance periodically.
- Train and provide information to employees. Occupational health training program should be provided as needed, for example, hazard awareness, specific hazards and safe work practices, to ensure that workers are capable of work safely.
- Provide appropriate personal protective devices to employee and ensuring that personal protective devices will be worn during working at all time.

- Restrict local community to access the site or area using fencing, signage and risks communication.
- Appropriately mark area signage and labeling of equipments, determine hazardous area, for example electrical rooms, compressor etc., as well as installations, materials and emergency exits, and label in accordance with international standards, and easily to understood by workers, visitors and general public.

Occupational, Sexual Transmission and Communicable Diseases

- Supervise and monitor performance of Contractor and sub contractors on housekeeping in the campsite.
- Include training programs for workers with these following topics: health awareness, hygiene and sanitary, waste management, communicable and transmission diseases, cultural awareness, regulations and compliance, and drug abuse.
- Register foreign or migrated workers should be seriously performed to ensure that these workers have medical and health certificates to guarantee their personal health conditions.
- Conduct surveillance and active screening and treatment of workers. Immunization program may be required.

Emergency Response and First-Aid

- Establish emergency response plan and procedures which also should be in place for any remote sites. The plan must be update/ revised depend on changing of environmental condition.
- Provide appropriate emergency services and personnel to expedite emergency response when needed, maintain equipment facilities, fire-fighting equipment in good working order, accessible and adequate for the dimension and the basis use.
- Provide health services and first-aid unit at all time, with comprehensive and appropriate equipments, establish the qualified the first-aid unit to properly handle with serious or trauma cases, and sufficient to meet the requirements, treat and/or patients to appropriate medical facilities in time.

<u>Community Health:</u>

Housing and Sanitation

- Provide sufficient infrastructure amenities and public health services in the campsite, for example accommodations, water and drinking water availability, solid wastes disposal and sewage treatment.

Environmental/Communicable Diseases:

- In close collaboration with the community health authorities, implement an integrated control strategy for environmental and occupational diseases, such as integrated vector control programs, eliminating of breeding habitats in the campsite, and eradicating disease reservoirs.
- Collaborate with community health authorities to enhance the worker families to access public health services, and promote immunization.
- Distribute appropriate education materials for example health awareness, sexual transmission disease and communicable disease.

Accidents/Fire/Chemical Leaks

- Consider the level of local fire fighting capacity to identify firefighting equipments that should be available when needed, and provide all necessary equipments with regular maintenance program.
- Communicate potential accidents and/or hazards to local authorities, communities and relevant parties.
- Conduct emergency response practices, including liaison with local response organizations and local responders.
- Revise or/and establish Emergency Response Plans that in concurrent with relevant policy, law and regulation .

Adequacy and Readiness of Healthcare Services

- Provide the first aid unit at the campsite for their workers, assess whether the local health service capacity sufficient for worker’s family and supporting industries, and in close collaborating with local authorities, consider supporting/additional health service facility.

(e) Description of Monitoring Program

MIE will keep monthly update of health and safety statistics and records. Performance of construction health and safety is monitored against a set benchmark. MIE to periodic inspect health and safety conditions of the CC and subContractor and sub contractor’s construction sites and camps.

(f) Work Plan (Duration)

Throughout the construction period.

(g) Responsible Organizations or Agency

MIE shall establish EHS Plan expanding necessary components as listed above. The EHS plan has to be communicated to CC and their subContractor. MIE will be responsible for keeping all health and safety records submitted by various Contractor and sub contractors. MIE is responsible to assessing health and safety performance of the Contractor and sub

contractors against the set performance indicators. MIE is the party coordinating with local authorities on behalf of the project in the matter related to health and safety of the construction site.

CC needs to implement the EHS Plan and ensure that their workers are aware of the details through training. CC has to keep their health and safety record as well as their subContractor.

(h) Budget

Included in construction budget.

8.2.12 Public Participation and Dissemination

a) Principle and Rational

Public participation and information dissemination is apart environmental assessment process and sustainable development that will be result in economic, environmental and social values. General public idea about the project such as concerns of stakeholders, information and recommendation from public can be gathered through public meetings and social surveys which this information will be considered and can take accounted by DRC for further project management plans.

b) Objectives

To inform the stakeholders about the Initial Industrial Estate project, gain public views, concerns and values, increase public confidence, improve transparency and accountability in the EIA decision-making process.

c) Project Area / Stakeholders

Project construction area and impacted area with various level of government agencies, relevant and responsible agencies, project impacted people, media and dependent organizations.

d) Description of Mitigation Measures

DRC shall establish public relation and public participation plan to incorporate in requests and recommendation of the continuous engagement of stakeholders following

- Inform about project activities to community
- Support nearby community as appropriate to build good relationship with community
- Communicate to build community understanding about
    - Construction activities and progress

- Potential environmental impacts and mitigation measures

- Conduct by MIE consistent with the applicable standard for public meeting/consultation
- Disclose about project information and public relation activities through channels such as website, e-mails, meeting/visiting and local exhibition board or local media.
- Take account the results of the public consultation in improving and revised the EMPs.

e) Description of Monitoring Program

MIE will conduct public meeting or public relation e.g. using questionnaire or attitude survey for communities surrounded the Initial Industrial Estate Project within 5 km in radius of the project areas. The result must be report and the method must achieve acceptable standard and been carried out with representative samples with confidence statistics.

f) Work Plan (Duration)

Once for the entire construction phase

g) Responsible Organizations or Agency

MIE as the project owner is ultimately responsible for this matter

h) Budget

Included in construction budget.

8.2.13 Grievances Redress

a) Principle and Rational

For transparency and performance of the project in dealting with grieves that raise by communities and affected people. Grievance mechanism shall be implemented.

b) Objectives

To received grieves and complains from affected people or organization and manage the grieves effectively.

c) Project Area / Stakeholders

Project construction area and impacted area with project impacted people or impacted organizations.

d) Description of Mitigation Measures

MIE shall establish Grievance Redress Committee and Grievance Redress procedure to address any complaints / grieves to resolve / settle disputes that brought forward by community pertaining to project activities.

e) Description of Monitoring Program

Ensure that the grievance redress mechanism has been implemented. Complaints/grieves are systematically recorded and cases are settled.

f) Work Plan (Duration)

Once for the entire construction phase

g) Responsible Organizations or Agency

MIE as the project owner is ultimately responsile for this matter

h) Budget

Included in construction budget.

8.3 ACTION PLAN FOR OPERATION PHASE (OEMP)

8.3.1 Air Quality and Emission and Noise Control Action Plan

(a) Principle and Rational

Combustion of industries and emissions are the main concern. Important air pollutants from the above activities include PM_{10}, SO_x, NO_x, and VOCs. Allowable loading per land area has been estimated based on broad calculation and numerical modeling to limit the maximum concentration of pollutants outside the industrial estate area to not exceeding the relevant international standards.

Noise from production process is not considered a significant impact as the production machinery that generate high level of noise are usually enclosed or the factories are further away from sensitive receptors (i.e. communities surrounding the industrial estate area).

(b) Objectives

To control the combustion of industries and emissions are the main concern and noise from production process to not exceeding the relevant international standards

(c) Project Area

Project and surrounding area

(d) Description of Mitigation Measures

Mitigation measures for air emission and noise can be listed below:

- The emission rate of PM_{10} for stack sources shall be no greater than 0.0025 kg/ha/day.
- The emission rate of NO_2 for stack sources shall be no greater than 0.003125 kg/ha/day.
- The emission rate of SO_2 for stack sources shall be no greater than 0.0075 kg/ha/day.
- VOCs recovery system shall be equipped for the industries that or use solvents or have potential to release high amount of VOCs.
- Encourage use of low NO_x burners.
- Encourage use of low sulfur fuels and SO_x removal system for industries where release of SO_x is of concern such as power plants.
- Equipment and machine that generate high level of noise shall be installed in an enclosed building so that, when operated, noise level at the fence line of the industries do not exceed 70 dB(A).
- Provision of installation and operation of Continuous Emission Monitoring System (CEMS) when hazardous and non-hazardous waste incinerators or concerned industries agree to set up a plant in the initial industrial estate project.
- Continual collect data from the industries and update the numerical model when data from the CEMS is available or at the 3rd year of the operation, whichever comes first. Then runs updated model every year afterwards based on the actual measured data.
- Plan for emission of GHGs from the Project shall be established and/or revised in concurrently with the relevant policy and regulations.

(e) Description of Monitoring Program

Monitoring of air quality from stack and at the sensitive receptors are the main activities in this phase.

- Monitoring of air quality at the sensitive receptor nearest to the industries and at the resettlement area has to be conducted. The framework of monitoring design include:
  - Monitoring frequency is every 6 months.
  - The parameters include TSP (24-hour mean), PM_{10} (24-hour mean), $PM_{2.5}$ (24-hour mean), SO_2 (1-hour and 24-hour mean, NO_2 (1-hour mean).in Table 8.3-1.

  - Sampling stations include Building management of project or township. Yalai Village (if still exist) and Ekani Village (Figure 8.3-1)

- The industries shall monitor the concentration of air pollutants in the stack according to the parameters recommended by the Pollution Prevention and Abatement Handbook (World Bank, 1998) or relevant local regulations every 6 months and report to MIE.
- Continuous monitoring results from the concerned industries and industrial waste incinerators where CEM system are installed.

Table 8.3-1 Analysis Methods of Ambient Air Quality Parameters and Sampling Stations During Operation Period

Parameters	Analysis Method[1/]	Sampling Station
Ambient air quality		Building management of project or township, Yalai Village (if still exist) and Ekani Village
TSP 24 hours	Gravitric – High Volume	
PM 10	Gravitric – High Volume or equivalent to USEPA	
PM 2.5	Gravitric – High Volume or equivalent to USEPA	
Wind speed and direction	Wind speed / direction metering Device	
Temperature	Thermometer	
Noise level		
Leq 24 hours	IEC 616721-1 / 616721-2	
Ldn	IEC 616721	
Lmax	IEC 616721	
L90	IEC 616721	

Source: ESIA Study Team

(f) Work Plan (Duration)

Throughout the operation phase.

(g) Responsible Organizations or Agency

MIE is responsible for monitoring of air quality at the sensitive receptors, maintaining data received from the industries, and update model runs based on actual measured data from the industries and at the receptors. MIE shall prepare the report with the result of the implementation for audit every 6 months.

The industries are responsible to controlling the emission to the committed level and report the results from the stack monitoring to MIE every 6 months.

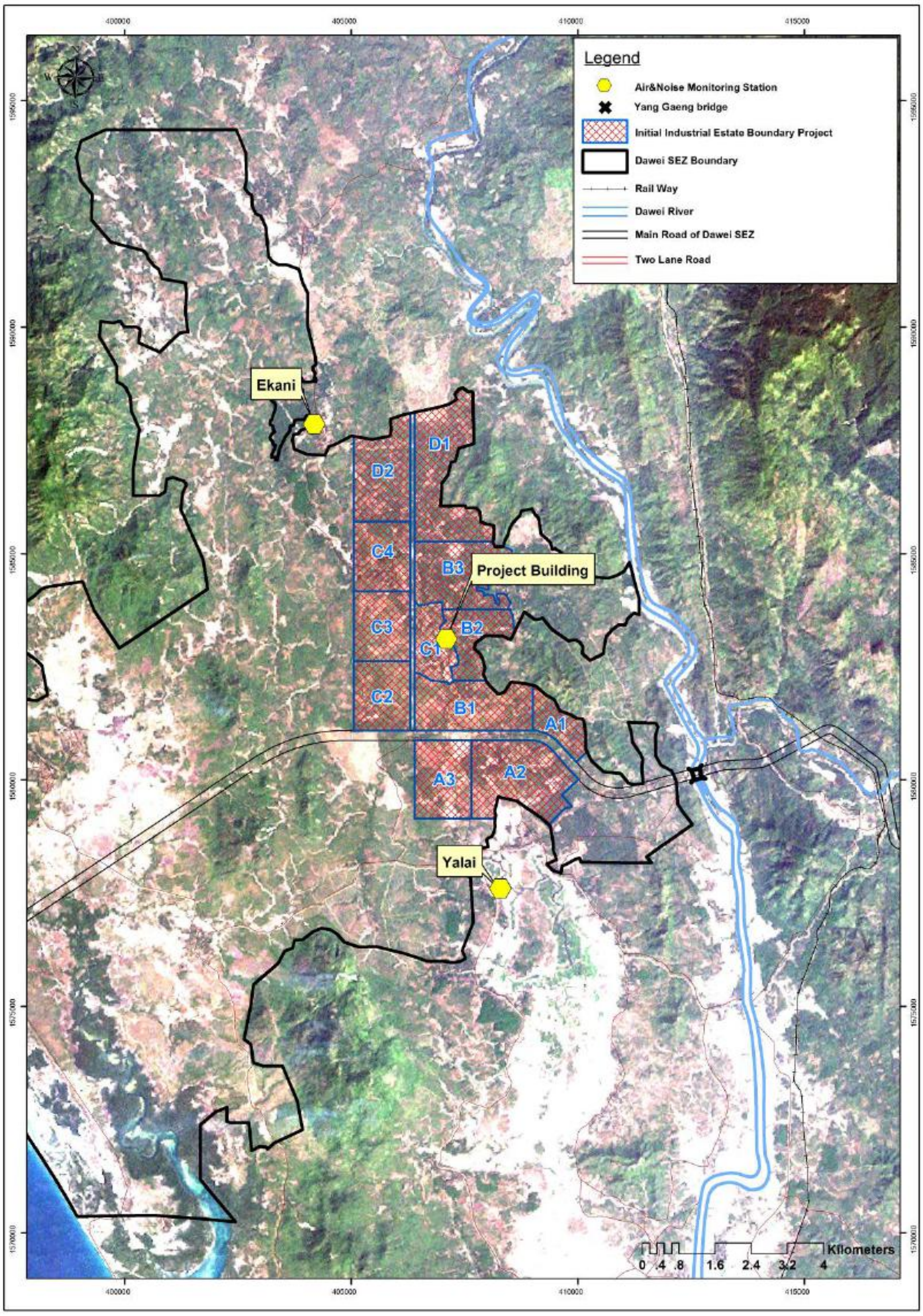
(h) Budget

Approximately 34,000 USD/Year .

8.3.2 Groundwater Quality Action Plan

(a) Principle and Rational

Leakage of waste from landfill site and release of chemical materials and/or used oils to the ground have potential to affect the quality of ground water and environment.



Source: ESIA Study Team

Figure 8.3-1 Sampling Locations for Air Quality and Noise Monitoring in Operation Phase

(b) Objectives

To control leakage of waste from landfill site and release of chemical materials and/or used oils to the ground have potential to affect the quality of ground water and environment .

(c) Project Area

Project and surrounding area.

(d) Description of Mitigation Measures

The mitigation measures for ground water quality management are mainly consistent with wastewater and waste management system. However, specific consideration is proposed to further reduce the potential impact in the ground water. The mitigation measures are discussed below:

- Directly drain raw wastewater and/or used chemicals/oils/lubricants to ground are forbidden.
- Raw wastewater must be discharged to wastewater collection system for treating
- Groundwater application of factories to be water supply in factories is prohibited

(e) Description of Monitoring Program

Ground water qualities monitoring should be established. 4 sampling stations are recommended:

2 stations at landfill site in waste management area :

(1) upstream well

(2) downstream well

2 stations in nearby village :

(1) well at Yalai village (if still exist)

(2) well at Ekani village

The parameter and sampling stations of ground water quality monitoring are shown in Table 8.3-2.

The groundwater monitoring should be conducted at least 2 times a year (dry and wet season).

Table 8.3-2 Analysis Methods of Ground Water Parameters and Sampling Stations During Operation Period

Parameters	Analysis Method[1/]	Sampling Station
pH	Electrometric Method	2 well at landfill unit , 1 well at Yalai village , 1 well at Ekani village
Electrical Conductivity	Electrical Conductivity Method	
Turbidity	Nephelometric Method	
Total Suspended Solids (TSS)	Total Suspended Solids Dried At 103-105 ^oC	
Total Dissolved Solids (TDS)	Total Dissolved Solids Dried At 180 ^oC	
Total Solids (TS)	Total Solids Dried At 103-105 ^oC	
Total Hardness		
Iron	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Manganese	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cadmium	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Hexavalent Chromium	Extraction and Direct Air Acetylene Flame Method	
Lead	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Zinc	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Nickel	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Copper	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cyanide	Distillation,Pyridine-barbituric acid Method	
Arsenic	Hydride Generation AAS Method	
Total Mercury	Cold Vapour AAS Method	
Total Coliform Bacteria (TCB)	Multiple Tube Fermentation Technique	
Faecal Coliform Bacteria (FCB)	Multiple Tube Fermentation Technique	
E.Coli	Multiple Tube Fermentation Technique	

(f) Work Plan (Duration)

Throughout the operation phase.

(g) Responsible Organizations or Agency

MIE is responsible for monitoring of groundwater quality at the sensitive receptors, maintaining data received from the landfill, MIE shall prepare the report with the result of the implementation for audit every 6 months.

(h) Budget

Approximately 30,000 USD/Year .

8.3.3 Waste Management Action Plan

(a) Principle and Rational

Waste generated from industries is expected to have great variation depending on the production process and type of industries. However, they can be essentially divided into 2 types: hazardous and non-hazardous waste. The facility will be able to handle both hazardous and non-hazardous waste. However, prior to the commission of the facility, waste generated from Dawei SEZ Initial Industrial Estate Development Project will also have to be properly managed to reduce potential impact to the environment.

(b) Objectives

To control both hazardous and non-hazardous waste that will effect to water resources nearby project area and reducing impact potential impact to the environment

(c) Project Area

Project and surrounding area

(d) Description of Mitigation Measures

Due to incompletion of waste management facilities during the operation, mitigation measures may be discussed in 2 scenarios: before and after the completion of the waste management facility.

Before Completion of Waste Management Facility

- Classify hazardous and non-hazardous waste according to the definitions in the *Waste Management Plan* prepared during the construction phase.
- The Dawei SEZ Initial Industrial Estate Development Project will provide sanitary landfill for disposal of non-hazardous waste generated from the industries.

- Design and construction of the landfill shall be in accordance with *Solid Waste Disposal Facility Criteria – Technical Manual* published by U.S. EPA (1993) or other applicable standards.
- Detailed hydrogeological condition of the proposed landfill area has to be studied in the design of landfill.
- Groundwater monitoring wells will be installed. As a minimum, 1 well is to be installed upgradient of the landfill and at least 2 wells is to be installed downgradient of the land fill. Depth of screens and well construction depends on the results from the hydrogeological condition study.
- Hazardous waste will be temporarily stored until the hazardous waste stabilization and disposal system at the waste management system is functional. Minimum requirements of the temporary hazardous waste storage areas include:
  - Impervious floor without cracks or spaces that may allow spills to perforate into the ground;
  - Surrounded by secondary containment bunds. The secondary containment bunds shall be at least 0.5 m high with a volume large enough to contain the spill of the largest container expected in the storage area;
  - Designate storage area for liquids or materials that are not allowed to be mixed, such as acids and alkalis;
  - Equipped with spill response kits;
  - Consider providing the area with roofing and temporary walls with a provision that the temporary hazardous waste storage area will have to be in use for at least 3 years until the permanent hazardous waste management facilities of the industrial estate are functional.
  - Type and quantity of hazardous waste in the storage area shall be recorded and kept current.
- The landfill shall be closed daily to prevent vectors and odors.
- Workers need to be trained of *Waste Management Plan*.
- When the permanent waste management facility is operational, evaluate options of permanent closure of the landfill site or moving the waste material in the landfill to the permanent facility.

<u>After Completion of Waste Management Facility</u>

- The components of the waste management facility: i.e. sanitary landfill, secured landfill, and incinerator, shall be designed and constructed according to the internationally accepted standards.
- Detailed hydrogeological condition of the proposed landfill area has to be studied in the design of landfill.

- Groundwater monitoring wells will be installed. Location and number of groundwater monitoring wells depends on the results of the study and the layout of the facility. Depth of screens and well construction depends on the results from the hydrogeological condition study.
- All hazardous and non-hazardous waste generated by the industries in the estate shall be transferred to the facility for disposal.
- Waste manifest system has to be created and implemented.
- The facility shall create its *Standard Operating Procedure* covering steps from receiving waste, laboratory analysis, stabilization, temporary storage, incineration, and disposal. Audit by third party is necessary.
- Workers need to be trained of *Waste Management Plan*.
- Record of type of waste including its quantity and origins shall be kept in the data base of MIE. This knowledge can be used in promoting material and waste flow management between industries within the industrial estate.

(e) Description of Monitoring Program

Monitoring of environmental quality around the site is necessary. The monitoring requirements may be divided into each type of environmental matrix as follow:

- Groundwater monitoring:
  - Collect baseline groundwater quality before the operation of the landfill.
  - Monitor groundwater quality every month for the first 6 months and then every 6 months unless unusual concentrations are observed.
  - For Initial Industries Phase, monitor the following parameters: pH, redox potential, dissolved oxygen, temperature, conductivity, turbidity, and heavy metals (cadmium, copper, lead, manganese, nickel, arsenic, selenium, and mercury).
  - For the waste management facility where hazardous waste stabilization and disposal is conducted, monitor the following parameters: pH, redox potential, dissolved oxygen, temperature, conductivity, turbidity, heavy metals (cadmium, copper, lead, manganese, nickel, arsenic, selenium, and mercury), and selected species of VOCs relevant to the waste stream.
  - Compare the results with applicable international standards.
- Ambient air quality and stack monitoring of incinerator
  - Integrate the monitoring requirement of the ambient air quality and stack monitoring with the air quality monitoring program of the industrial estate.
- Runoff and wastewater monitoring

– The waste management facility is considered equal to an industry facility. The same requirements of wastewater management will be applied.

(f) Work Plan (Duration)

During the operation of the waste management facility.

(g) Responsible Organizations or Agency

MIE is the party responsible for operating the infrastructure and utility system and thus is the operator of the waste management facilities, both during Initial Industries Phases and at full development stage.

(h) Budget

Included in operation budget

8.3.4 Wastewater and Storm Water Management Action Plan

(a) Principle and Rational

The industrial estate has central wastewater treatment systems receiving pretreated wastewater from different zones of the project. Wastewater from the industries needs to be pretreated to meet the acceptance criteria of the central wastewater treatment systems. Wastewater collection is separated from storm drainage system. Each industrial facility will have a monitoring manhole installed before the pretreated wastewater is discharged to the wastewater collection system. The central wastewater treatment systems are designed to meet the requirement of Industrial Estate Authority of Thailand (IEAT) or other relevant local requirement.

(b) Objectives

To control wastewater treatment systems and storm drainage system for reducing impact to environment

(c) Project Area

Project and surrounding area

(d) Description of Mitigation Measures

MIE as the operator of infrastructure and utility systems need to establish a detailed wastewater management rules to be integrated into the *Environmental Rules* to be distributed to the industries. Mitigation measures for wastewater management during operation phase, that should be incorporated in the wastewater management rules include:

- All industry facility in the industrial estate shall pretreat the wastewater to meet the acceptance criteria of the central wastewater treatment system.

- A detention pond with a sufficient capacity to retain 1 day expected flow rate has to be constructed at each industry facility (if necessary) and at each central wastewater treatment system as a buffer storage in case the treated wastewater fails to meet the effluent criteria.
- Inside each industry facility, wastewater stream that requires chemical pretreatment shall be collected separately from other wastewater streams to minimize and use of chemical and increase efficiency of chemical pretreatment process.
- Wastewater stream has to be separated from storm drain. Dilution of wastewater is not acceptable.
- An inspection manhole has to be installed at the point where the pretreated wastewater is discharged to the collection system of the industrial estate.
- Warning and penalty system needs to be established for industry facility that fails to meet the acceptance criteria repeatedly.
- Storm water retention system needs to be constructed to prevent surge of storm water discharge to the natural environment in case of large storm and to act as a buffer storage in case of spills into storm drainage system.
- Thermal wastewater needs to be treated so that temperature at the edge of the mixing zone, or 100 m from the discharge point, is change from natural conditions by less than 3 degree celsius.
- Recycling of wastewater should be promoted. Treated effluent should be used in the industrial estate wherever possible, such as for watering the green areas.

(e) Description of Monitoring Program

Monitoring of effluent of wastewater treatment system is essential as it provides a confirmation if the system is performing as it was designed. Monitoring of wastewater quality can be divided into 2 groups, which are:

- Pretreated wastewater from the industry facilities:
  - Within the 1st month of commissioning, the industry facility has to analyze the pretreated wastewater to confirm if the pretreated wastewater fully conforms with the acceptance criteria. If not, adjustment shall be made until the pretreated wastewater is acceptable to the central wastewater treatment systems.
  - The industry shall conduct daily check of BOD, COD, and SS if the are consistent with the acceptance criteria. The daily record shall be collected, verified by responsible persons at the facility, and submitted to MIE every 6 months.

  - Full-suite analysis of pretreated wastewater shall be conducted once every 6 months. The results shall be submitted to MIE together with summary of daily wastewater quality indicators mentioned above.
  - MIE may random check the quality of pretreated wastewater at the inspection manhole without prior notification to the industry.
- Treated wastewater from central wastewater treatment systems:
  - Daily check of BOD, COD, pH and SS in the effluent shall be conducted to monitor performance of the system.
  - Full-suite analysis of treated wastewater from the central system shall be conducted at a frequency of 1 months or less.

(f) Work Plan (Duration)

Throughout operation phase of the project.

(g) Responsible Organizations or Agency

MIE is the operator of central wastewater treatment systems and is responsible to monitor the quality of pretreated wastewater from the industry entering the system. MIE will collect information of influent and effluent quality of the central wastewater treatment system and prepare the report with the result of the implementation for audit every 6 months.

Industry facility is responsible to ensure that the raw wastewater from their facilities is pretreated to meet the acceptance standards of MIE.

(h) Budget

Included in operation budget.

8.3.5 Surface Water and Sediment Quality Action Plan

(a) Principle and Rational

Discharge of wastewater and release of waste materials to the receiving water have potential to affect the quality of water and sediment in freshwater environment. Organic loading in the treated wastewater may reduce the dissolved oxygen content in the receiving water to the point that is not suitable for living organisms.

(b) Objectives

To prevent wastewater from project area runoff into natural water resources.

(c) Project Area

Project and surrounding area

.

(d) Description of Mitigation Measures

The mitigation measures for water quality management are mainly consistent with wastewater and waste management system. However, specific consideration is proposed to further reduce the potential impact in the receiving water. The mitigation measures are discussed below:

- Prepare and implement the measures for Waste Management.
- Prepare and implement the measures for Wastewater Management.
- The discharged of untreated wastewater into the receiving water is strictly prohibited at all time.
- Retention areas/pond should be provided for treated wastewater from each zone, and retention period should be calculated to ensure that wastewater effluent complied with the effluent requirements according to Industrial Estate Authority of Thailand (IEAT) or other relevant/designated requirements.
- Emergency plan for operation of wastewater treatment should be established to prevent untreated effluent discharged into the receiving water.
- Regularly check and maintain wastewater treatment plant to control the treated wastewater quality, at least as required effluent from Dawei Industrial Estate's Wastewater Treatment System especially BOD must be less than mentioned values for minimizing the impact to water and sediment in freshwater environment.

(e) Description of Monitoring Program

- Surface water and sediment qualities monitoring should be established. 10 sampling stations are recommended:that shown in Table 8.3-3 and Figure 8.3-2.
- The parameter and sampling stations of surface water and sediment quality monitoring are shown in Table 8.3-3.
- The surface water and sediment monitoring should be conducted at least 2 times a year (dry and wet season).

Table 8.3-3 Analysis Methods of Surface Water and Sediment Quality Parameters and Sampling Stations During Operation Period

Parameters	Analysis Method[1/]	Sampling Station
Surface Water		
Water Level/Depth/ Width	Depth Meter	10 same stations in construction phase
Temperature	Thermometer	
Flow Rate	Flow Meter	
pH	Electrometric Method	
Salinity	Electrical conductivity Method	
Electrical Conductivity	Electrical Conductivity Method	
DO	Membrane Electrode Method	
BOD	Membrane Electrode Method	
Turbidity	Nephelometric Method	
COD	Open Reflux Method	
TSS	TSS Dried At 103-105 ^{o}C	
TDS	TDS Dried At 180 ^{o}C	
TS	TS Dried At 103-105 ^{o}C	
Nitrate-Nitrogen	Cadmium Reduction Method	
Ammonia-Nitrogen	Phenate Method	
Phosphate –Phosphorus	Ascorbic Acid Method	
TKN	Kjeldahl Method	
Oil&Grease	Soxhlet Extraction Method	
Phenol	Distillation, 4-aminoantipyrine Method	
TPH	Soxhlet Method	
Iron	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Manganese	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cadmium	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Hexavalent Chromium	Extraction and Direct Air Acetylene Flame Method	

Table 8.3-3 Analysis Methods of Surface Water and Sediment Quality Parameters and Sampling Stations During Operation Period (Cont.)

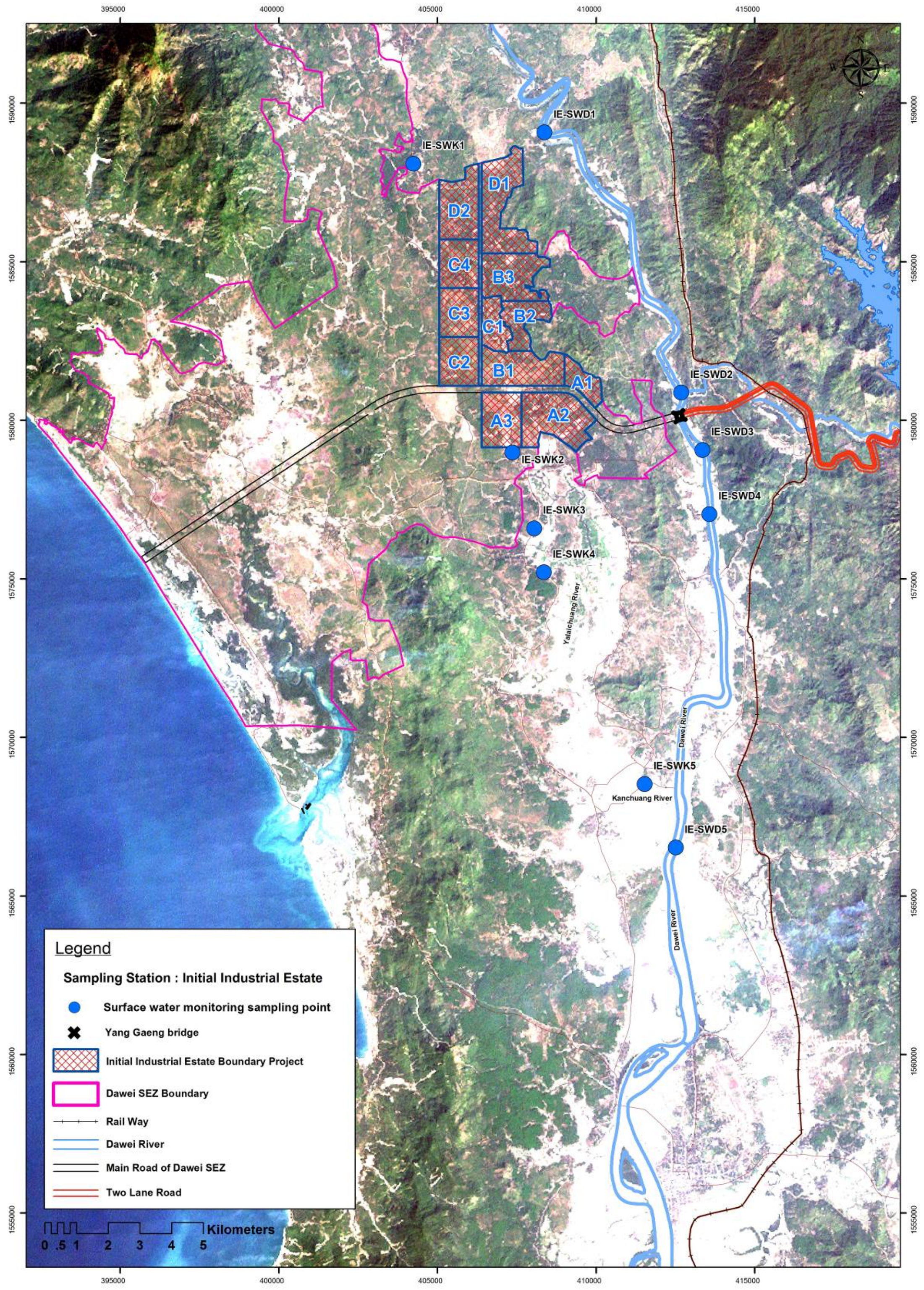
Parameters	Analysis Method[1/]	Sampling Station
Lead	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Zinc	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Nickel	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Copper	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cyanide	Distillation,Pyridine-barbituric acid Method	
Arsenic	Hydride Generation AAS Method	
Total Mercury	Cold Vapour AAS Method	
Total Coliform Bacteria (TCB)	Multiple Tube Fermentation Technique	
Faecal Coliform Bacteria (FCB)	Multiple Tube Fermentation Technique	
E.Coli	Multiple Tube Fermentation Technique	
Sediment [2/]		
Particle size	Sieve Analysis and Hydrometer Test[3/]	
Oil and Grease	Soxhlet Extraction Method	
Iron	Acid Digestion and Flame AAS Method	
Arsenic	Acid Digestion and Hydride Generation AAS Method	
Cadmium	Acid Digestion and Flame AAS Method	
Total Chromium	Acid Digestion and Flame AAS Method	
Copper	Acid Digestion and Flame AAS Method	
Mercury	Acid Digestion and Cold Vapour AAS Method	
Nickel	Acid Digestion and Flame AAS Method	
Lead	Acid Digestion and Flame AAS Method	
Zinc	Acid Digestion and Flame AAS Method	

Remark:

[1/] APHA, AWWA and WEF. Standard Methods For The Examination of Water And Wastewater. 22nd ed. Washington, DC: APHA. 2012.

[2/] United States Environmental Protection Agency. SW-846 Method.

Source: ESIA Study Team



Source: ESIA Study Team

Figure 8.3-2 Sampling Locations for Surface Water, Sediment and Aquatic Ecology Monitoring in Operation Phase

(f) Work Plan (Duration)

Throughout the project operation phase.

(g) Responsible Organizations or Agency

MIE shall maintain overall ambient environment monitoring program and results.

MIE shall prepare the report with the result of the implementation for audit every 6 months

(h) Budget

8.3.6 Approximately 75,000 USD/Year.Surface Water Ecology Action Plan

(a) Principle and Rational

Degraded quality of environment will results in impacts to ecological conditions. Biological indicators provide useful information as to change in environment due to excessive loading of organic matters.

(b) Objectives

To prevent wastewater from project area runoff into natural water resources.and reducing impact to aquatic life habitats,

Project and surrounding area

(c) Description of Mitigation Measures

The mitigation measures are the same as water and sediment quality, wastewater management, and waste management.

(d) Description of Monitoring Program

- Monitor of surface water ecology at 10 stations (same station with surface water quality monitoring program The organisms and sampling stations of surface water ecology are shown in Table 8.3-4.

Table 8.3-4 Surface Water Biological Parameters and Sampling Stations

Parameters	Sampling Station
Surface Water Ecology Phytoplankton Zooplankton Benthos Fishes	Same stations with surface water quality and sediment

Source: ESIA Study Team

(e) Work Plan (Duration)

Throughout the project operation phase.

(f) Responsible Organizations or Agency

MIE shall maintain overall ambient environment monitoring program and results.

MIE shall prepare the report with the result of the implementation for audit every 6 months

(g) Budget

Included in surface water quality in operation phase budget.

8.3.7 Terrestrial Ecology Action Plan

(a) Principle and Rational

Potential impacts to terrestrial ecology during operation phase are considered negligible. However, influx of workers from outside the area may result in increased demand of wildlife meat and poaching. Plantation of native plant species should be encourage to reduce risk of introducing alien species to the environment.

(b) Objectives

(1.) To prevent waste from project area runoff into natural resources.and reducing impact to wildlife habitats or plants

(c) Project Area

Project and surrounding area

(d) Description of Mitigation Measures

The mitigation measures for terrestrial biology is proposed as follow:

- Wherever possible, conserve the existing trees, particularly in the green areas,
- Encourage the manufacturers to conserve the existing trees in the design of their facilities.
- Select local species if plantation in the project area is needed.
- Coordinate with local authorities and engage local communities for reforestation projects surrounding the project area.
- Discourage and educate the workers in the industrial estate against wildlife consumption to reduce demand and indirect impacts to the wildlife in reserved forests elsewhere outside the project area.

(e) Description of Monitoring Program

No monitoring program is required.

(f) Work Plan (Duration)

Throughout the operation phase.

(g) Responsible Organizations or Agency

MIE in corporation with the industry and local authorities should promote the implementation of the above mitigation measures.

(h) Budget

Included in operation monitoring budget.

8.3.8 Land Use and Community Management Action Plan

(a) Principle and Rational

Change of land use surrounding the project area is of concern. Spontaneous development surrounding the industrial estate need to be planned and controlled.

(b) Objectives

To control the effect to landuse changing and community.

(c) Project Area

Project and surrounding area

(d) Description of Mitigation Measures

Special Plan and Buffer Zone

A special specific area plan is needed to control the land use adjacent to the project estate. The plan must be legitimate and authorized by the state. The purpose of the plan is to control land use nearby but outside the estate and to prevent forming of temporary settlement growing outside the estate area at inappropriate places. Moreover, a clear and marked buffer zone all around the estate boundaries should be set up to control and prevent any uses other than agriculture and forest. The size of the buffer zone should be determined by land use expert to ensure that in case of fire, chemical leakage or other hazards, only a minimum number of people will be affected and rescue and relocation efforts will be with ease.

In addition, the town of Dawei, the nearest town and most likely place to be used for services to the estate personnel, will be greatly affected by the estate development. A comprehensive plan authorized by the state for the the future of Dawei is needed for appropriate growth. Otherwise, the project development will likely cause uncontrollable growth

of Dawei resulting in degrading physical, uses, and cultural condition of Dawei in the near future.

Setting up a management committee overseeing the project land use.

A team or committee should be set up to monitor and manage activities and structures built in and around the project estate. The purpose is to insure that those temporary service centers originated from basic needs and convenience of the workers are always in the appropriate places that will not obstruct or endanger the operation of the estate. The team should have legitimate authority to control the areas adjacent or nearby, though outside the estate boundaries. Squatters must be notified that they are only allowed to operate temporarily and must be relocated when the time comes in order to prevent scattered temporary structures from evolving into unsuitable permanent settlements outside the estate area.

Transportation and Infrastructure Outside the Estate Area

For the area immediately outside the estate, not only land use should be controlled, but also other infrastructure that will enable setting up structures and services, such as, local roads, electricity, water supply, and drainage, should be also well planned and controlled. The strategic locating or prohibiting of these basic infrastructure will induce and encourage early settlers and services outside designated township zone into the area planned by the management to provide temporary services in the early stage of development.

Enforcement

The proposed set-up land use management committee/team should have duty to regularly monitor land use activities outside and inside the project estate as the development progresses. Co-operation with local or state authority is needed to be able to control, direct, or enforce private buildings outside the project boundaries to prevent unsuitable and obstructing growth nearby the project estate.

(e) Description of Monitoring Program

The mitigation measures mentioned above a long-term and involve many parties in planning and implementing the land use surrounding the project to help ensure that on a longer term, communities will be located at a safe distance from the industrial estate and conflicts between both developments can be reduced.

(f) Work Plan (Duration)

Throughout operation phase.

(g) Responsible Organizations or Agency

MIE through cooperation with local authorities.

(h) Budget

Included in operation monitoring budget .

8.3.9 Public and Occupational Health Plan Action Plan

(a) Principle and Rational

Operation phase of the project possess different risks to the workers and public. MIE as the owner of the project will need to have a program in place to handle the situations that may arise from the work-related illness and impacts in workers and local populations.

(b) Objectives

(1.) To reduce risk and prevent danger and accident which may happen to worker and people transport or live in the operational area of the project.
(2) To acknowledge problem about occupational health and safety in operational phase for further analysis and find the way to prevent and solve that problem as appropriate.

(c) Project Area

Project and surrounding area.

(d) Description of Mitigation Measures

<u>Occupational Health and Safety:</u>

During operation phase, MIE/DSEZ or the project owner should establish the preventive and protective measures to mitigate the potential occupational health impacts as follows:

Accidents and Injuries

- Provide the environmental health and safety management system and programs for the whole industrial estate.
- Request for each individual industry to provide proper and capable to manage occupational health and safety issues to protect health and safety of workers and public
- Establish occupational health and safety management plans and programs to assess and manage EHS impacts and risks which are based on comprehensive job safety analyses.
- Include the following issues in the occupational health and safety management system:
  - Accident investigation, recording and reporting
  - Surveillance of the working environment and worker health
  - Training and hazard communication

  - Monitoring and auditing procedures to evaluate the effectiveness of prevention and control measures.
- Perform occupational accidents and disease recording and reporting, investigate all incidents to understand the cause of accident and to identify measures necessary to prevent a recurrence.
- Provide provisions for Contractor and sub contractor to ensure that the Contractor and sub contractor will have safety procedures to protect their employees, and periodically monitor Contractor and sub contractor performance.
- Restrict access into site or area including fencing, signage and communication of risks to local community, appropriately provide area signage and labeling of equipments in accordance with international standards and easily to understood by workers, visitors and general public.
- Promote traffic safety programs to all personnel, for example
  - Specifying limits for trip duration
  - Improving driving skill
  - Use of speed control devices

Occupational, Sexual Transmission and Communicable Diseases:

- Conduct surveillance and active screening and treatment of workers. Immunization program may be required.
- Register foreign or migrated workers to ensure that these workers have medical and health certificates to guarantee their personal health conditions.
- Provide training programs for workers in these following topics: health awareness, and promote health protection strategies including encouraging condom use.
- Perform periodic worker health checks in accordance with the potential risks.

Fire, Explosion, Chemical Leaks and Major Hazards:

- Conduct major hazard assessment of each specified industry prior establishment in order to identify buffer zone/strips or other physical separation methods to protect public from any potential hazards.
- Provide comprehensive emergency preparedness and response plan and procedures covering fire, explosion, chemical Leaks and major hazards control. The plans must be update/ revised depend on changing of environmental condition.
- Provide appropriate emergency services and personnel to execute emergency response when needed, and maintain equipment facilities, fire-fighting

equipment in good working order, accessible and adequate for the dimension and the basis use.

- Establish fire safety system using appropriate prescriptive standards regarding with type and number of industries, and revise fire risk management periodically to ensure its capability to cope with all the potential hazards.
- Perform mutual aid agreements among the industries in the industrial estate as well as local authorities to provide a clear basis for response to share personnel and specialized equipments.
- Conduct annual training and updating emergency preparedness and response plan to account for changes in equipment, personnel and facilities.

Adequacy and Readiness of Healthcare Services

- Establish the hospital in the township area, and periodically evaluate in terms of adequacy, capacity and readiness in accordance with the change in numbers and types of industry and potential risks.

<u>Community Health:</u>

Sanitation

- Provide sufficient infrastructure amenities and public health services for the industrial estate and township, for example accommodations, water and drinking water availability, solid wastes disposal and sewage treatment in order to reduce pressure on local authorities in servicing public.
- Technically support or collaborate with local authorities to enhance potentiality of communities in solid waste disposal by means of 3 R (Reduce, Reuse and Recycle).
- Distribute appropriate education materials for example health awareness, hygiene and sanitation.

Environmental/Communicable/Non-Communicable Diseases:

- Establish the buffer strip/zone to separate the township and industries to protect dwellers from pollutions emitted.
- Implement engineering preventive measures to install physical separation between industry and community, for example fence or tree plantation as buffer zone along the estate boundaries, and use of air modeling results and/or potential pollutions of each industry as the criteria for the distance between industries and affected community.
- With close collaboration with community health authorities, implement an integrated control strategy for environmental and occupational diseases, for example promoting immunization, eradicating disease reservoir and promoting healthy workplace.
- Provide worker health information to local government agencies.

