The Republic of the Union of Myanmar
Thilawa SEZ Management Committee

PREPARATORY SURVEY ON THILAWA SEZ DEVELOPMENT PROJECT IN THE REPUBLIC OF THE UNION OF MYANMAR

FINAL REPORT

March 2016

Japan International Cooperation Agency
(JICA)

Mizuho Bank, Ltd.
Mizuho Research Institute Ltd.
ERM Japan, Ltd.

The Republic of the Union of Myanmar

The Ministry of National Planning and Economic Development of the Republic of the Union of Myanmar, SEZ Management Committee

Preparatory Study Report for the Thilawa Special Economic Zone (SEZ) Development Project (Public Version)

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(for “6. Environmental Impact Assessment (EIA)” section)

Abbreviation	Name
CEO	: Community Engagement Officer
CSR	: Corporate Social Responsibility
ECD	: Environmental Conservation Department
EIA	: Environmental Impact Assessment
EMP	: Environmental Management Plan
GAD	: General Administration Department
GHG	: Greenhouse Gas
IEE	: Initial Environmental Examination
IUCN	: International Union for Conservation of Nature
JICA	: Japan International Cooperation Agency
MOECAF	: Ministry of Environmental Conservation and Forestry (Myanmar)
NGO	: Non-Governmental Organization
OSSC	: One Stop Service Centre
SEA	: Strategic Environmental Assessment
SEZ	: Special Economic Zone
SIA	: Social Impact Assessment
TSEZMC	: Thilawa SEZ Management Committee

1 Introduction

1.1 Background to the study

Years of international isolation have restricted economic development in the Republic of the Union of Myanmar (hereinafter "Myanmar"). However, since the inauguration of the Thein Sein administration in March 2011, the country has undergone rapid development as it moves towards democratization and a market economy. In order to raise national incomes through economic growth, the Myanmar government is trying to entice direct investment from overseas. In particular, it has adopted a policy of trying to attract foreign companies by developing Special Economic Zones (hereinafter "SEZ") in areas such as Thilawa, Dawei and Kyaukpyu. To this end, the new administration has made a number of gradual revisions to the legal system and so on since its inauguration. In November 2012, the Myanmar parliament enacted the Foreign Investment Law, a move intended to attract foreign firms to the country. In the middle of July 2013, meanwhile, the House of Representatives (the lower house in parliament) approved a bill to revise the Myanmar Special Economic Zones (SEZ) Law.

Lying next to Yangon city, the Thilawa SEZ is an around 2,400 ha area to be developed that encompasses the Thanlyin and Kyauktan Townships. As well as an ample supply of manpower, the area is also blessed with a pre-existing accumulation of industry and good connectivity to ports. The paved roadways circling the land earmarked for the SEZ are also being rolled out to the north, south, east and west. However, marshlands, rice paddies and dry fields can still be found within the SEZ. The government urgently needs to further develop water facilities and other infrastructure in and around the SEZ if it is to attract businesses to the area.

Among the Thilawa SEZ (around 2,400 ha), the early development area (Zone-A Area: around 400 ha) has been developed in advance by Myanmar Japan Thilawa Development Ltd. (MJTD) since 2013. In March 2014, a decision was made to provide funding through JICA's overseas investment and lending operations, with Zone A subsequently opened in September 2015.

There has not been necessary research into the remaining around 2,000 ha of the SEZ, though, so the Myanmar government has asked JICA to carry out a study. Based on this request, JICA will undertake a study to prepare materials that will help determine the feasibility of private sector involvement in the area.

1.2 Study objectives

This study aims to prepare materials to help determine the feasibility of investment in the 2,000 ha that lie outside the Zone-A Area. It will do so by analyzing the project-site potential of the area and formulating a land-use plan, etc.

1.3 Target area

The study targets a total of the around 2,400-ha Thilawa SEZ on the outskirts of Yangon city in Myanmar, specifically the around 2,000 ha that lie outside the Zone-A Area (around 400 ha).

2 Methods and Contents of the Study

2.1 Basic principles

This study will be carried out in accordance with the following basic principles.

1) Basic principles related to the feasibility study
2) Basic principles related to operations involving environmental and social considerations
3) Basic principles related to how to pursue the study

1) Basic principles related to the feasibility study

Basic principle 1)-1	<u>The final output of this study will be the formulation of a basic development plan for the concerned 2,000ha. The study will carry out the necessary research and analysis to achieve this aim.</u> ・This study aims to help the governments of Japan and Myanmar reach an agreement on the developmental direction of the entire Thilawa project. It will do so by drawing up a feasible plan for land usage (industrial and commercial properties, public facilities, housing, etc.) within the Thilawa SEZ.
Basic principle 1)-2	<u>A basic development plan will be formulated based on concrete data obtained by market research.</u> ・The basic development plan will reflect the opinions of the Japanese and Myanmar governments and will also consider geographical conditions. Furthermore, in order to increase the feasibility of the plan, it will be formulated based on market research, particularly with regards to the potential for attracting industry to the area and surveys of actual real-estate demand, etc.
Basic principle 1)-3	<u>As far as possible, market research will refer to data from the actual real-estate market.</u> ・When conducting market research (into actual real-estate demand and the potential for attracting industry to the area, etc.) in relation to basic principle 1)-2, actual real estate market trends will be consulted as much as possible.
Basic principle 1)-4	<u>The basic development plan will be formulated based on actual cases of similar complex urban developments.</u> ・The study will collect information pertaining to other large-scale complex urban developments across the globe. This data will be consulted when formulating the basic development plan.

2) Basic principles related to operations involving environmental and social considerations

Basic principle 2)-1	<u>The project will be pursued based on environmental and social considerations.</u> ・This project is classified as Category A in accordance with the "JICA Guidelines for Environmental and Social Considerations" (released April 2010). Sufficient attention should be paid to these guidelines when setting schedules or allocating study group members, etc. ・Sufficient attention should be paid to environmental and social considerations when analyzing the potential of the project site or when formulating the basic development plan, etc. Potential project participants will also be given assistance with checking Myanmar's environmental and social procedures, and with acquiring the necessary permits

3) Basic principles related to how to pursue the study

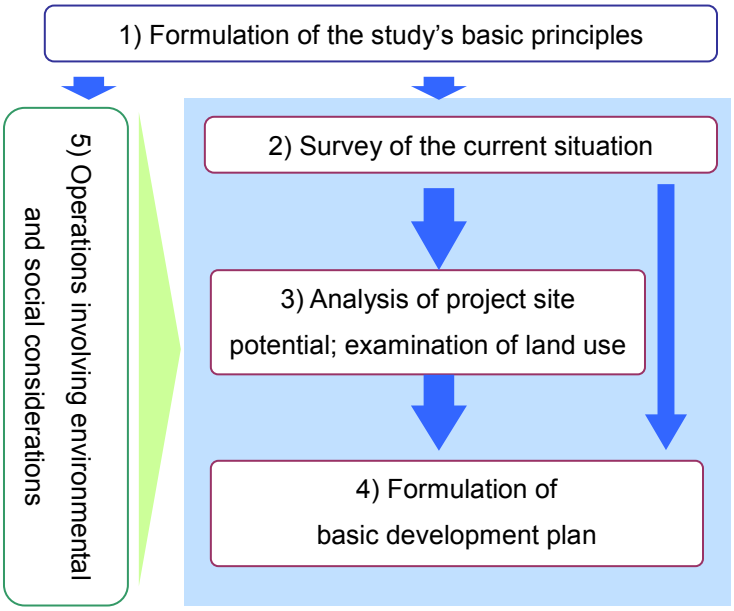
Basic principle 3)-1	<u>Related parties from the Myanmar side will be updated as necessary with regards to the status of this study and their opinions will also be solicited. In this way, the results of the study will reflect the opinions and wishes of parties on the Myanmar side.</u> ・The Thilawa project is a joint project between Japan and Myanmar. It will demonstrate to Myanmar and the outside world that the country is developing economically following the transition to a civilian government. ・Considering the importance of this project, the intentions and wishes of the Myanmar side shall be taken into account when formulating the basic development plan. JICA will also liaison with these parties on an as-needed basis. ・Related parties on the Myanmar side are expected to include the Thilawa SEZ Management Committee, the Ministry of National Planning and Economic Development, the Ministry of Construction, and the Chamber of Commerce.
Basic principle 3)-2	<u>Information will be shared with developers in the early development area and data will be gathered pertaining to the status of the formulation of resettlement plans.</u> ・The early development area (400 ha) will be located within the 2,400 ha SEZ and it is expected to have a significant relation and impact on development in the other 2,000 ha, with the reverse also expected to be true. This study will be carried out in close collaboration with private-sector entities and other

	parties involved in the early development area. Opinions will be exchanged on an as-needed basis and as much data as possible will be obtained with regards to the development plan of the early development area and measures to attract companies, etc. The basic development plan will be formulated thereafter. ・ Furthermore, the status of the formulation of resettlement plans will be checked periodically and this will be reflected in the basic development plan and so on. The development phasing will depend in part on the status of the resettlement of people living inside the Thilawa SEZ, while the feasibility of the project is also likely to be significantly impacted if developers are asked to pay compensation for resettlements.
Basic principle 3)-3	Stakeholders will be consulted and information shared publicly as appropriate ・ Information about environmental and social considerations will be publicly released in tandem with the scoping proposal and the draft report. Following an analysis of stakeholders, consultations with local stakeholders will be then be undertaken, with the results of the consultations reflected in the study's results. ・ Stakeholder consultations of various forms have already taken place, so there needs to be an understanding of how consultations have proceeded heretofore.
Basic principle 3)-4	Existing data and research will be utilized in order to prevent any overlaps ・ This study will utilize existing data as much as possible. For this reason, JICA and related parties on the Myanmar side will be requested to share information beforehand and, if necessary, the information will be checked (by JICA). ・ Furthermore, pre-existing operations involving environmental and social considerations have been undertaken for this project and advisory councils have also been held to discuss matters. While utilizing this data in an effective manner, care will be taken to ensure the study does not overlap with other baseline surveys and so on. ・ At present, there is thought to be insufficient environmental data with regards to water quality (including groundwater) as well as flora and fauna. Attention should be paid to the fact that arsenic contamination is a common problem affecting the Mekong Delta. ・ Myanmar is prone to sudden changes in related rules and regulations, so the study needs to follow up on legal developments in an appropriate manner.

2.2 Implementation process

This study's implementation process is as follows.

Task 1): Formulation of the study's basic principles (information sharing with JICA about confirmed items; formulation of inception report, etc.)
Task 2): Survey of the current situation (review of previous plans and related studies; confirmation of current situation; confirmation of bottlenecks, etc.)
Task 3): Analysis of project site potential; examination of land use concepts (analysis of the economic situation; survey of potential demand; identification of candidate industries based on studies of similar cases, etc.; examination of land use concepts)
Task 4): Formulation of basic development plan (formulation of basic plan for land usage)
Task 5): Operations involving environmental and social considerations (implementation of baseline surveys into environmental and social conditions; examination of alternative land use plans)



2.3 Implementation method

The study contents and methods are outlined below in line with the implementation process.

【Task 1】Formulation of the study's basic principles (information sharing with JICA about confirmed items; formulation of inception report, etc.)