- Set up a grievance procedure to manage complaints, if any.

Accidents/Fire/Chemical Leaks

- Invite representative of local emergency and securities services to participate in annual site inspections to ensure familiarity with the potential hazards present.
- Inform and communicate potential accidents and hazards of the project that may impact to community to local communities and relevant parties.
- Prepare and train workers and nearby communities to respond to accidents, including providing technical and financial resources in order to control and response such events effectively and safely, and provide periodic emergency response practice with communities.
- Revised or/and establish Emergency Response Plans in concordance with recent policy, law and regulation.

Adequacy and Readiness of Healthcare Services

- Promote collaboration with local authorities to enhance access of community to public health services, consider whether the capacity of the local health services sufficient for the worker family and support industries, and, if not sufficient, in close collaborating with local authorities support technical and financial resources to develop health service facility.
- Collaborate with local health authorities to provide relevant information and technical as well as financial resources to set up the public health and occupation health surveillance system.

(e) Description of Monitoring Program

MIE will keep monthly update of health and safety statistics and records. Performance of operation health and safety is monitored against a set benchmark. MIE to periodic inspect health and safety conditions of the industry.

(f) Work Plan (Duration)

Throughout the operation period.

(g) Responsible Organizations or Agency

MIE shall establish EHS Plan expanding necessary components as listed above. The EHS plan has to be communicated to the industries and that agreed safety indicators are established. MIE will be responsible for keeping all health and safety records submitted by the industries. MIE is responsible to assessing health and safety performance of the industrial estate against the set performance indicators. MIE is the party coordinating with local authorities on behalf of the project in the matter related to health and safety of the Initial Industrial Estate.

(h) Budget

Included in operation monitoring budget.

8.3.10 Employment and Training Program Plan

a) Principle and Rational

Development of the DSEZ Initial Industrial Estate will involve resttlement and social impacts i.e. living condition and income restoration. To assisted the PAPs and to promote work force base on local labour therefore, the project commit to employ 1 member of the Project Affected People and establish the training program and plan.

b) Objectives

To support the employment and employment opportunities.

c) Project Area

In the Project vicinity.

d) Description of Mitigation Measures

MIE to comply with IFC EHS General guideline/Laws and regulations in terms of the employee management and establish plan for implementation of the training program.

established plan for training programme and implement.

- Inform about project activities to community

e) Description of Monitoring Program

Ensure that relavant mitigation measures will be implemented.

f) Work Plan (Duration)

For the entired operation phase

g) Responsible Organizations or Agency

MIE

h) Budget

Included in operation budget

8.3.11 Public Participation and Dissemination

a) Principle and Rational

Public participation and information dissemination is apart environmental assessment process and sustainable development that will be result in economic, environmental and social values. General public idea about the project such as concerns of stakeholders, information and recommendation from public can be gathered through public meetings and social surveys which this information will be considered and can take accounted by MIE for further project management plans.

b) Objectives

To inform the stakeholders about the Initial Industrial Estate project, gain public views, concerns and values, increase public confidence, improve transparency and accountability in the EIA decision-making process.

c) Project Area / Stakeholders

Project operation area and impacted area with various level of government agencies, relevant and responsible agencies, project impacted people, media and dependent organizations.

d) Description of Mitigation Measures

MIE shall establish public relation and public participation plan to incorporate in requests and recommendation of the continuous engagement of stakeholders following

- Inform about project activities to community
- Support nearby community as appropriate to build good relationship with community
- Communicate to build community understanding about
  - Potential environmental impacts and mitigation measures
  - CSR activity
- Conduct by MIE consistent with the applicable standard for public meeting/consultation
- Disclose about project information and public relation activities through channels such as website, e-mails, meeting/visiting and local exhibition board or local media.
- Take account the results of the public consultation in improving and revised the EMPs.

e) Description of Monitoring Program

MIE will conduct public meeting or public relation e.g. using questionnaire or attitude survey for communities surrounded the Initial Industrial Estate Project within 5 km in radius of the project areas every 5 years. The result must be report and the method must achieve acceptable standard and been carried out with representative samples with confidence statistics.

f) Work Plan (Duration)

Every 5 years for the entire operation phase

g) Responsible Organizations or Agency

MIE as the project owner is ultimately responsible for this matter

h) Budget

Included in operation budget

8.3.12 Grievances Redress

a) Principle and Rational

For transparency and performance of the project in dealting with grieves that raise by communities and affected people. Grievance mechanism shall be implemented.

b) Objectives

To received grieves and complains from affected people or organization and manage the grieves effectively.

c) Project Area / Stakeholders

Project operation area and impacted area with project impacted people or impacted organizations.

d) Description of Mitigation Measures

MIE shall establish Grievance Redress Committee and Grievance Redress procedure to address any complaints / grieves to resolve / settle disputes that brought forward by community pertaining to project activities.

e) Description of Monitoring Program

Ensure that the grievance redress mechanism has been implemented. Complaints/grieves are systematically recorded and cases are settled.

f) Work Plan (Duration)

Every 5 years for the entire operation phase

g) Responsible Organizations or Agency

MIE as the project owner is ultimately responsile for this matter

h) Budget

Included in operation budget

Summary of the Environmental Management Plan (EMP) are shown in Table 8.3-5 to Table 8.4-3. It should be noted that the two EMPs prepared as part of this ESIA study are invariably framework plans as they are based on outline designs of the Project. They are therefore intended to prescribe requirements for the preparation of detailed CEMP and OEMP by the appointed EPC contractor (Contractor). Consequently, they could be considered and reffered to as the Project Proponent's or Owner's EMPs to distinguish them from the Contractor's EMP after the ESIA during project implementation. Nevertheless, it should be noted that the planning and development of the Project has been dynamic throughout the study period. This includes also the organization of the project and other relevant agencies. The information used as the based scenario is considered the most valid one at the time of the report preparation. Changes to the project information may occur overtime and, therefore, readers and project implementers are advised to review at the time of the implementation.

Table 8.3-5 Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
1. Physical resources		
1.1 Air quality	1. Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. 2. Clearing and grubbing to be done, just before the start of next activity on that site. In case of time gap, water should be sprinkled regularly till the start of next activity. 3. In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried out at regular intervals to prevent dust generation. 4. Embankment slopes to be covered with turf /stone pitching immediately after completion 5. Exhaust gas from construction vehicles are acceptable. However, all equipment and vehicles will need to be maintained in good mechanical conditions 6. Water shall be sprayed covering the access road and on every construction in order to control dust suppression the least 2 times/day (morning and afternoon) during dry season 7. Haulage truck must be covered or the aggregates sprayed with water before loading the haulage truck 8. Covered construction materials such as sand, gravel, cement by canvas 9. Foliage planting and cover cropping are very good mitigation for dust controlling that must be planted completely in the early period of construction phase especially buffer zone area of the initial industrial estate which adjacent to communities 10. Open burning of solid waste or any material is not permitted	Myandawei Industrial Estate Company Limited
1.2 Noise and vibration	1. The Contractor and Sub-contractor shall endeavor to keep noise generating activities to a minimum. 2. The Contractor and Sub-contractor shall restrict all operations that result in undue noise disturbance to local communities and/or dwellings (e.g. blasting, crushing, etc.) to daylight hours on weekdays or as otherwise agreed with the ER. 3. The Contractor and Sub-contractor shall warn any local communities and/or residents that could be disturbed by noise generating activities such as blasting well in advance and shall keep such activities to a minimum. 4. The Contractor and Sub-contractor shall be responsible for compliance with the relevant legislation with respect to noise. 5. Construction works within the distance of 500 m from villages and resettlement areas will be carried out between 06:00 to 18:00	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

Table 8.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	6. Avoid impact pile-driving where possible in vibration-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver causes lower vibration levels where the geological conditions permit their use 7. Construction workers exposed to noise levels of 80 dBA or more shall be provided with adequate hearing protection. 8. Regularly maintain engines, equipment machines and vehicles in good condition 9. Consider alternatives of construction method to reduce noise 10. Construction and haulage activities to be limited to daytime 11. Contractor must use equipment and machines that generate low noise levels 12. Install temporary noise barriers, if necessary	
1.3 Erosion/ Sedimentation Control	1. Embankment slopes to be covered, soon after completion 2. Next layer/activity to be planned, soon after completion of, clearing and grubbing, laying of embankment layer, sub grade layer, sub-base layer, scarification etc. 3. Top soil from borrow area, Debris disposal sites; borrow area, construction site to be protected/covered for soil erosion. 4. Debris due to excavation of foundation, dismantling of existing cross drainage structure will be removed from the water course immediately. 5. Diversions for bridges will be removed from the water course before the onset of monsoon. Any runnels or erosion channels developed during the construction or maintenance period shall be backfilled and compacted and the areas restored to a proper condition. 6. In areas where construction activities have been completed and where no further disturbance would take place, rehabilitation and re-vegetation should commence as soon as possible. 7. An assessment of the potential for contamination of natural waterways. Basic principles include the size of the disturbed area, site drainage, and waterways receiving storm water from the disturbed area 8. Sedimentation controls shall be implemented in the form of silt trap fences and sedimentation basins where be suit, and all runoff from the disturbed area shall be directed to the sediment controls 9. Measures to be taken to collect, store and treat storm water prior to discharge from the site considering options for water re-use onsite	Myandawei Industrial Estate Company Limited

Table 8.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	10. Management of material storage area – Stockpile and spoil disposal area shall not be located on drainage line 11. Control of erosion and sedimentation shall be constructed progressively prior to commencement of each stage of earthworks until the permanent protection is established	
1.4 Ground water and surface water	1. Construction work close to water bodies should be avoided. 2. Labor camps are to be located away from water bodies. 3. Car washing/workshops near water bodies are to be avoided 4. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course and ground are banned 5. Saving water sanitary wares such as faucet, flush toilet must be applied 6. “ Water is worth it ” need to be reminded all workers/sectors forward water saving 7. In case insufficient ground water quantity supply, the project must use other water source for tap water production to avoid water supply conflict	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor
2. Biological resources		
2.1 Terrestrial Biology	1. Only clear the area needed for construction of infrastructure and utility system. 2. Avoid disturbance of beach forest as much as possible. 3. Wherever possible, identify the endangered species and transfer them to safe locations prior to clearing the vegetation. 4. Hunting of wildlife is prohibited 5. Disturbance of forest areas outside the project area is prohibited.	Myandawei Industrial Estate Company Limited

Table 8.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
3. Human use values		
3.1 Water supply	1. Directly drain raw wastewater and/or used chemicals/oils/lubricants to ground are banned 2. Treated wastewater must be discharged to surface water course or recycled 3. Saving water sanitary wares such as faucet, flush toilet must be applied 4. “ Water is worth it “ need to be reminded all workers/sectors forward water saving 5. Pipeline of water supply must be regularly checked and immediately repaired for preventing of water leakage	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor
3.2 Wastewater treatment	1. Provide sufficient number of toilet and bathing facilities for labors, the contractors/subcontractors must not be allowed to establish worker camps outside PROJECT OWNER labor camp 2. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course are banned 3. Discharged treated wastewater to surface water must meet effluent standard of IEAT and/or related local regulations of Myanmar 4. Seepage unit/pit is not recommended for water pollution prevention 5. Consider alternatives for treated wastewater recycling such as watering trees 6. Provide sedimentation pond for sediments quantity reduction before run off water flow into surface water	Myandawei Industrial Estate Company Limited/ Contractor and Sub-contractor
3.3 Waste Management	1. Sorting waste must be regularly operated at construction site and labor camp 2. Solid waste must not be thrown away to surface water course or directly dumped on ground 3. Reuse and recycle waste buyers in Myanmar must be contacted in early stage of construction period and provide lists to factories 4. “Solid waste is worth ” must be promoted for labor awareness 5. landfill units need to design and operate as US EPA guidelines	Myandawei Industrial Estate Company Limited /Contractor and Sub-contractor

Table 8.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	6. Hazardous waste disposal in or off the construction site is strictly prohibited 7. Project owner must have a strict control system for construction waste disposal	
3.4 Transportation	1. All access roads in the construction area shall be signposted with the following information in Myanmese and English: – Speed limit; – Construction activities and machinery; – Roadside borrow pits and material stockpiles; – Any applicable load limit, particularly for temporary bridges; and – Road features that may affect driving conditions such as curves, hidden accesses etc. 2. A speed limit of 40 km/hr shall be applied in village areas and construction camps. Drivers shall be trained and notified of such limit; 3. Consider building speed humps before and after each village, where appropriate; 4. Route for heavy vehicles used for transportation of construction materials shall be designated. Route with least number of villages and residential area is most preferable; 5. Survey of the access roads to identify blind spots need to be regularly conducted. Improvement to the blind spots such as removal of obstructing objects when necessary; 6. Access road used for the construction activities shall be maintained in good conditions. 7. Roads should be kept free of construction debris. Debris, created as a result of construction, should be cleared timeously 8. Material shall be appropriately secured to ensure safe passage between destinations during transportation 9. Loads shall have appropriate cover to prevent them spilling from the vehicle during transit – The Contractor and Sub-contractor shall be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials.	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

Table 8.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	– Existing access routes should not be blocked or impeded by construction. If this is unavoidable, adequate prior planning should be implemented to ensure that safety and access to routes is maintained. 10. Construction vehicle may not be left overnight on or near to any environmentally sensitive area, or in a position where water runoff, in the event of rain, will cause a negative impact on the sensitive area	
3.5 Historical and Cultural Resources	1. Sites with historical and cultural values shall be identified, recorded and located in the map. This information shall be agreed upon by the local authorities and villagers. 2. If construction activities have to be carried out within 50 m from these sites, the leaders of the communities that the sites belong to need to be notified at least 1 week prior to commencement of the activities. 3. Establish a plan and communication channel in case an unidentified site is encountered during the construction work to avoid damage to the site. 4. Removal and relocation method and destination shall be a mutual agreement between PROJECT OWNER, local authorities, and the leader of the communities that the site belongs to.	Myandawei Industrial Estate Company Limited
4. Quality of life values		
4.1 Economic and social conditions	1. Facilitate in compensation and relocation process for all households in the project areas, prior to the commencement of any construction activities. 2. Consider hiring local workers with relevant skills to create incomes for local communities near the constructions areas. 3. Regularly, provide information related to progress of the Project activities during the construction phase.	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

Table 8.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
4.2 Occupational Health and Safety	1. Establish occupational and safety management plan and program for the construction should be established to assess and manage EHS impacts and risks. Project or activity-specific plans or procedures should be prepared and the basic site rules of work should be included. 2. Perform occupational accidents and disease recording and reporting, and investigate all incidents to understand the cause of accident and to identify measures necessary to prevent a recurrence. 3. Provide Contractor and Sub-contractor management plan to ensure that the Contractor and Sub-contractor will have safety performances and procedures to protect their employee. Supervise and monitor Contractor and Sub-contractor performance periodically. 4. Train and provide information to employees. Occupational health training program should be provided as needed, for example, hazard awareness, specific hazards and safe work practices, to ensure that workers are capable of work safely. 5. Provide appropriate personal protective devices to employee and ensuring that personal protective devices will be worn during working at all time. 6. Restrict local community to access the site or area using fencing, signage and risks communication. 7. Appropriately mark area signage and labeling of equipment, determine hazardous area, for example electrical rooms, compressor etc., as well as installations, materials and emergency exits, and label in accordance with international standards, and easily to understood by workers, visitors and general public. 8. Supervise and monitor performance of Contractor and Sub-contractors and sub-Contractor and Sub-contractors on housekeeping in the campsite. 9. Include training programs for workers with these following topics: health awareness, hygiene and sanitary, waste management, communicable and transmission diseases, cultural awareness, regulations and compliance, and drug abuse. 10. Register foreign or migrated workers should be seriously performed to ensure that these workers have medical and health certificates to guarantee their personal health conditions. 11. Conduct surveillance and active screening and treatment of workers. Immunization program may be required. 12. Establish emergency response plan and procedures which also should be in place for any remote sites. The plan must be update/ revised depend on changing of environmental condition.	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

Table 8.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	13. Provide appropriate emergency services and personnel to expedite emergency response when needed, maintain equipment facilities, fire-fighting equipment in good working order, accessible and adequate for the dimension and the basis use. 14. Provide health services and first-aid unit at all time, with comprehensive and appropriate equipment, establish the qualified the first-aid unit to properly handle with serious or trauma cases, and sufficient to meet the requirements, treat and/or patients to appropriate medical facilities in time. 15. Provide sufficient infrastructure amenities and public health services in the campsite, for example accommodations, water and drinking water availability, solid wastes disposal and sewage treatment. 16. In close collaboration with the community health authorities, implement an integrated control strategy for environmental and occupational diseases, such as integrated vector control programs, eliminating of breeding habitats in the campsite, and eradicating disease reservoirs. 17. Collaborate with community health authorities to enhance the worker families to access public health services, and promote immunization. 18. Distribute appropriate education materials for example health awareness, sexual transmission disease and communicable disease. 19. Consider the level of local fire fighting capacity to identify firefighting equipment that should be available when needed, and provide all necessary equipment with regular maintenance program. 20. Communicate potential accidents and/or hazards to local authorities, communities and relevant parties. 21. Conduct emergency response practices, including liaison with local response organizations and local responders. . 22. Provide the first aid unit at the campsite for their workers, assess whether the local health service capacity sufficient for worker's family and supporting industries, and in close collaborating with local authorities, consider supporting/additional health service facility.	
4.3 Community Health and sanitation	1. Camp rules shall be established and informed to all residences. The rules should contain the following components: a. Policy on alcohol and substance abuse; b. Safety measures and emergency response particularly in case of fire;	Myandawei Industrial Estate Company Limited /

Table 8.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	c. Waste management requirements; d. Other measures to prevent dissemination of vectors and transmissible disease including STDs and HIV/AIDs; 2. General areas of the camp shall be kept clean and tidy. Waste shall be collected regularly to avoid accumulation of waste in the camp; 3. Conduct emergency response practices, including liaison with local response organizations and local responders. 4. Revise or/and establish Emergency Response Plans that in concurrent with relevant policy, law and regulation. 5. Toilets shall be provided at a ratio of 1 toilet per 15 workers. All toilets shall be equipped with septic and treatment tanks of adequate size. The toilets need to be at least 100 m from any natural waterways. The pit shall be at least 1 km from any groundwater wells and is higher than groundwater table; 6. Proper drainage has to be provided. Improve areas with stagnant water as much as possible; and 7. Pest control measures shall be planned and implemented. All bedrooms need to be equipped with mosquito protection.	Contractor and Sub-contractor
5.Social and Information		
5.1 Public participation and dessimination	1. Establish *Public Relation and Public Participation Plan* to incorporate in requests and recommendation of the continuous engagement of stakeholders following: a. Inform about project activities to community b. Support nearby community as appropriate to build good relationship with community c. Communicate to build community understanding about - Construction activities and progress - Potential environmental impacts and mitigation measures d. Conduct by MIE consistent with the applicable standard for public meeting/consultation e. Take account the results of the public consultation in improving and revised EMPs 2. Disclose about project information, ESIA, Environmental Monitoring report and public relation activities through channels such as website, e-mails, meeting/visiting and local exhibition board or local media.	Myandawei Industrial Estate Company Limited

Table 8.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
5.2 Grievances redress	Establish *Grievance Redress Procedure* to address any complaints/ grieves to resolve/ settle disputes that brought forward by community pertaining to project activities.	Myandawei Industrial Estate Company Limited
6.Overall management		
6.1 Revise and reort	1. Revised Environmental Management Plan as necessary at every stage and submitted to DSEZMC and MONREC or since the type and number of invested industrial can be known in details. 2. Revised ESIA report and Emergency Response Plan depending on the changing in condition such fire hazard, safety from chemicals, flooding and earthquake and submitted to DSEZMC and MONREC. 3. Reporting on performance of basic infrastructure e.g. local roads, electricitity, water supply, safety and results of continuous public consultation in the monitoring reports that will carry out every 6 months and submitted to DSEZMC and MONREC.	Myandawei Industrial Estate Company Limited

Source: ESIA Study Team

Table 8.3-6 Environmental Mitigation Plan for Operation Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
1. Physical resources		
1.1 Air quality	1. Dust generation due to vehicle wheel will be reduced due to increased/widened paved surface. 2. Avenue plantation to be maintained, casualties to be replaced. 3. Avenue plantation includes species having dust absorption characteristic. 4. Community properties and realignment locations has been proposed for peripheral plantation and landscaping. 5. Maintenance of roads to be ensured. 6. With the reduction in journey time, idle engine running time air pollution will reduce. 7. Avenues plantation is proposed throughout the corridor, casualties to be replaced. 8. Avenue plantation includes species having air purifying characteristic. 9. Enforce Pollution Under Control (PUC) Programs. The public will be informed about the regulations on air pollution of vehicles. 10. Air pollution monitoring program has been devised for checking pollution level and suggesting remedial measures. 11. VOCs recovery system shall be equipped for the industries that or use solvents or have potential to release high amount of VOCs. 12. For combustion process, the Project would equip Dry Low NOx Burner in order to minimize Nitrogen Oxide This burner is automatic control system. 13. Periodically maintain and provide readiness, and Preventive Maintenance Program for equipment should be implemented. 14. Provision of installation and operation of Continuous Emission Monitoring System (CEMS) when hazardous and non-hazardous waste incinerators or concerned industries agree to set up a plant in the initial industrial estate project. 15. Continual collect data from the industries and update the numerical model when data from the CEMS is available or at the 3rd year of the operation, whichever comes first. Then runs updated model every year afterwards based on the actual measured data.	Myandawei Industrial Estate Company Limited

Table 8.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	16. Regularly check and maintenance various equipment, machines, and vehicles in good condition to minimize the exhaust emission 17. Plant trees around the project site boundaries and empty land to increase green area 18. Consider cleaner technology for alternative of production process 19. Promote awareness that fuel combustion caused global warming, energy saving is a rule 20. Provision of air pollution loading control system such as emitted pollutant loading and its control of each factory is necessary for industrial estate operator 21. Control emission loads of main air pollutants as mentioned ; – Emission rate of PM10 for stack sources shall be no greater than 0.0025 kg/ha/day. – Emission rate of NO2 for stack sources shall be no greater than 0.003125 kg/ha/day. – Emission rate of SO2 for stack sources shall be no greater than 0.0075 kg/ha/day. 22. Provide Continuous Emission Monitoring System (CEMS) for power plant and waste incinerators 23. Control emitted air quality from stacks of power plant and waste incinerators are giving standard 24. Measure emitted air quality from stacks regularly by ISO/IEC 17025 qualified laboratory (twice a year, dry and wet season) 25. Plan for emission of GHGs from the Project shall be established and/or revised in concurrently with the relevant policy and regulations.	
1.2 Noise and vibration	1. Maintenance of noise barriers need to be conducted. 2. Discouraging local people from establishing sensitive receptor near the road. 3. The public to be informed about the regulations on noise pollution. 4. Monitoring of noise pollution to be done regularly as per frequency and suggesting remedial measures. 5. Equipment and machine that generate high level of noise shall be installed in an enclosed building so that, when operated, noise level at the fence line of the industries do not exceed 70 dB(A).	Myandawei Industrial Estate Company Limited
1.3 Ground water and surface water	1. All industry facility in the industrial estate shall pretreat the wastewater to meet the acceptance criteria of the central wastewater treatment system. 2. A detention pond with a sufficient capacity to retain 2 day expected flow rate has to be constructed at each industry facility and at each Central Wastewater Treatment System as a buffer storage in case the treated wastewater fails to meet the effluent criteria. 3. Inside each industry facility, wastewater stream that requires chemical pretreatment shall be collected separately from other wastewater streams to minimize and use of chemical and increase efficiency of chemical pretreatment process. 4. Wastewater stream has to be separated from storm drain. Dilution of wastewater is not acceptable.	Myandawei Industrial Estate Company Limited

Table 8.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	5. An inspection manhole has to be installed at the point where the pretreated wastewater is discharged to the collection system of the industrial estate. 6. Warning and penalty system needs to be established for industry facility that fails to meet the acceptance criteria repeatedly. 7. Storm water retention system needs to be constructed to prevent surge of storm water discharge to the natural environment in case of large storm and to act as a buffer storage in case of spills into storm drainage system. 8. Thermal wastewater needs to be treated so that temperature at the edge of the mixing zone, or 100 m from the discharge point, is change from natural conditions by less than 3 Degree Celsius. 9. Recycling of wastewater should be promoted. Treated effluent should be used in the industrial estate wherever possible, such as for watering the green areas. 10. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course and ground are banned 11. Discharged treated wastewater to surface water must meet effluent standard of IEAT and/or related local regulations of Myanmar (except BOD that must be lower than 10 mg/l when zone C and/or D developed) 12. Water balance of each factory is need to be show PROJECT OWNER for update water consumption 13. Provide emergency holding pond, retreated system and emergency plan for over effluent standard treated wastewater storage 14. Regularly maintain equipment and machines of wastewater treatment plant in good condition 15. Provide stand by aerators and diesel engine generator at the wastewater treatment plant for emergency case 16. laboratory analysis of influent and effluent of Central Wastewater Treatment System should be regularly conducted 17. Raw wastewater must be discharged to wastewater collection system for treating to meet effluent standard 18. Ground water application of factories to be water supply in factories is prohibited	
2. Biological resources		
2.1 Terrestrial Ecology	1. Wherever possible, conserve the existing trees, particularly in the green areas, 2. Encourage the manufacturers to conserve the existing trees in the design of their facilities. 3. Select local species if plantation in the project area is needed. 4. Coordinate with local authorities and engage local communities for reforestation projects surrounding the project area. 5. Discourage and educate the workers in the industrial estate against wildlife consumption to reduce demand and indirect impacts to the wildlife in reserved forests elsewhere outside the project area.	Myandawei Industrial Estate Company Limited

Table 8.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
3. Human use values		
3.1 Water supply from central water treatment plant (WTP)	1. Directly drain raw wastewater and/or used chemicals/oils/lubricants to ground or surface water course are banned 2. Ground water application of factories to be water supply in factories is prohibited 3. Saving water sanitary wares such as faucet, flush toilet must be applied 4. "Water is worth it " need to be reminded all workers/sectors forward water saving industries 5. Pipeline of water supply must be regularly checked and immediately repaired for preventing of water leakage 6. Cleaner technology for production processes especially water saving machines/equipment must be first alternative for investors 7. Reusing and recycling of treated wastewater must be promoted and awarded 8. Application of raw water source must be accepted by local communities to avoid water supply conflict and project ban 9. Laboratory analysis of product water or tap water should be conducted regularly 10. Surveillance of Trihalomethane (THM) compounds in product water or tap water is recommended 11. Transportation of chlorine gas and other chemicals must be under UN recommendation on the transport of dangerous goods and ASEAN Framework Agreement on Facilitation of Goods in Transit 12. Chemicals storage safety OSHA requirements should be conducted	Myandawei Industrial Estate Company Limited
3.2 Wastewater treatment	1. The discharged of untreated wastewater into the receiving water is strictly prohibited at all time 2. Emergency plan for operation of wastewater treatment should be established to prevent untreated wastewater or over standard effluent discharged into the receiving water 3. Regularly check and maintain wastewater treatment plant to control the treated wastewater quality, at least as required effluent from Dawei Industrial Estate's Wastewater Treatment System especially BOD must be less than mentioned values for minimizing the impact to surface water and sediment qualities. 4. Installation of online monitoring system for flow measurement of both influent and effluent and BOD concentration of the effluent 5. Regularly maintain equipment and machines of wastewater treatment plant in good condition 6. Provide stand by aerators and diesel engine generator at the wastewater treatment plant for emergency case 7. Discharged treated wastewater to surface water must meet effluent standard of IEAT (except BOD that must be lower than 10 mg/l when zone C and/or D developed) 8. Consider alternatives for treated wastewater reusing and recycling such as watering trees, raw water for some production process 9. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course and ground are banned 10. laboratory analysis of influent and effluent of central wastewater treatment plant should be regularly conducted	Myandawei Industrial Estate Company Limited

Table 8.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
3.3 Waste management	<u>Before Completion of Waste Management Facility</u> 1. Classify hazardous and non-hazardous waste according to the definitions in the Waste Management Plan prepared during the construction phase. 2. The Dawei SEZ Initial Industrial Estate Project will provide sanitary landfill for disposal of non-hazardous waste generated from the Industrial Estate area. 3. Design and construction of the landfill shall be in accordance with Solid Waste Disposal Facility Criteria – Technical Manual published by U.S. EPA (1993) or other applicable standards. 4. Detailed hydrogeological condition of the proposed landfill area has to be studied in the design of landfill. 5. Groundwater monitoring wells will be installed. As a minimum, 1 well is to be installed up gradient of the landfill and at least 1 well is to be installed down gradient of the land fill. Depth of screens and well construction depends on the results from the hydrogeological condition study. 6. Hazardous waste will be temporarily stored until the hazardous waste stabilization and disposal system at the waste management system is functional. Minimum requirements of the temporary hazardous waste storage areas include: – Impervious floor without cracks or spaces that may allow spills to perforate into the ground; – Surrounded by secondary containment bunds. The secondary containment bunds shall be at least 0.5 m high with a volume large enough to contain the spill of the largest container expected in the storage area; – Designate storage area for liquids or materials that are not allowed to be mixed, such as acids and alkalis; – Equipped with spill response kits; – Consider providing the area with roofing and temporary walls with a provision that the temporary hazardous waste storage area will have to be in use for at least 3 years until the permanent hazardous waste management facilities of the industrial estate are functional. 7. Type and quantity of hazardous waste in the storage area shall be recorded and kept current. 8. The landfill shall be closed daily to prevent vectors and odors. 9. Workers need to be trained of Waste Management Plan. 10. When the permanent waste management facility is operational, evaluate options of permanent closure of the landfill site or moving the waste material in the landfill to the permanent facility. 11. Concept of 3 Rs (Reduce, Reuse, Recycle) must be promoted and awarded 12. Open burning is not permitted 13. Landfill site must be constructed above the record flooding level 14. Controlling vector populations that having capability of transmitting disease to humans 15. Control public access to prevent illegal dumping	Myandawei Industrial Estate Company Limited

Table 8.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	16. Build and maintain a control system designed to prevent surface water run-off and storm waters from running on the active part of the landfill <u>After Completion of Waste Management Facility</u> 1. The components of the waste management facility: i.e. sanitary landfill, secured landfill, and incinerator, shall be designed and constructed according to the internationally accepted standards. 2. Detailed hydrogeological condition of the proposed landfill area has to be studied in the design of landfill. 3. Groundwater monitoring wells will be installed. Location and number of groundwater monitoring wells depends on the results of the study and the layout of the facility. Depth of screens and well construction depends on the results from the hydrogeological condition study. 4. All hazardous and non-hazardous waste generated by the industries in the estate shall be transferred to the facility for disposal. 5. Waste manifest system has to be created and implemented. 6. The facility shall create its Standard Operating Procedure (SOP) covering steps from receiving waste, laboratory analysis, stabilization, temporary storage, incineration, and disposal. Audit by third party is necessary. 7. Workers need to be trained of Waste Management Plan. 8. Record of type of waste including its quantity and origins shall be kept in the data base of PROJECT OWNER. This knowledge can be used in promoting material and waste flow management between industries within the industrial estate. 9. Dioxin is need to be measured, when incinerator is operated 10. Methane gas produced from landfill site and other treatment unit must be flared 11. Cover disposed solid waste with at least 6 inches of earthen material at the end of each operating day to control vectors, fires, odors, blowing litters and scavenging. An alternative cover material or temporary cover sheet is allowed, if local climate conditions make such a requirement impractical. 12. Open burning of waste is not permitted 13. Controlling vector populations that having capability of transmitting disease to humans 14. Control public access to prevent illegal dumping 15. Build and maintain a control system designed to prevent surface water run-off and storm waters from running on the active part of the landfill	
3.4 Land Use	<u>Special Plan and Buffer Zone</u> 1. A special specific area plan is needed to control the land use adjacent to the project. The plan must be legitimate and authorized by the state. 2. The buffer zone all around the Industrial Estate boundaries should be set up to control and prevent any uses other than agriculture and forest	Myandawei Industrial Estate Company Limited / MC's Authorized Agency

Table 8.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	Setting up a management committee overseeing the project land use. 1. A team or committee should be set up to monitor and manage activities and structures built in and around the project 2. The team should have legitimate authority to control the areas adjacent or nearby, though outside the estate boundaries. Transportation and Infrastructure Outside the Industrial Estate Area The infrastructure of the Industrial Estate will be enable setting up structures and services, such as, local roads, electricity, water supply, and drainage, should be also well planned and controlled. Enforcement The proposed set-up land use management committee/team should have duty to regularly monitor land use activities outside and inside the project as the development progresses.	
4. Quality of life values		
4.1 Economic and social conditions	1. Facilitate and support community development initiatives. 2. Provide special training programs for local communities to have skills required to work in Initial Industrial Zones. 3. Consider hiring local workers to create incomes and/or special benefits to local communities near the Initial Industrial Zones. 4. Establish the Unit under the Initial Industrial Zone, to handle public consultation, information disclosure, and grievance redress mechanisms, both formally and informally.	Myandawei Industrial Estate Company Limited
4.2 Occupational Health and Safety	Accidents and Injuries 1. Provide the environmental health and safety management system and programs for the whole industrial estate. 2. Request for each individual industry to provide proper and capable to manage occupational health and safety issues to protect health and safety of workers and public 3. Establish occupational health and safety management plans and programs to assess and manage EHS impacts and risks which are based on comprehensive job safety analyses. 4. Include the following issues in the occupational health and safety management system: – Accident investigation, recording and reporting	Myandawei Industrial Estate Company Limited

Table 8.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	– Surveillance of the working environment and worker health – Training and hazard communication – Monitoring and auditing procedures to evaluate the effectiveness of prevention and control measures. 5. Perform occupational accidents and disease recording and reporting, investigate all incidents to understand the cause of accident and to identify measures necessary to prevent a recurrence. 6. Provide provisions for Contractor and Sub-contractor to ensure that the Contractor and Sub-contractor will have safety procedures to protect their employees, and periodically monitor Contractor and Sub-contractor performance. 7. Restrict access into site or area including fencing, signage and communication of risks to local community, appropriately provide area signage and labeling of equipment in accordance with international standards and easily to understand by workers, visitors and general public. 8. Promote traffic safety programs to all personnel, for examples: – Specifying limits for trip duration – Improving driving skill – Use of speed control devices Occupational, Sexual Transmission and Communicable Diseases: 1. Conduct surveillance and active screening and treatment of workers. Immunization program may be required. 2. Register foreign or migrated workers to ensure that these workers have medical and health certificates to guarantee their personal health conditions. 3. Provide training programs for workers in these following topics: health awareness, and promote health protection strategies including encouraging condom use. 4. Perform periodic worker health checks in accordance with the potential risks. Fire, Explosion, Chemical Leaks and Major Hazards: 1. Conduct major hazard assessment of each specified industry prior establishment in order to identify buffer zone/strips or other physical separation methods to protect public from any potential hazards. 2. Provide comprehensive emergency preparedness and response plan and procedures covering fire, explosion, chemical Leaks and major hazards control. The plan must be update/ revised depend on changing of environmental condition.	

Table 8.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	3. Provide appropriate emergency services and personnel to execute emergency response when needed, and maintain equipment facilities, fire-fighting equipment in good working order, accessible and adequate for the dimension and the basis use. 4. Establish fire safety system using appropriate prescriptive standards regarding with type and number of industries, and revise fire risk management periodically to ensure its capability to cope with all the potential hazards. 5. Perform mutual aid agreements among the industries in the industrial estate as well as local authorities to provide a clear basis for response to share personnel and specialized equipment. 6. Conduct annual training and updating emergency preparedness and response plan to account for changes in equipment, personnel and facilities. 7. Revised or/and establish Emergency Response Plans in concordance with recent policy, law and regulation Adequacy and Readiness of Healthcare Services 1. Establish the hospital and periodically evaluate in terms of adequacy, capacity and readiness in accordance with the change in numbers and types of industry and potential risks.	
4.3 Community Health	Sanitation 1. Provide sufficient infrastructure amenities and public health services for the industrial estate and township, for example accommodations, water and drinking water availability, solid wastes disposal and sewage treatment in order to reduce pressure on local authorities in servicing public. 2. Technically support or collaborate with local authorities to enhance potentiality of communities in solid waste disposal by means of 3 R (Reduce, Reuse and Recycle). 3. Distribute appropriate education materials for example health awareness, hygiene and sanitation. Environmental/Communicable/Non-Communicable Diseases: 1. Establish the buffer strip/zone to separate the township and industries to protect dwellers from pollutions emitted. 2. Implement engineering preventive measures to install physical separation between industry and community, for example fence or tree plantation as buffer zone along the estate boundaries, and use of air modeling results and/or potential pollutions of each industry as the criteria for the distance between industries and affected community. 3. With close collaboration with community health authorities, implement an integrated control strategy for environmental and occupational diseases, for example promoting immunization, eradicating disease reservoir and promoting healthy workplace. 4. Provide worker health information to local government agencies. 5. Set up a grievance procedure to manage complaints, if any.	Myandawei Industrial Estate Company Limited

Table 8.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	Accidents/Fire/Chemical Leaks 1. Invite representative of local emergency and securities services to participate in annual site inspections to ensure familiarity with the potential hazards present. 2. Inform and communicate potential accidents and hazards of the project that may impact to community to local communities and relevant parties. 3. Prepare and train workers and nearby communities to respond to accidents, including providing technical and financial resources in order to control and response such events effectively and safely, and provide periodic emergency response practice with communities. Adequacy and Readiness of Healthcare Services 1. Promote collaboration with local authorities to enhance access of community to public health services, consider whether the capacity of the local health services sufficient for the worker family and support industries, and, if not sufficient, in close collaborating with local authorities support technical and financial resources to develop health service facility. 2. Collaborate with local health authorities to provide relevant information and technical as well as financial resources to set up the public health and occupation health surveillance system.	
5.Social and Information		
5.1 Employment and training program	Comply with IFC EHS General guideline/Laws and regulations in terms of the employee management and established plan for training programme and implement.	Myandawei Industrial Estate Company Limited
5.2 Public participation and dessimination	1. Establish *Public Relation and Public Participation Plan* to incorporate in requests and recommendation of the continuous engagement of stakeholders following: a. Inform about project activities to community b. Support nearby community as appropriate to build good relationship with community c. Communicate to build community understanding about - Potential environmental impacts and mitigation measures - CSR activity	Myandawei Industrial Estate Company Limited

Table 8.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	d. Conduct by MIE consistent with the applicable standard for public meeting/consultation e. Take account the results of the public consultation in improving and revised EMPs 2. Disclose about project information and public relation activities through channels such as website,e-mails, meeting/visiting and local exhibition board or local media.	
5.3 Grievances redress	1. Establish *Grievance Redress Procedure* to address any complaints/ grieves to resolve/ settle disputes that brought forward by community pertaining to project activities.	Myandawei Industrial Estate Company Limited
6. Overall management		
6.1 Revise and report	1. Revised Environmental Management Plan as necessary at every stage and submitted to DSEZMC and MONREC or since the type and number of invested industrial can be known in details. 2. Revised ESIA report and Emergency Response Plan depending on the changing in condition such fire hazard, safety from chemicals, flooding and earthquake and submitted to DSEZMC and MONREC 3. Reporting on performance of basic infrastructure e.g. local roads, electricitity, water supply, safety and results of continuous public consultation in the monitoring reports that will carry out every 6 months and submitted to DSEZMC and MONREC	Myandawei Industrial Estate Company Limited

Source: ESIA Study Team

8.4 ENVIRONMENTAL MONITORING PLAN

As part of the action plans, the environmental monitoring plans including monitioring iterms, location, frequency, and responsibible organization at the pre-construction phase, construction phase, and operation phase are prescribed in details once in the previous sections, *Section 8.2* and *Section 8.3.*

The EMoP for pre-construction phase is summarized in Table 8.4-1. Responsible organizations shall review the monitoring plan in accordance with the progress of the Project and status of the situation before monitoring, if necessary, and implement monitorin activities and preparation of monitoring report onits results. The project proponent will submit the moitoring report at three phases to DSEZMC.

Table 8.4-1 Monitoring Pan for Pre-Construciton Phase

Category	Item	Location	Frequency	Responsible Organization
Common	- Checking and revising the Environmental Mitigation (as shown in Table , , and) and Management Plan by reviewing the final detailed design of the Project - Checking the Envoronmental Monitoring Plan during Construction prepared by Contractor/Sub-Contractor	Project site	Once	Contractor/Sub-Contractor
Social Environment -Involuntary Resettlemetn -Restoration -Vulnerable Group Cultural Heritage/Asset	- Monitoring the implementation status of Resettlement works such as provision of assistance pakage for PAPs and common assets.	Project site And Relocation Site	Once	DSEZMC
	- Monitoring of the implementation status for CSR activities such as community support program	Arouond Project site	Once/year	DSEZMC

Source: EIA Study Team

During construction phase, mitigation meausres in each location, as shown in Table 8.5-1 will be monitored once per month by Contractor or Sub-Contractor. Summary of EMoP for construction phase and operation phase is presented in Table 8.4-2 and Table 8.4-3, respectively.

Table 8.4-2 Monitoring Plan for Construction Phase

	Positions	**Number**	**Estimated Budgets/Year (USD)**
Staff	1. Environmental Health and Safety (EHS) Manager	**1**	55,200
	2. Environmental Supervisor	**1**	30,000
	- Staff	**3**	64,800
	3. Health and Safety Supervisor	**1**	37,200
	- Staff	**2**	43,200
Total Staff Estimated Budgets/Year			**230,400**

Environmental Aspect	**Inspection Issues and Monitoring Parameters**	**Method of Analysis**	**Location**	**Frequency**	**Responsibilities**	**Estimated Budgets (USD)**
1. Air Quality	Surveillance of ambient air quality should be carried out as follows; **Parameters:** - TSP average 24 hours, - PM10 average 24 hours, - Wind speed and Wind direction, - Temperature	- TSP by Gravimetric-High Volume - PM-10 by Gravimetric-High Volume or equivalent to U.S EPA or method determined by Government Authority - Temperature, Wind Speed and Wind Direction by Thermometer and Metering Device	- Yalai village (during zone A2 and A3 construction period) - Ekani village (during zone D construction period)	5 Consecutive days, including weekend/holiday and weekdays Every 6 months	Project Owner	4,000/year

Table 8.4-2 Monitoring Plan for Construction Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
2. Noise	Surveillance of noise level should be carried out as follows; **Parameters:** - Leq 24 hours - Ldn - Lmax - L90	- Integrated Sound Level (International Electrotechnical Commission ; IEC 61672-1, 61672-2)	- Yalai village (during zone A2 and A3 construction period) - Ekani village (during zone D construction period)	5 Consecutive days, including weekend/holiday and weekdays Every 6 months	Project Owner	2,000/year
3. Surface Water Quality	**Parameter:** - Depth/ Width, - Temperature, - Flow Rate, - pH, - Salinity, - Electrical Conductivity, - Dissolved Oxygen (DO), - Biochemical Oxygen Demand (BOD), - Turbidity, - Chemical Oxygen Demand (COD), - Total Suspended Solids (TSS), - Total Dissolved Solids (TDS),	- APHA, AWWA and WEF. Standard Methods for the Examination of Water and Wastewater. 22nd ed. Washington, DC: APHA. 2012.	Dawei and Kunchaung Rivers for 10 Stations :	Twice a year, (dry and wet season)	Project Owner	50,000/year

Table 8.4-2 Monitoring Plan for Construction Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	- Nitrate-Nitrogen, - Ammonia-Nitrogen, - Phosphate –Phosphorus, - TKN, - Oil &Grease, - Phenol, - Total Coliform Bacteria (TCB), - Fecal Coliform Bacteria (FCB),					
4 Ground water quality	Laboratory analysis of ground water at site and nearby village should be carried out **Parameters:** - pH, - Turbidity, - Electrical Conductivity, - Total Dissolved Solids (TDS), - Total Suspended Solids (TSS), - Fluoride, - Iron, - Cyanide, - Total Hardness,	- APHA, AWWA and WEF. Standard Methods for the Examination of Water and Wastewater. 22nd ed. Washington, DC: APHA. 2012.	4 Locations: - 2 Monitoring wells at the Landfill unit - 2 Wells at Yalai village (if still exist) and Ekani village	Twice a year, (dry and wet season)	Project Owner	30,000/year

Table 8.4-2 Monitoring Plan for Construction Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	- Non carbonate hardness, - Sulfate, - Nitrate-Nitrogen, - Heavy Metals • Manganese (Mn), • Cadmium (Cd), • Hexavalent Chromium (Cr^{+6}), • Arsenic (As), • Lead (Pb), • Zinc (Zn), • Mercury (Hg), • Nickel (Ni), • Copper (Cu), • Selenium (Se), - Total Coliform Bacteria (TCB), - E.Coli					
Site Audit			Construction Areas	Every 6 months	Project Owner	7,000/year
Report Preparation				Every 6 months	Project Owner	12,000/year

Table 8.4-3 Monitoring Plan for Operation Phase

	Positions	Number	Estimated Budgets/Year (USD)
Staff	1. Environmental Health and Safety (EHS) Manager	**1**	55,200
	2. Environmental Supervisor	**1**	30,000
	- Staff	**3**	64,800
	3. Health and Safety Supervisor	**1**	37,200
	- Staff	**2**	43,200
Total Staff Estimated Budgets/Year			**230,400**

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
1. **Air quality**						
1.1 Ambient air quality	**Parameter:** - SO2 average 1 and 24-hour - NOx as NO2 average 1 hour - TSP average 24-hour - PM10 average 24-hour, - PM2.5 average 24-hour, - Wind Speed and Wind direction - Temperature	- SO_2 by UV-Fluorescence - NO_2 by Chemiluminescence - TSP by Gravimetric-High Volume - PM-10 and 2.5 by Gravimetric-High Volume or equivalent to U.S EPA or method determined by Government Authority - Temperature, Wind Speed and Wind Direction by Thermometer and Metering Device	- Building management or Township - Yalai village (if still exist) - Ekani village	5 Consecutive days, including weekend/holiday and weekdays Every 6 months	Project Owner	12,000/year

Table 8.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
1.2. Stacks emission	**Parameter:** - SO_2 average 1 and 24-hour - NOx as NO_2 average 1 and 24-hour - TSP average 1 and 24-hour - CO average 1 and 24-hour - Dioxin average 1 and 24-hour	- SO_2 by US.EPA method 6 or US.EPA method 8 - NOx as NO_2: US.EPA method7 - TSP by US.EPA method 5 - CO by US.EPA method 10 - Dioxin by US EPA method 23	Stacks of factories and waste incinerators	Every 6 months	Project Owner	20,000/stack/ year
2 Noise	**Parameters:** - Leq 24 hours - Ldn - Lmax - L90	- Integrated Sound Level (International Electrotechnical Commission; IEC 61672-1, 61672-2)	-Building management or Township -Yalai village (if still exist) **-** Ekani village (when zone D operated)	5 Consecutive days, including weekend/holiday and weekdays Every 6 months	Project Owner	2,000/year

Table 8.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
3 Surface Water Quality and Aquatic Ecology	**Parameter:** - Depth/ Width, - Temperature, - Flow Rate, - pH, - Salinity, - Electrical Conductivity, - Dissolved Oxygen (DO), - Biochemical Oxygen Demand (BOD), - Turbidity, - Chemical Oxygen Demand (COD), - Total Suspended Solids (TSS), - Total Dissolved Solids (TDS), - Nitrate-Nitrogen, - Ammonia-Nitrogen, - Phosphate –Phosphorus, - TKN, - Oil &Grease, - Phenol, - Heavy Metals	- APHA, AWWA and WEF. Standard Methods for the Examination of Water and Wastewater. 22nd ed. Washington, DC: APHA. 2012.	Dawei and Kunchaung Rivers 10-Station:	Twice a year, (dry and wet season)	Project Owner	50,000/year

Table 8.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	• Manganese (Mn), • Cadmium (Cd), • Hexavalent Chromium (Cr^{+6}), • Lead (Pb), • Zinc (Zn), • Nickel (Ni), • Copper (Cu), • Cyanide (as HCN), • Arsenic (As), • Total Mercury, - Total Coliform Bacteria (TCB), - Fecal Coliform Bacteria (FCB), - E.Col					
4 Sediment Quality	**<u>Parameter:</u>** - Particle size, - Oil and Grease, - Heavy Metals • Arsenic (As), • Cadmium (Cd),	- US EPA SW-846 Method.	Dawei and Kunchaung Rivers 10-Station:	Twice a year, (dry and wet season)	Project Owner	25,000/year

Table 8.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	• Total Chromium, • Copper (Cu), • Mercury (Hg), • Nickel (Ni), • Lead (Pb), • Zinc (Zn)					
5 Ground water quality	Laboratory analysis of ground water at site and nearby village should be carried out **Parameters:** - pH, - Turbidity, - Electrical Conductivity, - Total Dissolved Solids (TDS), - Total Suspended Solids (TSS), - Fluoride, - Iron, - Cyanide, - Total Hardness,	- APHA, AWWA and WEF. Standard Methods for the Examination of Water and Wastewater. 22nd ed. Washington, DC: APHA. 2012.	4 Locations: - 2 Monitoring wells at the Landfill site - 2 Wells at Yalai village (if still exist) and Ekani village	Twice a year, (dry and wet season)	Project Owner	30,000/year

Table 8.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	- Non carbonate hardness, - Sulfate, - Nitrate-Nitrogen, - Heavy Metals • Manganese (Mn), • Cadmium (Cd), • Hexavalent Chromium (Cr^{+6}), • Arsenic (As), • Lead (Pb), • Zinc (Zn), • Mercury (Hg), • Nickel (Ni), • Copper (Cu), • Selenium (Se), - Total Coliform Bacteria (TCB), - E.Coli					

Table 8.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
6 Wastewater Treatment	Laboratory analysis of effluent of each central wastewater treatment plant should be carried out Parameter: - pH, - Temperature, - Color /Odor, - Dissolved Oxygen (DO), - Biochemical Oxygen Demand (BOD), - Chemical Oxygen Demand (COD), - Total Suspended Solids (TSS), - Total Dissolved Solids (TDS), - TKN, - Oil &Grease, - Sulfide as H_2S, - Cyanide as HCN, - Formaldehyde, - Phenol Compound,	APHA, AWWA and WEF. Standard Methods for the Examination of Water and Wastewater. 22nd ed. Washington, DC: APHA. 2012.	Effluent discharged point(s)	Every 6 months	Project Owner	1,500/station/ year

Table 8.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	- Free Chlorine, - Pesticide, - Heavy Metals • Total Mercury (Hg), • Selenium (Se), • Cadmium (Cd), • Lead (Pb), • Arsenic (As), • Hexavalent Chromium (Cr^{+6}), • Barium (Ba) • Nickel (Ni), • Copper (Cu), • Zinc (Zn), • Manganese (Mn),					
Site Audit			Project Areas	Every 6 months	Project Owner	7,000/year
Report Preparation				Every 6 months	Project Owner	12,000/year

Source: ESIA Study Team

8.5 BUDGET FOR THE ENVIRONMENTAL MANAGEMENT AND MONITORING

This section describes the budget plans for the environmental management and environmental monitoring by the Project Proponent.

On the other hand, the tenants will take necessary environmental mitigation measures and its expense for the environmental management not only at the construction and operation phases but also at the cosling , termnation, and after termination phases in accordance with their EIA/IEE studies. However, the budget plan for environmental management of each work cannot be estimated at this stage becuas ther is nocertain information on industrial sections of tenants.

8.5.1 Budget Plan for Environmental Management

Most of the mitigation meausrea such as construction of retention ponds, polishing ponds, centrialized wastewater treatment plant, plans and trainings are already included in the project cost.

8.5.2 Budget Plan for Environmental Monitoring

In terms of the budget for environmental monitoring before/during construction and opertaiton phases, main monitoring cost is a cost for field measurements such as airquality, water, and quality noise. Annual costs for field measuremetns in the construction phase by constractor in the operation phase by the Project Proponent are estimated, repcitvely, as show in Table 8.5-1.

Table 8.5-1 Estimated Annual Costs for Monitoring in the Construction and Operation Phases

Phase	Monitoring Items	Implementing Organization	Expected Cost	Remarks
Construction Phase	Air Quality, Noise and Vibration, Surface water Quality and Grounwater Quality	Contractor	USD 105,000 /Year	Not included staff cost
Operation Phase	Air Quality, Noise and Vibration, Surface water Quality, Grounwater and Sediment quality	Project Proponent	USD 160,000/Year	Not included stack emission and wastewater treatment per station and staff cost

Remarks: Budget is estimated as of May, 2017

Source: EIA Study Team

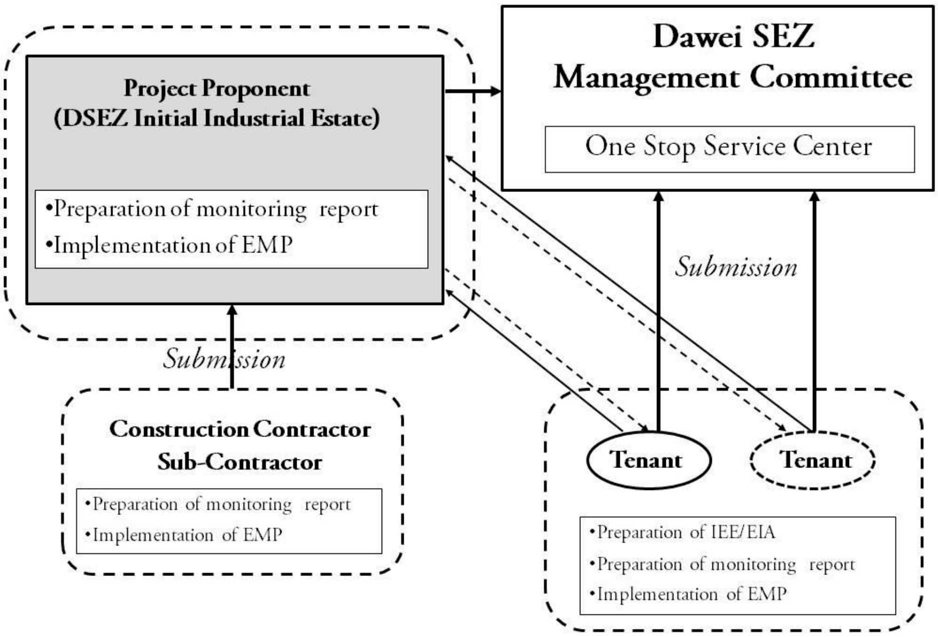
8.6 IMPLEMENTATION SCHEDULE

The implementation schedule as of May 2017 of the pre-construction, construction, and operation phases of the Dawei Initial Industrial Estate development project is as follows:

1) Pre-construction period : from 2017 to get aprpval of ESIA and land lease agreement
2) Construction period: 24 months after get approval of ESIA and land lease agreement, depend on demand basis.
3) Operation period: 75 years (Maximum)

8.7 INSTITUTIONAL ARRANGMENT

The organization structure for the operation and management of environmental monitoring is shown in Figure 8.7-1.



Source: EIA Study Team

Figure 8.7-1 Organizational Structure for EMP and EMoP of the Project during operation phase

8.7.1 Governing Bodies

According to the Myanmar Special Economic Zone Law (2014), there are 3 levels of government agencies directly associated with MIE:

- Central Body
- Central Working Body
- Dawei Special Economic Zone Management Committee (DSEZMC)

The Central Body (CB) consists of members from ministries and government departments as assigned by the Government of Myanmar. CB is a policy making level among the three organizations. The duties of CB include reviewing proposals for development of a Special Economic Zone, determining type business, and other financial and taxes related matter. It reports to the Government of Myanmar. The Central Body is responsible to forming and assigning detailed duties to the Central Working Body (CWB) and Dawei Special Economic Zone Management Committee (DSEZMC).

Central Working Body (CWB) assists CB in reviewing the Special Economic Zone plan, determining of appropriate category of investment, and advising CB on matters regarding administration, management, and legal issues in the Special Economic Zone. CWB reports to CB.

DSEZMC is the implementation of the governing bodies. One of the key duties of DSEZMC is supervising and inspecting the matters on implementation of investment plans and other matters including land use, environmental conservation, waste control, health, education, finance and taxation, transport, communication, security, electricity, energy and water supply etc. DSEZMC reports to both CB and CWB.

8.7.2 Project proponent

The Project Proponent will be in charge of the overall opertation of the DSEZ Initial Industrial Estate area. During the construction, the Project Propoent will implement, EMP and EMoP as stated in this ESIA report and almost by through construction contractors and sub contractors.

The Project Proponent will also formulate the internal regulations for the Initial Industrial area that stipulates several obligations such as effluent standards of wastewater and air, noise standard, and regulation of protective controls to the tenants.

The Project Proponent will assit tanents for environmental assessment and submit the monitoring report based on the results of implementation of EMP and EMoP for the Initial Industrial Estate development.

Main tasks for environmental and social consideration in the Project are managed by Environment, Safety and Health section and / or Community relation division in Table 8.7-1.

Table 8.7-1 Main Tasks for Environmental and Social Consideration in DSEZ Initial Industrial Estate

Division/Section	Main Tasks
Environment, Safety and Health section	1) Assisting tenants in the environmental assessment of factory development as follows: - Providing information on environmental regulations and location consultants - Facilitating communication with DSEZMC for environmental and social issues. 2) Monitoring the DSEZ Initial Industrial Estate area operations according to EMP and EMoP 3) Submitting environmental monitioring reports to DSEZMC
Community relation division	1) Grievance Adjustment - Handling complains/ claims/ requests from community and its response as necessary - Coordinaitng between tenant and community for grievance adjustment 2) Planning and implementation of CSR activities 3) Consultation with tanents related to community relation 4) Job matching and assistance

Source: EIA Study Team

8.7.2.1 Construction Contractor and Sub-Contractor

Construction Contractor and Sub-Contractors (CC) refer to the Contractors for development of Dawei Initial Industrial Estate, which include constructions of utility systems i.e. water treatment and distribution system, wastewater collection and treatment system, irrigation system, electricity generation and distribution system, solid and hazardous waste management facilities, internal roads, and basic infrastructure etc. They do not include the construction of tanents or an individual factory or manufacturing.

CC must operate in accordance with the mitigation measures stipulated in this ESIA report. CC must report to the Project Proponent. Responsibilities of CC during construction phase include:

- Implement environmental mitigation measures for the construction activities and work camps as required by the Project Proponent;
- Liaise and coordinate with the Project Proponent on matters related to environment and public consultation; and
- Develop emergency response plan and establish emergency response capability for construction phase, which may include accidents, fire and first aid and medical evacuation.

8.7.2.2 Factories / Manufacturers

The factories / manufacturers refer to the investors build and operate their facilities in the industrial estate. Responsibilities of the factories / manufacturers, which will be during the operating phase, include:

- Implement EMP and EMoP for each business and submit the environmental monitoring report to DSEZMC and the Project Proponent base on its IEE/EIA. Comply with environmental requirements of MIE during construction and operation of their facility.

8.8 PROJECT POLICY AND MITIGATION MEASURES COMMITMENTS

8.8.1 Policy

The Project Proponent refers to Myandawei Industrial Estate (Myanmar) (MIE), which falls under the category of '*Developer*' according to Myanmar Special Economic Zone Law (2015). Roles of the Project Proponent include design, construction, and operation of infrastructure and amenities in the Dawei Initial Industrial Estate. MIE will be responsible for technical planning, enforcing, and monitoring of all environmental mitigation measures as stipulated in the EMP. The Project Proponent must report to DSEZMC.

8.8.1.1 Policy for Construction Phase

Responsibilities of Project Proponent prior to and during construction phase include:

- Hold discussions with the government agencies to develop procedure for inter-agency coordination and reporting;
- Ensure that provision of relevant environmental mitigation measures are reflected in the contract between MIE and construction Contractor and sub contractors;
- Develop monitoring programs and monitor the implementation of environmental mitigation measures for construction period; and
- Liaise and coordinate with government agencies on the matters related to environment and public consultation.

  - Responsibilities of MIE during operation phase include:

- Establish environmental requirements for the industrial estate following the mitigation measures for the operation phase;
- Distribute the environmental requirements or guideline to the factories / manufacturers and ensure that the factories/manufacturers comply with the environmental requirements or guideline both during construction and operation of the facilities;

- Operate the utility systems of the industrial estate including electricity generation, water treatment and distribution, solid and hazardous waste management, and wastewater treatment system;
- Develop emergency response plan and establish emergency response capability for operating phase, which may include traffic accidents, fire and chemical pollution incidents within the industrial estate area;
- Develop monitoring programs and monitor the implementation of environmental mitigation measures for operating phase; and
- Liaise and coordinate with government agencies on the matters related to environment and public consultation.

8.8.1.2 Policy for operation phase

MIE as the project owner has to establish the environmental policy and rules that will govern environmental practices and performance of the industrial estate as a whole. The establishment and implementation of this component is of utmost important absence of local environmental regulations and authorities fully responsible for environment and pollution control in Myanmar. Once established, MIE shall adhere to these policy and rules. However, in the future, when the environmental protection laws may be announced and published by the Government of Myanmar, MIE shall ensure that the requirements as set in the policy and rules are fully in compliance with the laws.

Environmental policy and rules for Dawei Initial Industrial Estate shall be based on the following principles:

- Eco-Industrial Park (EIP) concept which have the following key components:
  - Integration with natural system.
  - Maximize energy efficiency through facility design, co-generation, and other means.
  - Material flow through the whole site and ensure maximum reuse and recycling among the industries in the industrial estate.
  - Water conservation, reuse, and recycling among the industries in the industrial estate.
- The type of industries shall be in accordance with types designated for each zone.
- Prepare Environmental, Health and Safety Plan. EHS management plan or programs should also be reassessed periodically to ensure that the key environmental health and safety risks are determined in accordance with changes in numbers or types of industries in order that the potential risks will be appropriately addressed. Thus, EHS system and performance should be improved continuously by a combination of ongoing monitoring of the industrial estate and high performances as well as effective accountability of the facility

- Establish Environmental Rules that the industries have to follow. These rules will be in accordance with the EMP for operation period. The rules will be attached with the contractual document between the industries and MIE.
- Establish Environmental, Health and Safety Screening Form for the industries to fill in for MIE to assess if the industries have acceptable environmental planning and mitigation measures. In the form, the industries will be requested to provide the following information, as the minimum:
  - Type, source, and quantity of raw materials and chemicals used in the process together with their MSDS.
  - Type and quantity of the products and by-products.
  - Characteristics and quantity of solid waste, hazardous waste, wastewater, and air pollution loading generated due to the production process.
  - The pretreatment system the industries plan to put in place to ensure that the release is in accordance with the Environmental Rules.
  - Environmental, Health, and Safety Plan of the industries.
  - Past health and safety records of their facilities elsewhere, if applicable.
  - Their policy and approach in energy, material, and water conservations.

In addition to the above policy and rules, MIE will play a leading role in maintaining and improving overall environmental performance of the whole industrial estate. The ESIA was prepared in a broad scope to cover all possible activities in the industrial estate in high level. MIE will have to establish a strong organization to handle the dynamic and changes that will occur during the operation and implementation phase of the project. To achieve environmental safety and health management goals, to protect the environment, workers and the public from any adverse impacts caused by the project, the strong environmental management commitments and the proficient mitigation measures are needed. In order to develop the comprehensive environmental management plan, MIE as the project owner should be aware of the change during the project development period, and should consider the following measures.

- MIE should establish a sector responsible for safety health and environmental management of the industrial estate to prepare and perform the environmental management plan and programs to ensure that the industrial estate comply with environmental legislation and other relevant safety health and environmental requirements, and to achieve the most up-to-date environmental protection requirements/ measures/ standards.
- MIE should periodically assess/re-assess the environmental management plan or programs to ensure that the key environmental health and safety risks are evaluate in accordance with numbers and types of industries so that potential risks will be addressed appropriately.

- Due to the long period of the industrial estate project, MIE should ensure that EHS performance will be improved continuously via a combination of ongoing monitoring program and cooperation with the industries inside the estate.
- MIE needs to prepare and commission a data base system to keep track of and analyze environmental data, flow of materials and waste, water consumption, wastewater generation rate and quality, and energy consumption. The data base will help organize the data from monitoring program of MIE and of the industries, and can also be used as a tool to promote conservation of material, energy, and water among the industries, if the data base is designed properly.
- MIE should facilitate, provide necessary guidance and adequate information to every industry in order to effectively apply environmental management, and to comply with occupational health and safety provisions of the industrial estate.
- MIE should provide provisions to ensure that every industry can apply proper environmental health and safety management, and manage occupational health and safety issues to protect health and safety of workers and the public.
- MIE should further study and identify buffer zone/strip or other physical separation methods to protect the public from any major hazards.
- MIE should designate types of industries: garments and textiles factories, food and beverages factories, cannery and frozen seafood industry, that have to conduct environmental impact assessment and/or major hazard assessments prior establishment to establish the appropriate environmental safety and health management plan.

8.8.2 Mitigation Measures Commitments

The Project Proponent commits all mitigation measures prescribed in this Chapter.

CHAPTER 9
PUBLIC CONSULTATION AND DISCLOSURE

Sustainable development is a result of economic, environmental, and social values integration. The importance of civil society participation has been recognized in international environmental law and policy, most prominently in Principle 10 of the Rio Declaration on Environment and Development which states that *"Environmental issues are best handled with the participation of all concerned citizens, at the relevant level*"[1].

In accordance with the Myanmar Environmental Impact procedure (2015), participation of public and information disclosure are a part of the process. It is requested the project proponent to provide opportunities of public to express their opinions, concerns, recommendation and suggestion in developing the project. The public participation and information disclosure are international practice and have long been used as a tool to assess concerns of the stakeholders. Therefore, herein the Dawei Initial Industrial Estate Project implements the public consultation.

9.1 PURPOSES OF THE CONSULTATION DURING THE PREPARATION OF ESIA REPORT

The objectives of public participation and disclosure are;

- to inform the stakeholders about the project,
- to gain public views, concerns and values,
- to increase public confidence, and
- to improve transparency and accountability in decision-making process.

9.2 METHODOLOGY AND APPROACH

9.2.1 Identification of Stakeholders and Group Affected by The Project

According to ADB Environmental Assessment Guideline, World Bank EHS Guideline, and IFC Performance Standard on Environmental and Social Responsibility, there are 5 categories of stakeholders; local communities, civil society, government bodies, private sector bodies, and other institutions. By adjusting ADB guideline into practice in Myanmar context, the key stakeholders of this project are divided into two main groups; 1) the regulatory authorities and 2) local stakeholders. The regulatory authorities and public/

[1] THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT. Year. Rio declaration on environment and development. *In:* Report of the United Nations conference on environment and development, Rio de Janeiro, 1992. 3-14.

private agencies include Provincial Authorities, District Authorities, and Dawei Special Economic Zone supportive group. The local stakeholders include villagers in the project area that have to move out. Therefore, the public consultations of this report already covered the primary stakeholders who are directly affected in positive and negative way.

The target groups for public consultation included 13 villages[2]; Ta Nyin In, Du Taung, Ya Ngae, Wa Zoon Taw, Ekani, Thittoh Taut, Kyauk Whet Kone, Yalai, Kha Maung Chaung, Min Dut, Tha Byae Zoon, and Pagaw Yun.

9.2.2 Methods of Consultations

The local consultant "*Resource & Environment Myanmar Ltd*." (*REM*) was sub-contracted to conduct meetings with local stakeholders, since it is more convenience to engage local communities in Myanmese. The reasons to select REM include their experiences in EIA study, their professional staffs, and the familiar of Dawei Projects. REM started conducting projects since 1998. Also, they have been involved in Dawei Sea Port, Main Road, and Dawei Industrial Estate projects; therefore they are well familiar with the area.

Thai consultant designs the public involvement process, defines stakeholders, and conducts presentation for REM. REM is responsible for coordinating with government permission process, inviting participants, managing public consultation meeting, and recording raw data. The guideline to arrange public consultation meeting is provided to REM to ensure that all necessary steps were conducted. Communications between the consultant and REM have been conducted via phone, email, and face-to-face meeting to safeguard the mutual understanding. The consultant also observed some meetings to ensure that the meeting process was correctly conducted.

To recruit the participants of each meeting, REM used the traditional process to invite people. Firstly, REM coordinator called the head of village and informed him/her about the meeting and objective of meeting as well as to make appointment for date and place of the meetings. The head of village later disseminated this information to the people who are interested to involve in the meeting.

In the public consultation process, the REM staffs firstly introduced themselves and the consultant to local people. Secondly, REM briefly informed about the project information. PowerPoint Presentation was used to show some pictures. The PowerPoint was conducted by the consultant and REM translated the content to Myanmese language. Regarding ADB Environmental Assessment Guideline, public consultation involves engaging people in

[2] Wet Chaung Village was excluded in these public involvement activities. Although the initial industrial estate project covers Wet Chaung village, all households in this village MUST move to Bawah relocation area before construction phase of initial estate. Thus, Wet Chaung villagers will not affected from Dawei SEZ Initial Industrial Estate Project. They will be affected by the relocation. For these reasons, Wet Chaung village is only included in the RAP report and the villagers will be fully mitigated by the new houses, compensation, training, and micro credit program. In the RAP report, Wet Chaung village was also informed about Dawei SEZ Initial Industrial Estate Project.

dialogue, a two-way flow of information and ideas between the project proponent and the stakeholders with opportunity for the stakeholders to express their views and concerns. Thus, REM staffs asked the participants whether they had any questions or concerns related to the project. All concerns were recorded and translated to English by REM staffs.

It is very essential to clearly notify that only concerns related to Initial Industrial Estate project were taken into consideration in this Chapter. Although most of concerns were related to relocation and compensation issues, these issues were beyond the scope of this ESIA report. The relocation and compensation of Dawei Industrial Estate has already been started before conducting this Initial Industrial Estate ESIA. Thus, the concerns regarding compensation and relocation of this Initial Industrial Estate project are separately presented in the RAP report.

9.2.3 Approach to The Public Meetings

The following approach to the public meetings was adopted;

- Each meeting at the community level was organized by the consultant in Myanmar namely "*Resource & Environment Myanmar Ltd. (REM)*" to confirm that the stakeholders feel free to express their concerns towards the project. The meetings were also conducted in local language to ensure that the stakeholders clearly understand the provided information.
- REM firstly contacted headman of each village to make appointment of the meeting. Headman of each village had identified participants to be invited, and in making arrangements for the meeting venue and issuing invitation.
- The project proponents and UAE (Thai consultant) were responsible for providing information on brief project information including development plan, EIA study as well as potential impacts of the projects and mitigation measures to minimize the impacts. This information was translated to local language by REM. The project proponent, UAE, and REM had worked as a project team.
- The meeting began by informing the participants of the objectives of the meeting and expected outcome. After that, the project team gave information about the project and EIA.
- The meeting then provided an open forum for discussions. The participants expressed their concerns, offer their views and suggestions.

9.3 SUMMARY OF CONSULTATION ACTIVITIES UNDERTAKEN

The Project conducted the public consultation program 3 times during the environmental impacts assessment process. The first consultation (Early program) were carried out during 2012 and 2013. To inform public overall about the initial industrial estate information, potential impacts and mitigation measures. See the summary in Annex 9-1. The second consultation (Middle program) was in 2015 and have details following:

9.3.1 Public consultation program in 2015 (Middle)

The public consultation meeting was conducted during 17-22th March 2015. The Project information were presented and disseminated to PAPs by handouts (Annex 9-2). The Project proponent also carried out opinion survey using questionnaire (Annex 9-3).

Figure 9.3-1 The Second Public Consultation during March 2015

To begin with, the consultant visited Dawei Working Body to introduce consultant team and to inform about the public consultation meeting. After receiving permission from the government, the meetings were conducted with 467 people in 13 affected villages. The date, place, stakeholder group, and number of participants involved in the public consultation meetings are shown in Table 9.3-1.

Table 9.3-1 Date, Place, Stakeholder Group, and Number of Participants in the Public Consultation Meetings

No	Date/Time	Village	Number of Participants
1	17 March 2015 8.30 hr	Ta Nyin In	15
2	17 March 2015 10.00 hr	Wong Po	15
3	17 March 2015 13.00 hr	Du Taung	15
4	17 March 2015 14.00 hr	Ya Ngae	20
5	17 March 2015 15.00 hr	Wa Zoon Taw	7
6	17 March 2015 16.00 hr	Ekani	50
7	18 March 2015 9.00 hr	Thit toh taut	35
8	18 March 2015 10.00 hr	Kyauk whet kone	30
9	18 March 2015 14.30 hr	Yalai	50
10	19 March 2015 9.00 hr	Kha maung chaung	90
11	21 March 2015 10.00 hr	Min dut	66
12	21 March 2015 14.00 hr	Tha Byae Zoon	18
13	22 March 2015 9.00 hr	Pagaw Yun	56
TOTAL	**467**		

Source: REM (2015)

9.3.1.1 Summary of main comments received from stakeholders

After receiving information of project, the participants expressed their concerns about the project as follows;

(1) Ta Nyin In

- The local people are worried about fire due to haystack and oil palm heaps in the project area. Thus, fire protection plan should be prepared.
- The developer came to measure land and counted trees. However, some villages did not get compensation. So far, the villagers can neither grow plant nor do anything in their land.
- There were over 60 acres of arable in this village. Thus, they want to have equal arable area after the project has developed.

(2) Wong Po

- The project is advantageous for the local people and for the country.
- The residents fear that the project will not be accomplished.
- The villagers want to be employed to work in the industries. Now some villagers who worked in foreign countries come back to work in this project but the project has not been operated yet.

(3) Du Taung

- The villagers are worried about impacts to the residents' health as well as air and water pollution, especially within 5 km radius from the industries.
- The road should be watered twice a day.
- The villagers request for sufficient numbers of doctors, clinics and modern healthcare facilities.
- The villagers would like to receive information about compensation of their farm land.

(4) Ya Ngae

- The villagers accept the project if the developer can minimize and mitigate environmental and social impacts. They expect that the project will develop their region and Myanmar.
- The villagers want to be employed to work in the Initial Industrial Estate.

(5) Wa Zoon Taw

- The villagers expect convenient transportation, electricity, clinic and hospital as well as better living standards after the project is implemented.
- The residents want to be employed to work in the Initial Industrial Estate.
- The villagers hope the project will be implemented as soon as possible and get the compensation as the regarded value.

(6) Ekani

- The villagers expect that they will be employed in the Initial Industrial Estate Project.
- The villagers expect that Myanmar will be developed more than present moment.
- Environmental impacts must be minimized.
- The project is now delayed. The villagers expect that the project will be implemented as soon as possible.
- High-grade infrastructures and electricity are needed.
- The villagers generally support the project.
- The villagers must be employed in the Initial Industrial Estate.
- The villagers must be involved in observing the project.

- The villagers need justice compensation.

(7) Thittoh Taut

- The villagers grow rubber trees in the area and need the compensation to these rubber trees.
- Overall, the villagers agree with and welcome the Dawei Initial Industrial Estate.
- The developer must minimize the impacts as much as possible.
- The villagers want to be employed to work in the Initial Industrial Estate.

(8) Kyauk Whet Kone

- The local people agree with the project, however, the developer must justly and timely compensate them.

(9) Yalai

- The villagers would like to know more about the project description and the mitigation measures that can minimize the impacts.
- Compensation should be justly given.
- The villagers expect to see the development of nation due to this project.
- The villagers want to be employed to work in the Initial Industrial Estate.

(10) Kha Maung Chaung

- The villagers generally agree with the project if it is justly implemented.
- The villagers requested for a training program that fits to working in the industries.
- The project is now delayed. The villagers expect that the project will be implemented as soon as possible.
- The villagers agree with the project if the developer can minimize and mitigate environmental and social impacts.
- The villagers request for justice compensation as regarded.
- The villagers want to be employed to work in the Initial Industrial Estate.

(11) Min Dut

- The villagers are worried that the project might lead to water pollution and they will not able to drink water from village's well. Thus, the project owners must be careful and the project activities should not harm their water resources.
- The villagers complained that they cannot use the stream besides the project because the project bulldozes the stream. Consequently, the villagers cannot grow any crops or trees because the stream is too shallow. The villagers requested the project owner to disinter the stream if possible.
- Residents want to be employed if the project is done. The villagers need a training program regarding to industrial works.
- The local people want to use the villages' existing road after the project is done.

(12) Tha Byae Zoon

- The labor rights law should be issued to protect the employment in Initial Industrial Estate. The local labor must get insurance from the project owners.
- The villagers want to work in the Initial Industrial Estate and get the same salary that they receive in Thailand. The Myanmese labor generally receives 10,000 kyats per day in Thailand.
- The villagers complained that the project owner did not help the necessity of the residents. Their fields were destroyed because of the flood when they bulldoze near the Ya Hlaing stream. They did not receive any help from the project owners.

(13) Pagaw Yun

- The villagers are confused about the management of existing oil-palm garden. The government informed them that the government will leave 350 oil-palm trees. However, ITD informed them that all oil-palm trees will be cut off. The villagers want to retain some oil-palm trees to keep the region green and to be a buffer zone of the project.
- Good waste management system should be operated.
- Some organizations often come to the villages to collect the concerns but they do nothing so far. Thus, the residents do not trust anything.
- The villagers suggested that the project owners should leave the trees around the villages.

- The villagers would like to know about the actual plan that will not be changed again and again.

In conclusion, the concerns towards the project are listed as follows;

- Health impact
- Environmental impacts especially water pollution
- Impartial compensation on crops and lands
- Local employment/ training program/ labor rights/ reasonable salary
- Improvement of infrastructure, electricity, sufficient doctors and healthcare facility

9.3.1.2 How these comments were taken in account

The project proponent took concerns and recommendation in the previous section in account in the social mitigation measures to minimize the public concerns. They were presented in Table 9.5-1 and Table 9.5-2 the mitigation measures for the public involvement and disclosure in construction phase and operation phase.

Table 9.3-2 Mitigation measures for construction phase

Mitigation Measures	Place	Period	Responsible Agency
1. Inform head of villagers about construction plan and activities	• 13 Villages	• At least 2 weeks prior to the construction	MIE
2. Local people can complain about the project activities directly to the complaint handling unit or via the community leader. The corrective actions of each complaint must be done within a month or at the period of time that developer and local people mutually agree	• via community leader house • putting complaint in the comment boxes • Oral inform at complaint handling unit	Over construction phase	MIE
3. Provide on-site construction skill training for local people and give them wages at least those indicated by Myanmese labor law	• At the construction site	• On-site training	MIE

Source: ESIA Study Team

Table 9.3-3 Mitigation measures for operation phase

Mitigation Measures	Place	Period	Responsible Agency
1. Inform head of villagers about the operation plan and activities in the operation phase	• 13 Villages	• At least once a month over operation phase	MIE
2. Local people can complain about the project activities directly to the complaint handling unit or via the community leader. The corrective actions of each complaint must be done within a month or at the period of time that developer and local people mutually agree	• via community leader house • putting complaint in the comment boxes • Oral inform at complaint handling unit	Over operation phase	MIE
3. Provide industrial skill skill training for local people	• In the community to avoid difficulty of travelling	• On-site training	MIE
4. Contract all tenants to give the first priority for local employment		Over operation phase	MIE

Source: ESIA Study Team

9.3.2 The Third Public Consultation Program (Final)

9.3.2.1 Objectives of The Public Consultation Meeting

The ESIA was approved on 9th November 2017. Thus the Project organized the public consultation again on 28th March 2018. The objectives of the public consultation were to introduce the project information and to inform about ESIA study, potential impacts, and mitigation measures to the local stakeholders as well as to gather recommendation for future cooperation.

9.3.2.2 Schedule and Stakeholder Group

The public consultation meeting was conducted on 28th March 2018. The consultation is hosted by the Environmental Conservation Department (ECD), MONREC. The consultation held in DSEZ MC Auditorium in DSEZ between 8.30 am and 12.00 am. The handout presentation (Annex 9-4) were disseminated and handed to participants. One thousands and sixty stakeholders (not include the project proponent staff) were among government agencies e.g. Tanintayi regional ministry, authorized agencies, Environmental Conservation Department, DSEZ management committee, CSO/ NGO and project affected villages are invited and participated. Details in the public consultation were noted in the Minute Of Meeting (MOM) in Annex 9-5 and result of the consultation can be summarized in Table 9.3-1.

Figure 9.3-2 Dawei DSEZ MC auditorium and participants in the final public consultation

Table 9.3-4 Summary of the final consultation for the Dawei SEZ Initial Industrial Estate Project

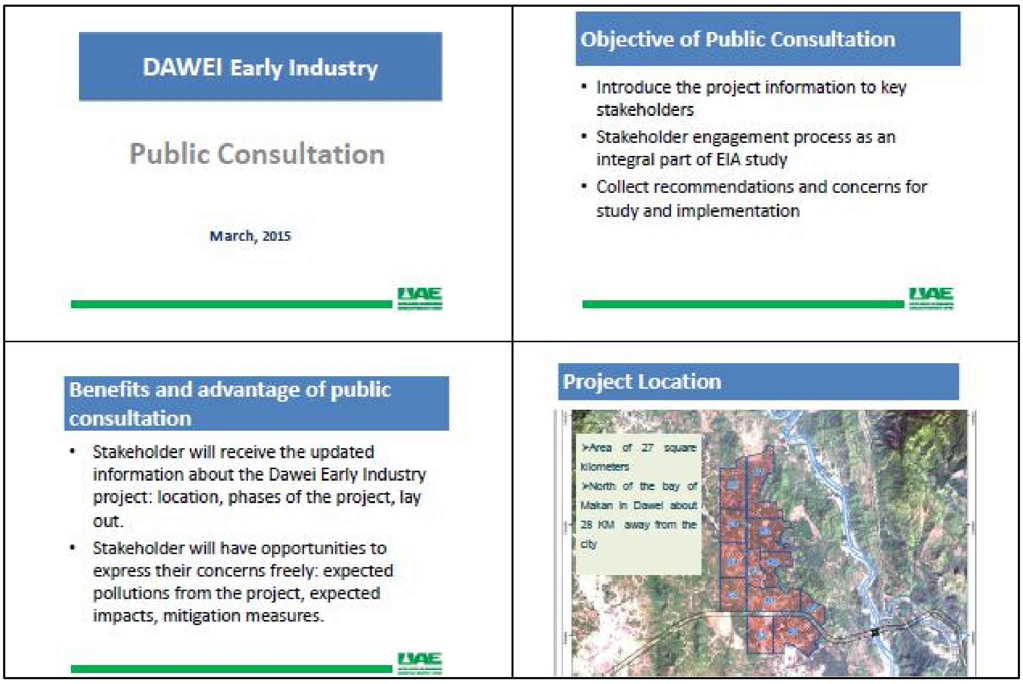
	Stakeholders	Issues	Responses
1.	Villagers	Information disclosure	Q: Do the villagers understand/know about the Project Information? A: Yes they do. We provided them information e.g. description, timeline, mitigation measures etc. to villagers in March 2017.
2.	NGO /CSO/CPO	EIA Procedure and Information disclosure	Q: Have you got ECC? How to disclose information to local people? A: The project proponent disclosure information in the website MIE. ECD-Dr. San-Oo explains about the EIA procedure and responsibility of ECD review team is responsible for issuing ECC that there have a committee includes 39 members and divided into 4 groups. There are civil, industrial, health and social. Their duties are commented and recommendations for the project proponent in developing the project. ECC is abbreviation.
3.	NGO /CSO/CPO	EIA Procedure and Information disclosure	Q: As he understands that the EIA process for only 6 days between 17-22th March 2015 is not enough to dealing with 13 villages. A: Those days are for public consultation and socio-economic survey. The consultant undertaken the survey 2 villages / day.
4.	NGO /CSO/CPO	EIA Procedure and Information disclosure	Q: Project proponent EIA procedure differs from EIA procedure (2015) because the project proponent did only time public consultation. Normally, there need to be 2 times, one in scoping and second time is in the investigation process. A: The project proponent did the first consultation in 2013 and the second consultation in 2015.
5.	Villagers	Project Timeline	C: We agree with the Project (villagers) but the Project is delay.

Remarks: Q: Question, A: Answer, C: Comment

Source: The ESIA Study Team

9.4 DESEMMINATION OF PROJECT INFORMATION

Public consultation and information disclosure were conducted since the beginning stage of the ESIA process through the ending stage, approval of the ESIA. Each of the public consultation and meeting, objectives of ESIA and the project details and mitigation measures were informed and communicate to the villagers through the Power Point Presentation and handouts type as shown in Figure 9.4-1 and in Annex 9-1, Annex 9-2 and Annex 9-4 both in Myanmese and in English.



Source: The ESIA Study Team

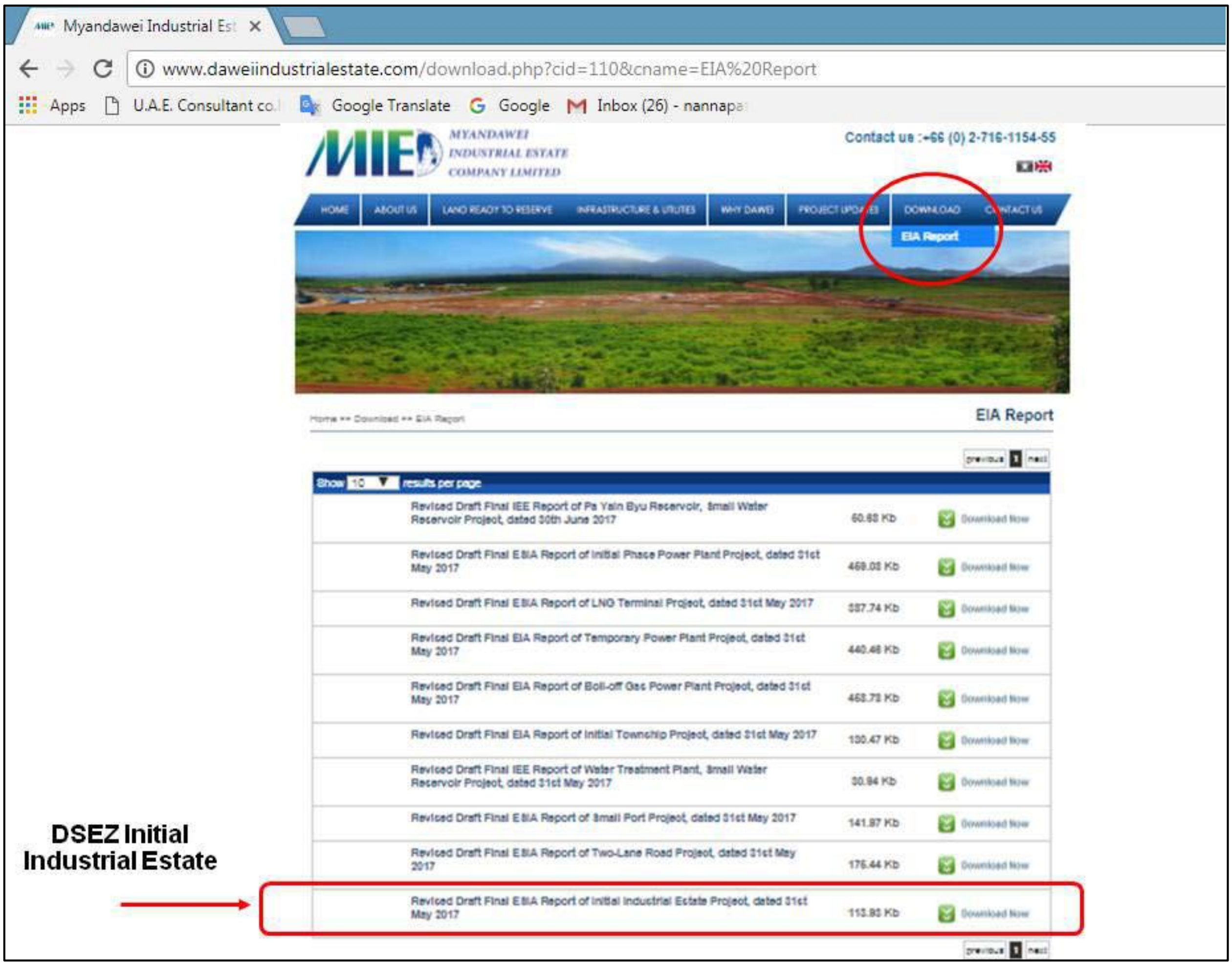
Figure 9.4-1 The Project information communicated through the Power Point Presentation in the Public consultation meetings

Outline of the Power Point Presentation are included;

- Objectives of EIA
- Updated Project location and layout
- Phase of the project, operation year, and targeted industries
- Potential impacts of the project
- Mitigation measures to minimize the impacts.