Information will be shared with regards to confirmed items from the projects of JICA and other public bodies. An initial desk-top analysis will then take place. In particular, the direction of the study will be determined through confirmation of the policies and agreements of the Japanese and Myanmar governments. Based on this, the basic principles (draft) pertaining to study methods, processes and procedures will be outlined and an inception report (draft) will be prepared.

The inception report (draft) will be revised in consultation with JICA. This revision will reflect comments solicited from related institutions at an investigative commission organized by JICA. The revised inception report will be submitted to JICA. The contents will also be explained to the Myanmar's government agencies. These agencies will be consulted about the contents and their understanding will be obtained.

【Task 2】Survey of the current situation (review of previous plans and related studies; confirmation of current situation; confirmation of bottlenecks, etc.)

The survey of the current situation will involve a review of other related studies, the Myanmar government's SEZ development plan (the relation with other SEZs), and infrastructure development plans. In particular, the contents of pre-existing studies into the target area (geographical conditions and basic infrastructure) will be checked in detail to ensure there are no overlaps.

Kick-off meetings will be held on the ground with related parties on the Myanmar side. The inception report will be presented and explained at these meetings. The business promotion structures on the Myanmar side will also be checked. Furthermore, an on-the-ground confirmation of the current status of the Thilawa project and any bottlenecks will be undertaken. This confirmation will take into account matters raised in the reviews carried out in Tasks 1 and 2.

If deemed necessary, interviews and surveys with the Myanmar government and related agencies will also commence. These will cover items related to operations from Task 3 onward.

【Task 3】Analysis of project site potential; examination of land use concepts (analysis of the economic situation; survey of potential demand; identification of candidate industries based on studies of similar cases, etc.; examination of land use concepts)

This task will involve an analysis of the potential of the project site from various angles. This analysis will be carried out from the perspective of the markets and those on the demand side. Based on this analysis, an examination will then be carried out into land usage concepts.

The concrete steps for this task are outlined below.

1) A study will be carried out into Thilawa SEZ's potential for attracting industry. This study will be based on geographical characteristics, economic circumstances and population movements, etc.

A study will be conducted into the connectivity of the Thilawa SEZ and Myanmar's ports, etc. in relation to global trade, Myanmar's economic/industrial structure, the growth scenario based on the stage of industrial development, and potential labor supply and consumer markets based on population movements. A roadmap for the Thilawa SEZ's industrial development will then be prepared based on the results of this study. Matters that could contribute to economic growth and help attract industry (promising or important industries; energy resources; necessary infrastructure; policies to encourage industrial development, etc.) will be identified and analyzed.

Interviews will be carried out with industry groups, etc. to discuss the contents of the roadmap. The roadmap will then be refined to reflect actual industry and business trends.

Item	Contents
Location analysis	A survey will be carried out into the location and geographical characteristics of the Thilawa SEZ. A study will be carried out into the Thilawa SEZ's potential for attracting industry. This will check items such as the development status of neighboring areas; the ease of access to domestic and export markets, the proximity to ports, and the possibility of development in the hinterlands.
Analysis of economic conditions (Myanmar)	Macroeconomic data about Myanmar will be compiled based on statistics related to GDP (trends and contribution levels for each industry sector and demand component), trade (import and export items) and direct investment from overseas. This will be used to identify elements that could contribute to economic growth in Myanmar.
Analysis of economic conditions (Yangon Region)	A macroeconomic analysis of the Yangon Region will be carried out. This will be used to prepare scenarios with regards to economic growth in the Yangon Region and infrastructure areas that need improvement.

Analysis of industrial development stage	The past economic growth scenarios of various nations within the ASEAN region will be analyzed according to their stage of industrial development. This analysis will be used to obtain clues to economic growth scenarios for Myanmar.
Analysis of population movements	A survey and forecast will be carried out with regards to the demographic situation in the Yangon and Thilawa regions. This will be used to analyze potential labor supply and consumer markets

2) Study of similar cases

A study will look into other SEZs within Myanmar and across the ASEAN region and China, etc. It will examine the kind of policies that were adopted to entice industry and the kind of industries gathered in the SEZs, etc. This study will be used when examining the most appropriate ways to attract industry to the Thilawa project.

The study of similar cases will focus on the items mentioned below, taken from other industrial complex projects, and the items will be organized and analyzed.

Items to be organized /analyzed in the study of similar cases
・ Concepts and location ・ Composition of SEZs; industrial composition; land use composition and facilities

3) Selection of target industries for solicitation

Industries to target for solicitation will be identified based on global trends and so on. The growth potential of industries targeted for the Thilawa SEZ will be examined in detail.

More specifically, a review of major industries will be carried using various statistics (UNIDO Industrial Demand-Supply Balance Database, OCC Consulting FDI Database, Myanmar government statistics and so on). This will look into global production volumes, growth trends and the potential for attracting trade/FDI. These results will be used to identify promising industry sectors. A list of 15 to 20 industry sectors will then be compiled based on Myanmar's economic and industrial structure, and industrial trends in Thilawa and neighboring areas. The mix of the target industries will then be examined with a focus on inter-industry connections.

A detailed examination will then be carried out into the growth potential of each industry targeted for the Thilawa SEZ, possible product categories, and various preferential treatments. An analysis will also be undertaken into the advantages and merits of setting up in the Thilawa SEZ (inter-industry synergy effects; support industries; possibility of procuring raw materials; port access; available labor force and so on), future potential; and value chains, etc. In order to

enhance the analysis, interviews will be carried out with multiple firms at a sub-segment level for each industry.

4) Examination of land usage concepts

Based on the examination results of 1) to 3) above, a calculation will be made of how much land area will be needed for industrial sites as part of the envisaged industrial mix. A forecast of labor supply and population will be carried out based on the results of the calculation. Based on this forecast, an examination will be carried out into supply and demand levels in relation to land for commercial use or housing. A review will then be undertaken with regards to the most appropriate land usage classifications.

When examining land usage concepts, several alternative options will be reviewed. This will be a comprehensive review that considers feasibility, economic effects, and environmental and social considerations. The review materials will be sorted to enable parties related to the project to choose the best option.

【Task 4】Formulation of basic development plan (formulation of basic plan for land usage)

In Task 4, a basic development plan will be reviewed and prepared based on the work carried out in Tasks 1 to 3.

1) Site analysis

In order to facilitate a review of development concepts, goals and targets, as well as land classification options, an analysis of the following will be undertaken first: the geographical conditions of the target area; the current land usage situation and characteristics (vegetation, the status of lien settings, etc.); and the basic necessary infrastructure (utilities and transportation). This analysis will be done using field surveys and data collection within the Thilawa SEZ. A review will then be carried out into the advantages of the target area as well as any limitations related to geography and so on. Furthermore, the condition of infrastructure within the Thilawa SEZ will also be checked in order to facilitate a review of infrastructure development. In order to ensure an efficient study and analysis, sufficient attention will be paid to the pre-existing data that was confirmed in Tasks 1 to 2 as well as the details of the survey from Task 3.

2) Examination and formulation of the basic development plan

Based on the results of the study in Task 3 (analysis of project site potential; examination of the land use concepts), a basic development plan will be formulated in accordance with the views of JICA and related parties on the Myanmar side.

First of all, a maximum of three draft plans will be prepared. Development concepts, goals and targets will be formulated. Concrete examples of land division and phasing will be presented. These will be reviewed by JICA and related parties on the Myanmar side, and opinions from both sides will be confirmed. An examination of land plotting will be carried out. This will consider the environment and the efficient use of basic infrastructure.

【Task 5】Operations involving environmental and social considerations (implementation of baseline surveys into environmental and social conditions; examination of alternative land use plans)

1) Strategic Environmental Assessment (SEA)

During the initial stage of the project, environmental and social policies will be incorporated into the development plan in accordance with the relevant Myanmar policies and JICA Guidelines for Environmental and Social Considerations. This will ensure the project takes full account of environmental and social considerations. Where necessary, the development plan will be revised in accordance with the results of the environmental and social baseline study. The baseline study will be implemented based on the results of existing and additional sources (such as *in situ* meetings, stakeholder interviews and so on). The acquisition of baseline data will make full use of the results of existing reports. It will also take into account seasonal variations (such as monsoons and dry seasons).

Alternative land usage plans will then be reviewed when examining land usage concepts. Strategic environmental assessment methodologies will be applied during this review, with the alternative options compared and examined from the perspectives of feasibility, economic effects, transportation, construction, and environment and social considerations. The result of this review will be opened to public comment in Myanmar at the earliest possible opportunity.

2) Acquisition of the latest information regarding the environmental impact assessment system and environmental laws; the offering of assistance when it comes to obtaining the necessary permits

In order to implement the project in a smooth manner, it is important to obtain an environmental impact assessment (EIA) and other relevant permits in an appropriate timeframe. The Foreign Investment Law and related ordinances (Notification No. 11/2013) of the Republic of the Union of Myanmar contain stipulations about EIAs and social impact assessments (SIAs). The types of projects requiring an EIA are defined in a separate ordinance (Notification No. 1/2013).

The EIA Procedures are in the drafting stage in Myanmar (as of February 2013). It is thought the draft is being formulated in accordance with Asian Development Bank (ADB) Guidelines

under the auspices of the Ministry of Environmental Conservation and Forestry and the Ministry of National Planning and Economic Development. Until these Myanmar-specific guidelines are developed, it will be possible to carry out an EIA based on the aforementioned JICA Guidelines and ADB guidelines.

Myanmar's Environmental Conservation Law consists of 14 chapters, and stipulates that the Myanmar Government will establish an Environmental Conservation Committee (Chapter 3, Article 4) that will be charged with determining Myanmar's basic environmental policy and other environmental policies (Chapter 3, Article 6). It also sets down the different roles of each ministry that implements the basic environment policy when it comes to devising and implementing environmental measures (state or regional environmental planning, standards setting, monitoring programs, EIA/SIA approval processes, etc.) based on the basic environmental policy determined by the Committee (Chapter 4, Article 7). At present, there are no established environmental standards. The main environmental laws of Myanmar are outlined below. Items related to this study will be identified and included in the EIA report. Furthermore, the relevant environmental permits identified by the study will be organized and supports will be offered to obtain these permits.

○ Main Environment Laws, Regulations and Policies of Myanmar

- Foreign Investment Law (2012)
- Forestry Law (1992)
- Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994)
- Public Health Law (1972)
- Factory Act (1951)
- Territorial Sea and Maritime Zone Law (1977)
- National Environment Policy (1994)
- Mines Law (1994)
- Freshwater Fisheries Law (1991)
- Marine Fisheries Law (1990)
- Law on Aquaculture (1989)
- Irrigation Laws and Regulations (1982)
- Conservation of Water Resources and Rivers Law (2006)
- Environmental Conservation Law (2012)
- Draft Environmental Conservation Rules (As of February 2013, the draft had received ministerial approval and was going through parliament)
- Draft EIA Procedures (at the drafting stage)

3 Survey of the Current Situation

3.1 Related studies

In order to raise national incomes through economic growth, the Myanmar government is trying to entice direct investment from overseas. In particular, it has adopted a policy of trying to attract foreign companies by developing Special Economic Zones (hereinafter "SEZ") in areas such as Thilawa, Dawei and Kyaukpyu.

Under these circumstances, the studies described in the table below have been carried in relation to the Thilawa SEZ. Japan's Ministry of Economy, Trade and Industry (METI) also carried out the "FY2011 Project for Promoting Export of Infrastructure System (Study on the Possibility of Implementing Smart-Community in Myanmar)," with the results of the study compiled in a report released on February 2013 (hereinafter "METI report").

Table 3.1.1 Studies related to Thilawa SEZ

Study Name	Target Area	Outline
Feasibility Study for Thilawa SEZ	2,400ha	Outline of a basic plan for the entire Thilawa SEZ area
Feasibility Study for Thilawa Special Economic Zone (SEZ) Class A Development	420ha	Joint project between Japan and Myanmar
Preparatory study on Thilawa special economic zone infrastructure development in the Republic of the Union of Myanmar	2,400ha and its surrounding areas	Formulation of development plan for infrastructure deemed necessary for the development of Class A area as priority area
The Preparatory Survey for the Project for Expansion of Yangon Port in Thilawa Area	Thilawa Port	800m × 750m (a 3-stage development plan)

Source: Preparatory Study for Thilawa SEZ Infrastructure Development in the Republic of the Union of Myanmar

The METI report provides a snapshot of Myanmar's economy. In its "Basic Plan," the report also discusses the meaning and background to SEZ development, an outline of the Thilawa SEZ, and the effects of development. Its "Feasibility Review" also looks into population/infrastructure demand forecasts, infrastructure development plans for each sector, project costs and financing, and risk analysis. In its development concept for the Thilawa SEZ, the report states that "as a national project, it is desirable that the Thilawa SEZ is not just developed as a manufacturing hub but also as a pioneering model city for Myanmar." To this end, the report lists the following development strategies.

This study will be implemented based on these related studies.

Table 3.1.2 Development strategies for Thilawa SEZ, as outlined in the METI report

1) Vitalization of economic activity and development of human resources
2) Introduction of green and smart technology
3) Development of efficient infrastructure
4) Building of safe, secure towns
5) Building of environmentally-friendly towns

Source: The METI report

3.2 Review of the Myanmar government's SEZ development plans/infrastructure development plans

(1) The Myanmar government's SEZ development plan

1) SEZ development plan

The Myanmar government is developing SEZs in Thilawa, Dawei and Kyaukpyu.

Kyaukpyu SEZ

- Located in **Rakhine State**
- Size: **520 Ha**
- Launched in 2008, in collaboration with **Government of China for the development of oil & gas and other related industries**
- In September 2013, GoM announced the **new concept design for the SEZ**

Oil & Gas Pipeline ~ Kyaukpyu

Thilawa SEZ (subject site)

- Located **20 km south of Yangon city center**
- In 2012, GoM signed MOU with **Government of Japan** for the SEZ
- Size: **2,400 Ha** (Phase 1: 400 Ha)
- **Phase 1** of the SEZ is envisaged to be launched in **2015**

Dawei SEZ

- Located in **Dawei, 350 km from Thailand**
- In 2008, GoM signed an MOU with **Thailand** to develop the SEZ
- In 2011, **Dawei SEZ Law** was enacted
- In 2013, Governments signed **shareholders agreement for the SPV**
- **Deep Sea Port** is planned to be developed at the SEZ

Source: JICA Study Team

Figure 3.2.1 The Myanmar government's main SEZ development plans

2) Legal developments related to SEZs

Myanmar has developed and revised its system of economic law. In 2012 it promulgated the Foreign Investment Law 2012 and in January 2013 it released a notification detailing regulations for enforcing the law. The criteria for foreign investment in Myanmar (preferential treatment for foreign investors; prohibited activities; activities only permitted by way of a joint venture, etc.) had previously been somewhat unclear, but these announcements clarified things to a certain extent.

Table 3.2.1 Outline of the Foreign Investment Law 2012

Merits	Prohibited Activities
・ Investors have the right to lease land from the private sector or the government (for a maximum of 70 years: 50 + 10 +10). ・ Investors receive an income tax exemption for the first five years of business. ・ Investors can only engage in manufacturing and marketing (of cereal products, beverages, alcohol, plastic and rubber, chemical products using local materials, etc.) in joint ventures with Myanmar citizens (maximum share: 80%). ・ Tax exemptions apply to machinery and equipment imported during the construction phase and raw materials and machinery imported for production in the first three years after the completion of the construction period.	・ The Law focuses on protecting traditional and foundation industries. ・ Manufacturing and services related to forestry management and conservation; the drilling of shallow oil wells up to 1,000 ft.; small- and medium-sized mining operations; manufacturing and marketing of scrap iron, etc. ・ Agriculture and livestock breeding that does not use new facilities and technologies. ・ Fishing activities involving shrimp, fish or other marine products found in Myanmar's territorial waters, rivers or streams.

Source: Foreign Investment Law 2012

In addition to the Foreign Investment Law, foreign investors can also invest in Myanmar in accordance with the Special Economic Zone Law. This law was established from the perspective of stimulating Myanmar's economic development through the establishment and operation of special economic zones (SEZs). The previously-established Myanmar Special Economic Zone Law and Dawei Special Economic Zone Law were both abolished with the establishment of the new Special Economic Zone Law in January, 2014.

Table 3.2.2 Outline of the new SEZ Law

Outline of the new SEZ Law	
Corporate income tax exemptions or reductions	・ With regards to businesses located in an exempted zone or investment business in an exempted zone, there will a corporate income tax exemption for the first seven years from the commencement of operations. ・ With regards to businesses located in a business promotion zone or investment business in a business promotion zone, there will a corporate income tax exemption for the first five years from the commencement of operations. ・ With regards to businesses located in an exempted zone or business promotion zone, corporate income tax will be reduced by 50% in the five years after the initial exemption period comes to an end. ・ Once the initial exemption period or the 50% exemption period has ended, if profits are re-invested within one year, then tax on any profits derived from this re-investment will be reduced by 50% over the next five years.
Exemptions on customs duty or other taxes related to raw materials	・ Imports of raw materials, machinery and equipment, and other specific items will be exempt from customs duty and other taxes (this applies to investors in an exempted zone). ・ Imports of machinery and equipment for construction purposes will be exempt from customs duty and other taxes for the first five years from the commencement of operations (this applies to investors in a business promotion zone). A 50% relief in customs duties and other taxes will apply for the subsequent five years.
Carrying forward losses	・ Losses can be carried forward for five years after they occur.
Land usage	・ Investors can lease land for use land for up to 50 years and this term may be extended by a further 25 years. ・ With the permission of the management committee, developers or investors may rent land or buildings to a third party for investment purposes, use land or property as collateral, or sell land or buildings.

Source: Special Economic Zone Law

(2) Infrastructure development plans

Listed below are infrastructure development plans (including government projects) that are currently at the discussion or implementation stage in Myanmar.

Infrastructure	Details
1) Ports	The Myanmar government is planning to expand the Thilawa Area Port
2) Airports	A new international airport is scheduled to be built on the outskirts of Bago City. The current airport will also be expanded.
3) Roads	Road infrastructure in the Yangon Region is being upgraded in accordance with the Yangon City Development Concept Plan.
4) Railways	The Myanmar government is considering privatizing the Yangon Circular Railway and Suburban Lines
5) Electric power	Natural gas thermal power stations are being expanding and new facilities are being built

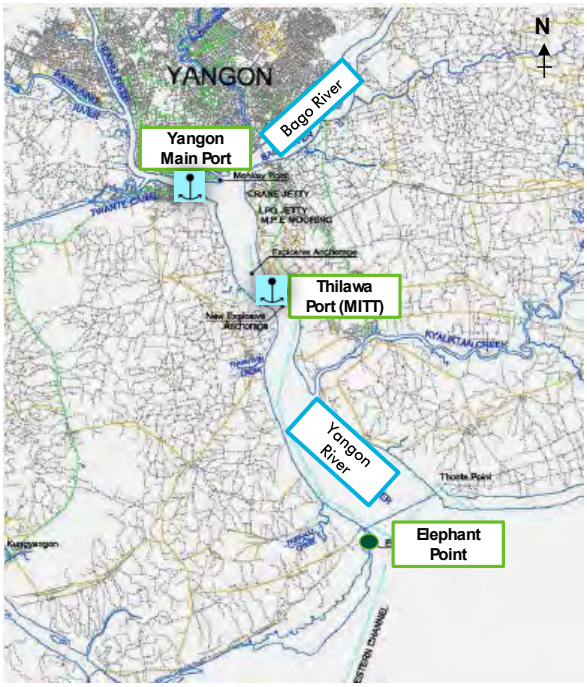
1) Ports

Yangon Port is comprised of Yangon city's Yangon Main Port (32 km from Yangon River's Elephant Point) and Thilawa Port (halfway between Elephant Point and Yangon Main Port).

Yangon Main Port is close to Yangon city and it houses four international ports (Asia World Port Terminal (AWPT), Myanmar Industrial Port (MIP), Sule Pagoda Wharf (SPW), and Bo Aung Kyaw Wharf (BSW)) with 18 wharves.

Thilawa Port is comprised of 5 wharves belonging to the Myanmar International Terminals Thilawa (MITT; a subsidiary of Hutchison Port Holding) and 1 wharf belonging to Myanmar Integrated Port Ltd. (MIPL). The Myanmar government plans to expand the port by building 5 more wharves to meet an expected increase in demand following the opening of the Thilawa SEZ.

Ports in Yangon



Map not to scale, for representation purposes only

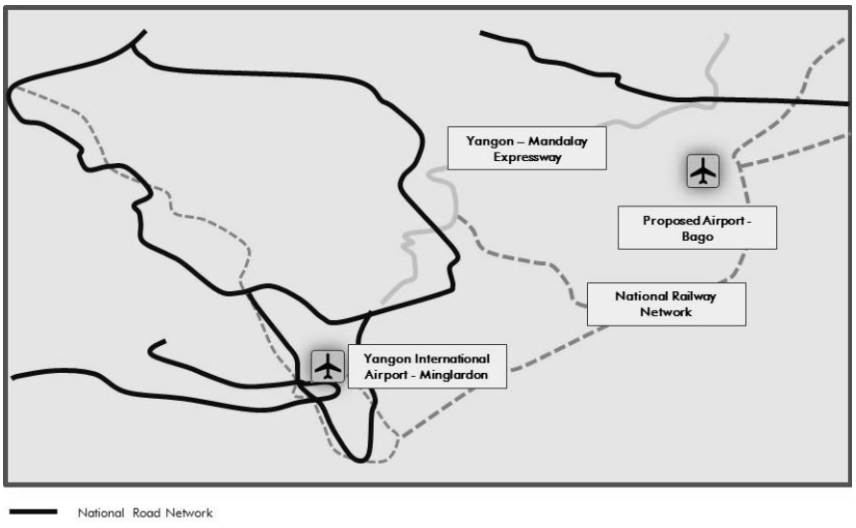
Table 3.2.3 Outline of Yangon Main Port and Thilawa Port

	Wharf Owners	Length (m)	Apron Width (m)	Container Volumes (CEU)
Yangon Main Port	AWPT			
	No.1	198	30.5	1,000
	No.2	156	19.5	
	No.3	260	30.5	
	MIP	310	18	300
	BSW			
	No.1-2	137	15	1,000
	No.3	183	30	
	SPW			
	No.1-4	137	12	NA
	No.5-7	160	15	
Thilawa Port	MITT	1,000	30	1,500
	MIPL	200	17	NA

Source: Myanmar Port Authority

2) Airports

Yangon International Airport (YIA) is located virtually at the center of the Yangon Region. It serves 19 domestic routes and 17 international routes. With passenger and freight volumes expected to increase, the Myanmar government is planning to build a new international airport in the Bago Region (65 km from Yangon). The airport is scheduled to open in 2018.