Furthermore, the ESIA report is disclosed on the MIE's website as presented in Figure 9.4-3, public can access and gain more the Project information here. The ESIA Report has been published on the following website link: http://www.daweiindustrialestate.com/download.php?cid=110&cname=EIA%20Report. .

Figure 9.4-2 Public consultation meetings.



Source: MIE (2017)

Figure 9.4-3 Disclosure of the ESIA Report on the MIE's Website.

9.5 RECOMMENDATION FOR FUTURE CONSULTATION

Generally, the villagers agree and support the Initial Industrial Estate Project because they believe that Myanmar will be much developed because of this project. In additions, their living standards, electricity, and health facilities will be consequently developed. The major concerns obtained from the public consultation meetings included compensation and employment in the industrial estate.

For compensation, the villagers need to be compensated and requested that the project owners pay for compensation immediately after measuring the land and counting the trees. In additions, some villagers who have realized that they will lose the agricultural land and have perception in changing occupation from agricultural to industrial sector. Due to lack of working skills and qualification, the villagers do not sure they will have opportunities to work in the factories. Thus, a training program that can help them work in the industry is strongly requested.

The key recommendations from public consultation are to keep inform the villagers about project schedule, impacts, and mitigation measures to minimize the social impacts as well as to provide appropriate training and income restoration program to the local people including establish committee, which will consist of government agencies, villagers and project proponent to organize and manage social issues.

CHAPTER 10

INVOLUNTARY RESETTLEMENT

10.1 PHYSICAL DISPLACEMENT AND AFFECTED ASSETS BY PROJECT COMPONENTS

Development of the Initial Industrial Estate will affect four (4) villages within Dawei Township. Two hundred and ninety one (291) of Project Affected Households (PAHs) and one thousand, one hundred and sixty four (1,164) of Project Affected People (PAPs) will be physically displaced as presented in Table 1.2-1. Development of zone A3, B1, C1, C2, C3, C4, D2, Main Road (MR) and North-South Road (N-SR), accounting for 46.97 percent of the entire Project's land (approximately 3134.31 acre) will almost affect private-owned land, and require land acquisition and compensation for their assets (See Figure 10.1-1).

Table 10.1-1 Affected villages from development of Initial Industrial Estate

Zone	Affected Village	Estimated number of resettlement	
		Households	People
Zone A3	Pagaw Zoon, Yalai	8	32
Zone B1	Pagaw Zoon, Khamaung Chaung	1	4
Zone C1	Wat Chaung, Khamanung Chaung	116	464
Zone C2	Yalai	10	40
Zone C3	Yalai, Khamaung Chaung	16	64
Zone C4	Khamaung Chaung	128	512
Zone D2	Kamaung Chaung	2	8
Main Road	Pagaw Zoon, Yalai	7	28
North Road	Khamaung Chaung	3	12
Total		**291**	**1,164**

Source: ERM (2015) and MIE (2016)

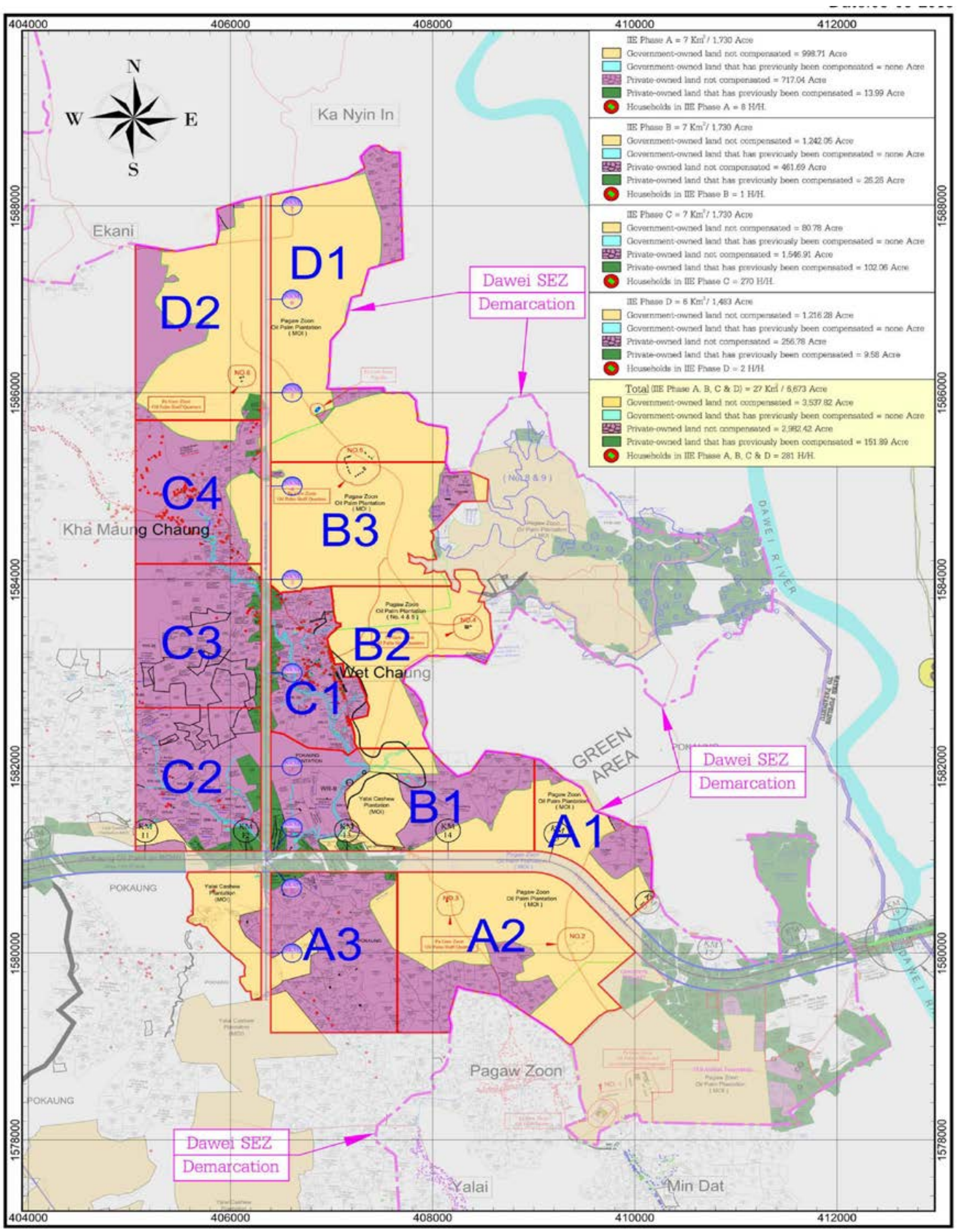
Development of zone A1, A2, B2, B3, D1 and D2 will also affect almost agricultural land of government (Majority is under Ministry of Industry) accounting for 53.03 percent of the Project's land. Majority of the land is plantation for palm oil production covering approximately 3,537.82 acre including 18 buildings which are labor houses, oil palm factory and garage as presented in Table 10.1-2. Minority of the land is cashew plantation.

Table 10.1-2 Affected government land and asset

Zone	Estimated area of oil palm plantation and staff quarters' houses		
	Oil palm plantation (Acre)	Households	People
Zone A	998.71	10	10
Zone B	1242.05	14	56
Zone C	80.78	ND	ND
Zone D	1216.28	10	44
Total	**3,537.82**	**34**	**110**

Remark: ND: No Data

Source: ESIA Study Team



Source: MIE (2017)

Figure 10.1-1 Occupied Land Map for the Initial Industrial Estate

10.2 MINIMIZING RESETTLEMENT

Potential social impacts on numerous people and their livelihood in the Dawei Special Economic Zone had been considered since the early stage of Project planning. Prior becoming the present Project' Master plan, the Project layout had been revised about

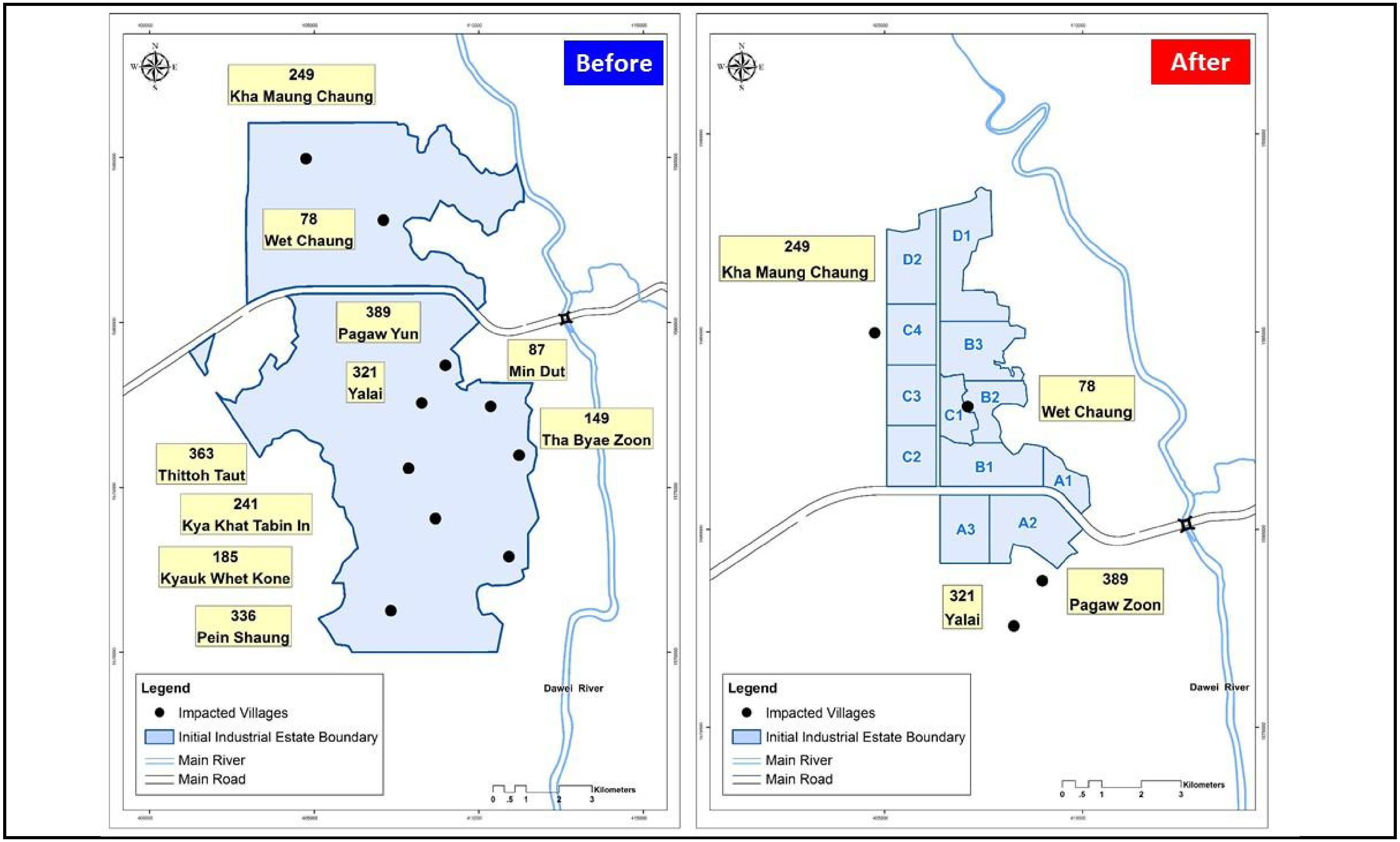
- Size of the Initial Industrial Estate
- Project Affected Households (PAHs)
- Land reclamation and restoration

As presented in Table 10.2-1, after the re-layout (Figure 10.2-1) the Project development area to the present master plan, the affected villages and households were reduced. The Project Affected Households (PAHs) was minimized to only 291 households.

Table 10.2-1 Comparison of displacement before and after revision of the Project layout

No.	Items	Before	After
1.	Number of affected villages	10	4
2.	Number of affected households	2,398	291
3.	Number of affected people	-	1,164

Source: RAP Study Team



Source: MIE, 2017

Figure 10.2-1 Comparison of displacement villages before and after revision of the Project layout

10.3 SCOPE OF LAND ACQUISITION

About 27 km^2 of land to be acquired for Initial Industrial Estate development. Four (4) villages, Yalai, Kha Muang Chuang, Wet Chaung and Pagaw Zoon in Yebyu Township will be affected. Location of the overall impacted villages are indicated in Figure 10.3-1.

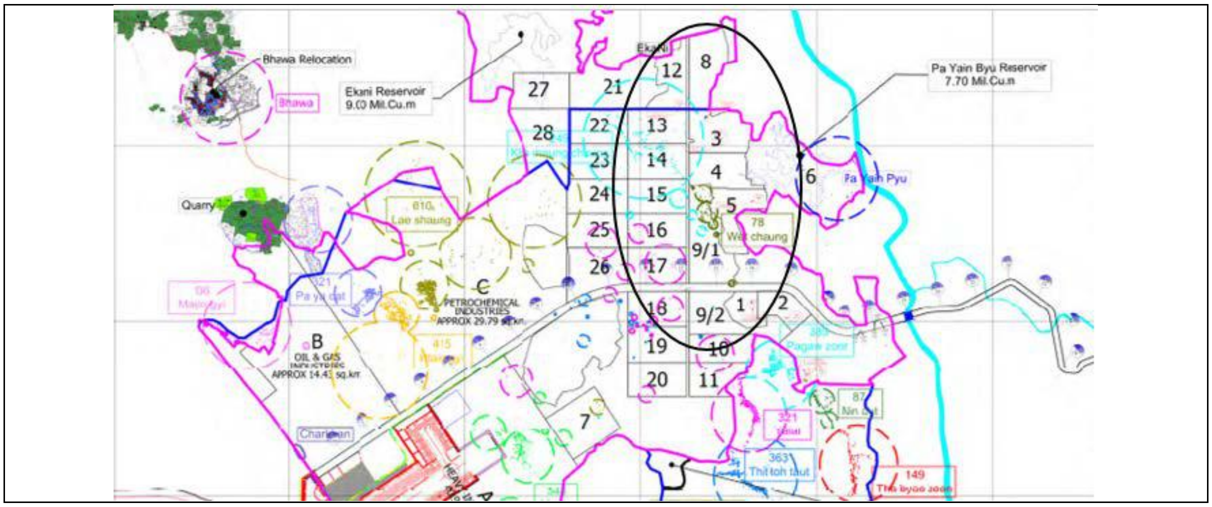


Figure 10.3-1 Location of the overall impacted villages from displacement

Approximate areas, population and number of households are presented in Table 10.3-1. However, only a number of people or households in these villages; Project Affected Peoples (PAPs) and Project Affected Households (PAHs) will experience permanently displacement and relocation to new resettlement area.

Table 10.3-1 Demographic of the affected villages in general

No.	Village	Total Area (Acre)	Total Population	Total Household
1.	Pagaw Zoon	5,783.64	2,212	410
2.	Wet Chaung	-	449	104
3.	Kha Maung Chaung	525.56	1,453	338
4.	Yalai	1,244.71	1,623	348

Source: ERM (2015)

Thus, scope of land acquisition also include social impact on host community i.e. Bawah village. Further details of the resettlement area is in Section 10.6 Resettlement Site.

10.3.1 Impact On Household Level

The land acquisition will result in the following impacts:

- Permanent loss of land: agricultural land and home plot including trees and crops.
- Permanent loss of immovable productive and non-productive assets: houses, residential structures e.g. groundwater wells and storage and building etc.
- Partial loss of income due to the disruption of livelihoods, earning of income and opportunities during the transition period starting from formal notification of land acquisition, relocation, and recovery of income. The loss also included such as restricted access to land for cultivate crops or rear livestock or fishing grounds.

Project Affected People (PAPs) people to be affected by the Project, or Project Affected People (PAPs) are 1,164 persons, living in 291 households, as shown in Table 10.1-1. They live in the project area and will lose all their lands, houses, livelihood, and income due to land acquisition. They will need to be relocated / displaced to designated resettlement sites or they may opt for cash compensation and move opt new places at their choices.

10.3.1.1 Asset Inventory Loss

Inventory loss of land plot, paddy field, perennial trees, houses and associate residential structures belong to the PAPs were estimated by the census and land survey. Result of the surveys are following

- **Tree**

Criteria for countable trees in reclamation must be complied with the announcement of the Office of Rural Community Development such as type (e.g. Rubber, Cashew, Oil Palm and Coconut etc.), age (3 years up) or size and price. Most of countable trees in the affected villages (except Wet Chaung) have been counted (in yellow is for affected villages and in green, pink and red are in affected plantation area) as presented in Table 10.3-2. The trees counting has been progress for more than 90 percent of the entire Project area, accounting for 2,652.3 acre.

Table 10.3-2 Trees census work in the villages in general

No.	Village	Households	Affected	
			Household (Unit)	Tree (Acre)
1	Yalai	348	13	1,244.7
2	Kha Muang Chuang	338	44	525.6
3	Wet Chaung*	104	-	-
4	Pagaw Zoon	410	-	882.0
	Summary	**1200**	**57**	**2652.3**

Source: (TEAM, 2013)

Figure 10.3-2 Tree and household census

- **Houses and land plots**

Both affected houses of villagers and their associate residential structures and affected houses of staff and buildings in Pagaw Zoon Oil Palm Farm and Factory were measured and counted. However most land plots for plantation belong to government, Ministry of Industry.

Villagers' houses were classified by their size, small, medium and large (Figure 10.3-3 to Figure 10.3-5). 1,037 houses were counted and they will be likely to be displaced by the Project, as present in Table 10.3-3.

Table 10.3-3 Affected households and their size of houses

No.	Villages	No. of Household	House Size		
			Large	Medium	Small
1	Pagaw Zoon	389	76	62	251
2	Yalai	321	53	67	201
3	Wet Chaung	78	4	7	67
4	Kha Muang Chaung	249	12	54	183
Total		**1,037**	**145**	**190**	**702**

Source: ERM (2015)

Source: (MIE, 2014)

Figure 10.3-3 Small house of the affected household

Source: MIE (2015)

Figure 10.3-4 Medium house of the affected household

Source: MIE (2015)

Figure 10.3-5 Large houses of the affected household

Affected staff houses in the Pagaw Zoon oil palm farm and factory range in size from small, medium to large. Number of affected houses and affected buildings/structures e.g. factory, garages, workshops, stores, oil lake stores, oil palm nursery, offices and water tanks are presented in Table 10.3-4.

Table 10.3-4 Affected households in the Pagaw Zoon oil palm farm and factory and their size of houses

No.	Affected Buildings	No. of Household	No. of Family members	Size (m²)		
				Large House (over 100 m²)	Medium House (50-100 m²)	Small House (less 50 m²)
1	Staff houses	29	130	1	16	12
2	Factory	0	0	2,705		
3	Garage	0	0	198-240		
4	Workshop	0	0	185-356		
5	Store	0	0	600		
6	Oil lake store	0	0	100-270		
7	Oil palm nursery	0	0	284		
8	Office	0	0	397-470		
9	Water tank	0	0	250		

Source: ESIA Study Team

Source: TEAM (2013)

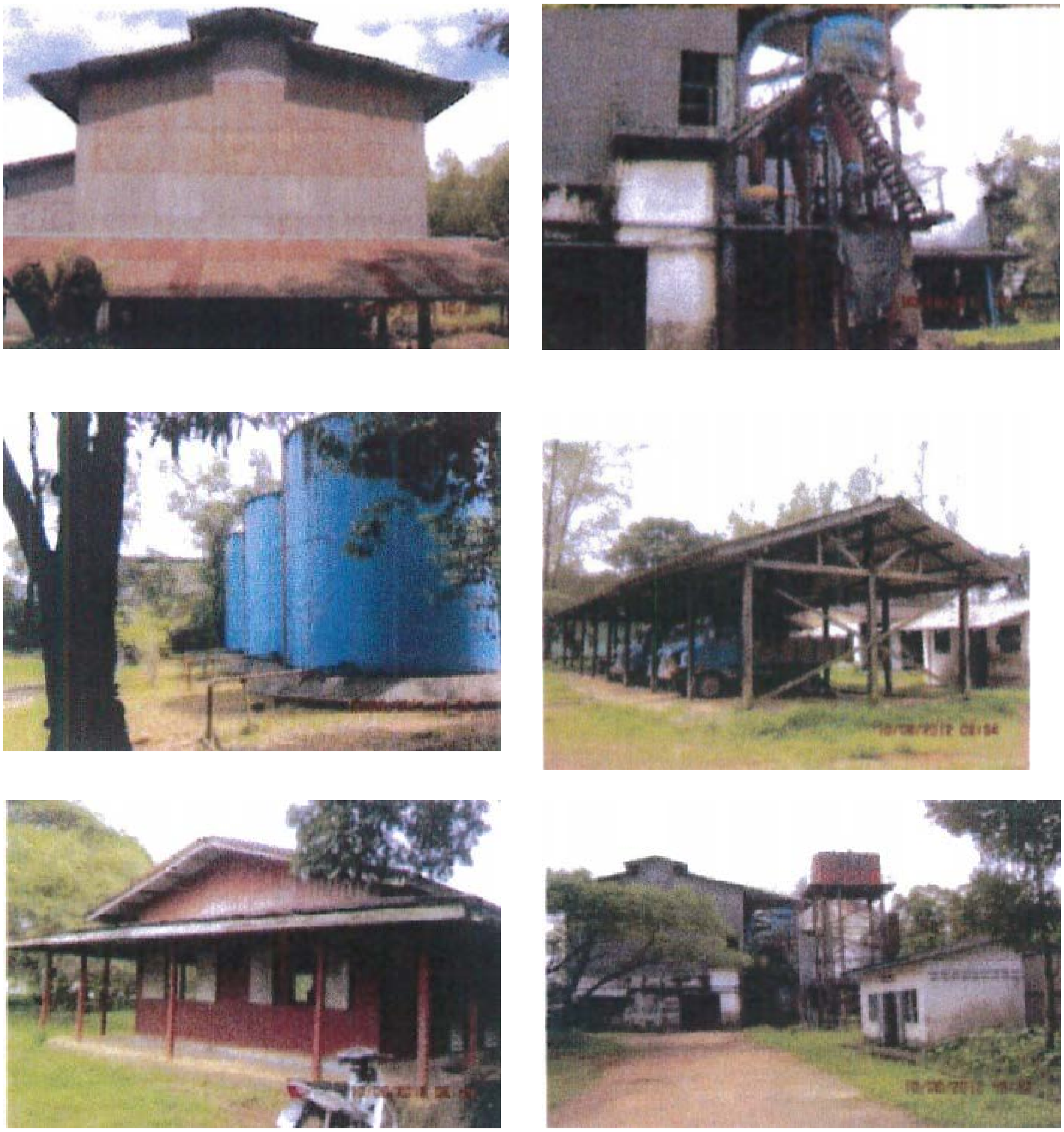
Figure 10.3-6 Staff' houses in the Pagaw Zoon oil palm farm and factory

- **Cultivated land and orchard**

Inventory of loss of paddy field and perennial trees belong to the PAPs are measured and counted. The majority of plantations are oil palm which seem to be the most favorite due to low input with good price of these crops. Fruit trees (e.g. jack fruit, mango, and other crops) are cultivated in the smaller area.

Table 10.3-5 Loss of land plot cultivated land of affected villagers

No.	Village Name	No. of Owner	No. of Plot	Areas (Acre)		
				Plantation	Rice field	Total
1	Pagaw Zoon and Wet Chaung	210	239	5,643.463	140.180	5,783.643
2	Yalai	272	307	1,182.34	62.370	1,244.71
3	Kha Muang Chuang	114	115	524.56	1.00	525.56



Source: (TEAM,2013)

Figure 10.3-7 Affected buildings in the Pagaw Zoon oil palm farm and factory

10.3.2 Impacts On Communities Level

The land acquisition will result in the following impacts:

- Permanent loss of common land and natural resources;
- Permanent loss of all infrastructure and facilities as well as religious and cultural buildings;
- Disruption of socio-cultural fabric

Common properties and resources will be affected. The land acquisition will result in the loss of existing infrastructures and facilities. The losses include schools, administrative offices, and monasteries, as summarized below

- 2 primary schools
- 1 high schools
- 5 monastery
- 3 administrative office
- 4 cemetery

Table 10.3-6 Existing basic infrastructures in affected villages

No.	Village Name	Affected Public Infrastructure				
		Primary school	High school	Monastery	Administration office	Cemetery
1	Pagaw Zoon	1	None	2	1	1
2	Yalai	None	1	2	1	1
3	Wet Chuang	1	None	1	None	1
4	Kha Muang Chuang	1	None	None	1	1

Source: ERM (2015)

Source: UAE (2015)

Figure 10.3-8 Affected common properties and resources in the Pagaw Zoon oil palm farm and factory

10.4 ENTITLEMENT FOR COMPENSATION

Compensation is defined by IFC as "*Payment in cash or in kind for an asset or a resource that is acquired or affected by a project at the time the asset needs to be replaced*". This RAP adopts a general principle that the people affected will not be worse off compared to the pre-project level.

Project Affected People (PAPs) is defined who will lose all land and immovable assets, the project will provide adequate appropriate replacement land and structures or cash compensation at full replacement cost for lost land and structures including adequate compensation for partially damaged structures, and relocation assistance, if applicable, prior to their relocation.

Based on IFC Performance Standard, "*(b) When displacement cannot be avoided, the compensation will be offered to displaced communities and people for loss of assets at full replacement cost and other assistance to help them improve or restore their standards of living or livelihoods. (c) In the case of physically displaced persons, compensation in kind should be considered in lieu of cash. Cash compensation levels should be sufficient to replace the lost land and other assets at full replacement cost in local markets. (d) In case of physically displaced persons, the choice of replacement property will be offered with equal or higher value*".

The project will pay cash to PAPs at replacement costs for lost assets, including land, house, immovable properties and assets, such as water wells, and agricultural assets including plants, trees, and farm infrastructure. The project will provide allowance for PAPs who will lose partially or entirely their income during the relocation and resettlement period.

Cut-off date is defined the day on and beyond which any person who occupies land or assets or constructs assets on land that required by the Project (Affected land) will not be eligible for compensation.

10.4.1 Criteria for Entitlement for Compensation

Eligibility will be determined using two basic criteria: cut-off date and possession of Land Use Right Certificates (LURCs).

Cut-off Date: The cut-off date will be determined by Compensation and Relocation Committee (CRC). The PAPs will be informed of the cut-off date. Any people who settle after the cut-off date will not be entitled for compensation.

A single cut-off date is suggested to be applied across the Project. This will help to ensure consistency in the approach and minimize risk that the project will experience in-migration/population flux that will result in community impact.

LURC: The eligibility for compensation to PAPs for land loss will be determined by the possession of LURCs or a claim that is recognizable under national laws. Persons who do not have LURCs or any recognizable claims to their land will not be eligible for compensation for land but will be entitled to compensation for their affected assets upon land and are entitled to assistance if they opt to relocate.

- The following principles shall be applied in determining eligibility for entitlements:
  - ✓ All loss of land, crops, trees, residential and commercial buildings and structures resulting from the Project will be compensated at full replacement coats.
  - ✓ Vulnerable PAPs who are specifically defined by the Project, and have specific provisions as vulnerable group. This can include physically and/ or mentally challenged villagers as well as the elderly, women headed households, poor or landless PAPs.
  - ✓ The entitlement matrix will be discussed with the PAPs prior to finalization. Consultation with the PAPs will be an ongoing process, throughout the resettlement process.
  - ✓ Where land is occupied on a temporary basis, the PAP will be compensated for the period of use and land will be returned. Any unavoidable impacts will be compensated. This will include compensation for the reestablishment of croplands and crop yields after the temporary disruption.
  - ✓ Where livelihoods depend on natural resources, continued access to those resources will be provided for, or alternative resources that will provide the same amount of income or livelihood earning potential will be provided. This will take into account the necessary steps to take advantage of the new alternative resources.

10.4.2 Entitlement Matrix

An entitlement matrix will be prepared as part of the sub – project RAPs. The following principles will be followed in determining eligibility for entitlements:

Table 10.4-1 Entitlement Matrix

Type of Loss	Entitled Person	Compensation Policy	Implementation Issues
Dwellings	291 Households or 1,164 people	Full replacement cost so as to enable affected persons to have a dwelling of a least similar size and standard	Stakeholder consensus on replacement valuation assessment
Agricultural land	7,553.92 Acre	Land for land replacement of land or compensation in cash at full replacement cost	Stakeholder consensus on valuation assessment
Crops/ trees/ plantations		Full replacement cost at market value	Stakeholder consensus on valuation assessment
Loss of livelihood in transition period	No Data	Transition allowance to all PAPs until such time when the income generation activities are restored	Consensus among stakeholders on allowance
Common property resources, including cultural sites	4 Schools, 10 Religious places, 3 Administrative offices	Restoration of affected buildings and structures to at least previous condition or placement of the structures in consultation with PAPs	Consensus among village representatives
Temporary impact during construction	No Data	Care by contractors to avoid damaging properties; where damage does occur, the contractor should be required to pay compensation. Damaged property will be restored immediately to its former condition.	Consensus among stakeholders

10.5 LIVELIHOOD RESTORATION

10.5.1 Target Income

Due to the survey, the average annual income was 1,500,000 kyat. In additions, the UNDP survey found that the average annual income of people in Myanmar is about 2,000 US$ or 1.62 million kyat. The income restoration program is aimed to raise income above this average level. Annual target will need to be set based on results of the monitoring of achievements of the income restoration program.

10.5.2 Entitlement for Livelihood Restoration Program

A combination of choices for income restoration program are offered according to their entitlement as presents in the Table 10.5-1. In order to mitigate, their losses the restoration measures will be implemented.

Table 10.5-1 Restoration Program And Entitlement

Period	Entitlement	Program
Immediate		
Loss of wage	Assistance to find at least unskilled employment. Cash compensation for loss jobs until the business is re-instated	1. Skills training, including basic life skills and appropriate level business development training and support
Long term		
Loss of agricultural land	Land for Land	1. Support for re-establishing fields and reinstating irrigation channels where necessary 2. Advice on improved techniques and inputs, processing, storage and marketing 3. Support in establishing small associated enterprises
Loss of vegetable gardens	Land for Land	1. Support for land preparation 2. Extension advice on improved seeds and techniques 3. Support for groups of vegetable growers 4. Advice on marketing and sales 5. Savings and credit schemes

Table 10.5-2 Restoration Program And Entitlement (Cont.)

Period	Entitlement	Program
Loss of grazing lands	Community negotiation to enable access to other grazing land	1. Support to promote conflict resolution with agricultural communities 2. Support to small enterprise development for animal health 3. Community infrastructure in host communities
Loss of commercial or nutritive trees	Cash compensation for loss	1. Provide access to tree seedling projects 2. Support knowledge/technology linkages to products technologies and marketing
Loss of fishing areas	Community compensation for sharing fishing areas	1. Community infrastructure for communities sharing fishing rights-jetties, landing platforms and processing sites 2. Support to fishermen's associations 3. Saving and credit/loans for fishing equipment
	Individual livelihood restoration	1. Savings and credit/loans for equipment repair and replacement 2. Skill training in fishing industry skills-boat building, outboard motor repair, net making, sails etc.
If no replacement land	Individual livelihood restoration	1. Assistance to identify new skills and areas of interest, (small trading, and new small businesses) in Commerce or the service sector e.g. Hairdressing, tailoring etc. 2. Skill training including function literacy if appropriate 3. Assistance to gain employment 4. Access to savings and credit program 5. Access to tool, equipment and other inputs 6. Support to enterprise development

Source: ERM (2015)

10.5.3 Offered Livelihood Restoration Program

Livelihood restoration of the villagers should be implemented in line with their preferred occupations listed above. Training should also be provide to develop skills needed for their interested occupations. In addition, start-up capital should also be provide in the form of low-cost loans. Community organization should also be promoted to enable the settlers to work in collaboration for their benefits.

A comprehensive program for income restoration is outlined below:

1) Employment at the Initial Industrial Estate

To ensure a stable source of income for people during the transitional period and beyond, the project commits to employ them both during construction and operation periods with the entitlements and offered programs following:

- ✓ One (1) member of PAHs, subject to his/her capability and competency, will be employed and skill training can be provided to those who are really interesting to work with the Project.
- ✓ For the indirect affected persons/households; for example, those who do not have to relocate but whose access and use of the farmland for cultivation or/and who work for livelihood or/and natural resources are affected by the Project, the Project will assist them for their employment opportunities and their income will be restored in accordance with Table 10.5-1.

2) Agricultural Development

To minimize the impacts on livelihood and income, it is necessary to provide agricultural land to all households who will lose their farmlands. As the average land holding of the villagers is about 8.7 acres per household, thus at least 9 acres will be provided to each household to compensate the previous farmland or money equivalent to their land lost will be paid. In addition, the farmers will need to change their occupations and ways of life. They will need intensive training to develop skills for new non-farm occupations.

The villagers who are still interested in continuing their agricultural occupation must be trained about their selected farming model based on the concept of sustainable farming such as integrated farming system with chemical use. The training would cover such subjects as on-farm soil and water management, integrated pest management, farm cost management, product marketing, and farmer co-operatives.

3) Training Programs in Agricultural Related Occupations

A number of training programs will be provided focusing on some agricultural related occupations that use small areas. An area of about 1,600 m^2 will be allocated for the training in vegetable gardening and mushroom growing, The plot will accommodate demonstration plots including a small classroom and a storage shed for gardening tools, equipment and chemicals. Three example training programs are following:

✓ Training in Home Vegetable Gardening

The training in home vegetable gardening will be provided quarterly subject to demand. Each training session would take about two days and would accommodate about 20 trainees. A budget of 16,040 US$ is tentatively estimated at this stage to cover the training of about 80 persons per year for about 160 person-days (=4 sessions x 20 persons x 2 days).

✓ Training in Mushroom Cultivation

A comprehensive training in mushroom cultivation will be provided and the number of training sessions will depend on the number of interested persons. Each training session will be about three days and will accommodate about 25 trainees. A budget of 45,300 US$ is tentatively estimated at this stage to cover six training sessions, a total of about 450 persons-day (=6 sessions x 25 persons x 3 days).

✓ Training in Food/Fruit Preparation, Processing and Preservation

This training program will serve to woman group in particular as they play the major role on household nutrition and hygiene. A small-scale making of local food/fruit products will provided covering such products as cooking varieties of food, making dried meat, salted eggs, preserved cashew nut and vegetables, smoked meat snacks and sweet. A training survey will need to be carried out to determine the training specific product would take about one day. A budget of 43,350 US$ is tentatively estimated at this stage to cover about 15 training per year, a total of about 450 persons-day (=15 sessions x 30 persons x 1 day).

4) Training for Skill Development

To prepare the employment in Initial Industrial Estate and new business opportunities that come with the Project, short-term training should be provide in various skills that would be in demand in Initial Industrial Estate development. Such skills include;

- Construction related skills including carpentry, welding, painter, masonry;

- Motorcycle repair;
- Computer training and computer repair and home appliance repair;
- Small business management;
- Handicraft making; and
- Other subject to adequate demand.

Each training will require about 75 hours (about 10 days). A skill training requirement survey should be carried out to design an appropriate program. At this stage of planning, a budget is tentatively estimated at about 236,000 US$ adequate for training in about 8 skills for about 1,600 training days (=8 training session x 20 person x 10 day for each session).

5) Micro-Credit Program

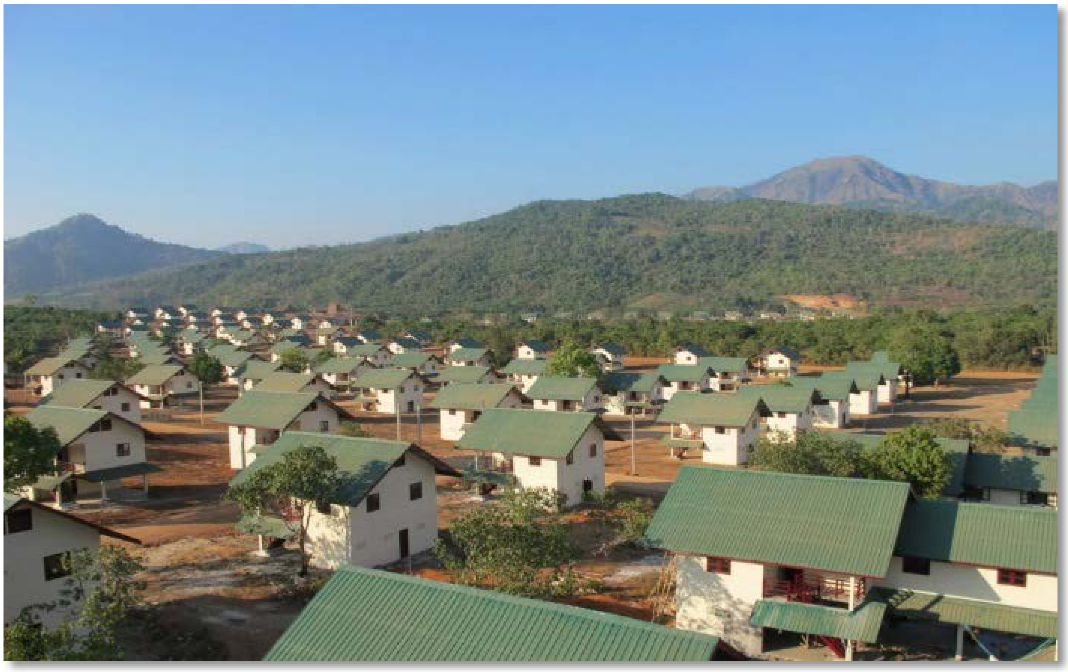
Micro-credit has proved to be an effective means to help financing small investment by persons with no collaterals. A bank will be needed to operate the micro-credit with fund to be provide by MIE or GUM. All PAPs should be eligible for micro-edit financing but priority should be accorded to villagers. The applicants can obtain loans without collateral for setting up and financing their investments related to income restoration. At this stage budgeting purpose, about 1 million US$ equivalent should be provide as the seed capital assuming an average loan of 500 US$ equivalent per household and all 1,037 affected households will be interested in receiving the credit. A detailed operation procedure of the micro-credit program will need to be designed in consultation with the relevant agencies and villagers.

6) Community Organization

This work component will provide two full-time rural development specialists to help organize communities for productive purposes, particularly for new business ventures. The settlers should be organized into various production groups to collaborate among members of each group in marketing their products, buying of production inputs, exchanging experience in various aspects of the business, and productivity improvement. The groups will also represent their members in discussions with the relevant government development agencies. Networks may also be established linking various groups to created synergies among the production groups. Alternatively, an NGO may be contracted to provide the services.

10.6 RESETTLEMENT SITES

Resettlement site has been preparing for all affected villages. Bawah relocation area (Figure 10.6-1) has been completed and ready for the affected villagers who choose this option to be moved in.



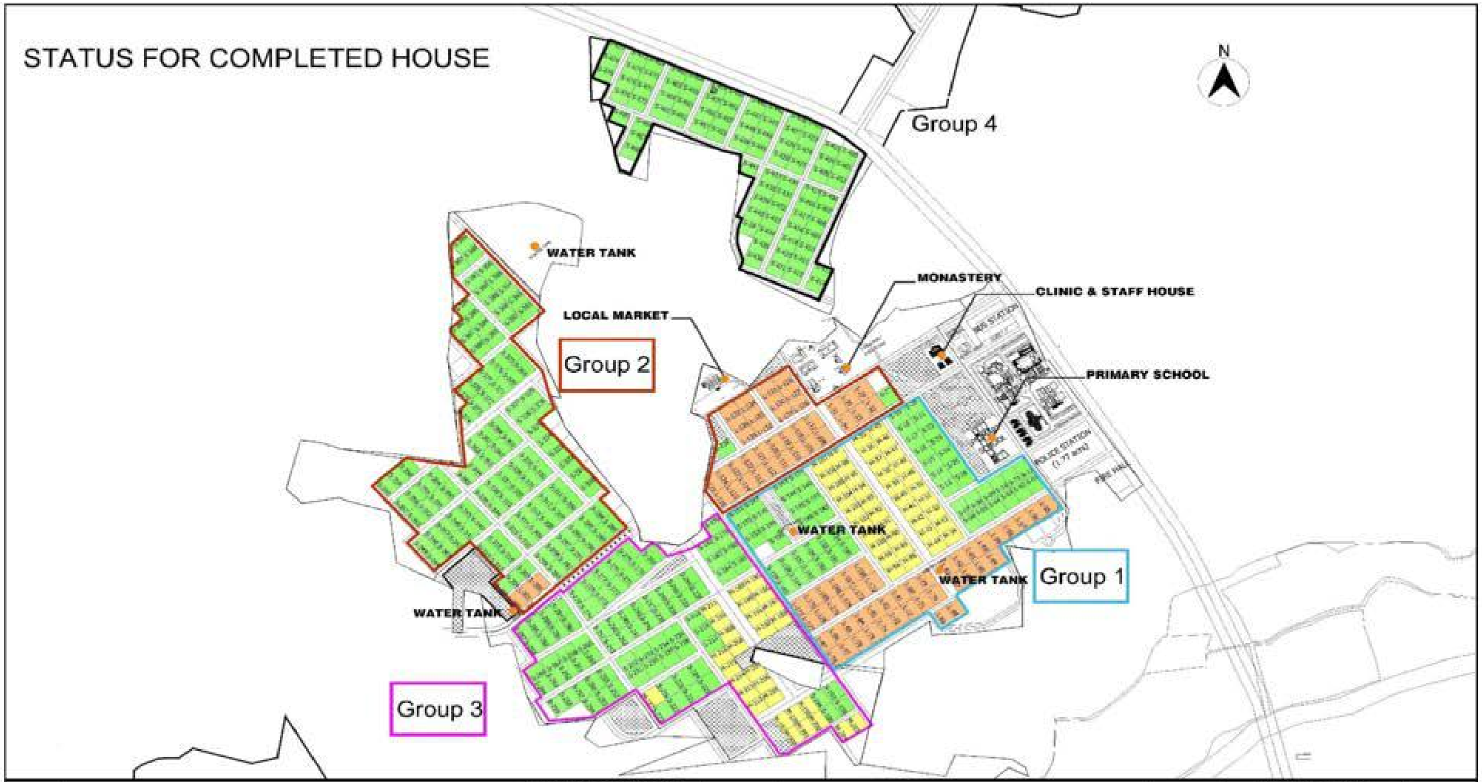
Source: MIE (2016)

Figure 10.6-1 House units in Bawah resettlement site

10.6.1 Site Description

The total area of Bawah relocation site is 1,125 acres. Tree counting in this area had been 100% completed and compensation was paid up to 867.23 acre (78%), with an amount of 2,516.56 million kyats (March, 2013). Bawah resettlement site consists of 480 units of house including facilities of primary school, clinic, staff house, monastery, sanitary work, roadwork, wiring cable and water tank (Figure 10.6-3 to Figure 10.6-4).

House units have three (3) features, small, medium and large. The small size unit is 128 m^2. The medium size unit is 160 m^2. The large size unit is 195 m^2. All are two bedrooms units with different size of family room accordingly the unit's size. Construction cost for each unit are 15,524,231, 18,069,904 and 20,643,235 KYATs, respectively (Figure 10.6-5).



ITEM		HOUSE DESCRIPTION	COMPLETED HOUSE			TOTAL UNIT	PUBLIC BUILDING DESCRIPTION	TOTAL UNIT	MUDU VILLAGE			TOTAL UNIT
			Type S	Type M	Type L				Type S	Type M	Type L	
1		Group 1	53	40	45	138	MONASTERY	1	202	69	72	343
2		Group 2	111	0	39	150	PRIMARY SCHOOL	1				
3		Group 3	81	29	0	110	CLINIC	1				
4		Group 4	82	0	0	82	STAFF HOUSE	2				
		TOTAL	327	69	84	480	LOCAL MARKET	1				
							WATER TANK	4				

Source: MIE (2017)

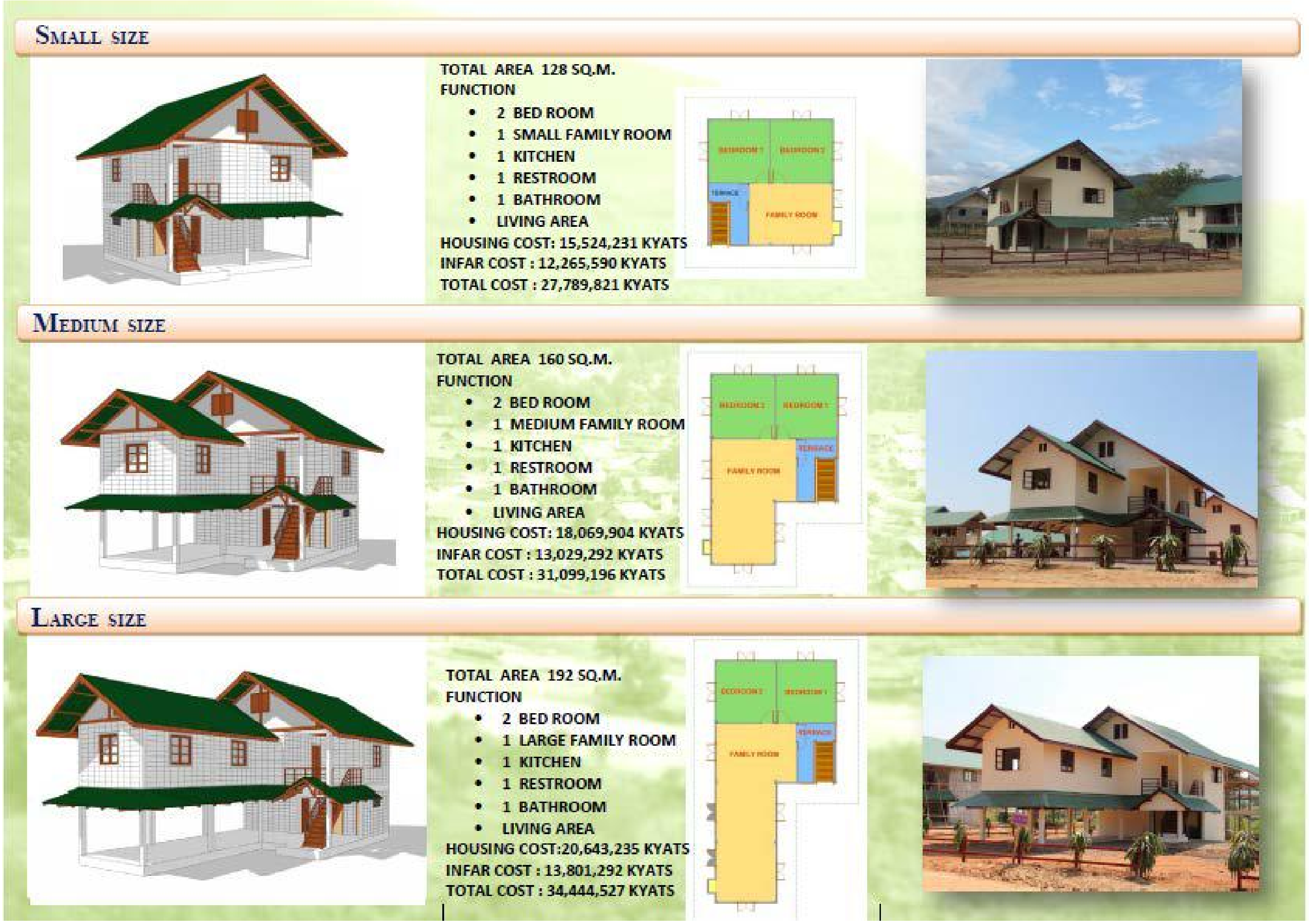
Figure 10.6-2 Resettlement Site Layout

Source: MIE (2015)

Figure 10.6-3 Constructed monastery (above) and primary school (below)

Source: MIE (2015)

Figure 10.6-4 Constructed clinic (above) and staff house (below)



Source: MIE (2015)

Figure 10.6-5 Housing at Bawah resettlement site

- Bawah is approximately 3 km to the sea where local fishermen land their catches. This may open opportunities for fish paste making and fish processing for the villagers who move there.
- There are sufficient water resources in Bawah. Weir structure could be constructed at natural streams, in the area to retain water for use during the dry season.
- Bawah is approximately 10 km from the Early Industry which would be the major source of direct employment and consumption of produces from Bawah.
- The constraint at present is the small household plot and uncertainty in finding agricultural land to compensate for the lost farmlands.
- The constraint is the small household plot and lack of land for farming.

Considering the proximity of Bawah resettlement site to the initial industry, there are opportunities for the villagers to work in the Initial Industrial Estate or to produce some consumer goods, particularly foods, for selling in initial industry.

10.7 IMPLEMENTATION SCHEDULE

Exact timing will be confirmed as part of development of the Project RAPs. However, development and implementation of the Project RAPs will follow this sequence set out in

Table 10.7-1 Sequence of Steps

Step	Description
Census, land and asset inventories	The socio – economic census and land and asset inventories help to understand what will be impacted by the Project (either permanently or temporarily). A key part of the land inventory is to understand land tenure and ownership arrangements. The socio – economic census helps to understand the likely land users (including uses and income derived from these activities). The results from the census and inventories will provide a baseline for determining compensation and future monitoring and evaluation (i.e. post – resettlement/ land procurement).
Cut – off date	The cut – off date should be set following the census and inventories. Anyone moving into an area or improving their land/ assets after the cut – off date will not be compensated.
Resettlement Action Plan and/ or a Livelihood Restoration Plan	The focus will be on establishing the process that will be followed (and the actions that will be taken) to mitigate adverse impacts and provide benefits to PAPs affected by a project. This includes

Table 10.7-1 Sequence of Steps

Step	Description
	strategies that will be applied in relation to livelihood restoration, and the approach that will be taken to providing compensation (at full replacement value). This applies to permanent and temporary impacts.
Grievance mechanism	A mechanism should be developed to identify, respond to and resolve grievances. The grievance mechanism should be developed in parallel with the Project RAPs.
Implementation	The activities involved in implementation will depend on the type of displacement that occurs – e.g. compensation, livelihood restoration, land acquisition. Implementation will include ongoing engagement with affected PAPs, including resolution of any grievances that arise.
Monitoring and evaluation	The last step is monitoring and evaluation, which is an on – going process. Monitoring will be based on the performance indicators identified in the documentation developed. At the conclusion, it will need to be demonstrated that the PAPs are not worse off as a result of the project.

Source: ERM (2015)

The process will be underpinned by ongoing consultation. This includes disclosure of key project information – i.e. the aspects of the project that may contribute to impacts – and consultation throughout the land acquisition and resettlement process.

It is important that vulnerable groups/ people are engaged as part of the process. Vulnerable people are those who by virtue of their gender, ethnicity, age, physical or mental disability, economic disadvantage, or social status may be more adversely affected by a project (when compared to others) and who may struggle to take advantage of assistance offered by a project. Implementation of the resettlement and compensation plan is presented in Table 10.7-2.

Table 10.7-2 Implementation Schedule for the RAP

Tasks/Activities	Responsible Organization
Appointment of Committee and Organizational Setup	
Setting up the Resettlement Office (RSO)	MIE
Resettlement and relocation institutional arrangment	MCDSEZ
Compensation	
Finalize the compensation policy and entilement matrix	MIE/CRC
Detailed measurement surveys of PAPs' properties	MIE/CRC
Determination of compensation amount	MIE/CRC
Payment of compensation	MIE/CRC
Development of Resettlement Sites and Relocation	
Prepare layout and detailed design	MIE
Review and approval of the layout and design	
Construction of houses and infrastructure at Bahwah site	CRC
Prepare schedules for moving the PAPs to designated sites	MIE
Prepare reception facilities at each new site	MIE
Physical/health check-up of PAPs	MIE
Make logistic arrangments for moving the PAPs	MIE
Move the PAPs as scheduled to Bawah site	MIE
Provide transition and settlement allowances	MIE
Income Restoration	
Conduct surveys for tranining needs	MIE
Make arrangement for employment at DSEZ	MIE/CRC
Agricultural land development and allocation	MIE
Prepare designs and make arrangments for training program	MIE
Conduct training in vegetable home gardening	MIE
Conduct training in mushroom farming	MIE
Conduct training in fish processing	MIE
Conduct training in various technical skills	MIE
Prepare adetailed design of micro-credit system	MIE/CRC/Bank
Make arrangements for setting up the micro-credit system	MIE/CRC/Bank
Operate the micro-credit system	Bank
Community organization assistance	MIE
Public Consulation and Information Disclosure	CRC
Review and approval of the proposed grievance procedure	
Disclose information and hold public consultaions as needed	MIE/CRC
Monitoring and Evaluation of RAP Implementation	
Set up performance monitoring indicators and procedure	MIE/CRC
Conduct M&E and prepare reprots	Consultant†
Handover settlement sites to MC-DSEZ	

Schedule columns: Year 0 (Q3, Q4); Year 1* (Q1–Q4); Year2 (Q1–Q4); Year3 (Q1–Q4); Year4 (Q1–Q4); Year5 (Q1–Q4); Year6 (Q1–Q4); Year7 (Q1–Q4); Year8 (Q1–Q4); Year9 (Q1–Q4); Year10 (Q1–Q4)

Remarks:
- Phase A
- Phase B
- Phase C
- Phase D

* To begin after ESIA approval date
† Independent Consultant

Source: ESIA Study Team

10.8 GRIEVANCE REDRESS

10.8.1 Objectives

The project owner in collaboration with Supporting Working Body (SWB) and Regional Authority of Taninthayi will develop mechanisms or procedures to provide avenues for the refugees to relieve their grievances. The grievance redress mechanisms and procedures will be operated with the objective to ensure that the grievances raised by the impacted people will be effectively dealt with in a timely and satisfactory manner. Thus, all refugees can send any queries to concerned government agencies regarding their rights in relation with entitlement of compensation, compensation policy, rates, land acquisition, resettlement, allowance and income restoration.

10.8.2 Procedures

The grievance redress procedure is proposed in Figure 10.8-1. The procedure is based on recommended practices in ADB's Involuntarily Resettlement Policy (1995), Handbook on Resettlement (1998) and Safeguard Policy Statement (2009), and is in accordance with the Land Acquisition Act of Myanmar (1894). The procedures consider the fact that DSEZ is a special area which is developed and administered by the Management Committee of Dawei Special Economic Zone. Based on the ADB's recommendation, complaints will pass through three stages as follows;

Stage 1: MIE Level

An Information Disclosure and Grievance Redress Unit (IDGRU) will be established. An aggrieved person must file a formal complaint to the IDGRU, either verbally or in writing. The complaint issues should consist of:

Factual background information on the complaint :.............................
The issues to be addressed :...
The complainant's position on the issues: ....

Box 10.8-1 Complaints issues to be written in the procedure

The IDGRU through its incumbent person will personally meet with the Complainant to take note of the complaint, if it is verbally presented, document and properly filing the complaint for processing as soon as possible. Processing of the complaint will involve the following activities:

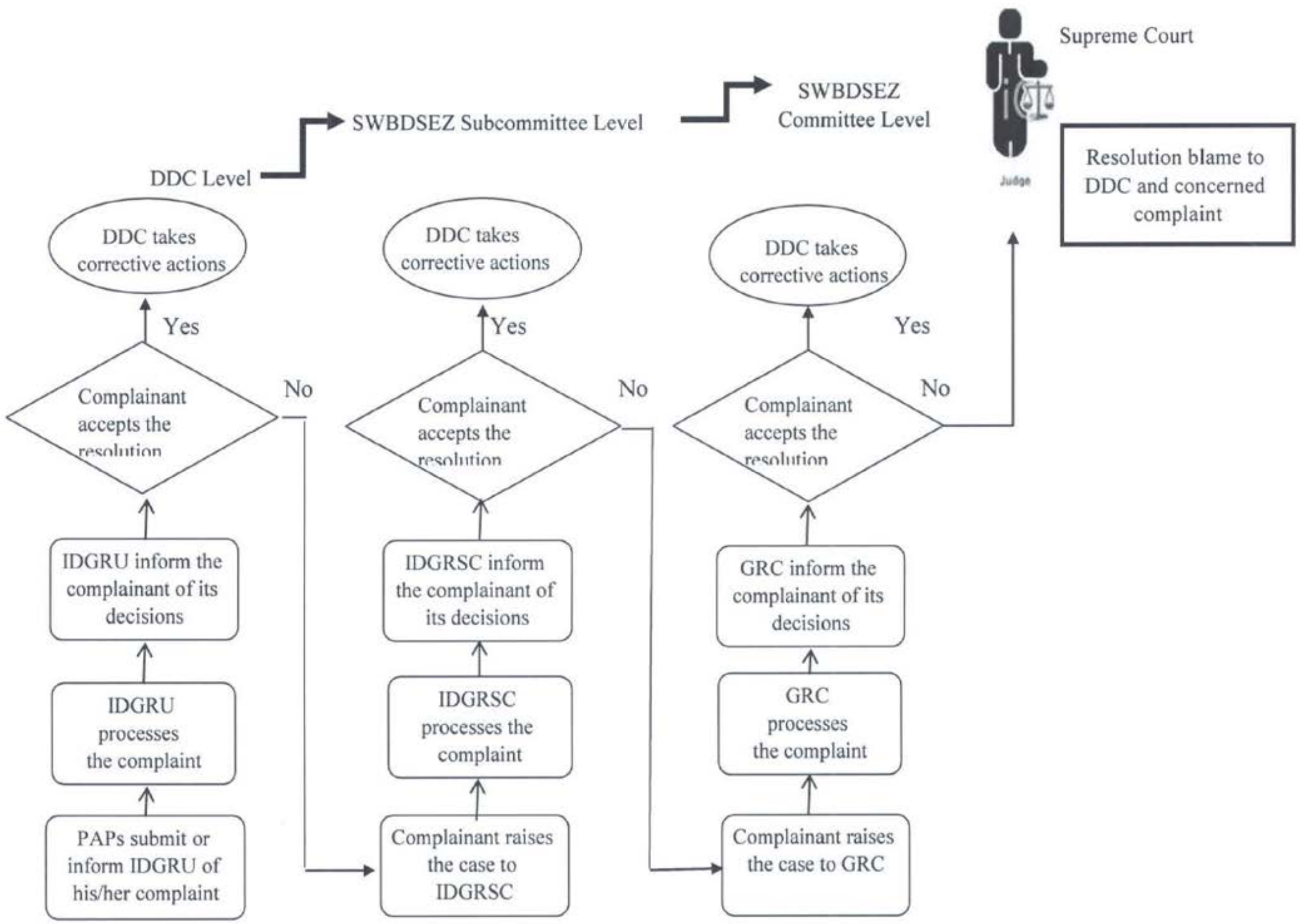


Figure 10.8-1 Grievance Redress Mechanism

Review the validity of complaint within the context of the approved entitlement matrix; existing policy, regulations, and procedures applicable to entitlements of refugees as provided for in the Law of Dawei Special Economic Zone (2011), Land Acquisition Act (1894), Notification of Vice-President of the Union No. 49 (12/7/President Office) on June 15, 2011 and Concession Proposal of Italian-Thai Development Public Company Ltd. (2009), including relevant implementation plans and activities.

In conducting the review, the IDGRU should consult with the Resettlement Manager of MIE and the Information Disclosure and Grievance Redress Sub-committee (IDGRSC) of the Supporting Working Body of DSEZ and take their views into account in making resolution on the complaint.

- The IDGRU will convene a meeting with the relevant units of MIE's
- Resettlement Office to find out a resolution on the complaint.
- The IDGRU will inform the Complainant of the resolution within 15 days after receiving the complaint.
- If the resolution is to reject the complaint, the Complainant must be informed of his or her right to take the complaint further to the IDGRSC for review and final decision.
- If the resolution is to support the complaint, measures to address the
- Complaint must be worked out and the Complainant has to be informed accordingly.
- The resolutions of the IDGRU are binding on the other concerned units of the Resettlement Office.

Stage 2: Subcommittee Level

If the Complainant does not hear from the IDGRU within 15 days after submitting the complaints or if he/she is not satisfied with the resolution of the IDGRU, the Complainant may submit the complaint to the IDGRSC of the Supporting Working Body of DSEZ. Upon receipt of the complaint, the IDGRSC will document the complaint, conduct its own investigations and process the complaint following the same process used by the IDGRU. However, the meeting will involve members of other subcommittees of the Supporting Working Body of DSEZ. The IDGRSC is obligated to make a decision and inform the Complainant of its decision within 15 days after receiving the complaint. Subsequently, the IDGRSC will inform the Resettlement Committee (see Chapter 11) of its decision. The IDGRSC must maintain a public record of all received complaints and its decisions.

- The resolutions of the IDGRSC are binding on the Resettlement Office of MIE.

Stage 3: Committee Level

A Grievance Redress Committee (GRC) will be set up under the Supporting Working Body of DSEZ. If the Complainant does not hear from the IDGRSC of the Resettlement Committee within 15 days of submitting the complaint, or is still not satisfied with the decision of the IDGRSC, he or she may submit the claim to the GRC. Upon receipt of the complaint, the GRC will do document works conduct its own investigations and process the complaint following the process adopted by the IDGRSC. The GRC is obligated to make a decision and inform the Complainant of its decision within 15 days after receiving the complaint. Subsequently, the GRC will inform the Supporting Body of DSEZ of the decision. The GRC must also maintain a public record of all received complaints and its decisions. The resolutions of the GRC are binding on MIE.

Final Stage: the Court of Law Arbitrates

If the Complainant does not hear from the GRC within 15 days after submitting the complaint, or if he/she is not satisfied with the decision of the GRC, the Complainant may bring the case to a court of law for adjudication. In this case, the courts will be the Supreme Court and the defendant will be MIE. After receiving the case, the court should inform the Resettlement Monitoring and Coordination Unit of the Supporting Working Body of DSEZ. The information will then flow to the Resettlement Committee and the IDGRSC. Court's verdicts will also follow the same information flow route. The court's verdicts are binding on MIE and relevant government agencies. The above grievance redress mechanisms and procedures will be disclosed and discussed with refugees and interested public to ensure that the stakeholders understand the process correctly.

The Project Proponent commits to implement the grievances redress procedure, to feedback/concern of the locals, as described in Chapter 13 of the Resettlement and Compensation Action Plan. In order to mitigate the social impacts especially the involuntary resettlement, these received comments will be considered, depending on subjects and level of their impacts in association with the relevant laws and regulations.

Table 10.8-1 Summary of the Grievance Management Process

Step 1	**Receive grievance** Record the grievance in the stakeholder database
Step 2	**Acknowledge the grievance** Respond to the compliant indicating that the grievance will be reviewed. This should occur within 48 hours of receiving the grievance.
Step 3	**Determine validity of the grievance** For grievance determined not to valid provide response to complainant. For all the grievances, undertake an investigation.
Step 4	**Investigate the grievance** This may require a site visit – e.g. to investigate property damage – and/or an internal review – e.g. to confirm management process are being followed as required.
Step 5	**Respond to stakeholder** Identify corrective actions (or steps to be taken in response to the grievance). Agree corrective actions with complainant. Confirm agreement in writing –signed by MIEH and complainant. If compensation has been agreed, pay compensation.
Step 6	**Close-out the grievance** Record final outcome in the stakeholder database and close-out grievance.

Source: ERM (2015)

10.9 COST AND BUDGETS

10.9.1 COST ESTIMATES

The Project commits to bear the expenses of relocating and paying compensation in accordance with the agreements of the assets those are required to relocate and shall relocate the persons so as not to lower their original standard of living, to fulfill the fundamental needs as promulgated in The Special Economic Zone Law (2011), *Section 80*. Cost estimates are prepared for the following components or work items:

- Compensation for land and properties;
- Relocation and development of Bawah resettlement site and resettlement allowance;
- Livelihood, income restoration programs and transition allowance;
- Capacity building of relevant government personnel;
- Cost of administrative support of relevant government committees.

The administrative cost of the Resettlement Office of MIE is not included in the cost of RAP implementation. The cost of each work item is calculated from estimated work quantities and relevant unit costs. Table 10.9-1 presents a summary of cost estimates. The total cost in constant prices including 10% physical contingency is estimated at 8.42 Million US$ equivalent. The largest cost item is the compensation of land and properties followed by relocation and resettlement site development.

Table 10.9-1 Summary of cost estimates in constant August (2017) Prices

<table>
<tr><th>Work Item</th><th>Total Cost (US $)</th></tr>
<tr><td>Compensation for land and properties</td><td>67,920,000</td></tr>
<tr><td>Relocation and resettlement site development</td><td>14,490,000</td></tr>
<tr><td>Livelihood and income restoration programs</td><td rowspan="4">720,000</td></tr>
<tr><td>• Training programs and community organization assistance</td></tr>
<tr><td>• Transitional allowance</td></tr>
<tr><td>• Community development fund</td></tr>
<tr><td>Training of government personnel</td><td rowspan="2">990,000</td></tr>
<tr><td>Administrative support to government committees</td></tr>
<tr><td>Monitoring and evaluation consultancy</td><td>15,000</td></tr>
<tr><td>Total Base Cost</td><td>84,135,000</td></tr>
<tr><td>Physical contingency 10%</td><td>8,413,500</td></tr>
<tr><td>Total Cost</td><td>92,548,500</td></tr>
</table>

Source: MIE (2017)

CHAPTER 11
CONCLUSION

The development of the environmental policy was succeeded by the Myanmar Agenda 21; which aims at strengthening and promoting systematic, environmental, management in the country of Myanmar. It contains four main sections relating to sustainable use of: natural resources; sustainable social development; sustainable economic development; and sustainable institutional development. The implementing agencies are required to make efforts to mitigate the impacts. The existing legislations and regulations that have environmental implications in Myanmar include:

- The Constitution of the Union of Myanmar (2008)
- The Dawei Special Economic Zone Law (2014)
- The Special Economic Zone of Myanmar (2014)
- Forest Law (1992) and Myanmar Forest Policy (1995)
- The Protection of Wildlife and Conservation of Natural Areas Law (1994)
- The Protection and Preservation of Cultural Heritage Regions Law (1998)
- Environmental Conservation Law (2012)
- Public Health Law (1972)
- Environmental Impact Assessment Procedure (2015)
- National Environmental Quality (Emission) Guideline (2015)

Assessment of impacts on environment will be emphasized in the Project and adjacent areas, 27 square kilometers. Majority of impacted area in this ESIA study are assessed from data gained within 5 kilometers in radius from boundary. They are primary data gathered from the project sites, recently and secondary data from the previous studies and the related EIA and ESIA projects in DSEZ especially the Dawei Industrial Estate and Initial Phase Power Plant of Dawei SEZ.

Assessment of environmental impacts are carry out 4 types of resources: physical resources, ecological resources, economic development and social and cultural resources and the result reveals that most of the impacts are not significant impacts and can be managed under mitigation measures. Some impacts are negative and significant such as surface water and air quality during operation. Thus, the project proponent and implementation parties have to comply by laws, regulation and environmental and monitoring program. For example, during the construction phase such water spray and dust minimization need to be implement to mitigate the air quality impact including noise, sorting of equipment with low noise impact or construction location and period shall be planned.

Social impacts on relocation and resettlement of the PAHs will be implemented by Project proponent, RAP expert team through Resettlement Action Plan as in Annex 10-1, especially compensation and income restoration program. The Project proponent also has a plan for skill training program to employ locals in the early industry.

During the operation phase air quality and water quality shall be controlled and the project proponent shall implement the OEMP and mitigation measures in stringent manner. The project proponent has prepared plans for emergency responses to natural disasters i.e. fire, storms and chemical spills with range of facilities i.e. the flood controlling system and evacuation plans. Initially, waste will be managed in accord of Dawei Township Administration. Such 3 R and waste separation by non-hazardous and hazardous shall be appropriately handles as prescribed in the report. Disposal of waste are long-term planned on site in standard lined landfills in the waste management facilities including alternatively managed by license transport with manifest to Yangon disposal sites.

The public consultation meeting was once conducted in March 2015 through local sub-contractor, REM in Myanmese language. After receiving permission from the government, the meetings were carried out. Over 400 people in 13 villages; Ta Nyin In, Du Taung, Ya Ngae, Wa Zoon Taw, Ekani, Thittoh Taut, Kyauk Whet Kone, Yalai, Kha Maung Chaung, Min Dut, Tha Byae Zoon, and Pagaw Yun participated in the consultation activities using socio-economic survey and presentation. Also, the consultation was done with Project Affected Households/People who have to be relocated and restored their income.

Generally, the villagers agree and support the Initial Industrial Estate Project because they believe that the area will be much more develop by the project that will be consequences in improving their living standards, electricity, health facilities and income. The major concerns included compensation and employment in the industrial estate especially perception in losing agricultural land and changing in occupation due to insufficient working skills and qualification for the industries.

The key recommendations are effective communication with the villagers/PAHs/PAPs about project schedule and activities, environmental impacts. In addition, iimplementation of laws and regulations, commitments, EMPs, ERPs and RAP.

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Environmental Management Plan of The Dawei SEZ Initial Industrial Estate Project

April 2018

MYANDAWEI
INDUSTRIAL ESTATE
COMPANY LIMITED

Environmental Managment Plan

of Dawei SEZ Initial Industrial Estate Project

Prepared By IEC International Engineering Consultants in association with UAE

April 2018

ABBREVIATION

CB	Central Body
CC	Construction Contractor
CEMP	Construction phase Environmental Management Plan
CWB	Central Working Body
DSEZ	Dawei Special Economic Zone
DSEZMC	Dawei Special Economic Zone Management Committee
ECD	Environmental Conservation Department
EIA	Environmental Impact Assessment
EMoP	Environmental Monitioring Plan
EMP	Environmental Management Plan
ERP	Environmental Response Plan
ESIA	Environmental and Social Impact Assessment
IE	Initial Industrial Estate
IEC	International Engineering Consultant
IEE	Initial Environmental Examination
ITD	Italian Thai Development Company Limited
MIE	Myandawei Industrial Estate Company Limited
MONREC	Ministry Of Natural Resources and Environmental Conservation
NEQG	National Environmental Quality (Emissions) Guidelines
OEMP	Operation phase Environmental Management Plan
OHSA	Occupational Health and Safety Administration
PS	Performance Standard
SEZ	Special Economic Zone
SWB	Support Working Body
THB	Thai Baht
UAE	United Analyst and Engineering Consultant
US EPA	US Environmental Protection Agency
US$	The United States of America Dollar
WHO	World Health Organization

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ENVIRONMENTAL MANAGEMENT PLANS

For each of the potential environmental impacts described in the ESIA report, various preventative measures proposed to mitigate different types of the impacts. This Environment Management Plans included details of responsible authorities, implemented parties, location, estimated cost including monitoring plans are prescribed here.

The key organizations responsible for implementation of the mitigation measures include: the Governing Bodies of the Government of Myanmar, the Project Proponent, the Construction Contractor and Sub-Contractors and the investors or tenants.

1.1 ENVIRONMENTAL MANANGMENT ACTION PLANS

As enacted in the EIA Procedure, 2015. The two EMPs during construction phase and operation phase are defined as follows:

"***Construction Phase EMP*** *means a detailed and comprehensive Environmental Management Plan (EMP) for the construction phase of a Project. Such plan shall present all relevant commitments, Emission Limit Values, Environmental Quality Standards and other environmental requirements and include a description of the construction works, present an overview of adverse impacts, present mitigation measures and monitoring programs together with time schedules, overview maps, images, aerial photos, sattlelite image, site layout plans, cross sections, transects, environmental management and monitoring sub-plans for each construction site, thematic sub-plans, and management procedures as appropriate*".

"***Operation Phase EMP*** *means a detailed and comprehensive EMP for the operational phase of a Project. Such plan shall present all relevant commitments, Emission Limit Values, Environmental Quality Standards and other environmental requirements and include a description of the construction works, present an overview of adverse impacts, present mitigation measures and monitoring programs together with time schedules, overview maps, images, aerial photos, sattlelite image, site layout plans, cross sections, transects, environmental management and monitoring sub-plans for each construction site, thematic sub-plans, and management procedures as appropriate*".

The above definitions make clear that the two EMPs required by MONREC will need to be comprehensive and have more details than very brief EMPs presented in EIA reports. This requirement of MONREC is in line with current ESIA practices in developed countries. It should be noted that the two EMPs prepared as part of this ESIA study are invariably framework plans as they are based on outline designs of the Project. They are therefore intended to provide framework and prescribe requirements for the preparation of detailed CEMP and OEMP by the appointed EPC contractor (Contractor). Consequently, they could be considered and reffered to as the Project Proponent's or Owner's EMPs to distinguish them from the Contractor's EMP after the ESIA during project implementation.

1.2 ACTION PLANS FOR CONSTRUCTION PHASE (CEMP)

As described in the ESIA Report, the Project is not expected to have major environmental impacts during construction. The Project Propernent will ensue that the CEMP will be implemented and contractor will make the best efforts to minimize the impacts during the construction phase. In this regard, the Project Proponent will ensure that the Contractor-CEMP will incorporate all mitigation measures as prescribed in the Owner-CEMP in preparing detailed designs of the Initial Industrial Estate and its associated facilities, construction methods, and specifications. CEMP are following:

1.2.1 Air Emission and Noise Action Plan

(a) Principle and Rational

One of the main potential impacts to air quality during construction activities is fugitive dust generated from the construction areas and unpaved roads. Other sources include exhaust from machineries used in the construction activities. Construction machineries also generate noise which may affect nearby communities and receptors.

(b) Objectives

To reduce and control dispersion of dust and noise due to construction activity and to reduce air pollution emission and noise from construction machinery equipment. To reduce air pollution and noise impact on community nearby the area.

(c) Project Area

Project construction area

(d) Mitigation Measures

MIE shall formally notify CC and enforce the following measures to reduce emission of air pollutants and noise during construction activities.

- Exhaust gas from construction vehicles are acceptable. However, all equipments and vehicles will need to be maintained in good mechanical conditions;
- Stationary noise sources such as generators, batching plants etc. shall be sited as far as possible from villages, construction camps and resettlement areas;
- Construction works within the distance of 500 m from villages and resettlement areas shall be carried out between 06:00 to 18:00;
- Dump trucks with loads that may generate dust will be covered when travelling through communities;
- Water spraying at least twice a day in the construction areas and unpaved roads is required in the following conditions:

- On the section of unpaved transportation routes that pass through communities or construction work camps;
- When dust generating activities are being carried out within 100 m of a village or construction work camp;
- When visual inspection indicates excessive dust generation in the construction areas and unpaved roads used for material transportation;

- Burning of waste materials including waste vegetation from site clearing will be allowed under the following conditions:
  - The materials that are allowed to be burned are general garbage and vegetation waste. No burning of materials that may generate toxic gases is allowed;
  - A trained fire protection officer with appropriate fire fighting equipments has to be present near the burning areas;
  - Burning is not allowed during severe wind conditions;
  - Burning is carried out at a safe distance from vegetated areas and not within 2 km from a village, a construction work camp, or resettlement areas on the upwind direction;
- Avoid impact pile-driving where possible in vibration-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver causes lower vibration levels where the geological conditions permit their use.
- Construction workers exposed to noise levels of 80 dBA or more shall be provided with adequate hearing protection.

(e) Monitoring Program

MIE is responsible for monitoring that the CC is complying with the measures mentioned above. The monitoring program can be described as follow:

- Each construction machineries are inspected at least every 6 months with a written certificate / maintenance records of each machinery provided by qualified mechanics of the CC;
- Inspect that the dust suppression measures are implemented according to the mitigation measures and the burning of waste materials are conducted according to the relevant mitigation measures;
- Monitor the Community Grievance Record related to dust and noise and ensure that the complaints are responded to and closed appropriately according to the relevant mitigation measures.

Additionally, it is recommended that the project continue sampling of ambient air quality in industrial area and nearby villages every 6 months, dry and rainy season. A total of

2 sampling stations is recommended, which details of the stations and parameters are provided in Table 1.2-1 and Figure 1.2-1.

Table 1.2-1 Analysis Methods of Ambient Air Quality Parameters and Sampling Stations During Construction Period

Parameters	Analysis Method[1/]	Sampling Station
Ambient air quality		Yalai Village (if still exist) and Ekani Village (during zone D construction period)
TSP 24 hours	Gravitric – High Volume	
PM 10	Gravitric – High Volume or equivalent to USEPA	
Wind speed and direction	Wind speed / direction metering Device	
Temperature	Thermometer	
Noise level		
Leq 24 hours	IEC 616721-1 / 616721-2	
Ldn	IEC 616721	
Lmax	IEC 616721	
L90	IEC 616721	

Source: ESIA Study Team

(f) Implementation Period

During construction phase of the industrial estate.

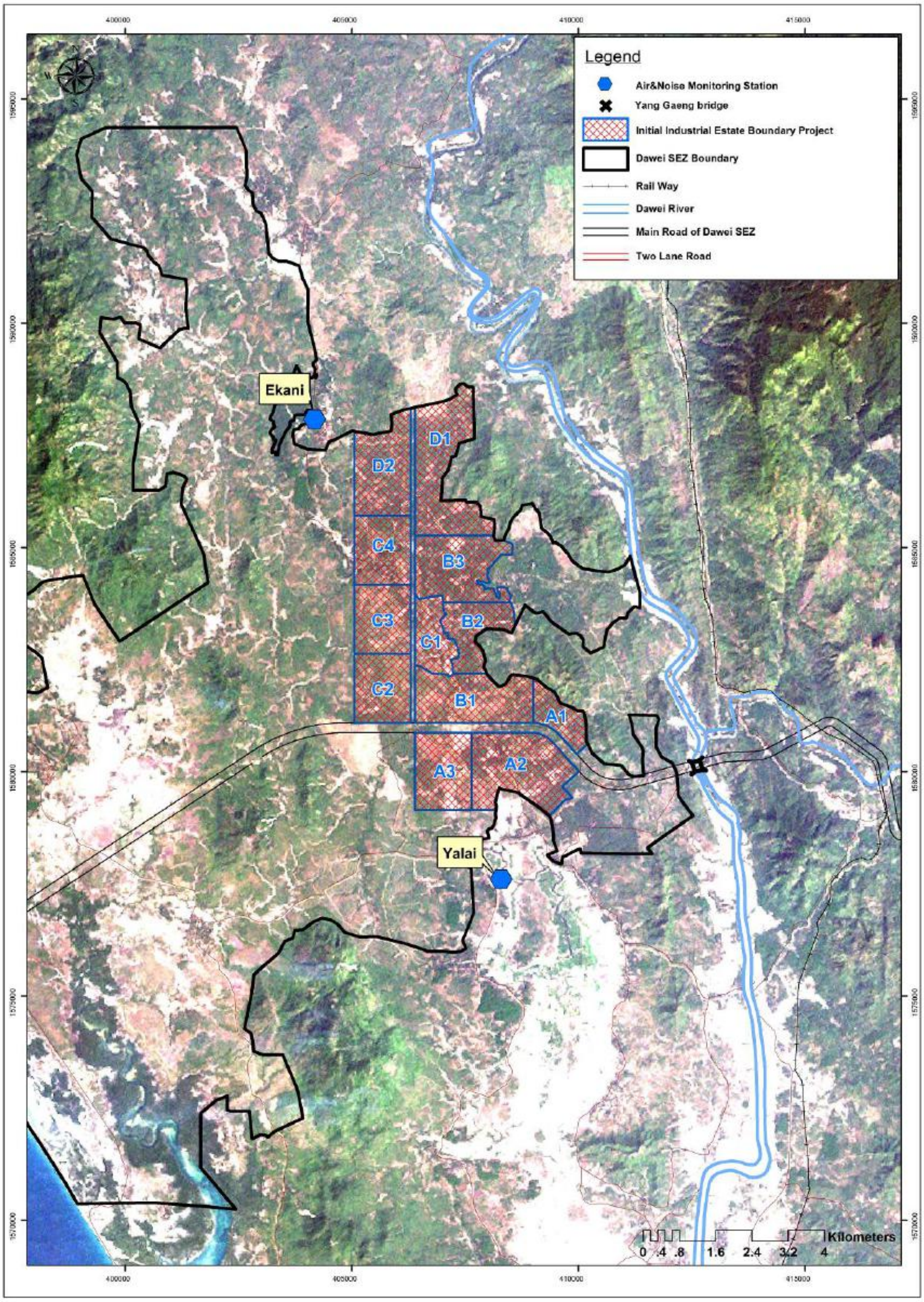
(g) Responsible Parties

MIE shall ensure that the mitigation measures were distributed to and acknowledged by CC.

CC shall implement the mitigation measures under supervision of MIE.MIE shall report the results of implementation for audit every 6 months.

(h) Budget

Approximately 6,000 USD/Year.



Source: ESIA Study Team

Figure 1.2-1 Sampling Stations for Air Quality and Noise Monitoring in Construction Phase

1.2.2 Groundwater Quality Action Plan

(a) Principle and Rational

Discharge of pollutants from construction activities, work camps, workshops, and chemical storage to the environment may affect quality of ground water. Control of release is necessary to limit the potential impacts caused by such activities.

(b) Objectives

To reduce pollution from construction activities into groundwater resources

(c) Project Area

Project construction area

(d) Mitigation Measures

The following mitigation measures need to be implemented by MIE and CC:

- Prepare and implement the measures for groundwater control;
- Saving water sanitary wares such as faucet, flush toilet must be applied;
- " *Water is worth it* " need to be reminded all workers/sectors forward water saving;
- Pipeline of water supply must be regularly checked and immediately repaired for preventing of water leakage;
- In case of insufficient ground water supply, the project must use other water source for tap water production to avoid water supply conflict;
- Provide sufficient number of toilet and bathing facilities for labors, the contractors/subcontractors must not be allowed to establish worker camps outside ITD labor camp.

(e) Monitoring Program

Integrate monitoring program for inspection of mitigation measure implementation with relevant plans. Additionally, it is recommended that the project continue sampling of groundwater quality in industrial area and nearby villages every 6 months, dry and rainy season. A total of 4 sampling stations is recommended, which details of the stations and parameters are provided in Table 1.2-2.

Table 1.2-2 Analysis Methods of Ground Water Parameters and Sampling Stations During Construction Period

Parameters	Analysis Method[1/]	Sampling Station
pH	Electrometric Method	2 well at landfill units , 1 well at Yalai village 1 well at Ekani village
Electrical Conductivity	Electrical Conductivity Method	
Turbidity	Nephelometric Method	
Total Suspended Solids (TSS)	Total Suspended Solids Dried At 103-105 ºC	
Total Dissolved Solids (TDS)	Total Dissolved Solids Dried At 180 ºC	
Total Solids (TS)	Total Solids Dried At 103-105 ºC	
Total Hardness		
Iron	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Manganese	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cadmium	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Hexavalent Chromium	Extraction and Direct Air Acetylene Flame Method	
Lead	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Zinc	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Nickel	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Copper	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cyanide Arsenic Total Mercury	Distillation,Pyridine-barbituric acid Method Hydride Generation AAS Method Cold Vapour AAS Method	
Total Coliform Bacteria (TCB)	Multiple Tube Fermentation Technique	
Faecal Coliform Bacteria (FCB)	Multiple Tube Fermentation Technique	
E.Coli	Multiple Tube Fermentation Technique	

Source: ESIA Study Team

(f) Implementation Period

Throughout the construction phase

(g) Responsible Parties

MIE shall ensure that the mitigation measures were implemented and acknowledged by CC. CC shall implement the mitigation measures under supervision of MIE. MIE shall prepare the report with the results of implementation for audit every 6 months.

(h) Budget

Approximately 30,000 USD/Year.

1.2.3 Erosion and Sedimentation Control Action Plan

(a) Principle and Rational

Construction and large earth-moving activities accelerates erosion. Particularly, by exposing large areas of soil to rain and running water. If this runoff is not properly controlled, the result is often serious siltation of nearby watercourses. The consequences are degradation or destruction of fish and wildlife habitats, and water being less useful for fresh water supplies.

(b) Objectives

To prevent change in soil quality and fertility as well as to prevent soil erosion in the construction site into water resource and area nearby.

(c) Project Area

Project construction area

(d) Mitigation Measures

CC shall prepare an *Erosion and Sediment Control Plan* for construction activities and submit to MIE for approval prior to commencement of construction activities in the area. The major effort at construction sites will focus on the management of erosion of excavated surfaces, especially during the wet season when the volume of runoff is expected to be high. The plan shall have the following components:

- An assessment of the potential for contamination of natural waterways. Basic principles include the size of the disturbed area, site drainage, and waterways receiving stormwater from the disturbed area;
- Plans for water management shall be established and include adequate drainage system to manage runoff;
- Sedimentation controls shall be implemented in the form of silt trap fences and sedimentation basins where be suit, and all runoff from the disturbed area shall be directed to the sediment controls;
- Measures to be taken to collect, store and treat stormwater prior to discharge from the site considering options for water re-use onsite;
- Management of material storage area i.e. stockpile and spoil disposal area shall not be located on drainage line;
- Control of erosion and sedimentation shall be constructed progressively prior to commencement of each stage of earthworks until the permanent protection is established.

(e) Monitoring Program

MIE shall develop a monitoring program to include inspections of drainage works, sediment traps, and other structures designed to treat water to meet an acceptable quality before discharge into natural and/or constructed watercourses meet the appropriate standard. The monitoring program for erosion and sediment control include:

- Inspect that erosion and sediment controls are in place prior to rainy season;
- Inspect that the drainage system and sediment controls are functional during rainy season;
- The sediment basins have a capacity of reducing the suspended solid from stormwater by fifty percent (50%); and
- Designate water quality monitoring plan to include locations of sampling upstream and downstream of the entry points of surface water runoff from construction area; frequency and methods of testing, and applicable standards for suspended solid.

(f) Implementation Period

During construction

(g) Responsible Parties

CC under supervision by MIE shall develop and implement *Erosion and Sediment Control Plan* according to the site condition and progress of construction work.

MIE shall review and approve the *Erosion and Sediment Control Plan* before the construction in the area can be commenced, then inspect and monitor the implementation of *Erosion and Sediment Control Plan* according to the monitoring program. MIE shall prepare the report with the result of the implementation for audit every 6 months.

(h) Budget

Included in construction budget.

1.2.4 Surface Water and Sediment Quality Action Plan

(a) Principle and Rational

Discharge of pollutants from construction activities, work camps, workshops, and chemical storage to the environment may affect quality of freshwater, coastal water, and sediment. Control of release is necessary to limit the potential impacts caused by such activities.

(b) Objectives

To prevent soil erosion and wastewater runoff into natural water resources. To prevent wastewater contamination from campsite

(c) Project Area

Project construction area.

(d) Mitigation Measures

The following mitigation measures need to be implemented by MIE and CC:

- Prepare and implement the measures for Erosion and Sediment Control.
- Prepare and implement the measures for Waste Management.
- Prepare and implement the measures for Construction Work Camps.
- Discharge of oil and grease from workshop facilities is prohibited. Used oil need to be stored separately and managed as per *Waste Management Plan*.
- Stock yards; gasoline, oil, lubricant and hydraulic oil storage areas; and machines/vehicles cleaning areas should be located at least 100 meter away from natural waterways.

(e) Monitoring Program

Integrate monitoring program for inspection of mitigation measure implementation with relevant plans. Additionally, it is recommended that the project continues sampling of surface water quality in Dawei and Kunchaug Rivers every 6 months, dry and rainy season, during the construction period for another 3 years so that the project has a more complete and continual baseline surface water quality before commencement of the industrial areas.