Source: JICA Study Team

Figure 3.2.2 Airports in and around the Yangon Region

3) Roads

Yangon is connected to Thailand along Asian Highway 1 (AH1). It is also connected to other cities within Myanmar by five highways. There are two main routes from Yangon to the Thilawa SEZ (the subject of this study): 1) Thanlyin Bridge - Strand Road and 2) Dagon Bridge - Main Road No. 6.

Listed below are plans to develop road infrastructure. Flyovers are also being built to alleviate traffic congestion in Yangon city.

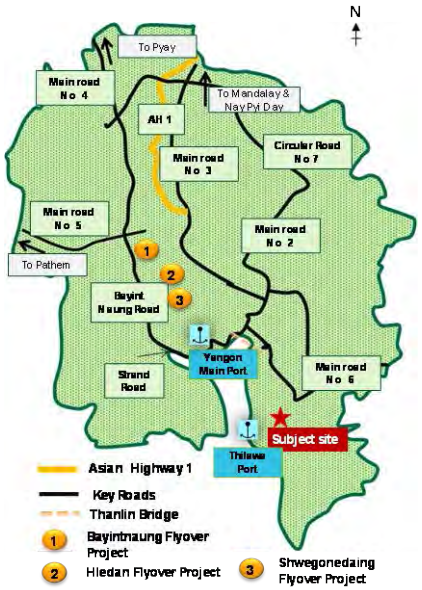


Table 3.2.4 Plans to improve the transportation network

Plans to improve the transportation network	
Yangon City Development Concept Plan	This is a proposal to build river bridges (or tunnels) to improve connectivity between Yangon city and the surrounding areas.
Yangon Structure Plan (Vision 2040)	This is a proposal to upgrade the inner and outer ring roads in order to alleviate traffic congestion in Yangon city.
Flyover Projects	The following flyovers projects have been proposed. 1) Bayintnaung Flyover Project 2) Hledan Flyover Project 3) Shwegonedaing Flyover Project

Source: Yangon Master Plan

4) Railways

Yangon has eight railway lines run by Myanmar Railways (including three main lines and four branch lines). The Yangon Circular Railway and the Suburban Lines carried an average of 130,000 passengers a day in 2011.

The Myanmar government is upgrading the railways based on a build–operate–transfer (BOT) scheme.

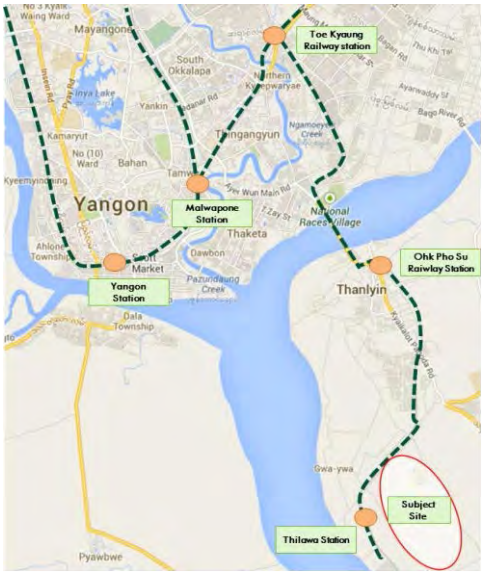


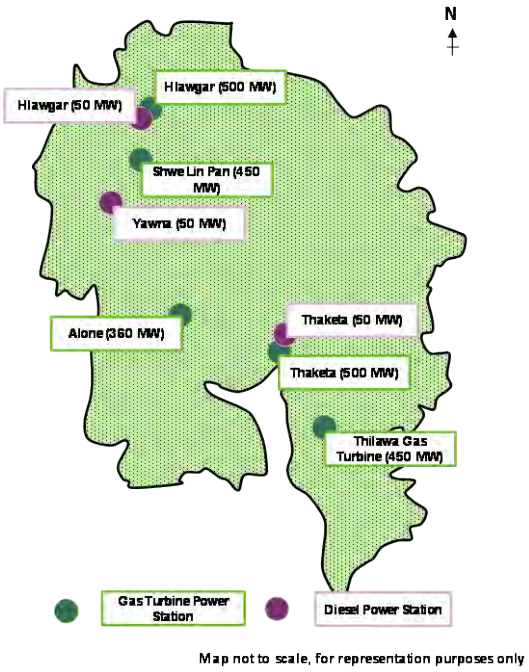
Table 3.2.5 Main railway infrastructure

Name	Length (Km)
Yangon Circular Line	47.5
Yangon – Mandalay Line	625 - 650
Yangon – Pyay Main Line	270 - 275
Thilawa Branch Line	26.2

Source: JICA Study Team

5) Electric power

Yangon suffers from frequent blackouts, with electricity shortages having a serious impact on industrial and corporate activity. Power facilities in Yangon can generate 470.7 MW, but the actual figure is around 50% this level at 235.5 MW. Four combined cycle gas turbine (CCGT) plants in Yangon city meet 31% of Yangon's energy needs. Across Myanmar as a whole, though, hydroelectricity accounts for 72% of the total electricity supply. This leads to frequent blackouts during the summer dry season, etc.



Source: Yangon Master Plan

Figure 3.2.3 Plans to upgrade Yangon's main power plants

The main factors behind the gap between energy supply and demand are thought to be: 1) power losses across distribution networks; 2) rising demand for electricity due to population increases and more business activity; 3) dips in hydroelectric power generation over the dry season; 4) the lack of appropriate maintenance and control at existing power stations.

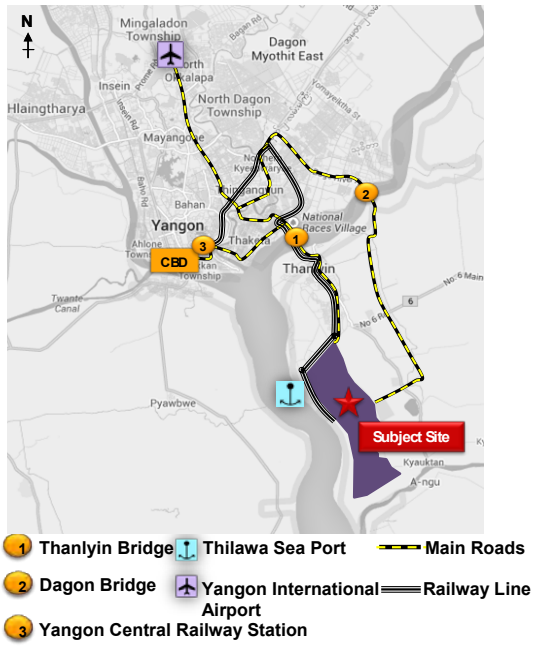
According to the Yangon Electricity Supply Board (YESB), demand for electricity is set to grow by 15% a year in the Yangon Region, even when the Thilawa SEZ is removed from the equation. Electric power infrastructure will need to be upgraded accordingly.

3.3 Confirmation of the current situation and bottlenecks

(1) Overview of the subject site

The subject site for the Thilawa SEZ covers a region around 2,400 hectares in size, located around 22–25 km southeast of Yangon city. Corporate activity near the site is limited to the Thilawa Industrial Zone and the Thanlyin refinery. When it comes to social infrastructure, the area also has few schools, universities and hospitals, etc.

Yangon city, Yangon Central Railway Station and Yangon Main Port lie around 22–25 km from the subject site, while Yangon International Airport, Hlaing Thar Yar Industrial Zone and Shwe Pyi Thar Industrial Zone are located around 30–45 km away.



The around 2,400-ha site lies on a flat terrain. As well as lying next to Yangon Main Port and Thilawa Area Port, the area is also connected to existing industrial infrastructure in the form of the Tharkayta, Dagon and Seikkan industrial zones. This is expected to lead to synergy effects.

Figure 3.3.1 Current situation at the subject site

(2) Social infrastructure and industrial zones around the subject site

The subject site encompasses the Thanlyin and Kyauktan Townships. These areas are not that developed and most of the land is still used for agriculture. Housing land development is also limited to Star City and Aung Chan Thar, while commercial and retail facilities are small scale and geared towards serving the needs of local residents.

Industrial zones within Thilawa are also in short supply at this moment in time. Thilawa Industrial Zone is a total area of 175 ha in size, but it still has many unused plots.

Table 3.3.1 Main social infrastructure around the subject site

	Type	Outline
Myanmar Maritime University	College	Marine courses - 2,250 students
Technological University Thanlyin	College	Engineering courses - 10,200 students
University of East Yangon, Thanlyin	College	Arts & Science courses - 8,700 students
Horizon International School	School	English medium school for primary, secondary and high school education
Thanlyin	School	Presence of 65 basic education schools
Kyauktan	School	Presence of 110 basic education schools
Thanlyin	Hospital	150- bed hospital, 1 station hospital – 16 beds
Kyauktan	Hospital	25-bed hospital, 1 station hospital – 16 beds
Thanlyin Club	Golf Course	18-Hole Golf Course
Capital Hypermarket	Retail	Closest prominent retail development in Tharkayta

Source: Yangon Master Plan

Table 3.3.2 Thilawa Industrial Zone

Thilawa Industrial Zone	
Total area	175 Ha
Year of establishment	1998-99
Open space ratio	80-90%
Average size of plots	0.76 Ha
Developer	DHSHD
Industries	Cement, apparel, electronics, logistics, steel frames

Source: JICA Study Team

(3) The subject site's strengths and bottlenecks

Outlined below are the strengths, opportunities and points to consider with regards to the subject site, Thilawa SEZ. The strengths are the business environment, with the government of Myanmar extending various preferential treatments to firms moving into the Thilawa SEZ, a large labor force, the existence of infrastructure such as ports and railways, and the ability to set up plots in a flexible manner in a 2,400 ha area. Furthermore, the Thilawa SEZ will be

Myanmar's first SEZ to come furnished with advanced infrastructure, so it is likely to attract a large number of investors and companies.

Meanwhile, points to consider include insufficient power infrastructure; the shortage of schools, hospitals and so on, and concerns about whether this large-scale SEZ will able to meet the demands of companies and employees moving into the area.

Table 3.3.3 The Thilawa SEZ's main strengths/opportunities and points to consider

Item	Details
Strengths	**Business environment** ・ **Policies to support investment:** Myanmar's SEZ policies are quite friendly to potential investors and manufacturers. For example, they can receive income tax exemptions on profits from overseas sales; commercial tax and value added tax exemptions; and exemptions from customs duty on imports of raw materials, machinery and equipment. **Manpower** ・ Manufacturers setting up in the Thilawa SEZ can utilize the Thilawa region's flexible, young labor force. **Strategic location** ・ The proximity to Thilawa Port will benefit importers/exporters and will lead to lower distribution costs. ・ The site is located on the perimeters of the city, so traffic congestion can be avoided. **The existence of neighboring industrial zones** ・ Thilawa SEZ lies close to Dagon Seikkan and Tharkayta, two existing industrial zones along the Bago River. Industries in these zones could also operate as support industries for the Thilawa SEZ. **Railways** ・ A railway line runs alongside the Thilawa SEZ. This can support the freight traffic needed for industrial development. **Large land area** ・ The Thilawa SEZ is a large plot of land covering around 2,400 ha. This will allow for flexible planning when it comes to the arrangement of housing, social infrastructure and facilities to support distribution and so on.
Opportunities	**Infrastructure initiatives** ・ A proposed deep-water port in the Thilawa area and Hanthawaddy airport on the outskirts of Bago are expected to boast larger transportation capacities than existing facilities. This will promote freight transportation and make distribution more efficient, thus improving access to foreign markets. **Project site location** ・ The Thilawa SEZ is strategically located near the city center of Yangon. This is a beneficial location when it comes to industrial activity and it also provides easy access to domestic markets. **First-mover advantages** ・ It will be Myanmar's first SEZ to come furnished with advanced infrastructure. **Attractive to foreign investors** ・ At present, foreign investors would face difficulties finding suitable industrial sites with high-quality infrastructure and services near Yangon.
Points to consider	・ **There is a shortage of suitable real estate agents, while high-quality social/support infrastructure is also in short supply.** This could have an impact on land sales during the SEZ's initial phase.

	・ **The possibility of delays:** If port infrastructure development is delayed, this could also push back Thilawa SEZ land acquisitions by companies. ・ **Competition with other industrial zones:** There is still land available in urban industrial zones and this could impact the appraisal of land in the Thilawa SEZ. However, the Thilawa SEZ will be furnished with superior infrastructure and this will probably lessen the aforementioned risk. ・ **The SEZ's location on the perimeters of the city:** The Thilawa SEZ's location is suitable for industrial activity and away from traffic congestion. ・ The social infrastructure around the Thilawa SEZ is limited and not sufficient to support large scale development within the Thilawa SEZ. ・ Yangon's power infrastructure is lacking and this will probably impact corporate acquisitions of land in the Thilawa SEZ.

Source: JICA Study Team

4 Analysis of Project Site Potential / Examination of the Land Use Concepts

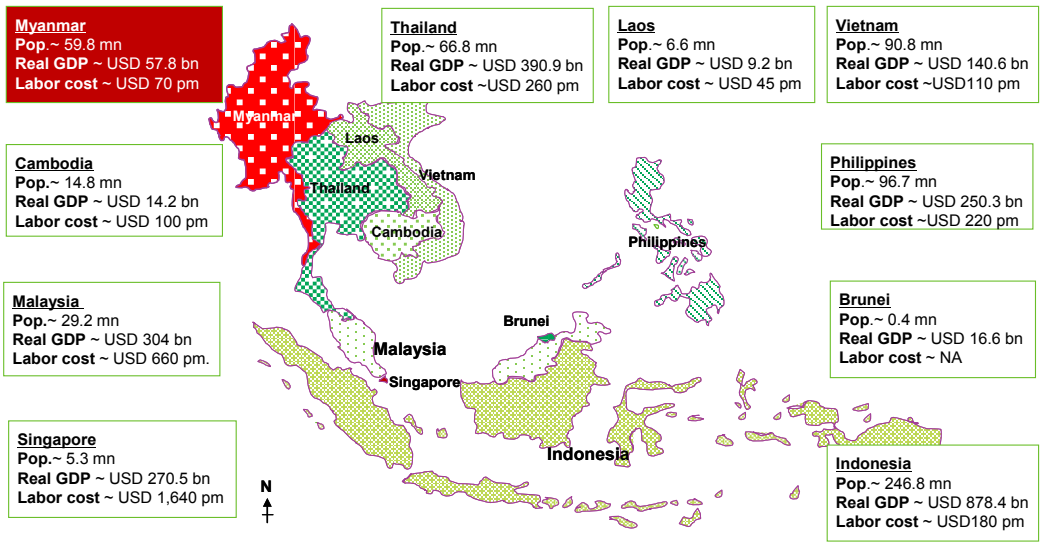
4.1 Analysis of economic conditions (macro and micro)

(1) The ASEAN economy

1) Overview

ASEAN of which Myanmar is a member is an economic zone composed of 10 Southeast Asian nations. It has a total GDP of around USD 2.3 trillion and it accounts for approximately 9% of the world's population. Thanks to stable macroeconomic conditions and a number of beneficial investment policies, the ASEAN economy as a whole has grown by an average of 6% a year these past 15 years.

ASEAN member states come in many shapes and forms. For example, Singapore is the most developed ASEAN member and in 2012 its per capita GDP stood at USD 52,052, higher than Japan's figure of USD 46,732. Indonesia is the largest member in terms of population and the size of its economy. Thailand, Malaysia, Vietnam and Indonesia, meanwhile, are newly-emerging economies with striking rates of growth. These countries also play key roles in Japan's global manufacturing supply chain.

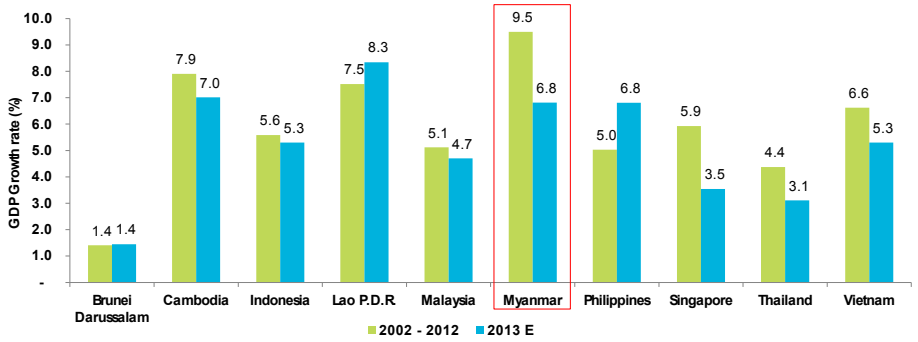


Source: UNCTAD, MNPED, etc.

Figure 4.1.1 Overview of the ASEAN region

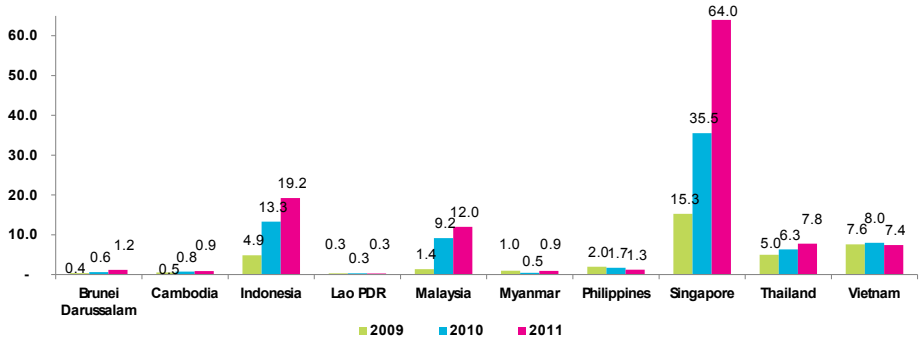
2) GDP, trade and FDI trends

A glance at ASEAN trends by nation shows many countries enjoying growth of over 5% per annum. Myanmar is a particularly high achiever and it grew at an average of 9.5% a year in the ten years up to 2012. Singapore, Thailand, Vietnam, Malaysia and Indonesia take the top spots when it comes to trade. Singapore also tops the list when it comes to foreign direct investment (FDI) inflows, thanks mainly to political stability, a good business environment and developed infrastructure.



Source: IMF

Figure 4.1.2 ASEAN economic growth by country



Source: ASEAN Database

Figure 4.1.3 ASEAN FDI inflows by country

3) Trends of Free Trade Agreement (FTA), etc.

In 2015, the ASEAN Free Trade Agreement (AFTA) is expected to result in the scrapping of customs duties and the establishment of the ASEAN Economic Community (AEC). As economic integration with the ASEAN region proceeds, competition between the bloc's nations and companies is growing fiercer, with Myanmar also facing tough competition. At the same time, though, Myanmar will probably be incorporated into the global manufacturing supply chain being built up with the ASEAN region. This will provide a great opportunity for Myanmar's economic development.

Table 4.1.1 Major Asian FTAs

Major Projects	Outline	Impact on Myanmar
ASEAN Free Trade Agreement (AFTA)	・ In 2010, six countries (Malaysia, Brunei, Indonesia, the Philippines, Singapore and Thailand) abolished inter-regional customs duties on almost all products on the Inclusion List (IL). ・ In addition the six founder nations, Cambodia, Laos, Myanmar and Vietnam (the so-called CLMV countries) will also abolish inter-regional customs duties by 2015*.	・ Competition with imports from other ASEAN nations will intensify. ・ In order to compete with other countries, Myanmar will need to improve its industrial input factors (skilled labor and energy supply).
The launch of the ASEAN Economic Community (AEC)	・ The ASEAN Economic Community is scheduled to launch in December 2015. The project is aiming for: 1) a single market and production base 2) a competitive economic region, 3) equitable economic development, and 4) integration into the global economy.	・ Against a backdrop of companies' activities seeking to expand or shift to low-cost countries, Myanmar is expected to be incorporated into major global supply chains.
Agreements with other regions	・ The ASEAN region has signed FTAs with China, Japan, South Korea, India, Australia and New Zealand.	・ While it will be easier to export to these countries, imports from these countries might also increase

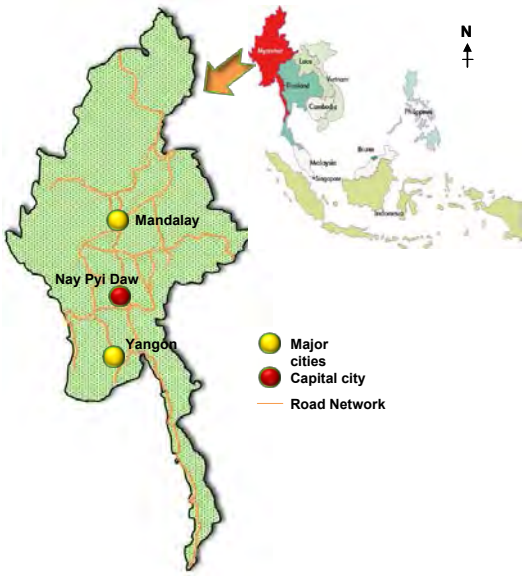
Note: The CLMV countries have abolished customs duties on approximately 66% of the products on the IL.

Source: JICA Study Team

(2) Myanmar's economy

1) Overview

Myanmar has a population of around 51.41 million. It is around 680,000 km^2 in size (about 1.8 times bigger than Japan). It stands at the western tip of the Indochina and borders Thailand and Laos to the east, India and Bangladesh to the west, China to the north, and the Indian Ocean to the south. It is located in a strategic position within Southeast Asia.