A total of 10 sampling stations is recommended, which details of the stations and parameters are provided in Table 1.2-3 and Figure 1.2-2

Table 1.2-3 Analysis Methods of Surface Water and Sediment Quality Parameters and Sampling Stations During Construction Period

Parameters	Analysis Method[1/]	Sampling Station
Surface Water		
Water Level/Depth/Width	Depth Meter	SWK1: about 100 m upstream before flow into boundary of project SWK2: discharged point of the effluent into Ya Liang Chaung SWK3: 2,000 m downstream after discharged point of the effluent SWK4: 4,000 m downstream after discharged point of the effluent SWK5: about 100 m before Kunchuang River mouth SWD1: about 500 m upstream before flow pass through boundary of project SWD2: Discharged point of the effluent into DAWEI River SWD3: 2,000 m.downstream after discharged point of the effluent into DAWEI River SWD4: 4,000 m. downstream after discharged point of the effluent into DAWEI River SWD5: 500 m downstream before Kunchuang River mouth
Temperature	Thermometer	
Flow Rate	Flow Meter	
pH	Electrometric Method	
Salinity	Electrical conductivity Method	
Electrical Conductivity	Electrical Conductivity Method	
DO	Membrane Electrode Method	
BOD	Membrane Electrode Method	
Turbidity	Nephelometric Method	
COD	Open Reflux Method	
TSS	TSS Dried At 103-105 ^{o}C	
TDS	TDS Dried At 180 ^{o}C	
Total Solids (TS)	TS Dried At 103-105 ^{o}C	
Nitrate-Nitrogen	Cadmium Reduction Method	
Ammonia-Nitrogen	Phenate Method	
Phosphate -Phosphorus	Ascorbic Acid Method	
TKN	Kjeldahl Method	
Oil&Grease	Soxhlet Extraction Method	

Table 1.2-3 Analysis Methods of Surface Water and Sediment Quality Parameters and Sampling Stations During Construction Period (Cont.)

Parameters	Analysis Method[1/]	Sampling Station
Phenol	Distillation, 4-aminoantipyrine Method	
Iron	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Manganese	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cadmium	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Hexavalent Chromium	Extraction and Direct Air Acetylene Flame Method	
Lead	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Zinc	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Nickel	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Copper	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cyanide	Distillation,Pyridine-barbituric acid Method	
Arsenic	Hydride Generation AAS Method	
Total Mercury	Cold Vapour AAS Method	
Total Coliform Bacteria (TCB)	MPN Technique	
Faecal Coliform Bacteria (FCB)	MPN Technique	
E.Coli	MPN Technique	
Sediment [2/]		
Particle size	Sieve Analysis and Hydrometer Test[3/]	
Oil and Grease	Soxhlet Extraction Method	
Iron	Acid Digestion and Flame AAS Method	
Arsenic	Acid Digestion and Hydride Generation AAS Method	
Cadmium	Acid Digestion and Flame AAS Method	
Total Chromium	Acid Digestion and Flame AAS Method	
Copper	Acid Digestion and Flame AAS Method	
Mercury	Acid Digestion and Cold Vapour AAS Method	
Nickel	Acid Digestion and Flame AAS Method	

Table 1.2-3 Analysis Methods of Surface Water and Sediment Quality Parameters and Sampling Stations During Construction Period (Cont.)

Parameters	Analysis Method[1/]	Sampling Station
Lead	Acid Digestion and Flame AAS Method	
Zinc	Acid Digestion and Flame AAS Method	

Remarks:

[1/] APHA, AWWA and WEF. Standard Methods For The Examination of Water And Wastewater. 22nd ed. Washington, DC: APHA. 2012.

[2/] United States Environmental Protection Agency. SW-846 Method.

Source: ESIA Study Team

(f) Implementation Period

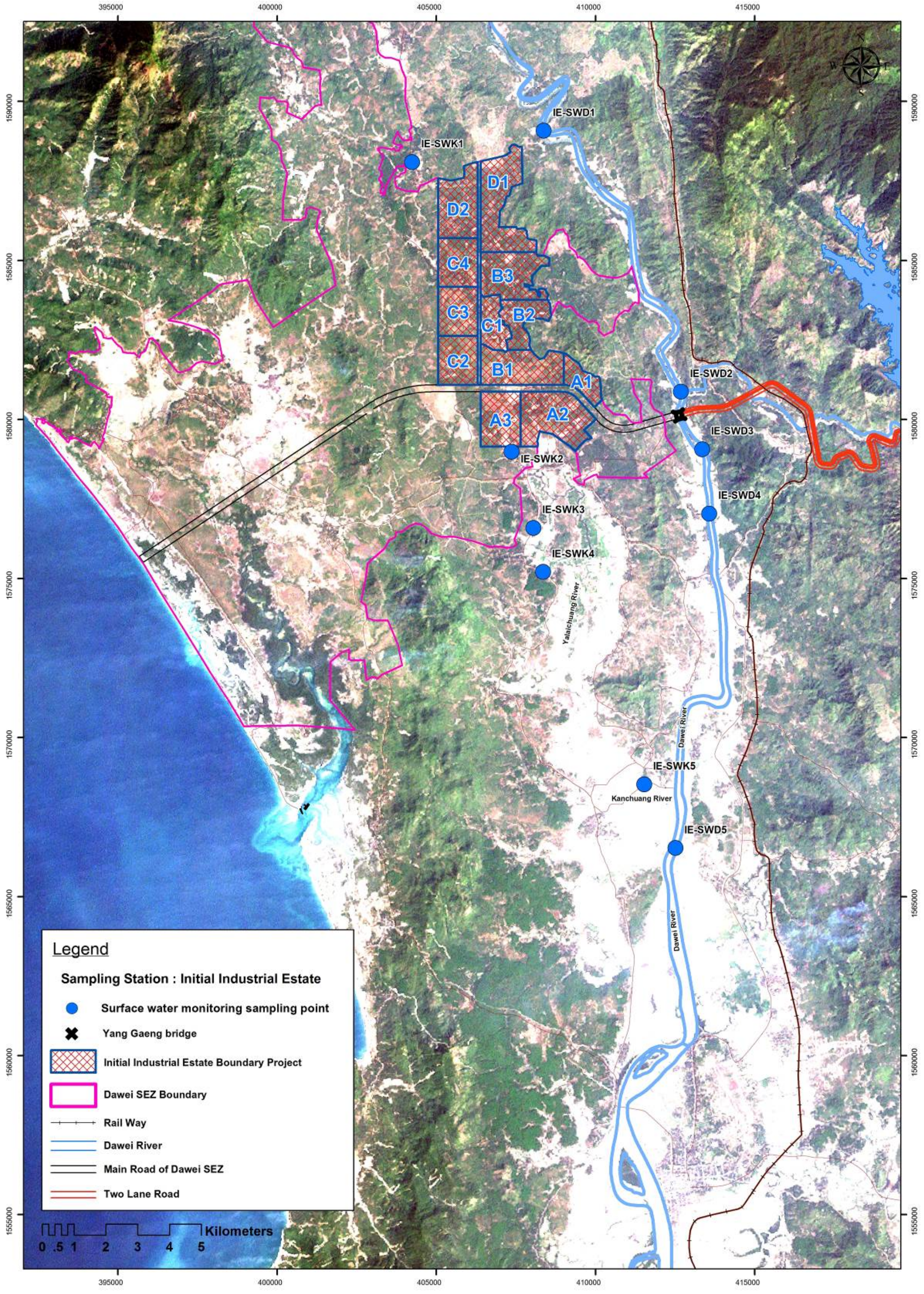
Throughout the construction phase.

(g) Responsible Parties

MIE shall ensure that the mitigation measures were distributed to and acknowledged by CC. CC shall implement the mitigation measures under supervision of MIE. MIE shall prepare the report with the results of implementation for audit every 6 months.

(h) Budget

Approximately 50,000 USD/Year.



Source: ESIA Study Team

Figure 1.2-2 Sampling Locations for Surface Water and Sediment Monitoring in Construction Phase

1.2.5 Terrestrial Biology Action Plan

(a) Principle and Rational

Although the much of the project area has been encroached by local villagers and used as farmland and residential areas, natural forests remains in some part of the area, and some endangered plant species were identified. Attempts should be made to conserve the native plant species and minimize disturbance to sensitive environment such as mangrove area.

(b) Objectives

To prevent a natural forests , endangered plant species ,native plant species and minimize disturbance to sensitive environment such as mangrove area.

(c) Project Area

Project construction area.

(d) Mitigation Measures

MIE needs to coordinate with CC to ensure that the measures below are incorporated in their construction plan.

- Only clear the area needed for construction of infrastructure and utility system. Avoid disturbance of beach forest and mangrove as much as possible.
- Wherever possible, identify the endangered species and transfer them to safe locations prior to clearing the vegetation.
- Hunting of wildlife is prohibited.
- Disturbance of forest areas outside the project area by CC and their subContractor is prohibited.

(e) Monitoring Program

MIE will monitor the progress of construction work and vegetation clearing. Excessive vegetation clearing particularly prior to rainy season has to be minimized. Natural forests and mangrove areas that can be conserved throughout the construction phase has to be identified and signposted.

(f) Implementation Period

Vegetation clearing plan and detailed survey of endangered species has to be conducted before an area is cleared. The plan can be revisited throughout the construction period.

(g) Responsible Parties

MIE is responsible to identify the area where natural forest can be conserved. MIE needs to consider further survey of endangered plant species identified in baseline environmental survey to map out their locations and numbers. MIE shall communicate the plan to CC for action.

(h) Budget

Included in construction budget.

1.2.6 Waste Management Action Plan

(a) Principle and Rational

A number of elements of the construction activities have the potential to generate waste that can have adverse effects on surrounding environment in terms of water quality, soil quality, air quality (odor and pollutants) and human health. Waste can be both non-hazardous and hazardous waste. These wastes require different management methods. Lack of appropriate waste management facilities in the vicinity of the project area requires that the project needs to manage the waste generated from the construction activities by themselves.

(b) Objectives

1) To prevent and resolve waste and solid waste impact from the project.
2) To minimize waste and provide guideline for solid waste management according to the law and regulation and appropriate method.
3) To prevent and resolve impact from remaining solid waste.
4) To get rid of bleeding area in solid waste storage location.

(c) Project Area

Project construction area.

(d) Mitigation Measures

MIE shall develop *Waste Management Plan* that will be applicable to all Contractor and sub contractors in the project. The *Waste Management Plan* shall include the following components:

- Identify classification of waste. The minimum waste classification shall be non-hazardous and hazardous waste;
- Identify the size and location of the temporary hazardous waste storage area and non-hazardous waste disposal site for the construction phase of the industrial estate;
- A mechanism for coordination between MIE and CC in waste separation, waste transfer, record of waste quantity.

- Non hazardous waste and construction waste such as glass, plastic, paper, wood shall be separated at the site for reusing and recycling. Unusable waste shall be disposed at sanitary landfill site.
- Hazardous waste in construction period shall include, but not limited to, the following waste materials. Any mixed waste stream that contains any of the hazardous waste shall be categorized as hazardous waste:
  - Alkalis and caustic waste;
  - Batteries;
  - Empty containers which held chemicals, paints, oil and solvents;
  - Oil contaminated waste including oily rags, oil filters, used gloves;
  - Used oil, hydraulic fluids, chemicals, and solvents;
  - First aid and medical waste;
  - Spill clean-up waste;
  - Waste from grease trap
- Hazardous waste shall be stored in appropriate temporary hazardous waste storage areas until the permanent hazardous waste management facilities for the operation phase is functional. Minimum requirements of the temporary hazardous waste storage areas include:
  - Impervious floor without cracks or spaces that may allow spills to perforate into the ground;
  - Surrounded by secondary containment bunds. The secondary containment bunds shall be at least 0.5 m high with a volume large enough to contain the spill of the largest container expected in the storage area;
  - Designate storage area for liquids or materials that are not allowed to be mixed, such as acids and alkalis;
  - Equipped with spill response kits;
  - Consider providing the area with roofing and temporary walls with a provision that the temporary hazardous waste storage area will have to be in use for at least 3 years until the permanent hazardous waste management facilities of the industrial estate are functional.
  - Type and quantity of hazardous waste in the storage area shall be recorded and kept current.
- Burning of the following non-hazardous waste is allowed: cardboard, pallets, papers, and wood/vegetation waste. The waste burning site shall be designated in the *Waste Management Plan* and shall be at least 2 km from any villages, construction work camps, or resettlement areas.

- Other non-hazardous waste shall be transferred to non-hazardous waste disposal site to be used during construction phase shall meet the following minimum requirements:
  - The disposal site shall be on higher ground not subject to flood.
  - The disposal site shall be at least 2 km from any groundwater well that is being used by workers or local villagers.
  - The disposal site shall be in the area where no excavation is planned. It shall be delineated with clear sign boards.
  - The waste shall be covered with soil on daily basis.
  - The location of all disposal sites during construction period shall be recorded as expanded appendices to the *Waste Management Plan*.
- Establish a training program for workers related to waste classification, storage, and disposal.
- The *Waste Management Plan* may be expanded to cover recyclable waste and compostable waste in the future.

(e) Monitoring Program

MIE is responsible for monitoring that the CC is complying with the measures mentioned above. The monitoring program is described below.

- Inspect that appropriate containers for type of waste as categorized in the *Waste Management Plan* are provided for construction work camps, workshops, construction sites, and other supporting facilities;
- Weekly inspection of waste segregation at the construction facilities and at the hazardous waste storage and non-hazardous waste disposal site;
- Weekly inspection of hazardous waste storage area and record of hazardous waste inventory.
- The location of waste burning area is designated and no waste burning is conducted outside the area;
- Waste management training record;

(f) Implementation Period

During construction phase of the industrial estate.

(g) Responsible Parties

MIE shall develop the *Waste Management Plan* to be implemented by both MIE and CC during construction phase. MIE shall operate the temporary hazardous waste storage area and waste disposal site. MIE shall keep record of types and quantity of waste received to the

temporary hazardous waste storage area and non-hazardous waste disposal site. MIE shall provide and keep record of waste management training program. MIE shall report the implementation of *Waste Management Plan* for audit every 6 months.

CC shall collect, separate, and transport the waste to the appropriate waste handling facility.

(h) Budget

Included in construction budget.

1.2.7 Quarry Management Action Plan

(a) Principle and Rational

One limestone quarry is identified to the north of the industrial estate area. The quarry will supply aggregates and rip-rap rocks for construction of the industrial estate and the port and jetty. Activities at the quarry include site clearing, rock blasting, crushing plant, stockpile and transportation of materials. Activities at the quarry may results in various impacts to the environment including erosion and sedimentation, noise, dust, and visual impacts.

(b) Objectives

To control results of activities at the quarry including erosion and sedimentation, noise, dust, and visual impacts

(c) Project Area

Project construction area.

(d) Mitigation Measures

MIE operates the quarry as a main source of construction materials for the construction of the industrial estate and other facilities. Operation of a quarry needs to be managed so that the potential impacts to the environment and communities surrounding it is reduced and controlled. MIE shall establish *Quarry Management Plan* that has the following components:

- Extent of the quarry, estimated quantity of material, and rock blasting safety zone around the quarry. The safety zone has to be barricaded and entrance by unauthorized persons shall be prohibited;
- Explosives shall be properly stored in secured, explosion-proof storage room. The storage room shall be guarded at all time. Procurement and use of explosives shall be in accordance with local regulations;
- *Erosion and Sedimentation Control Plan* for the quarry site has to be established according to the mitigation measures for erosion and sedimentation control;

- Dust suppression measures for the quarry, crushing plant, and stockpile area will be implemented on exposed areas during windy conditions, or when visual inspection indicates excessive dust generation;
- Blasting activities within a distance of 2 km from villages or construction camps will be carried out between 06.00 and 18.00. Blasting in all other areas may be undertaken 24 hours a day subject to suitable safety and lighting measures being implemented;
- Quarry closure method needs to be planned to minimize the visual effects after the operation is complete.

(e) Monitoring Program

MIE is responsible for monitoring the quarry operation for compliance with the measures mentioned above. The monitoring program can be described as follow:

- All measures as stipulated in the *Quarry Management Plan* are implemented;
- Monitor the Community Grievance Record related to quarry operation and ensure that the complaints are responded to and closed appropriately according to the relevant mitigation measures.

(f) Implementation Period

During the operation of quarry.

(g) Responsible Parties

MIE as the operator of the quarry shall ensure that the *Quarry Management Plan* is established and implemented. MIE shall prepare the report wiyh the results of the implementation for audit every 6 months.

(h) Budget

Included in construction budget.

1.2.8 On-site Traffic and Access Management Action Plan

(a) Principle and Rational

Access roads used for transportation of construction materials and for traveling between construction sites overlap with the existing roads used by local villagers inside the project area. Roads are currently unpaved and have blind spots. Improvement of road safety conditions will be required.

(b) Objectives

To control using for transportation of construction materials and for traveling between construction sites .

(c) Project Area

Project construction area.

(d) Mitigation Measures

MIE as the project owner shall be responsible and instruct relevant CC to implement the following measures to improve access road safety conditions.

- All access roads in the construction area shall be signposted with the following information in Myanmese and English:
  - Speed limit;
  - Construction activities and machinery;
  - Roadside borrow pits and material stockpiles;
  - Any applicable load limit, particularly for temporary bridges; and
  - Road features that may affect driving conditions such as curves, hidden accesses etc.
- A speed limit of 40 km/hr shall be applied in village areas and construction camps. Drivers shall be trained and notified of such limit;
- Consider building speed humps before and after each village, where appropriate;
- Route for heavy vehicles used for transportation of construction materials shall be designated. Route with least number of villages and residential area is most preferable;
- Survey of the access roads to identify blind spots need to be regularly conducted. Improvement to the blind spots such as removal of obstructing objects when necessary; and
- Access road used for the construction activities shall be maintained in good conditions.

(e) Monitoring Program

MIE is responsible for monitoring if the above measures are implemented by all parties. MIE shall coordinate with CC in selection of the most appropriate transportation routes that will contribute to least impact to the locals using the road for their daily travel.

(f) Implementation Period

During construction phase of the industrial estate, until the permanent roads are completed.

(g) Responsible Parties

CC responsible for construction and maintenance of the access roads shall be responsible for implementing the measures relevant to signposts and road improvement.

MIE and CC are responsible for using the designate routes for transportation of construction materials and traveling between construction sites. Speed limit needs to be respected and punishment system should be in place in case of violation.

(h) Budget

Included in construction budget.

1.2.9 Construction Work Camps Action Plan

(a) Principle and Rational

Construction work camps can be sources of wastewater pollution and health impacts. Thousands of workers are expected during the construction period, and proper management of the camps will be required to ensure that the potential impacts are controlled.

(b) Objectives

To control sources of wastewater pollution and health impacts from work camps.

(c) Project Area

Project construction area.

(d) Mitigation Measures

It is assumed that MIE, CC, and sub contractors will have their own compounds and camp management bodies. The following measures will be required for each of the worker camps in the project area:

- Camp rules shall be established and informed to all residences. The rules should contain the following components:
  - Policy on alcohol and substance abuse;
  - Safety measures and emergency response particularly in case of fire;
  - Waste management requirements;
  - Other measures to prevent dissemination of vectors and transmissible disease including STDs and HIV/AIDs;
- General areas of the camp shall be kept clean and tidy. Waste shall be collected regularly to avoid accumulation of waste in the camp;
- Toilets shall be provided at a ratio of 1 toilet per 15 workers. All toilets shall be equipped with septic and treatment tanks of adequate size. The toilets need to

be at least 100 m from any natural waterways. Sludge from tank cleaning shall be stabilized by adding lime (pH = 12 for 30 minutes) and disposed of in designated pit for sludge disposal. The pit shall be at least 1 km from any groundwater wells and is higher than groundwater table;

- Proper drainage has to be provided. Improve areas with stagnant water as much as possible; and
- Pest control measures shall be planned and implemented. All bedrooms need to be equipped with mosquito protection.

(e) Monitoring Program

MIE shall be the party inspecting the camps periodically to ensure that all the implementation are made.

(f) Implementation Period

Since the start of any construction work camp until end of its use.

(g) Responsible Parties

All parties are responsible for managing their own camps in line with the above mitigation measures.

(h) Budget

Included in construction budget.

1.2.10 Historical and Cultural Resources Action Plan

(a) Principle and Rational

There are a number of sites with historical and cultural values in the project area. Each village also has at least one temple. Pagodas are observed in many places within the project area. Construction activities may disturb and damage these structures. Removal or relocation of these sites will be eventually required when the project is fully developed. If not handled properly, this matter will create significant conflict between local populations and the project.

(b) Objectives

To reduce disturbing and damaging historical and cultural values in the project area.

(c) Project Area

Project construction area.

(d) Mitigation Measures

MIE as the project owner will need to take ultimate responsibility in handling the matter and ensure that CC understand the risk and follow the procedures and measures described below to reduce potential impacts with the communities.

- Sites with historical and cultural values shall be identified, recorded and located in the map. This information shall be agreed upon by the local authorities and villagers.
- If construction activities have to be carried out within 50 m from these sites, the leaders of the communities that the sites belong to need to be notified at least 1 week prior to commencement of the activities.
- Establish a plan and communication channel in case an unidentified site is encountered during the construction work to avoid damage to the site.
- Removal and relocation method and destination shall be a mutual agreement between MIE, local authorities, and the leader of the communities that the site belongs to.

(e) Monitoring Program

MIE needs to keep record and map up to date and make them available to all parties including CC and their subcontractor. MIE needs to monitor the construction work progress with the locations of known sites so that timely action can be taken is the sites will be subject to disturbance by construction activities.

(f) Implementation Period

Throughout the construction phase.

(g) Responsible Parties

MIE as the project owner is ultimately responsible for this matter.

(h) Budget

Included in construction budget .

1.2.11 Public and Occupational Health Action Plan

(a) Principle and Rational

Construction activities can directly and indirectly affect the conditions of public and occupational health. Potential impacts include accidents, injuries, communicable diseases, increase in stress to the existing public health facilities etc. Mitigation measures related to each aspect of public and occupational health are described below.

(b) Objectives

To reduce accidents, injuries, communicable diseases, increase in stress to the existing public health facilities .

(c) Project Area

Project construction area.

(d) Mitigation Measures

Occupational Health and Safety:

During the construction phase, MIE as the project owner and CC as the implementer should establish the preventive and protective measures to mitigate the potential occupational health impacts as follows:

Accidents and Injuries

- Establish occupational and safety management plan and program for the construction should be established to assess and manage EHS impacts and risks. Project or activity-specific plans or procedures should be prepared and the basic site rules of work should be included.
- Perform occupational accidents and disease recording and reporting, and investigate all incidents to understand the cause of accident and to identify measures necessary to prevent a recurrence.
- Provide Contractor and sub contractor management plan to ensure that the Contractor and sub contractor will have safety performances and procedures to protect their employee. Supervise and monitor Contractor and sub contractor performance periodically.
- Train and provide information to employees. Occupational health training program should be provided as needed, for example, hazard awareness, specific hazards and safe work practices, to ensure that workers are capable of work safely.
- Provide appropriate personal protective devices to employee and ensuring that personal protective devices will be worn during working at all time.
- Restrict local community to access the site or area using fencing, signage and risks communication.
- Appropriately mark area signage and labeling of equipments, determine hazardous area, for example electrical rooms, compressor etc., as well as installations, materials and emergency exits, and label in accordance with international standards, and easily to understood by workers, visitors and general public.

Occupational, Sexual Transmission and Communicable Diseases

- Supervise and monitor performance of Contractor and sub contractors on housekeeping in the campsite.
- Include training programs for workers with these following topics: health awareness, hygiene and sanitary, waste management, communicable and transmission diseases, cultural awareness, regulations and compliance, and drug abuse.
- Register foreign or migrated workers should be seriously performed to ensure that these workers have medical and health certificates to guarantee their personal health conditions.
- Conduct surveillance and active screening and treatment of workers. Immunization program may be required.

Emergency Response and First-Aid

- Establish emergency response plan and procedures which also should be in place for any remote sites. The plan must be update/ revised depend on changing of environmental condition.
- Provide appropriate emergency services and personnel to expedite emergency response when needed, maintain equipment facilities, fire-fighting equipment in good working order, accessible and adequate for the dimension and the basis use.
- Provide health services and first-aid unit at all time, with comprehensive and appropriate equipments, establish the qualified the first-aid unit to properly handle with serious or trauma cases, and sufficient to meet the requirements, treat and/or patients to appropriate medical facilities in time.

<u>Community Health:</u>

Housing and Sanitation

- Provide sufficient infrastructure amenities and public health services in the campsite, for example accommodations, water and drinking water availability, solid wastes disposal and sewage treatment.

Environmental/Communicable Diseases:

- In close collaboration with the community health authorities, implement an integrated control strategy for environmental and occupational diseases, such as integrated vector control programs, eliminating of breeding habitats in the campsite, and eradicating disease reservoirs.
- Collaborate with community health authorities to enhance the worker families to access public health services, and promote immunization.
- Distribute appropriate education materials for example health awareness, sexual transmission disease and communicable disease.

Accidents/Fire/Chemical Leaks

- Consider the level of local fire fighting capacity to identify firefighting equipments that should be available when needed, and provide all necessary equipments with regular maintenance program.
- Communicate potential accidents and/or hazards to local authorities, communities and relevant parties.
- Conduct emergency response practices, including liaison with local response organizations and local responders.
- Revise or/and establish Emergency Response Plans that in concurrent with relevant policy, law and regulation .

Adequacy and Readiness of Healthcare Services

- Provide the first aid unit at the campsite for their workers, assess whether the local health service capacity sufficient for worker's family and supporting industries, and in close collaborating with local authorities, consider supporting/additional health service facility.

(e) Monitoring Program

MIE will keep monthly update of health and safety statistics and records. Performance of construction health and safety is monitored against a set benchmark. MIE to periodic inspect health and safety conditions of the CC and subContractor and sub contractor's construction sites and camps.

(f) Implementation Period

Throughout the construction period.

(g) Responsible Parties

MIE shall establish EHS Plan expanding necessary components as listed above. The EHS plan has to be communicated to CC and their subContractor. MIE will be responsible for keeping all health and safety records submitted by various Contractor and sub contractors. MIE is responsible to assessing health and safety performance of the Contractor and sub contractors against the set performance indicators. MIE is the party coordinating with local authorities on behalf of the project in the matter related to health and safety of the construction site.

CC needs to implement the EHS Plan and ensure that their workers are aware of the details through training. CC has to keep their health and safety record as well as their subContractor.

(h) Budget

Included in construction budget .

1.2.12 Public Participation and Dissemination

a) Principle and Rational

Public participation and information dissemination is apart environmental assessment process and sustainable development that will be result in economic, environmental and social values. General public idea about the project such as concerns of stakeholders, information and recommendation from public can be gathered through public meetings and social surveys which this information will be considered and can take accounted by DRC for further project management plans.

b) Objectives

To inform the stakeholders about the Initial Industrial Estate project, gain public views, concerns and values, increase public confidence, improve transparency and accountability in the EIA decision-making process.

c) Project Area / Stakeholders

Project construction area and impacted area with various level of government agencies, relevant and responsible agencies, project impacted people, media and dependent organizations.

d) Description of Mitigation Measures

DRC shall establish public relation and public participation plan to incorporate in requests and recommendation of the continuous engagement of stakeholders following

- Inform about project activities to community
- Support nearby community as appropriate to build good relationship with community
- Communicate to build community understanding about
    - Construction activities and progress
    - Potential environmental impacts and mitigation measures
- Conduct by MIE consistent with the applicable standard for public meeting/consultation
- Disclose about project information and public relation activities through channels such as website, e-mails, meeting/visiting and local exhibition board or local media.
- Take account the results of the public consultation in improving and revised the EMPs.

e) Description of Monitoring Program

MIE will conduct public meeting or public relation e.g. using questionnaire or attitude survey for communities surrounded the Initial Industrial Estate Project within 5 km in radius of the project areas. The result must be report and the method must achieve acceptable standard and been carried out with representative samples with confidence statistics.

f) Work Plan (Duration)

Once for the entire construction phase

g) Responsible Organizations or Agency

MIE as the project owner is ultimately responsible for this matter

h) Budget

Included in construction budget

1.2.11 Grievances Redress

a) Principle and Rational

For transparency and performance of the project in dealting with grieves that raise by communities and affected people. Grievance mechanism shall be implemented.

b) Objectives

To received grieves and complains from affected people or organization and manage the grieves effectively.

c) Project Area / Stakeholders

Project construction area and impacted area with project impacted people or impacted organizations.

d) Description of Mitigation Measures

MIE shall establish Grievance Redress Committee and Grievance Redress procedure to address any complaints / grieves to resolve / settle disputes that brought forward by community pertaining to project activities.

e) Description of Monitoring Program

Ensure that the grievance redress mechanism has been implemented. Complaints/grieves are systematically recorded and cases are settled.

f) Work Plan (Duration)

Once for the entire construction phase

g) Responsible Organizations or Agency

MIE as the project owner is ultimately responsile for this matter

h) Budget

Included in construction budget

1.3 ACTION PLAN FOR OPERATION PHASE (OEMP)

1.3.1 Air Quality and Emission and Noise Control Action Plan

(a) Principle and Rational

Combustion of industries and emissions are the main concern. Important air pollutants from the above activities include PM_{10}, SO_x, NO_x, and VOCs. Allowable loading per land area has been estimated based on broad calculation and numerical modeling to limit the maximum concentration of pollutants outside the industrial estate area to not exceeding the relevant international standards.

Noise from production process is not considered a significant impact as the production machinery that generate high level of noise are usually enclosed or the factories are further away from sensitive receptors (i.e. communities surrounding the industrial estate area).

(b) Objectives

To control the combustion of industries and emissions are the main concern and noise from production process to not exceeding the relevant international standards

(c) Project Area

Project and surrounding area

(d) Mitigation Measures

Mitigation measures for air emission and noise can be listed below:

- The emission rate of PM_{10} for stack sources shall be no greater than 0.0025 kg/ha/day.
- The emission rate of NO_2 for stack sources shall be no greater than 0.003125 kg/ha/day.
- The emission rate of SO_2 for stack sources shall be no greater than 0.0075 kg/ha/day.

- VOCs recovery system shall be equipped for the industries that or use solvents or have potential to release high amount of VOCs.
- Encourage use of low NO_x burners.
- Encourage use of low sulfur fuels and SO_x removal system for industries where release of SO_x is of concern such as power plants.
- Equipment and machine that generate high level of noise shall be installed in an enclosed building so that, when operated, noise level at the fence line of the industries do not exceed 70 dB(A).
- Provision of installation and operation of Continuous Emission Monitoring System (CEMS) when hazardous and non-hazardous waste incinerators or concerned industries agree to set up a plant in the initial industrial estate project.
- Continual collect data from the industries and update the numerical model when data from the CEMS is available or at the 3rd year of the operation, whichever comes first. Then runs updated model every year afterwards based on the actual measured data.
- Plan for emission of GHGs from the Project shall be established and/or revised in concurrently with the relevant policy and regulations.

(e) Monitoring Program

Monitoring of air quality from stack and at the sensitive receptors are the main activities in this phase.

- Monitoring of air quality at the sensitive receptor nearest to the industries and at the resettlement area has to be conducted. The framework of monitoring design include:
  - Monitoring frequency is every 6 months.
  - The parameters include TSP (24-hour mean), PM_{10} (24-hour mean), $PM_{2.5}$ (24-hour mean), SO_2 (1-hour and 24-hour mean, NO_2 (1-hour mean).in Table 1.3-1.
  - Sampling stations include Building management of project or township. Yalai Village (if still exist) and Ekani Village (Figure 1.3-1)
- The industries shall monitor the concentration of air pollutants in the stack according to the parameters recommended by the Pollution Prevention and Abatement Handbook (World Bank, 1998) or relevant local regulations every 6 months and report to MIE.
- Continuous monitoring results from the concerned industries and industrial waste incinerators where CEM system are installed.

Table 1.3-1 Analysis Methods of Ambient Air Quality Parameters and Sampling Stations During Operation Period

Parameters	Analysis Method[1/]	Sampling Station
Ambient air quality		Building management of project or township, Yalai Village (if still exist) and Ekani Village
TSP 24 hours	Gravitric – High Volume	
PM 10	Gravitric – High Volume or equivalent to USEPA	
PM 2.5	Gravitric – High Volume or equivalent to USEPA	
Wind speed and direction	Wind speed / direction metering Device	
Temperature	Thermometer	
Noise level		
Leq 24 hours	IEC 616721-1 / 616721-2	
Ldn	IEC 616721	
Lmax	IEC 616721	
L90	IEC 616721	

Source: ESIA Study Team

(f) Implementation Period

Throughout the operation phase.

(g) Responsible Parties

MIE is responsible for monitoring of air quality at the sensitive receptors, maintaining data received from the industries, and update model runs based on actual measured data from the industries and at the receptors. MIE shall prepare the report with the result of the implementation for audit every 6 months.

The industries are responsible to controlling the emission to the committed level and report the results from the stack monitoring to MIE every 6 months.

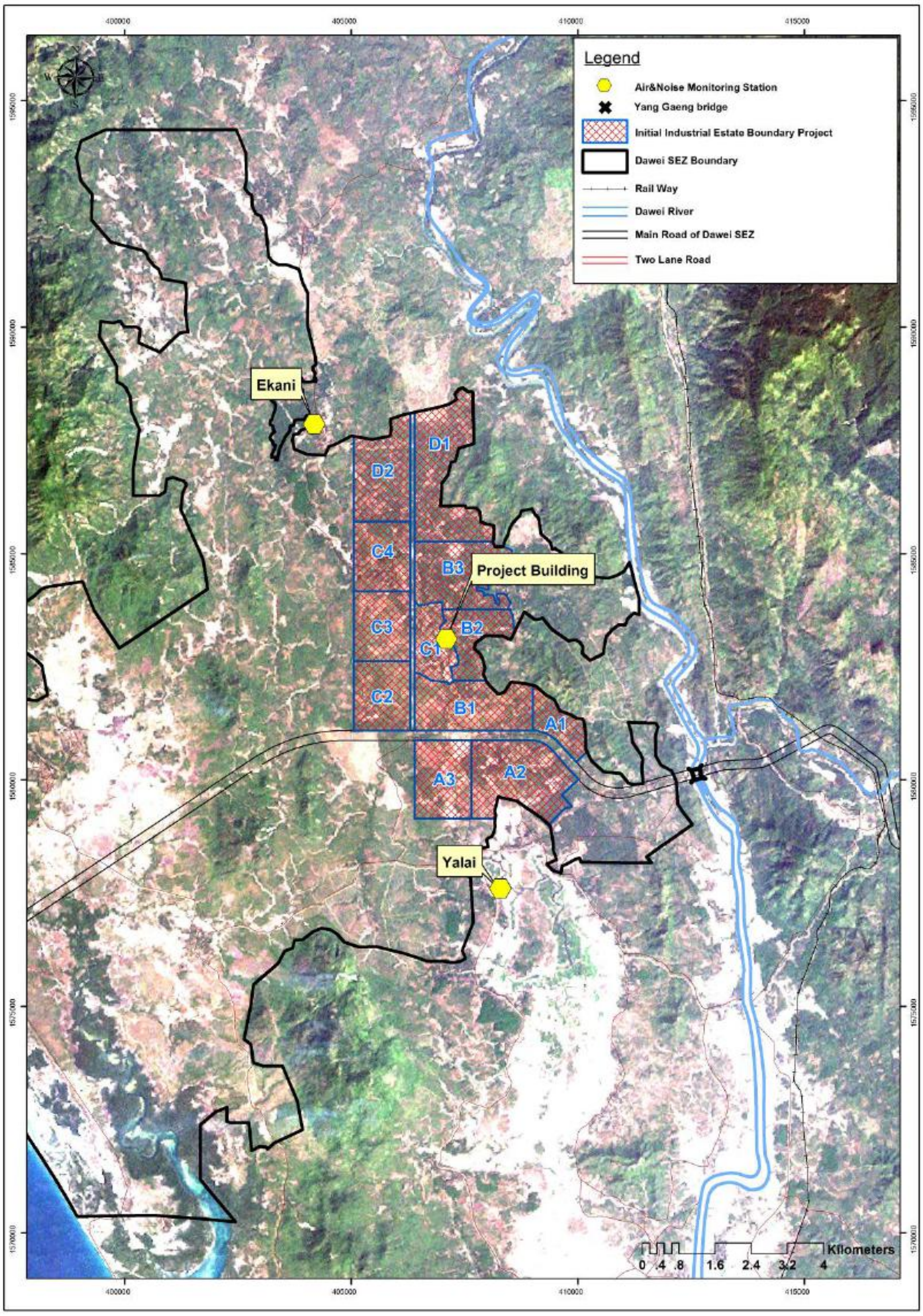
(h) Budget

Approximately 34,000 USD/Year .

1.3.2 Groundwater Quality Action Plan

(a) Principle and Rational

Leakage of waste from landfill site and release of chemical materials and/or used oils to the ground have potential to affect the quality of ground water and environment.



Source: ESIA Study Team

Figure 1.3-1 Sampling Locations for Air Quality and Noise Monitoring in Operation Phase

(b) Objectives

To control leakage of waste from landfill site and release of chemical materials and/or used oils to the ground have potential to affect the quality of ground water and environment .

(c) Project Area

Project and surrounding area.

(d) Mitigation Measures

The mitigation measures for ground water quality management are mainly consistent with wastewater and waste management system. However, specific consideration is proposed to further reduce the potential impact in the ground water. The mitigation measures are discussed below:

- Directly drain raw wastewater and/or used chemicals/oils/lubricants to ground are forbidden.
- Raw wastewater must be discharged to wastewater collection system for treating
- Groundwater application of factories to be water supply in factories is prohibited

(e) Monitoring Program

Ground water qualities monitoring should be established. 4 sampling stations are recommended:

2 stations at landfill site in waste management area :

(1) upstream well

(2) downstream well

2 stations in nearby village :

(1) well at Yalai village (if still exist)

(2) well at Ekani village

The parameter and sampling stations of ground water quality monitoring are shown in Table 1.3-2.

The groundwater monitoring should be conducted at least 2 times a year (dry and wet season).

Table 1.3-2 Analysis Methods of Ground Water Parameters and Sampling Stations During Operation Period

Parameters	Analysis Method[1/]	Sampling Station
pH	Electrometric Method	2 well at landfill unit , 1 well at Yalai village , 1 well at Ekani village
Electrical Conductivity	Electrical Conductivity Method	
Turbidity	Nephelometric Method	
Total Suspended Solids (TSS)	Total Suspended Solids Dried At 103-105 ^oC	
Total Dissolved Solids (TDS)	Total Dissolved Solids Dried At 180 ^oC	
Total Solids (TS)	Total Solids Dried At 103-105 ^oC	
Total Hardness		
Iron	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Manganese	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cadmium	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Hexavalent Chromium	Extraction and Direct Air Acetylene Flame Method	
Lead	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Zinc	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Nickel	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Copper	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cyanide	Distillation,Pyridine-barbituric acid Method	
Arsenic	Hydride Generation AAS Method	
Total Mercury	Cold Vapour AAS Method	
Total Coliform Bacteria (TCB)	Multiple Tube Fermentation Technique	
Faecal Coliform Bacteria (FCB)	Multiple Tube Fermentation Technique	
E.Coli	Multiple Tube Fermentation Technique	

(f) Implementation Period

Throughout the operation phase.

(g) Responsible Parties

MIE is responsible for monitoring of groundwater quality at the sensitive receptors, maintaining data received from the landfill, MIE shall prepare the report with the result of the implementation for audit every 6 months.

(h) Budget

Approximately 30,000 USD/Year .

1.3.3 Waste Management Action Plan

(a) Principle and Rational

Waste generated from industries is expected to have great variation depending on the production process and type of industries. However, they can be essentially divided into 2 types: hazardous and non-hazardous waste. The facility will be able to handle both hazardous and non-hazardous waste. However, prior to the commission of the facility, waste generated from Dawei SEZ Initial Industrial Estate Development Project will also have to be properly managed to reduce potential impact to the environment.

(b) Objectives

To control both hazardous and non-hazardous waste that will effect to water resources nearby project area and reducing impact potential impact to the environment

(c) Project Area

Project and surrounding area

(d) Mitigation Measures

Due to incompletion of waste management facilities during the operation, mitigation measures may be discussed in 2 scenarios: before and after the completion of the waste management facility.

Before Completion of Waste Management Facility

- Classify hazardous and non-hazardous waste according to the definitions in the *Waste Management Plan* prepared during the construction phase.
- The Dawei SEZ Initial Industrial Estate Development Project will provide sanitary landfill for disposal of non-hazardous waste generated from the industries.

- Design and construction of the landfill shall be in accordance with *Solid Waste Disposal Facility Criteria – Technical Manual* published by U.S. EPA (1993) or other applicable standards.
- Detailed hydrogeological condition of the proposed landfill area has to be studied in the design of landfill.
- Groundwater monitoring wells will be installed. As a minimum, 1 well is to be installed upgradient of the landfill and at least 2 wells is to be installed downgradient of the land fill. Depth of screens and well construction depends on the results from the hydrogeological condition study.
- Hazardous waste will be temporarily stored until the hazardous waste stabilization and disposal system at the waste management system is functional. Minimum requirements of the temporary hazardous waste storage areas include:
  - Impervious floor without cracks or spaces that may allow spills to perforate into the ground;
  - Surrounded by secondary containment bunds. The secondary containment bunds shall be at least 0.5 m high with a volume large enough to contain the spill of the largest container expected in the storage area;
  - Designate storage area for liquids or materials that are not allowed to be mixed, such as acids and alkalis;
  - Equipped with spill response kits;
  - Consider providing the area with roofing and temporary walls with a provision that the temporary hazardous waste storage area will have to be in use for at least 3 years until the permanent hazardous waste management facilities of the industrial estate are functional.
  - Type and quantity of hazardous waste in the storage area shall be recorded and kept current.
- The landfill shall be closed daily to prevent vectors and odors.
- Workers need to be trained of *Waste Management Plan*.
- When the permanent waste management facility is operational, evaluate options of permanent closure of the landfill site or moving the waste material in the landfill to the permanent facility.

<u>After Completion of Waste Management Facility</u>

- The components of the waste management facility: i.e. sanitary landfill, secured landfill, and incinerator, shall be designed and constructed according to the internationally accepted standards.
- Detailed hydrogeological condition of the proposed landfill area has to be studied in the design of landfill.

- Groundwater monitoring wells will be installed. Location and number of groundwater monitoring wells depends on the results of the study and the layout of the facility. Depth of screens and well construction depends on the results from the hydrogeological condition study.
- All hazardous and non-hazardous waste generated by the industries in the estate shall be transferred to the facility for disposal.
- Waste manifest system has to be created and implemented.
- The facility shall create its *Standard Operating Procedure* covering steps from receiving waste, laboratory analysis, stabilization, temporary storage, incineration, and disposal. Audit by third party is necessary.
- Workers need to be trained of *Waste Management Plan*.
- Record of type of waste including its quantity and origins shall be kept in the data base of MIE. This knowledge can be used in promoting material and waste flow management between industries within the industrial estate.

(e) Monitoring Program

Monitoring of environmental quality around the site is necessary. The monitoring requirements may be divided into each type of environmental matrix as follow:

- Groundwater monitoring:
  - Collect baseline groundwater quality before the operation of the landfill.
  - Monitor groundwater quality every month for the first 6 months and then every 6 months unless unusual concentrations are observed.
  - For Initial Industries Phase, monitor the following parameters: pH, redox potential, dissolved oxygen, temperature, conductivity, turbidity, and heavy metals (cadmium, copper, lead, manganese, nickel, arsenic, selenium, and mercury).
  - For the waste management facility where hazardous waste stabilization and disposal is conducted, monitor the following parameters: pH, redox potential, dissolved oxygen, temperature, conductivity, turbidity, heavy metals (cadmium, copper, lead, manganese, nickel, arsenic, selenium, and mercury), and selected species of VOCs relevant to the waste stream.
  - Compare the results with applicable international standards.
- Ambient air quality and stack monitoring of incinerator
  - Integrate the monitoring requirement of the ambient air quality and stack monitoring with the air quality monitoring program of the industrial estate.
- Runoff and wastewater monitoring

– The waste management facility is considered equal to an industry facility. The same requirements of wastewater management will be applied.