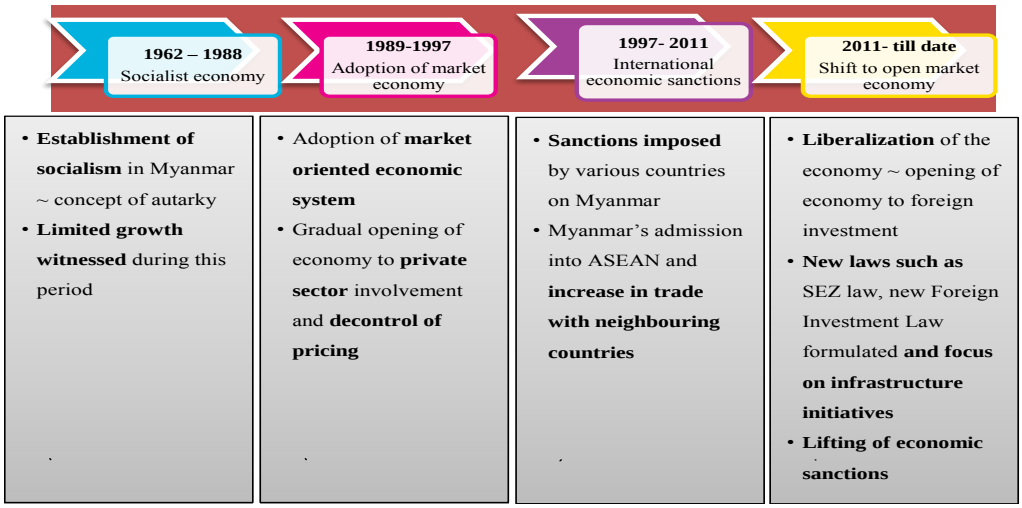


2011 saw the launch of a new administration and a shift towards civilian rule. Myanmar has also worked harder to attract foreign investment through the establishment of the Special Economic Zone Law (together with subsequent revisions) and a revised Foreign Investment Law. As a result, there are high hopes for Myanmar's economy.

Table 4.1.2 Overview of Myanmar

Myanmar snapshot	
Area	680,000 km^2
Population	51.41 million
Adult literacy rate	95.13 %
Nominal GDP	USD 55.3 billion

Source: Ministry of Foreign Affairs of Japan, etc.



Source: JICA Study Team

Figure 4.1.4 Myanmar's economic development

2) GDP, trade and FDI trends

Myanmar's nominal GDP stood at 39.9 trillion kyat in 2011. Primary industry, secondary industry and tertiary industry account for 44%, 21% and 35% of GDP, respectively. As this shows, Myanmar's economy relies heavily on primary industry.

As for trade, on a monetary basis, imports and exports have both moved around the USD 9 billion level in recent years. By item, major export items include natural gas, agricultural produce, wood and wood related products, and sewn products & garments. Major import items include crude oil, cement, machinery, transport equipment, electric & electronic parts. The ASEAN region is Myanmar's largest partner when it comes to imports and exports, followed by China/Hong Kong, India and Japan.

FDI inflows into Myanmar stood at USD 43.7 billion in 2013. A breakdown by sector shows most FDI going to the electricity, petroleum and gas sectors.

Table 4.1.3 Import/export composition by trading partner country/region (%)

	Exports	Imports
ASEAN	49	42
China/Hong Kong	25	30
India	11	3
Japan	5	12
South Korea	3	4
Other	7	9
Total	100	100

Note: Data for 2012-2013
Source: MNPED

Table 4.1.4 FDI inflows by sector (%)

	% of Total FDI
Electricity	44
Petroluem/Natural Gas	33
Manufacturing	8
Mining	6
Hotels/Tourism	4
Real Estate	3
Other	2
Total	100

Note: As of 2013
Source: MNPED

3) Labor force/Education

Myanmar's population is around 50 million, with 15 million people living in cities.

By age, 0–14 year olds account for 29% of the total, with 15–59 year olds accounting for 62% and those aged 60 or above accounting for 9%. The core 15–59 demographic is divided 50:50 between men and women. This group provides Myanmar with an ample supply of labor, while the high proportion of 0–14 year olds will provide the country with a large labor force in the future.

A glance at population distribution by region shows 12% of the total living in Yangon, with 14% living in Mandalay.

As for education levels, 132,500 people have completed higher education, with 5% of these going on to acquire master's degrees or Ph.Ds. Of those who complete higher education, 38% graduate in science and technology, 52% in arts, culture and language, 4% in healthcare and 3% in economics and education (as of 2013).

4) Strengths and issues of Myanmar's economy

To sum up the characteristics of Myanmar's economy, Myanmar's economy has grown mainly on the back of its primary sector such as agriculture, forestry and fisheries. It is located in a strategic position in Asia and is also a member of ASEAN, a body promoting economic

integration. In recent years it has also improved its policies regarding the economy and foreign investment. All of this will contribute to a growth in trade and investment.

From here on, Myanmar's economy is expected to grow strongly on the back of an improved investment environment, infrastructure development and the establishment of SEZs. Manufacturers seeking low production costs will also be attracted by Myanmar's cheap labor and rich resources. Myanmar's manufactured exports are expected to grow as a result.

The strengths and issues of Myanmar's economy are as the following table.

Table 4.1.5 Strengths and issues of Myanmar's economy

Strengths	Weaknesses
・ Rich natural resources ・ Low labor costs ・ Membership of the ASEAN group ・ Improved policies regards foreign investment	・ Weak existing infrastructure ・ Shortage of high- skilled workers ・ High real estate-related costs ・ Under-developed financial system

Source: JICA Study Team

(3) Yangon's economy

1) Economic overview

The commercial/financial city of Yangon is 598.75 km^2 in size with a population of around 7 million. Real GDP stood at USD 164.75 billion in 2010–2011, with the area accounting for 65% of Myanmar's total industrial production.

Processing and manufacturing (food and beverages, textiles, personal & household goods, etc.) account for the lion's share of Yangon's GDP at 37%, followed by commerce (25%), services (24%) and agriculture, forestry and fisheries (8%). A number of Myanmar's financial institutions are concentrated in Yangon, including 73 branches of state-owned banks and 86 branches of private banks.

The characteristics of Yangon's economy and industry are outlined below.

- The economy is driven by manufacturing (food and beverages, and clothing and wearing apparel, etc.)
- Yangon Port is a one of Myanmar's major trading centers and it could develop as a trading hub with Asian countries.
- Trade is expected to grow on the back of trade liberalization within the ASEAN region.
- There is potential for manufacturing growth on the back of the large labor force, sizeable domestic demand/consumer markets, and access to ports.

2) Labor force/education

Yangon has around 5.1 million full-time workers. This figure has grown by an average of 2.58% a year from 1998 to 2011. The tertiary sector accounts for 68% of these workers. By area, approximately 20% of the Yangon's population lives in the downtown/CBD area (around 20 km from the Thilawa SEZ).

Yangon is home to 24 higher-education institutions (Yangon Technological University, University of Yangon, etc.). This is small compared to the number of secondary education institutions (252) and primary education institutions (2,277), with the education advancement ratio quite low. The government of Myanmar plans to improve the country's education system.

Table 4.1.6 Yangon's population by area

Area	Share (%)	Growth Rate (%)
Downtown/CBD	20%	1.8%
Peripheral Areas	8%	NA
New Suburbs	29%	6.93%
Northern Suburbs	14%	2.36%
Older Suburbs	14%	0.94%
Outer Ring	11%	(0.03%)
South of CBD	4%	6.01%

Source: Yangon Master Plan

4.2 Examination of candidate industries

(1) Analysis of industrial structure

1) Characteristics of manufacturing in Myanmar

Manufacturing in Myanmar is centered around labor-intensive small- and medium-sized manufacturers. The industry is characterized by: 1) a prevalence of resource processing (agriculture, forestry and fisheries products, etc.); 2) a prevalence of small- and medium-sized companies; 3) the existence of informal companies; 4) a dependence on imports from neighboring Asian nations, etc.

Yangon and Mandalay account for around 88% of Myanmar's industrial production. An overview of these two cities is provided below.

Table 4.2.1 Overview of manufacturing in Yangon and Mandalay

	Mandalay	Yangon
Production Value (2011 –12)	USD 267.71 mn	USD 7.03 bn
Investment Value (2011–12)	USD 91.55 mn	USD 5.83 bn
No. of industries (2012-13)	7,300; Large scale factories – 1,098	6,029; Large scale factories – 2,171
Major Industrial Zones	Mandalay Industrial Zone, Myotha Industrial Park, Meiktila, etc.	Hlaing Thayar, Shwe Pyi Thar, Minglardon, etc.
Prominent manufacturing industries	Construction materials, food & beverages, transport vehicles	Food & beverages, clothing & wearing apparel, construction materials, etc.

Source: DISI

By type of industry, manufacturing in Myanmar is based around the production of food and beverages, and clothing and wearing apparel. These two sectors account for approximately 90% of the industrial production value. The construction materials sector is mainly based around cement production, while the Personal & Household goods sector is engaged in the production of soap & detergents, plastics and coating materials, etc.

The food and beverages sector alone accounts for just under 90% of the total value of capital investment.

Table 4.2.2 Myanmar's industrial structure (industrial production/capital investment)

Industry	Share of industrial production value 2012-2013	Average annual industrial production growth rate 2009-2013	Share of capital investment value 2012-2013
Food and Beverages	52.78%	5%	89.03%
Clothing and wearing apparel	39.37%	113%	3.23%
Construction materials	3.01%	39%	2.44%
Personal & Household goods	1.50%	29%	2.11%
Printing and publishing	0.04%	-12%	0.05%
Industrial raw materials	0.66%	-12%	0.50%
Minerals and petroleum products	0.59%	9%	1.41%
Agriculture equipment	0.01%	-25%	0.01%
Machinery and equipment	0.03%	-30%	0.12%
Transport vehicles	1.19%	23%	0.57%
Electrical goods	0.16%	-13%	0.16%
Miscellaneous	0.64%	-18%	0.37%

Source: DISI

2) Characteristics of manufacturing in Yangon

The food and beverages, and clothing and wearing apparel sectors account for over 90% of the total value of production in Yangon. The rising demand for food in Myanmar is partly behind the growth of production in food and beverages, with production in the labor-intensive clothing and wearing apparel sector also expanding on the back of low labor costs.

Table 4.2.3 Share of output value in Yangon

Industry	Share of industrial production value
Food and Beverages	85.71%
Clothing and wearing apparel	7.82%
Construction materials	2.90%
Personal & household goods	1.42%
Printing and publishing	0.04%
Industrial raw materials	0.28%
Minerals and petroleum products	0.04%
Machinery and equipment	0.04%
Transport vehicles	0.86%
Electrical goods	0.14%
Miscellaneous	0.73%

Source: DISI

The construction materials sector only accounts for 2.9% of the total, but in recent years it has grown at a breakneck year-on-year pace of 72% due to rising demand for infrastructure improvements.

The production value of transport vehicles is also growing rapidly by 153% year-on-year.

3) Industrial zones in Yangon

Most of the industrial production in Yangon takes place in industrial zones.

There is not much leeway to acquire land in the primary market (government sales), so

industrial estate land is acquired through the secondary market, but there are actually a large number of vacant lots and empty warehouses. Land sells on average for USD 60–100 per square meter.

Most industrial zones are furnished with basic infrastructure such as electricity, waterways and 2-lane roads. Some industrial zones are even equipped with security gates, streetlamps, transportation services for employees, and drainage, etc.

Details of the main industrial zones are outlined below.

Table 4.2.4 Main industrial zones in Yangon Region

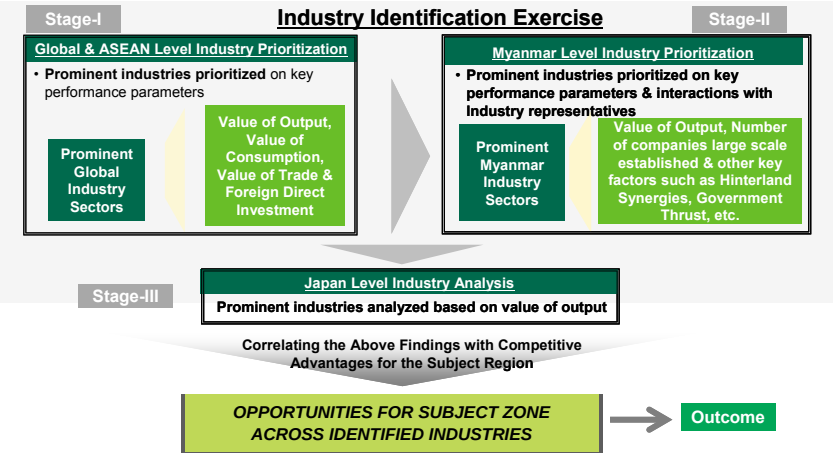
Industrial zone	Gross land area (ha)	App. Current occupancy	No. of industrial enterprises	Investment value (MMK bn)	Production value (MMK bn)	No. of workers	Capital value (USD/sqm)
Hlaing Thar Yar (1-7)	657	90%	682	220.45	508.23	39,248	111 – 148
Shwe Pyi Thar (1-4)	536	55%	240	42.06	264.78	19,748	99 – 123
Shwe Lin Pan	445	75%	302	-	-	30,000	49 – 51
Mingaladon	89	100%	20	188	-	8,750	58
Yangon	400	40%	68	32.58	257.18	13,703	87 – 99
East Dagon	317	40%	117	9.31	68.01	3,792	75 – 87
South Dagon	299	80%	831	11.36	114.02	17,316	124 – 185
Dagon Seikkan	490	40%	117	17.51	97.33	6,649	62 – 74
Tharkayta	81	90%	70	7.91	24.01	2,512	NA
Total	3,437	64%	2,447	529	1,334	141,718	-

Source: DISI

(2) Examination of candidate industries

1) Examination steps

The process of examining candidate industries that could be attracted to the Thilawa SEZ (hereinafter “candidate industries”) will begin with a 3-level examination (Stages I to III) of leading industries; 1) at a global level, 2) at a Myanmar/Yangon level, and 3) at a Japan level. Candidate industries will then be narrowed down based on the results of this examination.



Source: JICA Study Team

Figure 4.2.1 Steps for examining candidate industries

2) Global level

International statistics were used when examining candidate industries on a global level. First, 1) the top 10 industries were selected in each of four categories: industrial production (value and growth), consumption (value and growth), trade (value), and FDI (value). Then, 2) each category was assigned a weight and an overall ranking then took place. The results are as the following table.

Table 4.2.5 Examination of candidate industries on a global level

Rank	Industry sector
1	Chemical
2	Basic metals
3	Machinery / equipment
4	Food and Beverages
5	Coke and petroleum products
6	Electronic parts
7	Electric equipment
8	Automotive and automotive parts
9	Natural rubber & plastic products
10	Other non-metallic mineral products

Note: The rankings were calculated based on the UNIDO 2011 database and the following weightings: industrial production value (weight: 25%), industrial production growth (5%), trade value (25%), FDI (20%), consumption value (20%) and consumption growth (5%).

Source: JICA Study Team

3) Myanmar/Yangon level

Promising industries within Myanmar were ranked based on qualitative data (about government policies and so on) and each industry's share when it came to 1) industrial production, 2) number of companies, and 3) raw material exports. 2) and 3) are regarded as key

factors from the perspective of candidate industries for the Thilawa SEZ (the target of this study).

As for the raw material exports, wood and wood related products rank number 5 on the list of natural resource exports, but forests make up 49% of Myanmar's territory, and with the government looking into relaxing the rules on exports of unprocessed wood, this industrial sector is expect to grow from here on.

Table 4.2.6 Examination of candidate industries on a Myanmar/Yangon level

Rank	Industrial production value	No. of companies	Natural resource exports
1	Food and Beverages	Food and Beverages	Natural gas
2	Clothing and wearing apparel	Chemical products	Agriculture, forestry and fisheries products
3	Construction materials	Construction materials	Other products
4	Chemical products	Clothing and wearing apparel	Textiles
5	Transport equipment	Minerals and petroleum products	Wood and wood related products

Source: DISI

4) Japan level

The relevance of Japan's leading manufacturing sectors (in terms of production value) to Myanmar's economy is outlined below. The potential use of base metals as raw materials in Myanmar is limited, while the quality of natural rubber products made in Myanmar is low, so these two sectors may be excluded from the examination of candidate industries.

Table 4.2.7 The ranking of Japan's manufacturing production value by sector; and their relevance to Myanmar's economy

Rank	Industry sector	Relevance to Myanmar's economy	Candidate for examination
1	Automotive and automotive parts	Many automobiles in Myanmar are imports from Japan. Japanese carmakers are interested in setting up production in Myanmar.	○
2	Electronic products/ electromechanical equipment	The government of Myanmar is planning to upgrade Myanmar's electricity sector. Myanmar's low-cost labor force can be put to use installing facilities and factories.	○
3	Machinery and Equipment	Myanmar exports a lot its machinery from Japan. Demand is also expected to increase on the back of the Myanmar government's plans to develop and upgrade infrastructure.	○
4	Food and Beverages	This is a major industry in both Japan and Myanmar.	○
5	Chemical	This is a major industry in both Japan and Myanmar.	○
6	Base metals	The potential use of these as raw materials in Myanmar is limited.	×

7	Processed metal products (excluding machinery and equipment)	This could be regarded as part of the machinery and equipment sector.	○
8	Natural rubber & plastic products	There are natural rubber plantations around Yangon, but the product quality is low compared to other countries producing natural rubber	×

Source: JICA Study Team

5) Candidate industries

Based on the results of examination above, industries considered to be candidates for Thilawa SEZ are outlined below.

Table 4.2.8 The ranking of Japan's manufacturing sectors by production value; and their relevance to Myanmar's economy

Rank	Industry sector	Relevance to Myanmar's economy
1	Textiles	This is one of Myanmar's biggest industries and it also receives a lot of FDI.
2	Food and Beverages	This is a major industry in both Japan and Myanmar. It is also a globally-important industry.
3	Construction materials	This is a major industry, both globally and within Myanmar.
4	Automotive and automotive parts	This is a major industry, both globally and within Japan. Japanese carmakers are interested in setting up production in Myanmar.
5	Chemical	This is a major industry in both Japan and Myanmar. It is also a globally-important industry.
6	Wood and Wood related products	Myanmar is rich in these resources and this sector is expected to develop in future.
7	Electrical and Electronics	This is a major industry, both globally and within Japan. The government of Myanmar is planning to enhance and upgrade Myanmar's electricity infrastructure.
8	Machinery and Equipment	This is a major industry, both globally and within Japan. Demand is expected to increase as the natural gas sector expands and investment is ramped up in line with the Myanmar government's plans to develop and upgrade infrastructure.

Source: JICA Study Team

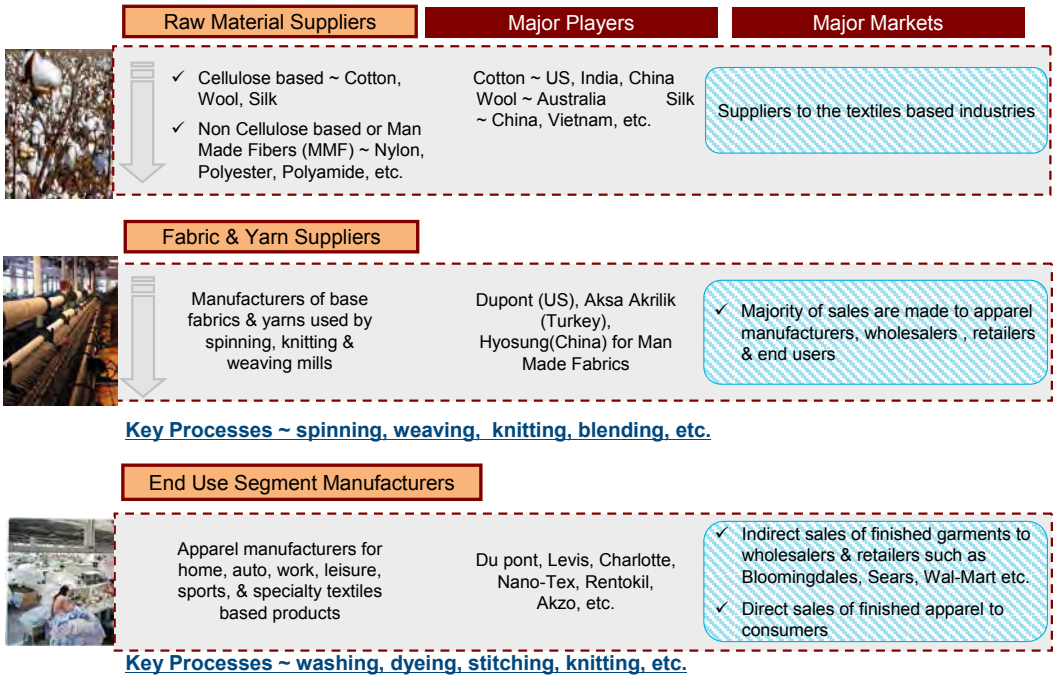
4.3 Opportunities to attract candidate industries

Based on the results of the investigation in the previous section, opportunities for attracting industries will be organized and examined. This process will cover 8 sectors: 1) Textiles, 2) Food and Beverages, 3) Construction materials, 4) Automotive Manufacturing, 5) Chemical, 6) Wood and Wood related products, 7) Electrical and Electronics, and 8) Machinery and Equipment. In the organization/examination work, interviews with relevant government institutions and companies, etc., were conducted, and the opinions of related parties were also organized.

(1) Textiles

1) Overview

The textiles industry is divided into two major sub-categories: High-grade textile goods (natural materials like cotton, wool and silk; hand-made goods; specialty textiles for furniture and automobiles, etc.) and ordinary textile goods (garments; coats and suits; leisure wear; nightwear; underwear, etc.). The structure of the textiles industry is also divided into three levels: raw material suppliers, fabric and yarn suppliers, and end-use segment manufacturers.