(f) Implementation Period

During the operation of the waste management facility.

(g) Responsible Parties

MIE is the party responsible for operating the infrastructure and utility system and thus is the operator of the waste management facilities, both during Initial Industries Phases and at full development stage.

(h) Budget

Included in operation budget

1.3.4 Wastewater and Storm Water Management Action Plan

(a) Principle and Rational

The industrial estate has central wastewater treatment systems receiving pretreated wastewater from different zones of the project. Wastewater from the industries needs to be pretreated to meet the acceptance criteria of the central wastewater treatment systems. Wastewater collection is separated from storm drainage system. Each industrial facility will have a monitoring manhole installed before the pretreated wastewater is discharged to the wastewater collection system. The central wastewater treatment systems are designed to meet the requirement of Industrial Estate Authority of Thailand (IEAT) or other relevant local requirement.

(b) Objectives

To control wastewater treatment systems and storm drainage system for reducing impact to environment

(c) Project Area

Project and surrounding area

(d) Mitigation Measures

MIE as the operator of infrastructure and utility systems need to establish a detailed wastewater management rules to be integrated into the *Environmental Rules* to be distributed to the industries. Mitigation measures for wastewater management during operation phase, that should be incorporated in the wastewater management rules include:

- All industry facility in the industrial estate shall pretreat the wastewater to meet the acceptance criteria of the central wastewater treatment system.

- A detention pond with a sufficient capacity to retain 1 day expected flow rate has to be constructed at each industry facility (if necessary) and at each central wastewater treatment system as a buffer storage in case the treated wastewater fails to meet the effluent criteria.
- Inside each industry facility, wastewater stream that requires chemical pretreatment shall be collected separately from other wastewater streams to minimize and use of chemical and increase efficiency of chemical pretreatment process.
- Wastewater stream has to be separated from storm drain. Dilution of wastewater is not acceptable.
- An inspection manhole has to be installed at the point where the pretreated wastewater is discharged to the collection system of the industrial estate.
- Warning and penalty system needs to be established for industry facility that fails to meet the acceptance criteria repeatedly.
- Storm water retention system needs to be constructed to prevent surge of storm water discharge to the natural environment in case of large storm and to act as a buffer storage in case of spills into storm drainage system.
- Thermal wastewater needs to be treated so that temperature at the edge of the mixing zone, or 100 m from the discharge point, is change from natural conditions by less than 3 degree celsius.
- Recycling of wastewater should be promoted. Treated effluent should be used in the industrial estate wherever possible, such as for watering the green areas.

(e) Monitoring Program

Monitoring of effluent of wastewater treatment system is essential as it provides a confirmation if the system is performing as it was designed. Monitoring of wastewater quality can be divided into 2 groups, which are:

- Pretreated wastewater from the industry facilities:
  - Within the 1st month of commissioning, the industry facility has to analyze the pretreated wastewater to confirm if the pretreated wastewater fully conforms with the acceptance criteria. If not, adjustment shall be made until the pretreated wastewater is acceptable to the central wastewater treatment systems.
  - The industry shall conduct daily check of BOD, COD, and SS if the are consistent with the acceptance criteria. The daily record shall be collected, verified by responsible persons at the facility, and submitted to MIE every 6 months.

   - Full-suite analysis of pretreated wastewater shall be conducted once every 6 months. The results shall be submitted to MIE together with summary of daily wastewater quality indicators mentioned above.
   - MIE may random check the quality of pretreated wastewater at the inspection manhole without prior notification to the industry.
- Treated wastewater from central wastewater treatment systems:
   - Daily check of BOD, COD, pH and SS in the effluent shall be conducted to monitor performance of the system.
   - Full-suite analysis of treated wastewater from the central system shall be conducted at a frequency of 1 months or less.

(f) Implementation Period

Throughout operation phase of the project.

(g) Responsible Parties

MIE is the operator of central wastewater treatment systems and is responsible to monitor the quality of pretreated wastewater from the industry entering the system. MIE will collect information of influent and effluent quality of the central wastewater treatment system and prepare the report with the result of the implementation for audit every 6 months.

Industry facility is responsible to ensure that the raw wastewater from their facilities is pretreated to meet the acceptance standards of MIE.

(h) Budget

Included in operation budget.

1.3.5 Surface Water and Sediment Quality Action Plan

(a) Principle and Rational

Discharge of wastewater and release of waste materials to the receiving water have potential to affect the quality of water and sediment in freshwater environment. Organic loading in the treated wastewater may reduce the dissolved oxygen content in the receiving water to the point that is not suitable for living organisms.

(b) Objectives

To prevent wastewater from project area runoff into natural water resources.

(c) Project Area

Project and surrounding area

.

(d) Mitigation Measures

The mitigation measures for water quality management are mainly consistent with wastewater and waste management system. However, specific consideration is proposed to further reduce the potential impact in the receiving water. The mitigation measures are discussed below:

- Prepare and implement the measures for Waste Management.
- Prepare and implement the measures for Wastewater Management.
- The discharged of untreated wastewater into the receiving water is strictly prohibited at all time.
- Retention areas/pond should be provided for treated wastewater from each zone, and retention period should be calculated to ensure that wastewater effluent complied with the effluent requirements according to Industrial Estate Authority of Thailand (IEAT) or other relevant/designated requirements.
- Emergency plan for operation of wastewater treatment should be established to prevent untreated effluent discharged into the receiving water.
- Regularly check and maintain wastewater treatment plant to control the treated wastewater quality, at least as required effluent from Dawei Industrial Estate's Wastewater Treatment System especially BOD must be less than mentioned values for minimizing the impact to water and sediment in freshwater environment.

(e) Monitoring Program

- Surface water and sediment qualities monitoring should be established. 10 sampling stations are recommended:that shown in Table 1.3-3 and Figure 1.3-2.
- The parameter and sampling stations of surface water and sediment quality monitoring are shown in Table 1.3-3.
- The surface water and sediment monitoring should be conducted at least 2 times a year (dry and wet season).

Table 1.3-3 Analysis Methods of Surface Water and Sediment Quality Parameters and Sampling Stations During Operation Period

Parameters	Analysis Method[1/]	Sampling Station
Surface Water		
Water Level/Depth/ Width	Depth Meter	10 same stations in construction phase
Temperature	Thermometer	
Flow Rate	Flow Meter	
pH	Electrometric Method	
Salinity	Electrical conductivity Method	
Electrical Conductivity	Electrical Conductivity Method	
DO	Membrane Electrode Method	
BOD	Membrane Electrode Method	
Turbidity	Nephelometric Method	
COD	Open Reflux Method	
TSS	TSS Dried At 103-105 ^oC	
TDS	TDS Dried At 180 ^oC	
TS	TS Dried At 103-105 ^oC	
Nitrate-Nitrogen	Cadmium Reduction Method	
Ammonia-Nitrogen	Phenate Method	
Phosphate –Phosphorus	Ascorbic Acid Method	
TKN	Kjeldahl Method	
Oil&Grease	Soxhlet Extraction Method	
Phenol	Distillation, 4-aminoantipyrine Method	
TPH	Soxhlet Method	
Iron	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Manganese	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cadmium	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Hexavalent Chromium	Extraction and Direct Air Acetylene Flame Method	

Table 1.3-3 Analysis Methods of Surface Water and Sediment Quality Parameters and Sampling Stations During Operation Period (Cont.)

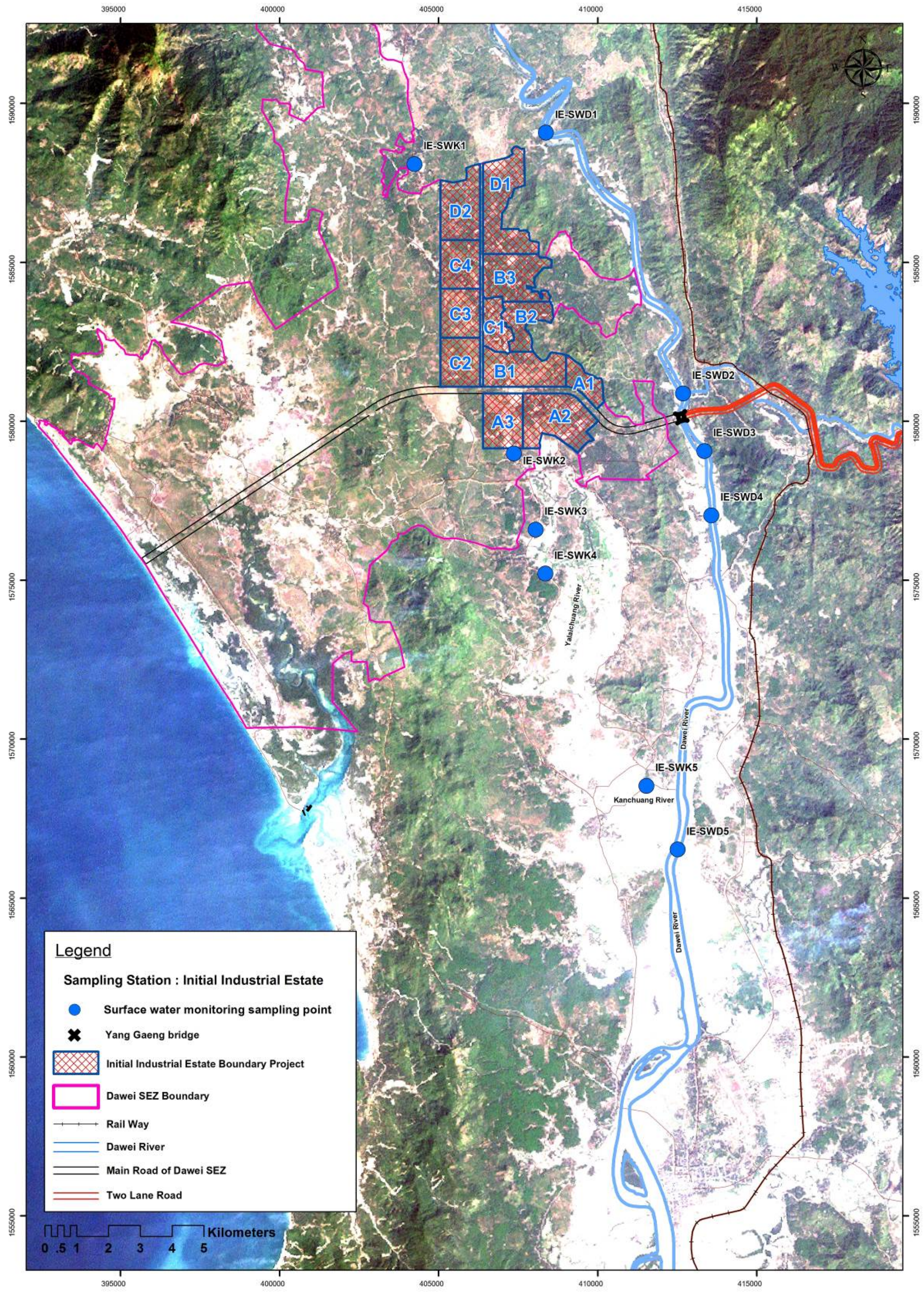
Parameters	Analysis Method[1/]	Sampling Station
Lead	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Zinc	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Nickel	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Copper	Nitric Acid Digestion and Direct Air Acetylene Flame Method	
Cyanide	Distillation,Pyridine-barbituric acid Method	
Arsenic	Hydride Generation AAS Method	
Total Mercury	Cold Vapour AAS Method	
Total Coliform Bacteria (TCB)	Multiple Tube Fermentation Technique	
Faecal Coliform Bacteria (FCB)	Multiple Tube Fermentation Technique	
E.Coli	Multiple Tube Fermentation Technique	
Sediment [2/]		
Particle size	Sieve Analysis and Hydrometer Test[3/]	
Oil and Grease	Soxhlet Extraction Method	
Iron	Acid Digestion and Flame AAS Method	
Arsenic	Acid Digestion and Hydride Generation AAS Method	
Cadmium	Acid Digestion and Flame AAS Method	
Total Chromium	Acid Digestion and Flame AAS Method	
Copper	Acid Digestion and Flame AAS Method	
Mercury	Acid Digestion and Cold Vapour AAS Method	
Nickel	Acid Digestion and Flame AAS Method	
Lead	Acid Digestion and Flame AAS Method	
Zinc	Acid Digestion and Flame AAS Method	

Remark:

[1/] APHA, AWWA and WEF. Standard Methods For The Examination of Water And Wastewater. 22nd ed. Washington, DC: APHA. 2012.

[2/] United States Environmental Protection Agency. SW-846 Method.

Source: ESIA Study Team



Source: ESIA Study Team

Figure 1.3-2 Sampling Locations for Surface Water, Sediment and Aquatic Ecology Monitoring in Operation Phase

(f) Implementation Period

Throughout the project operation phase.

(g) Responsible Parties

MIE shall maintain overall ambient environment monitoring program and results. MIE shall prepare the report with the result of the implementation for audit every 6 months

(h) Budget

1.3.6 Approximately 75,000 USD/Year.Surface Water Ecology Action Plan

(a) Principle and Rational

Degraded quality of environment will results in impacts to ecological conditions. Biological indicators provide useful information as to change in environment due to excessive loading of organic matters.

(b) Objectives

To prevent wastewater from project area runoff into natural water resources.and reducing impact to aquatic life habitats,

Project and surrounding area

(c) Mitigation Measures

The mitigation measures are the same as water and sediment quality, wastewater management, and waste management.

(d) Monitoring Program

- Monitor of surface water ecology at 10 stations (same station with surface water quality monitoring program The organisms and sampling stations of surface water ecology are shown in Table 1.3-4.

Table 1.3-4 Surface Water Biological Parameters and Sampling Stations

Parameters	Sampling Station
Surface Water Ecology Phytoplankton Zooplankton Benthos Fishes	Same stations with surface water quality and sediment

Source: ESIA Study Team

(e) Implementation Period

Throughout the project operation phase.

(f) Responsible Parties

MIE shall maintain overall ambient environment monitoring program and results. MIE shall prepare the report with the result of the implementation for audit every 6 months

(g) Budget

Included in surface water quality in operation phase budget.

1.3.7 Terrestrial Ecology Action Plan

(a) Principle and Rational

Potential impacts to terrestrial ecology during operation phase are considered negligible. However, influx of workers from outside the area may result in increased demand of wildlife meat and poaching. Plantation of native plant species should be encourage to reduce risk of introducing alien species to the environment.

(b) Objectives

(1.) To prevent waste from project area runoff into natural resources.and reducing impact to wildlife habitats or plants

(c) Project Area

Project and surrounding area

(d) Mitigation Measures

The mitigation measures for terrestrial biology is proposed as follow:

- Wherever possible, conserve the existing trees, particularly in the green areas,
- Encourage the manufacturers to conserve the existing trees in the design of their facilities.
- Select local species if plantation in the project area is needed.
- Coordinate with local authorities and engage local communities for reforestation projects surrounding the project area.
- Discourage and educate the workers in the industrial estate against wildlife consumption to reduce demand and indirect impacts to the wildlife in reserved forests elsewhere outside the project area.

(e) Monitoring Program

No monitoring program is required.

(f) Implementation Period

Throughout the operation phase.

(g) Responsible Parties

MIE in corporation with the industry and local authorities should promote the implementation of the above mitigation measures.

(h) Budget

Included in operation monitoring budget.

1.3.8 Land Use and Community Management Action Plan

(a) Principle and Rational

Change of land use surrounding the project area is of concern. Spontaneous development surrounding the industrial estate need to be planned and controlled.

(b) Objectives

To control the effect to landuse changing and community.

(c) Project Area

Project and surrounding area

(d) Description of Mitigation Measures

Special Plan and Buffer Zone

A special specific area plan is needed to control the land use adjacent to the project estate. The plan must be legitimate and authorized by the state. The purpose of the plan is to control land use nearby but outside the estate and to prevent forming of temporary settlement growing outside the estate area at inappropriate places. Moreover, a clear and marked buffer zone all around the estate boundaries should be set up to control and prevent any uses other than agriculture and forest. The size of the buffer zone should be determined by land use expert to ensure that in case of fire, chemical leakage or other hazards, only a minimum number of people will be affected and rescue and relocation efforts will be with ease.

In addition, the town of Dawei, the nearest town and most likely place to be used for services to the estate personnel, will be greatly affected by the estate development. A comprehensive plan authorized by the state for the the future of Dawei is needed for appropriate growth. Otherwise, the project development will likely cause uncontrollable growth of Dawei resulting in degrading physical, uses, and cultural condition of Dawei in the near future.

Setting up a management committee overseeing the project land use.

A team or committee should be set up to monitor and manage activities and structures built in and around the project estate. The purpose is to insure that those temporary service centers originated from basic needs and convenience of the workers are always in the

appropriate places that will not obstruct or endanger the operation of the estate. The team should have legitimate authority to control the areas adjacent or nearby, though outside the estate boundaries. Squatters must be notified that they are only allowed to operate temporarily and must be relocated when the time comes in order to prevent scattered temporary structures from evolving into unsuitable permanent settlements outside the estate area.

<u>Transportation and Infrastructure Outside the Estate Area</u>

For the area immediately outside the estate, not only land use should be controlled, but also other infrastructure that will enable setting up structures and services, such as, local roads, electricity, water supply, and drainage, should be also well planned and controlled. The strategic locating or prohibiting of these basic infrastructure will induce and encourage early settlers and services outside designated township zone into the area planned by the management to provide temporary services in the early stage of development.

<u>Enforcement</u>

The proposed set-up land use management committee/team should have duty to regularly monitor land use activities outside and inside the project estate as the development progresses. Co-operation with local or state authority is needed to be able to control, direct, or enforce private buildings outside the project boundaries to prevent unsuitable and obstructing growth nearby the project estate.

(e) Monitoring Program

The mitigation measures mentioned above a long-term and involve many parties in planning and implementing the land use surrounding the project to help ensure that on a longer term, communities will be located at a safe distance from the industrial estate and conflicts between both developments can be reduced.

(f) Implementation Period

Throughout operation phase.

(g) Responsible Parties

MIE through cooperation with local authorities.

(h) Budget

Included in operation monitoring budget .

1.3.9 Public and Occupational Health Plan Action Plan

(a) Principle and Rational

Operation phase of the project possess different risks to the workers and public. MIE as the owner of the project will need to have a program in place to handle the situations that may arise from the work-related illness and impacts in workers and local populations.

(b) Objectives

(1.) To reduce risk and prevent danger and accident which may happen to worker and people transport or live in the operational area of the project.
(2) To acknowledge problem about occupational health and safety in operational phase for further analysis and find the way to prevent and solve that problem as appropriate.

(c) Project Area

Project and surrounding area.

(d) Mitigation Measures

Occupational Health and Safety:

During operation phase, MIE/DSEZ or the project owner should establish the preventive and protective measures to mitigate the potential occupational health impacts as follows:

Accidents and Injuries

- Provide the environmental health and safety management system and programs for the whole industrial estate.
- Request for each individual industry to provide proper and capable to manage occupational health and safety issues to protect health and safety of workers and public
- Establish occupational health and safety management plans and programs to assess and manage EHS impacts and risks which are based on comprehensive job safety analyses.
- Include the following issues in the occupational health and safety management system:
  - Accident investigation, recording and reporting
  - Surveillance of the working environment and worker health
  - Training and hazard communication
  - Monitoring and auditing procedures to evaluate the effectiveness of prevention and control measures.
- Perform occupational accidents and disease recording and reporting, investigate all incidents to understand the cause of accident and to identify measures necessary to prevent a recurrence.
- Provide provisions for Contractor and sub contractor to ensure that the Contractor and sub contractor will have safety procedures to protect their employees, and periodically monitor Contractor and sub contractor performance.

- Restrict access into site or area including fencing, signage and communication of risks to local community, appropriately provide area signage and labeling of equipments in accordance with international standards and easily to understood by workers, visitors and general public.
- Promote traffic safety programs to all personnel, for example
  - Specifying limits for trip duration
  - Improving driving skill
  - Use of speed control devices

Occupational, Sexual Transmission and Communicable Diseases:

- Conduct surveillance and active screening and treatment of workers. Immunization program may be required.
- Register foreign or migrated workers to ensure that these workers have medical and health certificates to guarantee their personal health conditions.
- Provide training programs for workers in these following topics: health awareness, and promote health protection strategies including encouraging condom use.
- Perform periodic worker health checks in accordance with the potential risks.

Fire, Explosion, Chemical Leaks and Major Hazards:

- Conduct major hazard assessment of each specified industry prior establishment in order to identify buffer zone/strips or other physical separation methods to protect public from any potential hazards.
- Provide comprehensive emergency preparedness and response plan and procedures covering fire, explosion, chemical Leaks and major hazards control. The plans must be update/ revised depend on changing of environmental condition.
- Provide appropriate emergency services and personnel to execute emergency response when needed, and maintain equipment facilities, fire-fighting equipment in good working order, accessible and adequate for the dimension and the basis use.
- Establish fire safety system using appropriate prescriptive standards regarding with type and number of industries, and revise fire risk management periodically to ensure its capability to cope with all the potential hazards.
- Perform mutual aid agreements among the industries in the industrial estate as well as local authorities to provide a clear basis for response to share personnel and specialized equipments.
- Conduct annual training and updating emergency preparedness and response plan to account for changes in equipment, personnel and facilities.

Adequacy and Readiness of Healthcare Services

- Establish the hospital in the township area, and periodically evaluate in terms of adequacy, capacity and readiness in accordance with the change in numbers and types of industry and potential risks.

Community Health:

Sanitation

- Provide sufficient infrastructure amenities and public health services for the industrial estate and township, for example accommodations, water and drinking water availability, solid wastes disposal and sewage treatment in order to reduce pressure on local authorities in servicing public.
- Technically support or collaborate with local authorities to enhance potentiality of communities in solid waste disposal by means of 3 R (Reduce, Reuse and Recycle).
- Distribute appropriate education materials for example health awareness, hygiene and sanitation.

Environmental/Communicable/Non-Communicable Diseases:

- Establish the buffer strip/zone to separate the township and industries to protect dwellers from pollutions emitted.
- Implement engineering preventive measures to install physical separation between industry and community, for example fence or tree plantation as buffer zone along the estate boundaries, and use of air modeling results and/or potential pollutions of each industry as the criteria for the distance between industries and affected community.
- With close collaboration with community health authorities, implement an integrated control strategy for environmental and occupational diseases, for example promoting immunization, eradicating disease reservoir and promoting healthy workplace.
- Provide worker health information to local government agencies.
- Set up a grievance procedure to manage complaints, if any.

Accidents/Fire/Chemical Leaks

- Invite representative of local emergency and securities services to participate in annual site inspections to ensure familiarity with the potential hazards present.
- Inform and communicate potential accidents and hazards of the project that may impact to community to local communities and relevant parties.
- Prepare and train workers and nearby communities to respond to accidents, including providing technical and financial resources in order to control and

response such events effectively and safely, and provide periodic emergency response practice with communities.

- Revised or/and establish Emergency Response Plans in concordance with recent policy, law and regulation.

Adequacy and Readiness of Healthcare Services

- Promote collaboration with local authorities to enhance access of community to public health services, consider whether the capacity of the local health services sufficient for the worker family and support industries, and, if not sufficient, in close collaborating with local authorities support technical and financial resources to develop health service facility.
- Collaborate with local health authorities to provide relevant information and technical as well as financial resources to set up the public health and occupation health surveillance system.

(e) Monitoring Program

MIE will keep monthly update of health and safety statistics and records. Performance of operation health and safety is monitored against a set benchmark. MIE to periodic inspect health and safety conditions of the industry.

(f) Implementation Period

Throughout the operation period.

(g) Responsible Parties

MIE shall establish EHS Plan expanding necessary components as listed above. The EHS plan has to be communicated to the industries and that agreed safety indicators are established. MIE will be responsible for keeping all health and safety records submitted by the industries. MIE is responsible to assessing health and safety performance of the industrial estate against the set performance indicators. MIE is the party coordinating with local authorities on behalf of the project in the matter related to health and safety of the Initial Industrial Estate.

(h) Budget

Included in operation monitoring budget.

1.3.10 Employment and Training Program Plan

a) Principle and Rational

Development of the DSEZ Initial Industrial Estate will involve resttlement and social impacts i.e. living condition and income restoration. To assisted the PAPs and to promote work force base on local labour therefore, the project commit to employ 1 member of the Project Affected People and establish the training program and plan.

b) Objectives

To support the employment and employment opportunities.

c) Project Area

In the Project vicinity.

d) Description of Mitigation Measures

MIE to comply with IFC EHS General guideline/Laws and regulations in terms of the employee management and establish plan for implementation of the training program.

e) Description of Monitoring Program

Ensure that relavant mitigation measures are implemented.

f) Work Plan (Duration)

For the entired operation phase

g) Responsible Organizations or Agency

MIE

h) Budget

Included in operation budget

1.3.11 Public Participation and Dissemination

a) Principle and Rational

Public participation and information dissemination is apart environmental assessment process and sustainable development that will be result in economic, environmental and social values. General public idea about the project such as concerns of stakeholders, information and recommendation from public can be gathered through public meetings and social surveys which this information will be considered and can take accounted by MIE for further project management plans.

b) Objectives

To inform the stakeholders about the Initial Industrial Estate project, gain public views, concerns and values, increase public confidence, improve transparency and accountability in the EIA decision-making process.

c) Project Area / Stakeholders

Project operation area and impacted area with various level of government agencies, relevant and responsible agencies, project impacted people, media and dependent organizations.

d) Description of Mitigation Measures

MIE shall establish public relation and public participation plan to incorporate in requests and recommendation of the continuous engagement of stakeholders following

- Inform about project activities to community
- Support nearby community as appropriate to build good relationship with community
- Communicate to build community understanding about
  - Potential environmental impacts and mitigation measures
  - CSR activity
- Conduct by MIE consistent with the applicable standard for public meeting/consultation
- Disclose about project information and public relation activities through channels such as website, e-mails, meeting/visiting and local exhibition board or local media.
- Take account the results of the public consultation in improving and revised the EMPs.

e) Description of Monitoring Program

MIE will conduct public meeting or public relation e.g. using questionnaire or attitude survey for communities surrounded the Initial Industrial Estate Project within 5 km in radius of the project areas every 5 years. The result must be report and the method must achieve acceptable standard and been carried out with representative samples with confidence statistics.

f) Work Plan (Duration)

Every 5 years for the entire operation phase

g) Responsible Organizations or Agency

DRC as the project owner is ultimately responsible for this matter

h) Budget

Included in operation budget

1.3.12 Grievances Redress

a) Principle and Rational

For transparency and performance of the project in dealting with grieves that raise by communities and affected people. Grievance mechanism shall be implemented.

b) Objectives

To received grieves and complains from affected people or organization and manage the grieves effectively.

c) Project Area / Stakeholders

Project operation area and impacted area with project impacted people or impacted organizations.

d) Description of Mitigation Measures

MIE shall establish Grievance Redress Committee and Grievance Redress procedure to address any complaints / grieves to resolve / settle disputes that brought forward by community pertaining to project activities.

e) Description of Monitoring Program

Ensure that the grievance redress mechanism has been implemented. Complaints/grieves are systematically recorded and cases are settled.

f) Work Plan (Duration)

Every 5 years for the entire operation phase

g) Responsible Organizations or Agency

MIE as the project owner is ultimately responsile for this matter

h) Budget

Included in operation budget

Summary of the Environmental Management Plan (EMP) are shown in Table 1.3-5 to Table 1.4-3. It should be noted that the two EMPs prepared as part of this ESIA study are invariably framework plans as they are based on outline designs of the Project. They are therefore intended to prescribe requirements for the preparation of detailed CEMP and OEMP by the appointed EPC contractor (Contractor). Consequently, they could be considered and reffered to as the Project Proponent’s or Owner’s EMPs to distinguish them from the Contractor’s EMP after the ESIA during project implementation. Nevertheless, it should be noted that the planning and development of the Project has been dynamic throughout the

study period. This includes also the organization of the project and other relevant agencies. The information used as the based scenario is considered the most valid one at the time of the report preparation. Changes to the project information may occur overtime and, therefore, readers and project implementers are advised to review at the time of the implementation.

Table 1.3-5 Environmental Mitigation and Management Plan for Construction Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
1. Physical resources		
1.1 Air quality	1. Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. 2. Clearing and grubbing to be done, just before the start of next activity on that site. In case of time gap, water should be sprinkled regularly till the start of next activity. 3. In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried out at regular intervals to prevent dust generation. 4. Embankment slopes to be covered with turf /stone pitching immediately after completion 5. Exhaust gas from construction vehicles are acceptable. However, all equipment and vehicles will need to be maintained in good mechanical conditions 6. Water shall be sprayed covering the access road and on every construction in order to control dust suppression the least 2 times/day (morning and afternoon) during dry season 7. Haulage truck must be covered or the aggregates sprayed with water before loading the haulage truck 8. Covered construction materials such as sand, gravel, cement by canvas 9. Foliage planting and cover cropping are very good mitigation for dust controlling that must be planted completely in the early period of construction phase especially buffer zone area of the initial industrial estate which adjacent to communities 10. Open burning of solid waste or any material is not permitted	Myandawei Industrial Estate Company Limited
1.2 Noise and vibration	1. The Contractor and Sub-contractor shall endeavor to keep noise generating activities to a minimum. 2. The Contractor and Sub-contractor shall restrict all operations that result in undue noise disturbance to local communities and/or dwellings (e.g. blasting, crushing, etc.) to daylight hours on weekdays or as otherwise agreed with the ER. 3. The Contractor and Sub-contractor shall warn any local communities and/or residents that could be disturbed by noise generating activities such as blasting well in advance and shall keep such activities to a minimum. 4. The Contractor and Sub-contractor shall be responsible for compliance with the relevant legislation with respect to noise. 5. Construction works within the distance of 500 m from villages and resettlement areas will be carried out between 06:00 to 18:00	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

Table 1.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	6. Avoid impact pile-driving where possible in vibration-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver causes lower vibration levels where the geological conditions permit their use 7. Construction workers exposed to noise levels of 80 dBA or more shall be provided with adequate hearing protection. 8. Regularly maintain engines, equipment machines and vehicles in good condition 9. Consider alternatives of construction method to reduce noise 10. Construction and haulage activities to be limited to daytime 11. Contractor must use equipment and machines that generate low noise levels 12. Install temporary noise barriers, if necessary	
1.3 Erosion/ Sedimentation Control	1. Embankment slopes to be covered, soon after completion 2. Next layer/activity to be planned, soon after completion of, clearing and grubbing, laying of embankment layer, sub grade layer, sub-base layer, scarification etc. 3. Top soil from borrow area, Debris disposal sites; borrow area, construction site to be protected/covered for soil erosion. 4. Debris due to excavation of foundation, dismantling of existing cross drainage structure will be removed from the water course immediately. 5. Diversions for bridges will be removed from the water course before the onset of monsoon. Any runnels or erosion channels developed during the construction or maintenance period shall be backfilled and compacted and the areas restored to a proper condition. 6. In areas where construction activities have been completed and where no further disturbance would take place, rehabilitation and re-vegetation should commence as soon as possible. 7. An assessment of the potential for contamination of natural waterways. Basic principles include the size of the disturbed area, site drainage, and waterways receiving storm water from the disturbed area 8. Sedimentation controls shall be implemented in the form of silt trap fences and sedimentation basins where be suit, and all runoff from the disturbed area shall be directed to the sediment controls 9. Measures to be taken to collect, store and treat storm water prior to discharge from the site considering options for water re-use onsite	Myandawei Industrial Estate Company Limited

Table 1.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	10. Management of material storage area – Stockpile and spoil disposal area shall not be located on drainage line 11. Control of erosion and sedimentation shall be constructed progressively prior to commencement of each stage of earthworks until the permanent protection is established	
1.4 Ground water and surface water	1. Construction work close to water bodies should be avoided. 2. Labor camps are to be located away from water bodies. 3. Car washing/workshops near water bodies are to be avoided 4. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course and ground are banned 5. Saving water sanitary wares such as faucet, flush toilet must be applied 6. “ Water is worth it ” need to be reminded all workers/sectors forward water saving 7. In case insufficient ground water quantity supply, the project must use other water source for tap water production to avoid water supply conflict	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor
2. Biological resources		
2.1 Terrestrial Biology	1. Only clear the area needed for construction of infrastructure and utility system. 2. Avoid disturbance of beach forest as much as possible. 3. Wherever possible, identify the endangered species and transfer them to safe locations prior to clearing the vegetation. 4. Hunting of wildlife is prohibited 5. Disturbance of forest areas outside the project area is prohibited.	Myandawei Industrial Estate Company Limited

Table 1.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
3. Human use values		
3.1 Water supply	1. Directly drain raw wastewater and/or used chemicals/oils/lubricants to ground are banned 2. Treated wastewater must be discharged to surface water course or recycled 3. Saving water sanitary wares such as faucet, flush toilet must be applied 4. “ Water is worth it “ need to be reminded all workers/sectors forward water saving 5. Pipeline of water supply must be regularly checked and immediately repaired for preventing of water leakage	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor
3.2 Wastewater treatment	1. Provide sufficient number of toilet and bathing facilities for labors, the contractors/subcontractors must not be allowed to establish worker camps outside PROJECT OWNER labor camp 2. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course are banned 3. Discharged treated wastewater to surface water must meet effluent standard of IEAT and/or related local regulations of Myanmar 4. Seepage unit/pit is not recommended for water pollution prevention 5. Consider alternatives for treated wastewater recycling such as watering trees 6. Provide sedimentation pond for sediments quantity reduction before run off water flow into surface water	Myandawei Industrial Estate Company Limited/ Contractor and Sub-contractor
3.3 Waste Management	1. Sorting waste must be regularly operated at construction site and labor camp 2. Solid waste must not be thrown away to surface water course or directly dumped on ground 3. Reuse and recycle waste buyers in Myanmar must be contacted in early stage of construction period and provide lists to factories 4. “Solid waste is worth ” must be promoted for labor awareness 5. landfill units need to design and operate as US EPA guidelines	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

Table 1.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	6. Hazardous waste disposal in or off the construction site is strictly prohibited 7. Project owner must have a strict control system for construction waste disposal	
3.4 Transportation	1. All access roads in the construction area shall be signposted with the following information in Myanmese and English: – Speed limit; – Construction activities and machinery; – Roadside borrow pits and material stockpiles; – Any applicable load limit, particularly for temporary bridges; and – Road features that may affect driving conditions such as curves, hidden accesses etc. 2. A speed limit of 40 km/hr shall be applied in village areas and construction camps. Drivers shall be trained and notified of such limit; 3. Consider building speed humps before and after each village, where appropriate; 4. Route for heavy vehicles used for transportation of construction materials shall be designated. Route with least number of villages and residential area is most preferable; 5. Survey of the access roads to identify blind spots need to be regularly conducted. Improvement to the blind spots such as removal of obstructing objects when necessary; 6. Access road used for the construction activities shall be maintained in good conditions. 7. Roads should be kept free of construction debris. Debris, created as a result of construction, should be cleared timeously 8. Material shall be appropriately secured to ensure safe passage between destinations during transportation 9. Loads shall have appropriate cover to prevent them spilling from the vehicle during transit – The Contractor and Sub-contractor shall be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials.	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

Table 1.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	– Existing access routes should not be blocked or impeded by construction. If this is unavoidable, adequate prior planning should be implemented to ensure that safety and access to routes is maintained. 10. Construction vehicle may not be left overnight on or near to any environmentally sensitive area, or in a position where water runoff, in the event of rain, will cause a negative impact on the sensitive area	
3.5 Historical and Cultural Resources	1. Sites with historical and cultural values shall be identified, recorded and located in the map. This information shall be agreed upon by the local authorities and villagers. 2. If construction activities have to be carried out within 50 m from these sites, the leaders of the communities that the sites belong to need to be notified at least 1 week prior to commencement of the activities. 3. Establish a plan and communication channel in case an unidentified site is encountered during the construction work to avoid damage to the site. 4. Removal and relocation method and destination shall be a mutual agreement between PROJECT OWNER, local authorities, and the leader of the communities that the site belongs to.	Myandawei Industrial Estate Company Limited
4. Quality of life values		
4.1 Economic and social conditions	1. Facilitate in compensation and relocation process for all households in the project areas, prior to the commencement of any construction activities. 2. Consider hiring local workers with relevant skills to create incomes for local communities near the constructions areas. 3. Regularly, provide information related to progress of the Project activities during the construction phase.	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

Table 1.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
4.2 Occupational Health and Safety	1. Establish occupational and safety management plan and program for the construction should be established to assess and manage EHS impacts and risks. Project or activity-specific plans or procedures should be prepared and the basic site rules of work should be included. 2. Perform occupational accidents and disease recording and reporting, and investigate all incidents to understand the cause of accident and to identify measures necessary to prevent a recurrence. 3. Provide Contractor and Sub-contractor management plan to ensure that the Contractor and Sub-contractor will have safety performances and procedures to protect their employee. Supervise and monitor Contractor and Sub-contractor performance periodically. 4. Train and provide information to employees. Occupational health training program should be provided as needed, for example, hazard awareness, specific hazards and safe work practices, to ensure that workers are capable of work safely. 5. Provide appropriate personal protective devices to employee and ensuring that personal protective devices will be worn during working at all time. 6. Restrict local community to access the site or area using fencing, signage and risks communication. 7. Appropriately mark area signage and labeling of equipment, determine hazardous area, for example electrical rooms, compressor etc., as well as installations, materials and emergency exits, and label in accordance with international standards, and easily to understood by workers, visitors and general public. 8. Supervise and monitor performance of Contractor and Sub-contractors and sub-Contractor and Sub-contractors on housekeeping in the campsite. 9. Include training programs for workers with these following topics: health awareness, hygiene and sanitary, waste management, communicable and transmission diseases, cultural awareness, regulations and compliance, and drug abuse. 10. Register foreign or migrated workers should be seriously performed to ensure that these workers have medical and health certificates to guarantee their personal health conditions. 11. Conduct surveillance and active screening and treatment of workers. Immunization program may be required. 12. Establish emergency response plan and procedures which also should be in place for any remote sites. The plan must be update/ revised depend on changing of environmental condition.	Myandawei Industrial Estate Company Limited / Contractor and Sub-contractor

Table 1.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	13. Provide appropriate emergency services and personnel to expedite emergency response when needed, maintain equipment facilities, fire-fighting equipment in good working order, accessible and adequate for the dimension and the basis use. 14. Provide health services and first-aid unit at all time, with comprehensive and appropriate equipment, establish the qualified the first-aid unit to properly handle with serious or trauma cases, and sufficient to meet the requirements, treat and/or patients to appropriate medical facilities in time. 15. Provide sufficient infrastructure amenities and public health services in the campsite, for example accommodations, water and drinking water availability, solid wastes disposal and sewage treatment. 16. In close collaboration with the community health authorities, implement an integrated control strategy for environmental and occupational diseases, such as integrated vector control programs, eliminating of breeding habitats in the campsite, and eradicating disease reservoirs. 17. Collaborate with community health authorities to enhance the worker families to access public health services, and promote immunization. 18. Distribute appropriate education materials for example health awareness, sexual transmission disease and communicable disease. 19. Consider the level of local fire fighting capacity to identify firefighting equipment that should be available when needed, and provide all necessary equipment with regular maintenance program. 20. Communicate potential accidents and/or hazards to local authorities, communities and relevant parties. 21. Conduct emergency response practices, including liaison with local response organizations and local responders. . 22. Provide the first aid unit at the campsite for their workers, assess whether the local health service capacity sufficient for worker's family and supporting industries, and in close collaborating with local authorities, consider supporting/additional health service facility.	
4.3 Community Health and sanitation	1. Camp rules shall be established and informed to all residences. The rules should contain the following components: a. Policy on alcohol and substance abuse; b. Safety measures and emergency response particularly in case of fire;	Myandawei Industrial Estate Company Limited /

Table 1.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	c. Waste management requirements; d. Other measures to prevent dissemination of vectors and transmissible disease including STDs and HIV/AIDs; 2. General areas of the camp shall be kept clean and tidy. Waste shall be collected regularly to avoid accumulation of waste in the camp; 3. Conduct emergency response practices, including liaison with local response organizations and local responders. 4. Revise or/and establish Emergency Response Plans that in concurrent with relevant policy, law and regulation. 5. Toilets shall be provided at a ratio of 1 toilet per 15 workers. All toilets shall be equipped with septic and treatment tanks of adequate size. The toilets need to be at least 100 m from any natural waterways. The pit shall be at least 1 km from any groundwater wells and is higher than groundwater table; 6. Proper drainage has to be provided. Improve areas with stagnant water as much as possible; and 7. Pest control measures shall be planned and implemented. All bedrooms need to be equipped with mosquito protection.	Contractor and Sub-contractor
5.Social and Information		
5.1 Public participation and dessimination	1. Establish *Public Relation and Public Participation Plan* to incorporate in requests and recommendation of the continuous engagement of stakeholders following: a. Inform about project activities to community b. Support nearby community as appropriate to build good relationship with community c. Communicate to build community understanding about - Construction activities and progress - Potential environmental impacts and mitigation measures d. Conduct by MIE consistent with the applicable standard for public meeting/consultation e. Take account the results of the public consultation in improving and revised EMPs 2. Disclose about project information, ESIA, Environmental Monitoring report and public relation activities through channels such as website, e-mails, meeting/visiting and local exhibition board or local media.	Myandawei Industrial Estate Company Limited

Table 1.3-5 Environmental Mitigation and Management Plan for Construction Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
5.2 Grievances redress	Establish *Grievance Redress Procedure* to address any complaints/ grieves to resolve/ settle disputes that brought forward by community pertaining to project activities.	
6.Overall manaegment		
6.1 Revise and report	1. Revised Environmental Management Plan as necessary at every stage and submitted to DSEZMC and MONREC or since the type and number of invested industrial can be known in details. 2. Revised ESIA report and Emergency Response Plan depending on the changing in condition such fire hazard, safety from chemicals, flooding and earthquake and submitted to DSEZMC and MONREC. 3. Reporting on performance of basic infrastructure e.g. local roads, electricitity, water supply, safety and results of continuous public consultation in the monitoring reports that will carry out every 6 months and submitted to DSEZMC and MONREC.	Myandawei Industrial Estate Company Limited

Source: ESIA Study Team

Table 1.3-6 Environmental Mitigation Plan for Operation Phase

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
1. Physical resources		
1.1 Air quality	1. Dust generation due to vehicle wheel will be reduced due to increased/widened paved surface. 2. Avenue plantation to be maintained, casualties to be replaced. 3. Avenue plantation includes species having dust absorption characteristic. 4. Community properties and realignment locations has been proposed for peripheral plantation and landscaping. 5. Maintenance of roads to be ensured. 6. With the reduction in journey time, idle engine running time air pollution will reduce. 7. Avenues plantation is proposed throughout the corridor, casualties to be replaced. 8. Avenue plantation includes species having air purifying characteristic. 9. Enforce Pollution Under Control (PUC) Programs. The public will be informed about the regulations on air pollution of vehicles. 10. Air pollution monitoring program has been devised for checking pollution level and suggesting remedial measures. 11. VOCs recovery system shall be equipped for the industries that or use solvents or have potential to release high amount of VOCs. 12. For combustion process, the Project would equip Dry Low NOx Burner in order to minimize Nitrogen Oxide This burner is automatic control system. 13. Periodically maintain and provide readiness, and Preventive Maintenance Program for equipment should be implemented. 14. Provision of installation and operation of Continuous Emission Monitoring System (CEMS) when hazardous and non-hazardous waste incinerators or concerned industries agree to set up a plant in the initial industrial estate project. 15. Continual collect data from the industries and update the numerical model when data from the CEMS is available or at the 3rd year of the operation, whichever comes first. Then runs updated model every year afterwards based on the actual measured data.	Myandawei Industrial Estate Company Limited

Table 1.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	16. Regularly check and maintenance various equipment, machines, and vehicles in good condition to minimize the exhaust emission 17. Plant trees around the project site boundaries and empty land to increase green area 18. Consider cleaner technology for alternative of production process 19. Promote awareness that fuel combustion caused global warming, energy saving is a rule 20. Provision of air pollution loading control system such as emitted pollutant loading and its control of each factory is necessary for industrial estate operator 21. Control emission loads of main air pollutants as mentioned ; – Emission rate of PM10 for stack sources shall be no greater than 0.0025 kg/ha/day. – Emission rate of NO2 for stack sources shall be no greater than 0.003125 kg/ha/day. – Emission rate of SO2 for stack sources shall be no greater than 0.0075 kg/ha/day. 22. Provide Continuous Emission Monitoring System (CEMS) for power plant and waste incinerators 23. Control emitted air quality from stacks of power plant and waste incinerators are giving standard 24. Measure emitted air quality from stacks regularly by ISO/IEC 17025 qualified laboratory (twice a year, dry and wet season) 25. Plan for emission of GHGs from the Project shall be established and/or revised in concurrently with the relevant policy and regulations.	
1.2 Noise and vibration	1. Maintenance of noise barriers need to be conducted. 2. Discouraging local people from establishing sensitive receptor near the road. 3. The public to be informed about the regulations on noise pollution. 4. Monitoring of noise pollution to be done regularly as per frequency and suggesting remedial measures. 5. Equipment and machine that generate high level of noise shall be installed in an enclosed building so that, when operated, noise level at the fence line of the industries do not exceed 70 dB(A).	Myandawei Industrial Estate Company Limited
1.3 Ground water and surface water	1. All industry facility in the industrial estate shall pretreat the wastewater to meet the acceptance criteria of the central wastewater treatment system. 2. A detention pond with a sufficient capacity to retain 2 day expected flow rate has to be constructed at each industry facility and at each Central Wastewater Treatment System as a buffer storage in case the treated wastewater fails to meet the effluent criteria. 3. Inside each industry facility, wastewater stream that requires chemical pretreatment shall be collected separately from other wastewater streams to minimize and use of chemical and increase efficiency of chemical pretreatment process. 4. Wastewater stream has to be separated from storm drain. Dilution of wastewater is not acceptable.	Myandawei Industrial Estate Company Limited

Table 1.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	5. An inspection manhole has to be installed at the point where the pretreated wastewater is discharged to the collection system of the industrial estate. 6. Warning and penalty system needs to be established for industry facility that fails to meet the acceptance criteria repeatedly. 7. Storm water retention system needs to be constructed to prevent surge of storm water discharge to the natural environment in case of large storm and to act as a buffer storage in case of spills into storm drainage system. 8. Thermal wastewater needs to be treated so that temperature at the edge of the mixing zone, or 100 m from the discharge point, is change from natural conditions by less than 3 Degree Celsius. 9. Recycling of wastewater should be promoted. Treated effluent should be used in the industrial estate wherever possible, such as for watering the green areas. 10. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course and ground are banned 11. Discharged treated wastewater to surface water must meet effluent standard of IEAT and/or related local regulations of Myanmar (except BOD that must be lower than 10 mg/l when zone C and/or D developed) 12. Water balance of each factory is need to be show PROJECT OWNER for update water consumption 13. Provide emergency holding pond, retreated system and emergency plan for over effluent standard treated wastewater storage 14. Regularly maintain equipment and machines of wastewater treatment plant in good condition 15. Provide stand by aerators and diesel engine generator at the wastewater treatment plant for emergency case 16. laboratory analysis of influent and effluent of Central Wastewater Treatment System should be regularly conducted 17. Raw wastewater must be discharged to wastewater collection system for treating to meet effluent standard 18. Ground water application of factories to be water supply in factories is prohibited	
2. Biological resources		
2.1 Terrestrial Ecology	1. Wherever possible, conserve the existing trees, particularly in the green areas, 2. Encourage the manufacturers to conserve the existing trees in the design of their facilities. 3. Select local species if plantation in the project area is needed. 4. Coordinate with local authorities and engage local communities for reforestation projects surrounding the project area. 5. Discourage and educate the workers in the industrial estate against wildlife consumption to reduce demand and indirect impacts to the wildlife in reserved forests elsewhere outside the project area.	Myandawei Industrial Estate Company Limited

Table 1.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
3. Human use values		
3.1 Water supply from central water treatment plant (WTP)	1. Directly drain raw wastewater and/or used chemicals/oils/lubricants to ground or surface water course are banned 2. Ground water application of factories to be water supply in factories is prohibited 3. Saving water sanitary wares such as faucet, flush toilet must be applied 4. "Water is worth it " need to be reminded all workers/sectors forward water saving industries 5. Pipeline of water supply must be regularly checked and immediately repaired for preventing of water leakage 6. Cleaner technology for production processes especially water saving machines/equipment must be first alternative for investors 7. Reusing and recycling of treated wastewater must be promoted and awarded 8. Application of raw water source must be accepted by local communities to avoid water supply conflict and project ban 9. Laboratory analysis of product water or tap water should be conducted regularly 10. Surveillance of Trihalomethane (THM) compounds in product water or tap water is recommended 11. Transportation of chlorine gas and other chemicals must be under UN recommendation on the transport of dangerous goods and ASEAN Framework Agreement on Facilitation of Goods in Transit 12. Chemicals storage safety OSHA requirements should be conducted	Myandawei Industrial Estate Company Limited
3.2 Wastewater treatment	1. The discharged of untreated wastewater into the receiving water is strictly prohibited at all time 2. Emergency plan for operation of wastewater treatment should be established to prevent untreated wastewater or over standard effluent discharged into the receiving water 3. Regularly check and maintain wastewater treatment plant to control the treated wastewater quality, at least as required effluent from Dawei Industrial Estate's Wastewater Treatment System especially BOD must be less than mentioned values for minimizing the impact to surface water and sediment qualities. 4. Installation of online monitoring system for flow measurement of both influent and effluent and BOD concentration of the effluent 5. Regularly maintain equipment and machines of wastewater treatment plant in good condition 6. Provide stand by aerators and diesel engine generator at the wastewater treatment plant for emergency case 7. Discharged treated wastewater to surface water must meet effluent standard of IEAT (except BOD that must be lower than 10 mg/l when zone C and/or D developed) 8. Consider alternatives for treated wastewater reusing and recycling such as watering trees, raw water for some production process 9. Directly drain raw wastewater and/or used chemicals/oils/lubricants to surface water course and ground are banned laboratory analysis of influent and effluent of central wastewater treatment plant should be regularly conducted	Myandawei Industrial Estate Company Limited

Table 1.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
3.3 Waste management	<u>Before Completion of Waste Management Facility</u> 1. Classify hazardous and non-hazardous waste according to the definitions in the Waste Management Plan prepared during the construction phase. 2. The Dawei SEZ Initial Industrial Estate Project will provide sanitary landfill for disposal of non-hazardous waste generated from the Industrial Estate area. 3. Design and construction of the landfill shall be in accordance with Solid Waste Disposal Facility Criteria – Technical Manual published by U.S. EPA (1993) or other applicable standards. 4. Detailed hydrogeological condition of the proposed landfill area has to be studied in the design of landfill. 5. Groundwater monitoring wells will be installed. As a minimum, 1 well is to be installed up gradient of the landfill and at least 1 well is to be installed down gradient of the land fill. Depth of screens and well construction depends on the results from the hydrogeological condition study. 6. Hazardous waste will be temporarily stored until the hazardous waste stabilization and disposal system at the waste management system is functional. Minimum requirements of the temporary hazardous waste storage areas include: – Impervious floor without cracks or spaces that may allow spills to perforate into the ground; – Surrounded by secondary containment bunds. The secondary containment bunds shall be at least 0.5 m high with a volume large enough to contain the spill of the largest container expected in the storage area; – Designate storage area for liquids or materials that are not allowed to be mixed, such as acids and alkalis; – Equipped with spill response kits; – Consider providing the area with roofing and temporary walls with a provision that the temporary hazardous waste storage area will have to be in use for at least 3 years until the permanent hazardous waste management facilities of the industrial estate are functional. 7. Type and quantity of hazardous waste in the storage area shall be recorded and kept current. 8. The landfill shall be closed daily to prevent vectors and odors. 9. Workers need to be trained of Waste Management Plan. 10. When the permanent waste management facility is operational, evaluate options of permanent closure of the landfill site or moving the waste material in the landfill to the permanent facility. 11. Concept of 3 Rs (Reduce, Reuse, Recycle) must be promoted and awarded 12. Open burning is not permitted 13. Landfill site must be constructed above the record flooding level 14. Controlling vector populations that having capability of transmitting disease to humans 15. Control public access to prevent illegal dumping	Myandawei Industrial Estate Company Limited

Table 1.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	16. Build and maintain a control system designed to prevent surface water run-off and storm waters from running on the active part of the landfill After Completion of Waste Management Facility 1. The components of the waste management facility: i.e. sanitary landfill, secured landfill, and incinerator, shall be designed and constructed according to the internationally accepted standards. 2. Detailed hydrogeological condition of the proposed landfill area has to be studied in the design of landfill. 3. Groundwater monitoring wells will be installed. Location and number of groundwater monitoring wells depends on the results of the study and the layout of the facility. Depth of screens and well construction depends on the results from the hydrogeological condition study. 4. All hazardous and non-hazardous waste generated by the industries in the estate shall be transferred to the facility for disposal. 5. Waste manifest system has to be created and implemented. 6. The facility shall create its Standard Operating Procedure (SOP) covering steps from receiving waste, laboratory analysis, stabilization, temporary storage, incineration, and disposal. Audit by third party is necessary. 7. Workers need to be trained of Waste Management Plan. 8. Record of type of waste including its quantity and origins shall be kept in the data base of PROJECT OWNER. This knowledge can be used in promoting material and waste flow management between industries within the industrial estate. 9. Dioxin is need to be measured, when incinerator is operated 10. Methane gas produced from landfill site and other treatment unit must be flared 11. Cover disposed solid waste with at least 6 inches of earthen material at the end of each operating day to control vectors, fires, odors, blowing litters and scavenging. An alternative cover material or temporary cover sheet is allowed, if local climate conditions make such a requirement impractical. 12. Open burning of waste is not permitted 13. Controlling vector populations that having capability of transmitting disease to humans 14. Control public access to prevent illegal dumping 15. Build and maintain a control system designed to prevent surface water run-off and storm waters from running on the active part of the landfill	
3.4 Land Use	Special Plan and Buffer Zone 1. A special specific area plan is needed to control the land use adjacent to the project. The plan must be legitimate and authorized by the state. 2. The buffer zone all around the Industrial Estate boundaries should be set up to control and prevent any uses other than agriculture and forest	Myandawei Industrial Estate Company Limited / MC's Authorized Agency

Table 1.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	<u>Setting up a management committee overseeing the project land use.</u> 1. A team or committee should be set up to monitor and manage activities and structures built in and around the project 2. The team should have legitimate authority to control the areas adjacent or nearby, though outside the estate boundaries. <u>Transportation and Infrastructure Outside the Industrial Estate Area</u> The infrastructure of the Industrial Estate will be enable setting up structures and services, such as, local roads, electricity, water supply, and drainage, should be also well planned and controlled. <u>Enforcement</u> The proposed set-up land use management committee/team should have duty to regularly monitor land use activities outside and inside the project as the development progresses.	
4. Quality of life values		
4.1 Economic and social conditions	1. Facilitate and support community development initiatives. 2. Provide special training programs for local communities to have skills required to work in Initial Industrial Zones. 3. Consider hiring local workers to create incomes and/or special benefits to local communities near the Initial Industrial Zones. 4. Establish the Unit under the Initial Industrial Zone, to handle public consultation, information disclosure, and grievance redress mechanisms, both formally and informally.	Myandawei Industrial Estate Company Limited
4.2 Occupational Health and Safety	<u>Accidents and Injuries</u> 1. Provide the environmental health and safety management system and programs for the whole industrial estate. 2. Request for each individual industry to provide proper and capable to manage occupational health and safety issues to protect health and safety of workers and public 3. Establish occupational health and safety management plans and programs to assess and manage EHS impacts and risks which are based on comprehensive job safety analyses. 4. Include the following issues in the occupational health and safety management system: – Accident investigation, recording and reporting	Myandawei Industrial Estate Company Limited

Table 1.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	– Surveillance of the working environment and worker health – Training and hazard communication – Monitoring and auditing procedures to evaluate the effectiveness of prevention and control measures. 5. Perform occupational accidents and disease recording and reporting, investigate all incidents to understand the cause of accident and to identify measures necessary to prevent a recurrence. 6. Provide provisions for Contractor and Sub-contractor to ensure that the Contractor and Sub-contractor will have safety procedures to protect their employees, and periodically monitor Contractor and Sub-contractor performance. 7. Restrict access into site or area including fencing, signage and communication of risks to local community, appropriately provide area signage and labeling of equipment in accordance with international standards and easily to understand by workers, visitors and general public. 8. Promote traffic safety programs to all personnel, for examples: – Specifying limits for trip duration – Improving driving skill – Use of speed control devices <u>Occupational, Sexual Transmission and Communicable Diseases:</u> 1. Conduct surveillance and active screening and treatment of workers. Immunization program may be required. 2. Register foreign or migrated workers to ensure that these workers have medical and health certificates to guarantee their personal health conditions. 3. Provide training programs for workers in these following topics: health awareness, and promote health protection strategies including encouraging condom use. 4. Perform periodic worker health checks in accordance with the potential risks. <u>Fire, Explosion, Chemical Leaks and Major Hazards:</u> 1. Conduct major hazard assessment of each specified industry prior establishment in order to identify buffer zone/strips or other physical separation methods to protect public from any potential hazards. 2. Provide comprehensive emergency preparedness and response plan and procedures covering fire, explosion, chemical Leaks and major hazards control. The plan must be update/ revised depend on changing of environmental condition.	

Table 1.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	3. Provide appropriate emergency services and personnel to execute emergency response when needed, and maintain equipment facilities, fire-fighting equipment in good working order, accessible and adequate for the dimension and the basis use. 4. Establish fire safety system using appropriate prescriptive standards regarding with type and number of industries, and revise fire risk management periodically to ensure its capability to cope with all the potential hazards. 5. Perform mutual aid agreements among the industries in the industrial estate as well as local authorities to provide a clear basis for response to share personnel and specialized equipment. 6. Conduct annual training and updating emergency preparedness and response plan to account for changes in equipment, personnel and facilities. 7. Revised or/and establish Emergency Response Plans in concordance with recent policy, law and regulation <u>Adequacy and Readiness of Healthcare Services</u> 1. Establish the hospital and periodically evaluate in terms of adequacy, capacity and readiness in accordance with the change in numbers and types of industry and potential risks.	
4.3 Community Health	<u>Sanitation</u> 1. Provide sufficient infrastructure amenities and public health services for the industrial estate and township, for example accommodations, water and drinking water availability, solid wastes disposal and sewage treatment in order to reduce pressure on local authorities in servicing public. 2. Technically support or collaborate with local authorities to enhance potentiality of communities in solid waste disposal by means of 3 R (Reduce, Reuse and Recycle). 3. Distribute appropriate education materials for example health awareness, hygiene and sanitation. <u>Environmental/Communicable/Non-Communicable Diseases:</u> 1. Establish the buffer strip/zone to separate the township and industries to protect dwellers from pollutions emitted. 2. Implement engineering preventive measures to install physical separation between industry and community, for example fence or tree plantation as buffer zone along the estate boundaries, and use of air modeling results and/or potential pollutions of each industry as the criteria for the distance between industries and affected community. 3. With close collaboration with community health authorities, implement an integrated control strategy for environmental and occupational diseases, for example promoting immunization, eradicating disease reservoir and promoting healthy workplace. 4. Provide worker health information to local government agencies. 5. Set up a grievance procedure to manage complaints, if any.	Myandawei Industrial Estate Company Limited

Table 1.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	Accidents/Fire/Chemical Leaks 1. Invite representative of local emergency and securities services to participate in annual site inspections to ensure familiarity with the potential hazards present. 2. Inform and communicate potential accidents and hazards of the project that may impact to community to local communities and relevant parties. 3. Prepare and train workers and nearby communities to respond to accidents, including providing technical and financial resources in order to control and response such events effectively and safely, and provide periodic emergency response practice with communities. Adequacy and Readiness of Healthcare Services 1. Promote collaboration with local authorities to enhance access of community to public health services, consider whether the capacity of the local health services sufficient for the worker family and support industries, and, if not sufficient, in close collaborating with local authorities support technical and financial resources to develop health service facility. 2. Collaborate with local health authorities to provide relevant information and technical as well as financial resources to set up the public health and occupation health surveillance system.	
5.Social and Information		
5.1 Employment and training program	Comply with IFC EHS General guideline/Laws and regulations in terms of the employee management and established plan for training programme and implement.	Myandawei Industrial Estate Company Limited
5.2 Public participation and dissemination	1. Establish *Public Relation and Public Participation Plan* to incorporate in requests and recommendation of the continuous engagement of stakeholders following: a. Inform about project activities to community b. Support nearby community as appropriate to build good relationship with community c. Communicate to build community understanding about - Potential environmental impacts and mitigation measures - CSR activity d. Conduct by MIE consistent with the applicable standard for public meeting/consultation e. Take account the results of the public consultation in improving and revised EMPs 2. Disclose about project information and public relation activities through channels such as website,e-mails,	Myandawei Industrial Estate Company Limited

Table 1.3-6 Environmental Mitigation Plan for Operation Phase (Cont.)

Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities
	meeting/visiting and local exhibition board or local media.	
5.3 Grievances redress	1. Establish *Grievance Redress Procedure* to address any complaints/ grieves to resolve/ settle disputes that brought forward by community pertaining to project activities.	Myandawei Industrial Estate Company Limited
6.Overall managment		
6.1 Revise and report	1. Revised Environmental Management Plan as necessary at every stage and submitted to DSEZMC and MONREC or since the type and number of invested industrial can be known in details. 2. Revised ESIA report and Emergency Response Plan depending on the changing in condition such fire hazard, safety from chemicals, flooding and earthquake and submitted to DSEZMC and MONREC 3. Reporting on performance of basic infrastructure e.g. local roads, electricitity, water supply, safety and results of continuous public consultation in the monitoring reports that will carry out every 6 months and submitted to DSEZMC and MONREC	Myandawei Industrial Estate Company Limited

Source: ESIA Study Team

1.4 ENVIRONMENTAL MONITORING PLAN

As part of the action plans, the environmental monitoring plans including monitioring iterms, location, frequency, and responsibible organization at the pre-construction phase, construction phase, and operation phase are prescribed in details once in the previous sections, *Section 1.2* and *Section 1.3.*

The EMoP for pre-construction phase is summarized in Table 1.4-1. Responsible organizations shall review the monitoring plan in accordance with the progress of the Project and status of the situation before monitoring, if necessary, and implement monitorin activities and preparation of monitoring report onits results. The project proponent will submit the moitoring report at three phases to DSEZMC.

Table 1.4-1 Monitoring Pan for Pre-Construciton Phase

Category	Item	Location	Frequency	Responsible Organization
Common	- Checking and revising the Environmental Mitigation (as shown in Table 1.3-5 and 1.3-6) and Management Plan by reviewing the final detailed design of the Project - Checking the Envoronmental Monitoring Plan during Construction prepared by Contractor/Sub-Contractor	Project site	Once	Contractor/Sub-Contractor
Social Environment -Involuntary Resettlemetn -Restoration -Vulnerable Group Cultural Heritage/Asset	- Monitoring the implementation status of Resettlement works such as provision of assistance pakage for PAPs and common assets.	Project site And Relocation Site	Once	DSEZMC
	- Monitoring of the implementation status for CSR activities such as community support program	Arouond Project site	Once/year	DSEZMC

Source: EIA Study Team

During construction phase, mitigation meausres in each location, as shown in Table 1.5-1 will be monitored once per month by Contractor or Sub-Contractor. Summary of EMoP for construction phase and operation phase is presented in Table 1.4-2 and Table 1.4-3, respectively.

Table 1.4-2 Monitoring Plan for Construction Phase

	Positions			**Number**	**Estimated Budgets/Year (USD)**	
Staff	1. Environmental Health and Safety (EHS) Manager			**1**	55,200	
	2. Environmental Supervisor			**1**	30,000	
	- Staff			**3**	64,800	
	3. Health and Safety Supervisor			**1**	37,200	
	- Staff			**2**	43,200	
Total Staff Estimated Budgets/Year					**230,400**	
Environmental Aspect	**Inspection Issues and Monitoring Parameters**	**Method of Analysis**	**Location**	**Frequency**	**Responsibilities**	**Estimated Budgets (USD)**
1. Air Quality	Surveillance of ambient air quality should be carried out as follows; **<u>Parameters:</u>** - TSP average 24 hours, - PM10 average 24 hours, - Wind speed and Wind direction, - Temperature	- TSP by Gravimetric-High Volume - PM-10 by Gravimetric-High Volume or equivalent to U.S EPA or method determined by Government Authority - Temperature, Wind Speed and Wind Direction by Thermometer and Metering Device	- Yalai village (during zone A2 and A3 construction period) - Ekani village (during zone D construction period)	5 Consecutive days, including weekend/holiday and weekdays Every 6 months	Project Owner	4,000/year

Table 1.4-2 Monitoring Plan for Construction Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
2. Noise	Surveillance of noise level should be carried out as follows; **Parameters:** - Leq 24 hours - Ldn - Lmax - L90	- Integrated Sound Level (International Electrotechnical Commission ; IEC 61672-1, 61672-2)	- Yalai village (during zone A2 and A3 construction period) - Ekani village (during zone D construction period)	5 Consecutive days, including weekend/holiday and weekdays Every 6 months	Project Owner	2,000/year
3. Surface Water Quality	**Parameter:** - Depth/ Width, - Temperature, - Flow Rate, - pH, - Salinity, - Electrical Conductivity, - Dissolved Oxygen (DO), - Biochemical Oxygen Demand (BOD), - Turbidity, - Chemical Oxygen Demand (COD), - Total Suspended Solids (TSS), - Total Dissolved Solids (TDS),	- APHA, AWWA and WEF. Standard Methods for the Examination of Water and Wastewater. 22nd ed. Washington, DC: APHA. 2012.	Dawei and Kunchaung Rivers for 10 Stations :	Twice a year, (dry and wet season)	Project Owner	50,000/year

Table 1.4-2 Monitoring Plan for Construction Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	- Nitrate-Nitrogen, - Ammonia-Nitrogen, - Phosphate –Phosphorus, - TKN, - Oil &Grease, - Phenol, - Total Coliform Bacteria (TCB), - Fecal Coliform Bacteria (FCB),					
4 Ground water quality	Laboratory analysis of ground water at site and nearby village should be carried out **<u>Parameters:</u>** - pH, - Turbidity, - Electrical Conductivity, - Total Dissolved Solids (TDS), - Total Suspended Solids (TSS), - Fluoride, - Iron, - Cyanide, - Total Hardness,	- APHA, AWWA and WEF. Standard Methods for the Examination of Water and Wastewater. 22nd ed. Washington, DC: APHA. 2012.	4 Locations: - 2 Monitoring wells at the Landfill unit - 2 Wells at Yalai village (if still exist) and Ekani village	Twice a year, (dry and wet season)	Project Owner	30,000/year

Table 1.4-2 Monitoring Plan for Construction Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	- Non carbonate hardness, - Sulfate, - Nitrate-Nitrogen, - Heavy Metals • Manganese (Mn), • Cadmium (Cd), • Hexavalent Chromium (Cr^{+6}), • Arsenic (As), • Lead (Pb), • Zinc (Zn), • Mercury (Hg), • Nickel (Ni), • Copper (Cu), • Selenium (Se), - Total Coliform Bacteria (TCB), - E.Coli					
Site Audit			Construction Areas	Every 6 months	Project Owner	7,000/year
Report Preparation				Every 6 months	Project Owner	12,000/year

Table 1.4-3 Monitoring Plan for Operation Phase

	Positions	Number	Estimated Budgets/Year (USD)
Staff	1. Environmental Health and Safety (EHS) Manager	**1**	55,200
	2. Environmental Supervisor	**1**	30,000
	- Staff	**3**	64,800
	3. Health and Safety Supervisor	**1**	37,200
	- Staff	**2**	43,200
Total Staff Estimated Budgets/Year			**230,400**

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
1. **Air quality**						
1.1 Ambient air quality	**Parameter:** - SO2 average 1 and 24-hour - NOx as NO2 average 1 hour - TSP average 24-hour - PM10 average 24-hour, - PM2.5 average 24-hour, - Wind Speed and Wind direction - Temperature	- SO_2 by UV-Fluorescence - NO_2 by Chemiluminescence - TSP by Gravimetric-High Volume - PM-10 and 2.5 by Gravimetric-High Volume or equivalent to U.S EPA or method determined by Government Authority - Temperature, Wind Speed and Wind Direction by Thermometer and Metering Device	- Building management or Township - Yalai village (if still exist) - Ekani village	5 Consecutive days, including weekend/holiday and weekdays Every 6 months	Project Owner	12,000/year

Table 1.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
1.2. Stacks emission	**Parameter:** - SO_2 average 1 and 24-hour - NOx as NO_2 average 1 and 24-hour - TSP average 1 and 24-hour - CO average 1 and 24-hour - Dioxin average 1 and 24-hour	- SO_2 by US.EPA method 6 or US.EPA method 8 - NOx as NO_2: US.EPA method7 - TSP by US.EPA method 5 - CO by US.EPA method 10 - Dioxin by US EPA method 23	Stacks of factories and waste incinerators	Every 6 months	Project Owner	20,000/stack/ year
2 Noise	**Parameters:** - Leq 24 hours - Ldn - Lmax - L90	- Integrated Sound Level (International Electrotechnical Commission; IEC 61672-1, 61672-2)	-Building management or Township -Yalai village (if still exist) - Ekani village (when zone D operated)	5 Consecutive days, including weekend/holiday and weekdays Every 6 months	Project Owner	2,000/year

Table 1.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
3 Surface Water Quality and Aquatic Ecology	**Parameter:** - Depth/ Width, - Temperature, - Flow Rate, - pH, - Salinity, - Electrical Conductivity, - Dissolved Oxygen (DO), - Biochemical Oxygen Demand (BOD), - Turbidity, - Chemical Oxygen Demand (COD), - Total Suspended Solids (TSS), - Total Dissolved Solids (TDS), - Nitrate-Nitrogen, - Ammonia-Nitrogen, - Phosphate –Phosphorus, - TKN, - Oil &Grease, - Phenol, - Heavy Metals	- APHA, AWWA and WEF. Standard Methods for the Examination of Water and Wastewater. 22nd ed. Washington, DC: APHA. 2012.	Dawei and Kunchaung Rivers 10-Station:	Twice a year, (dry and wet season)	Project Owner	50,000/year

Table 1.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	• Manganese (Mn), • Cadmium (Cd), • Hexavalent Chromium (Cr^{+6}), • Lead (Pb), • Zinc (Zn), • Nickel (Ni), • Copper (Cu), • Cyanide (as HCN), • Arsenic (As), • Total Mercury, - Total Coliform Bacteria (TCB), - Fecal Coliform Bacteria (FCB), - E.Col					
4 Sediment Quality	**<u>Parameter:</u>** - Particle size, - Oil and Grease, - Heavy Metals • Arsenic (As), • Cadmium (Cd),	- US EPA SW-846 Method.	Dawei and Kunchaung Rivers 10-Station:	Twice a year, (dry and wet season)	Project Owner	25,000/year

Table 1.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	• Total Chromium, • Copper (Cu), • Mercury (Hg), • Nickel (Ni), • Lead (Pb), • Zinc (Zn)					
5 Ground water quality	Laboratory analysis of ground water at site and nearby village should be carried out **Parameters:** - pH, - Turbidity, - Electrical Conductivity, - Total Dissolved Solids (TDS), - Total Suspended Solids (TSS), - Fluoride, - Iron, - Cyanide, - Total Hardness,	- APHA, AWWA and WEF. Standard Methods for the Examination of Water and Wastewater. 22nd ed. Washington, DC: APHA. 2012.	4 Locations: - 2 Monitoring wells at the Landfill site - 2 Wells at Yalai village (if still exist) and Ekani village	Twice a year, (dry and wet season)	Project Owner	30,000/year

Table 1.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	- Non carbonate hardness, - Sulfate, - Nitrate-Nitrogen, - Heavy Metals • Manganese (Mn), • Cadmium (Cd), • Hexavalent Chromium (Cr^{+6}), • Arsenic (As), • Lead (Pb), • Zinc (Zn), • Mercury (Hg), • Nickel (Ni), • Copper (Cu), • Selenium (Se), - Total Coliform Bacteria (TCB), - E.Coli					

Table 1.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
6 Wastewater Treatment	Laboratory analysis of effluent of each central wastewater treatment plant should be carried out Parameter: - pH, - Temperature, - Color /Odor, - Dissolved Oxygen (DO), - Biochemical Oxygen Demand (BOD), - Chemical Oxygen Demand (COD), - Total Suspended Solids (TSS), - Total Dissolved Solids (TDS), - TKN, - Oil &Grease, - Sulfide as H_2S, - Cyanide as HCN, - Formaldehyde, - Phenol Compound,	APHA, AWWA and WEF. Standard Methods for the Examination of Water and Wastewater. 22nd ed. Washington, DC: APHA. 2012.	Effluent discharged point(s)	Every 6 months	Project Owner	1,500/station/ year

Table 1.4-3 Monitoring Plan for Operation Phase(Cont.)

Environmental Aspect	Inspection Issues and Monitoring Parameters	Method of Analysis	Location	Frequency	Responsibilities	Estimated Budgets (USD)
	- Free Chlorine, - Pesticide, - Heavy Metals • Total Mercury (Hg), • Selenium (Se), • Cadmium (Cd), • Lead (Pb), • Arsenic (As), • Hexavalent Chromium (Cr^{+6}), • Barium (Ba) • Nickel (Ni), • Copper (Cu), • Zinc (Zn), • Manganese (Mn),					
Site Audit			Project Areas	Every 6 months	Project Owner	7,000/year
Report Preparation				Every 6 months	Project Owner	12,000/year

Source: ESIA Study Team

1.5 BUDGET FOR THE ENVIRONMENTAL MANAGEMENT AND MONITORING

This section describes the budget plans for the environmental management and environmental monitoring by the Project Proponent.

On the other hand, the tenants will take necessary environmental mitigation measures and its expense for the environmental management not only at the construction and operation phases but also at the cosling , termnation, and after termination phases in accordance with their EIA/IEE studies. However, the budget plan for environmental management of each work cannot be estimated at this stage becuas ther is nocertain information on industrial sections of tenants.

1.5.1 Budget Plan for Environmental Management

Most of the mitigation meausrea such as construction of retention ponds, polishing ponds, centrialized wastewater treatment plant, plans and trainings are already included in the project cost.

1.5.2 Budget Plan for Environmental Monitoring

In terms of the budget for environmental monitoring before/during construction and opertaiton phases, main monitoring cost is a cost for field measurements such as airquality, water, and quality noise. Annual costs for field measuremetns in the construction phase by constractor in the operation phase by the Project Proponent are estimated, repcitvely, as show in Table 1.5-1.

Table 1.5-1 Estimated Annual Costs for Monitoring in the Construction and Operation Phases

Phase	Monitoring Items	Implementing Organization	Expected Cost	Remarks
Construction Phase	Air Quality, Noise and Vibration, Surface water Quality and Grounwater Quality	Contractor	USD 105,000 /Year	Not included staff cost
Operation Phase	Air Quality, Noise and Vibration, Surface water Quality, Grounwater and Sediment quality	Project Proponent	USD 160,000/Year	Not included stack emission and wastewater treatment per station and staff cost

Remarks: Budget is estimated as of May, 2017

Source: EIA Study Team

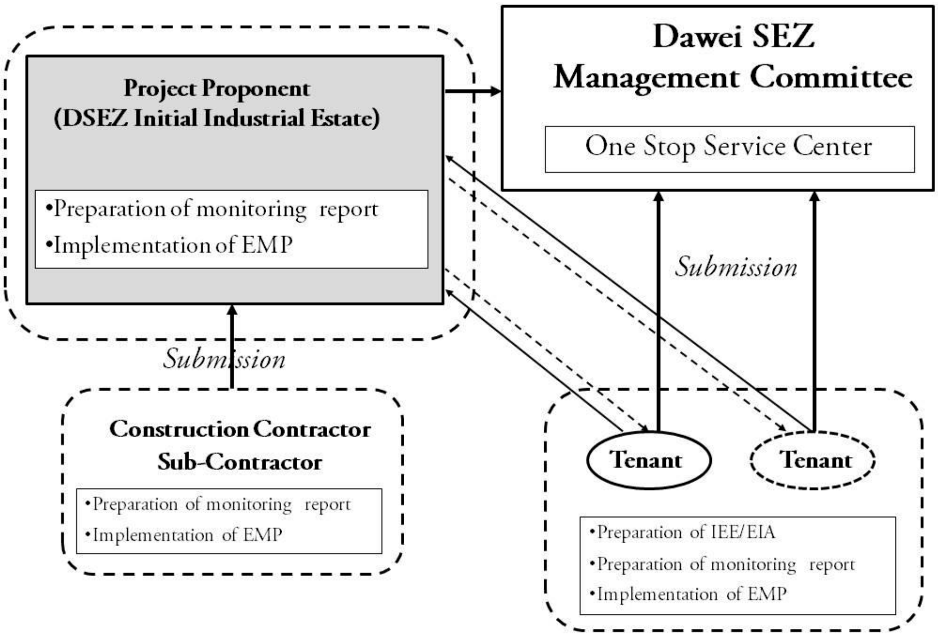
1.6 IMPLEMENTATION SCHEDULE

The implementation schedule as of May 2017 of the pre-construction, construction, and operation phases of the Dawei Initial Industrial Estate development project is as follows:

1) Pre-construction period : from 2017 to get aprpval of ESIA and land lease agreement
2) Construction period: 24 months after get approval of ESIA and land lease agreement, depend on demand basis.
3) Operation period: 75 years (Maximum)

1.7 INSTITUTIONAL ARRANGMENT

The organization structure for the operation and management of environmental monitoring is shown in Figure 1.7-1.



Source: EIA Study Team

Figure 1.7-1 Organizational Structure for EMP and EMoP of the Project during operation phase

1.7.1 Governing Bodies

According to the Myanmar Special Economic Zone Law (2014), there are 3 levels of government agencies directly associated with MIE:

- Central Body
- Central Working Body
- Dawei Special Economic Zone Management Committee (DSEZMC)

The Central Body (CB) consists of members from ministries and government departments as assigned by the Government of Myanmar. CB is a policy making level among the three organizations. The duties of CB include reviewing proposals for development of a Special Economic Zone, determining type business, and other financial and taxes related matter. It reports to the Government of Myanmar. The Central Body is responsible to forming and assigning detailed duties to the Central Working Body (CWB) and Dawei Special Economic Zone Management Committee (DSEZMC).

Central Working Body (CWB) assists CB in reviewing the Special Economic Zone plan, determining of appropriate category of investment, and advising CB on matters regarding administration, management, and legal issues in the Special Economic Zone. CWB reports to CB.

DSEZMC is the implementation of the governing bodies. One of the key duties of DSEZMC is supervising and inspecting the matters on implementation of investment plans and other matters including land use, environmental conservation, waste control, health, education, finance and taxation, transport, communication, security, electricity, energy and water supply etc. DSEZMC reports to both CB and CWB.

1.7.2 Project proponent

The Project Proponent will be in charge of the overall opertation of the DSEZ Initial Industrial Estate area. During the construction, the Project Propoent will implement, EMP and EMoP as stated in this ESIA report and almost by through construction contractors and sub contractors.

The Project Proponent will also formulate the internal regulations for the Initial Industrial area that stipulates several obligations such as effluent standards of wastewater and air, noise standard, and regulation of protective controls to the tenants.

The Project Proponent will assit tanents for environmental assessment and submit the monitoring report based on the results of implementation of EMP and EMoP for the Initial Industrial Estate development.

Main tasks for environmental and social consideration in the Project are managed by Environment, Safety and Health section and / or Community relation division in Table 1.7-1.

Table 1.7-1 Main Tasks for Environmental and Social Consideration in DSEZ Initial Industrial Estate

Division/Section	Main Tasks
Environment, Safety and Health section	1) Assisting tenants in the environmental assessment of factory development as follows: - Providing information on environmental regulations and location consultants - Facilitating communication with DSEZMC for environmental and social issues. 2) Monitoring the DSEZ Initial Industrial Estate area operations according to EMP and EMoP 3) Submitting environmental monitioring reports to DSEZMC
Community relation division	1) Grievance Adjustment - Handling complains/ claims/ requests from community and its response as necessary - Coordinaitng between tenant and community for grievance adjustment 2) Planning and implementation of CSR activities 3) Consultation with tanents related to community relation 4) Job matching and assistance

Source: EIA Study Team

1.7.2.1 Construction Contractor and Sub-Contractor

Construction Contractor and Sub-Contractors (CC) refer to the Contractors for development of Dawei Initial Industrial Estate, which include constructions of utility systems i.e. water treatment and distribution system, wastewater collection and treatment system, irrigation system, electricity generation and distribution system, solid and hazardous waste management facilities, internal roads, and basic infrastructure etc. They do not include the construction of tanents or an individual factory or manufacturing.

CC must operate in accordance with the mitigation measures stipulated in this ESIA report. CC must report to the Project Proponent. Responsibilities of CC during construction phase include:

- Implement environmental mitigation measures for the construction activities and work camps as required by the Project Proponent;
- Liaise and coordinate with the Project Proponent on matters related to environment and public consultation; and
- Develop emergency response plan and establish emergency response capability for construction phase, which may include accidents, fire and first aid and medical evacuation.

1.7.2.2 Factories / Manufacturers

The factories / manufacturers refer to the investors build and operate their facilities in the industrial estate. Responsibilities of the factories / manufacturers, which will be during the operating phase, include:

- Implement EMP and EMoP for each business and submit the environmental monitoring report to DSEZMC and the Project Proponent base on its IEE/EIA. Comply with environmental requirements of MIE during construction and operation of their facility.

1.8 PROJECT POLICY AND MITIGATION MEASURES COMMITMENTS

1.8.1 Policy

The Project Proponent refers to Myandawei Industrial Estate (Myanmar) (MIE), which falls under the category of '*Developer*' according to Myanmar Special Economic Zone Law (2015). Roles of the Project Proponent include design, construction, and operation of infrastructure and amenities in the Dawei Initial Industrial Estate. MIE will be responsible for technical planning, enforcing, and monitoring of all environmental mitigation measures as stipulated in the EMP. The Project Proponent must report to DSEZMC.

1.8.1.1 Policy for Construction Phase

Responsibilities of Project Proponent prior to and during construction phase include:

- Hold discussions with the government agencies to develop procedure for inter-agency coordination and reporting;
- Ensure that provision of relevant environmental mitigation measures are reflected in the contract between MIE and construction Contractor and sub contractors;
- Develop monitoring programs and monitor the implementation of environmental mitigation measures for construction period; and
- Liaise and coordinate with government agencies on the matters related to environment and public consultation.

  - Responsibilities of MIE during operation phase include:

- Establish environmental requirements for the industrial estate following the mitigation measures for the operation phase;
- Distribute the environmental requirements or guideline to the factories / manufacturers and ensure that the factories/manufacturers comply with the environmental requirements or guideline both during construction and operation of the facilities;

- Operate the utility systems of the industrial estate including electricity generation, water treatment and distribution, solid and hazardous waste management, and wastewater treatment system;
- Develop emergency response plan and establish emergency response capability for operating phase, which may include traffic accidents, fire and chemical pollution incidents within the industrial estate area;
- Develop monitoring programs and monitor the implementation of environmental mitigation measures for operating phase; and
- Liaise and coordinate with government agencies on the matters related to environment and public consultation.

1.8.1.2 Policy for operation phase

MIE as the project owner has to establish the environmental policy and rules that will govern environmental practices and performance of the industrial estate as a whole. The establishment and implementation of this component is of utmost important absence of local environmental regulations and authorities fully responsible for environment and pollution control in Myanmar. Once established, MIE shall adhere to these policy and rules. However, in the future, when the environmental protection laws may be announced and published by the Government of Myanmar, MIE shall ensure that the requirements as set in the policy and rules are fully in compliance with the laws.

Environmental policy and rules for Dawei Initial Industrial Estate shall be based on the following principles:

- Eco-Industrial Park (EIP) concept which have the following key components:
  - Integration with natural system.
  - Maximize energy efficiency through facility design, co-generation, and other means.
  - Material flow through the whole site and ensure maximum reuse and recycling among the industries in the industrial estate.
  - Water conservation, reuse, and recycling among the industries in the industrial estate.
- The type of industries shall be in accordance with types designated for each zone.
- Prepare Environmental, Health and Safety Plan. EHS management plan or programs should also be reassessed periodically to ensure that the key environmental health and safety risks are determined in accordance with changes in numbers or types of industries in order that the potential risks will be appropriately addressed. Thus, EHS system and performance should be improved continuously by a combination of ongoing monitoring of the industrial estate and high performances as well as effective accountability of the facility.

- Establish Environmental Rules that the industries have to follow. These rules will be in accordance with the EMP for operation period. The rules will be attached with the contractual document between the industries and MIE.
- Establish Environmental, Health and Safety Screening Form for the industries to fill in for MIE to assess if the industries have acceptable environmental planning and mitigation measures. In the form, the industries will be requested to provide the following information, as the minimum:
    - Type, source, and quantity of raw materials and chemicals used in the process together with their MSDS.
    - Type and quantity of the products and by-products.
    - Characteristics and quantity of solid waste, hazardous waste, wastewater, and air pollution loading generated due to the production process.
    - The pretreatment system the industries plan to put in place to ensure that the release is in accordance with the Environmental Rules.
    - Environmental, Health, and Safety Plan of the industries.
    - Past health and safety records of their facilities elsewhere, if applicable.
    - Their policy and approach in energy, material, and water conservations.

In addition to the above policy and rules, MIE will play a leading role in maintaining and improving overall environmental performance of the whole industrial estate. The ESIA was prepared in a broad scope to cover all possible activities in the industrial estate in high level. MIE will have to establish a strong organization to handle the dynamic and changes that will occur during the operation and implementation phase of the project.

To achieve environmental safety and health management goals, to protect the environment, workers and the public from any adverse impacts caused by the project, the strong environmental management commitments and the proficient mitigation measures are needed. In order to develop the comprehensive environmental management plan, MIE as the project owner should be aware of the change during the project development period, and should consider the following measures.

- MIE should establish a sector responsible for safety health and environmental management of the industrial estate to prepare and perform the environmental management plan and programs to ensure that the industrial estate comply with environmental legislation and other relevant safety health and environmental requirements, and to achieve the most up-to-date environmental protection requirements/ measures/ standards.
- MIE should periodically assess/re-assess the environmental management plan or programs to ensure that the key environmental health and safety risks are evaluate

in accordance with numbers and types of industries so that potential risks will be addressed appropriately.

- Due to the long period of the industrial estate project, MIE should ensure that EHS performance will be improved continuously via a combination of ongoing monitoring program and cooperation with the industries inside the estate.
- MIE needs to prepare and commission a data base system to keep track of and analyze environmental data, flow of materials and waste, water consumption, wastewater generation rate and quality, and energy consumption. The data base will help organize the data from monitoring program of MIE and of the industries, and can also be used as a tool to promote conservation of material, energy, and water among the industries, if the data base is designed properly.
- MIE should facilitate, provide necessary guidance and adequate information to every industry in order to effectively apply environmental management, and to comply with occupational health and safety provisions of the industrial estate.
- MIE should provide provisions to ensure that every industry can apply proper environmental health and safety management, and manage occupational health and safety issues to protect health and safety of workers and the public.
- MIE should further study and identify buffer zone/strip or other physical separation methods to protect the public from any major hazards.
- MIE should designate types of industries: garments and textiles factories, food and beverages factories, cannery and frozen seafood industry, that have to conduct environmental impact assessment and/or major hazard assessments prior establishment to establish the appropriate environmental safety and health management plan.

1.8.2 Mitigation Measures Commitments

The Project Proponent commits all mitigation measures prescribed in this Chapter.