Source: JICA Study Team

Figure 4.3.1 Structure of the textiles industry

2) The textiles industry in Myanmar

Myanmar's textiles industry is the second largest sector when it comes to industry production value (behind food and beverages). It is a labor-intensive industry, with 45% of all employees in secondary industry employed in the textile sector. It provides job opportunities for women in particular. Textiles exports grew by an average of 15% a year from 2007 to 2011. Exports of clothing and wearing apparel to Japan and South Korea have grown particularly fast. Now economic sanctions have been lifted, exports of clothing and wearing apparel to the EU are also expected to expand going forward.

Yangon is home to large factories owned by Opal International or Great World Wide, for example, with Yangon accounting for 91% of Myanmar's total production of textiles, clothing and wearing apparel.

3) Opportunities in the textile industry

Based on global trends in the textile industry and the situation in Asia and Myanmar, it seems short- to medium-term prospects for attracting companies and factories to Thilawa SEZ rest on: firms involved in the production of clothing and wearing apparel for export; or those involved in the production of footwear, upholstery & cushions, and materials for suits, etc. In the medium- to long-term, meanwhile, it may be possible to attract firms involved in the production of high-grade goods (such as cotton, wool and silk products or hand-made goods).

An overview of this prognosis is outlined below. Company-related parties have also voiced positive opinions about growth potential and opportunities in the textile industry.

Table 4.3.1 Opportunities for attracting the textiles industry

[Production of clothing and wearing apparel for export]

○ Current situation: Industrial activity is bustling and many factories have set up in Yangon.
○ Prospects: Short to medium term
○ Opportunities:
・ Companies from China and South Korea are ramping up production and are expanding their factories in Yangon, so with the development of the SEZ's infrastructure, it should be possible to attract these large firms and factories to the SEZ.
・ Local firms are increasing their orders and are starting to expand their operations in Yangon. It should be possible to attract these firms to the SEZ through the prudent setting of land prices and the establishment of payment methods for land.
・ The U.S. and EU have lifted economic sanctions. If major foreign retailers now look to Myanmar as a source of clothing and wearing apparel, this will lead to the building of new factories. The SEZ will be able to attract these firms through its excellent infrastructure and preferential treatments.

[Production of footwear, upholstery & cushions, and materials for suits, etc.]

○ Current situation: There is a certain level of industrial activity
○ Prospects: Short to medium term
○ Opportunities:
・ If apparel buyers from the U.S. and EU seek to produce higher-quality quilts and cushion covers, etc., the SEZ may also be able to attract factories from this sector.
・ Myanmar's leather goods are of a higher quality than those of surrounding Asian nations, so the SEZ could attract factories involved in the manufacture of footwear and other leather products.

[Production of high-grade goods (such as cotton, wool and silk products or hand-made goods)]

○ Current situation: There is a certain level of industrial activity
○ Prospects: Medium to long term
○ Opportunities:
・ Factories producing high-grade fabric and yarn could be set up in Myanmar on the back of increasing cotton production and growing apparel exports. The structure of the textiles industry sector and the SEZ's system of preferential treatments, etc. should provide growing opportunities to attract companies and factories involved in the production of high-grade goods.

Source: JICA Study Team

Table 4.3.2 Opinions of company-related parties

Key Factors	Comments
Growth Potential	・ Exports have expanded these past two years and orders are also increasing by an annual rate of 20 –30% – **General Manager, Company A** ・ Demand has recovered remarkably well from the economic slowdown in 2009, with our factories working at full capacity. We have leased a new 2.8 ha factory with an eye to future expansion. – **Factory Manager, Company B**
Issues	・ The main issues are the unstable power supply and restrictions on distribution facilities – **Factory Manager, Great Company C** ・ The quality of Myanmar's cloth, yarn, zippers and buttons are quite low compared to Chinese products, so we have to rely on imports from China. ―**Managing Director Company D**
Major Markets	・ Our major export destinations are Japan, South Korea, Germany and China; sales to Myanmar's domestic market are limited. – **General Manager, Company E** ・ With the lifting of economic sanctions, we expect the U.S. and EU to become major export destinations in future. – **Managing Director, Company F**
Infrastructure	・ Around 1.2–2 ha of land is needed for medium-sized production facilities. There need to be improvements when it comes to a stable energy supply, the development of industrial sites, and connectivity to ports and airports. **– General Manager, Company A**
Opportunities	・ New markets could be opened in the U.S. and EU. These markets offer the prospects of higher margins compared to Asian markets. **– Managing Director, Company F** ・ Chinese and South Korean apparel companies are very interested in setting up production bases in Yangon. ―**Factory Manager, Company C** ・ We are producing a wide range of products, from shirts and trousers to towels, curtains and cushion covers. **– General Manager, Company A**

Source: JICA Study Team

(2) Food and Beverages

1) Overview

The food and beverages industry is divided into four sectors: Processed Foods (processed meat and fish, processed fruit and vegetables, confectionary, etc.), Beverages (drinking water, soft drinks, alcohol, etc.), Dairy Products (milk, butter, cheese, etc.) and Other Food Products.

2) The food and beverages industry in Myanmar

Myanmar's food and beverages industry is the country's largest industry sector and it accounts for over half of all industrial production. It is a labor-intensive industry, with 34% of all employees in the secondary industry employed in this sector. The manufacture of high value-added goods is limited, with most production centered around food like agricultural products and processed fish or beverages like alcohol, fizzy drinks and juice, etc.

Yangon accounts for over 90% of Myanmar's food and beverages production and the region has become a processing hub for the food and beverages industry. Population movements and lifestyle changes are leading to increased demand for convenient, processed food and drinks.

3) Opportunities in the food and beverages industry

It seems short- to medium-term, prospects for attracting companies and factories from the food and beverages industry to Thilawa SEZ rest on firms involved in the production of processed food and drink products. Depending on government policy, in the long-term it may be possible to attract firms involved in the manufacture of dairy products.

An overview of this prognosis is outlined below. Company-related parties have pointed to infrastructure issues, but they have also voiced positive opinions about demand for food and beverages.

Table 4.3.3 Opportunities for attracting the food and beverages industry

[Processed Foods] ○ Current situation: Industrial activity is picking up, with exports mainly taking the form of ingredients or lightly processed goods ○ Prospects: Short term ○ Opportunities: ・ The Thilawa SEZ borders Yangon, which has a broad population of potential consumers for processed foods. ・ Production in the Thilawa SEZ can utilize Yangon's unskilled and semi-skilled work force. ・ It is easy to make use of packing, warehouse and refrigerated storage facilities.
[Beverages] ○ Current situation: There is a certain level of industrial activity, with products consumed within Myanmar. ○ Prospects: Short term ○ Opportunities: ・ The Thilawa SEZ is near Yangon, which has a broad population of potential consumers for bottled drinks, juice, beer and other alcoholic beverages. ・ Myanmar is rich in the necessary agriculture products for beverage production. ・ Global beverage companies are looking to invest in Myanmar, with the country expected to develop as an Asian manufacturing hub.

[Dairy Products]
○ Current situation: There is a certain level of industrial activity, with ingredients imported.
○ Prospects: Limited (there is a long-term possibility)
○ Opportunities:
・ Dairy products production in Myanmar is kept in check by a shortage of ingredients.
・ Imports currently supply around 40% of domestic demand, but this is expected to change in the long term in line with government policy.

Source: JICA Study Team

Table 4.3.4 Opinions of company-related parties

Key Factors	Comments
Growth Potential	・ With the region developing an appetite for processed food, Myanmar's Food and Beverage industry has a lot of growth potential. – **Owner, Company G**
Issues	・ The quality of products produced by Myanmar's food-related industries is very low compared to major products from abroad. – **CEO, Company H** ・ Frequent blackouts and unstable water supplies pose issues when processing sea foods. The cost of operation is also becoming a growing issue. **– CEO, Company I**
Major Markets	・ Yangon has a huge urban population and income levels are rising, so the region is becoming a key market for processed foods. Demand for food and beverages is also being driven by exports to Malaysia, India and Japan. – **CEO, Company H**
Infrastructure	・ Railway infrastructure is lacking and this is impeding the transportation of agricultural ingredients from northern Myanmar to Yangon. – **MD, Company J** ・ There are not enough refrigerated storage facilities and costs are quite high as a result. – **Managing Director, Company K**
Opportunities	・ Local tastes are shifting towards bread and other wheat products. – **CEO, Company J** ・ If it improves its infrastructure and technical knowhow, Myanmar could use its long coastline to develop its seafood and frozen food sectors. – **CEO, Company H**

Source: JICA Study Team

(3) Construction materials

1) Overview

The construction materials industry sector is based around cement, ceramic and glass products. It developed mainly on the back of infrastructure spending. It is a mature, energy-intensive sector with many participants, from SMEs to global corporations.

2) The construction materials industry in Myanmar

Myanmar's construction materials industry has grown sharply on the expansion of port facilities and other infrastructure development. In terms of production value, the sector grew by an average of 39% a year from 2009 to 2013.

With the sharp rise in demand, Myanmar suffers a cement shortage to the tune of 4.8 million tons a year, with the shortfall covered by imports from neighboring countries. However, Myanmar does have ample deposits of limestone, the main ingredient of cement, so cement production is likely to expand in future. There is hardly any industrial activity when it comes to

glass and glass-related sectors. This is down to a shortage of production technology, skilled workers and electricity. Extracting materials from the Thilawa riverbed could provide a long-term opportunity.

Most operators in the construction materials industry are small scale. Large companies account for less than 17% of the total, with most of these based around Yangon.

3) Opportunities in the construction materials industry

With infrastructure development well underway in Myanmar, the construction materials industry is full of opportunity. It seems short-term prospects for attracting companies and factories to the Thilawa SEZ rest on firms involved in the production of cement products. For a start, Myanmar is a producer of materials like lime and clinker, while demand for concrete is also growing in line with real-estate development in neighboring Yangon. However, the production of other lime products or glass products will have to wait for more medium- to long-term development. It will also be kept in check by undeveloped infrastructure, so caution will be needed.

An overview of the construction material sector is outlined below. Company-related parties have pointed to issues with infrastructure, thought they have also talked about the opportunities presented by rising domestic demand.

Table 4.3.5 Opportunities for attracting the construction materials industry

[Cement products] ○ Current situation: There is a certain level of industrial activity ○ Prospects: Short term ○ Opportunities: ・ The development of infrastructure and the subsequent rise in domestic demand will provide an opportunity to utilize to the maximum extent the limestone and other natural resources produced in Myanmar. ・ Companies in the Thilawa SEZ will probably manufacture cement using lime and clinker transported from northern Myanmar. ・ Cement products like pillars, pipes and beams are likely to be produced to meet growing demand related to infrastructure and real-estate development in Yangon.
[Other lime products] ○ Current situation: There is a small level of industrial activity ○ Prospects: Medium term ○ Opportunities: ・ There will be an opportunity to maximize the usage of raw materials produced in Myanmar. ・ Feed additives and agricultural lime can be produced from lime in the Thilawa SEZ.
[Glass products] ○ Current situation: There is a small level of industrial activity ○ Prospects: Long term ○ Opportunities: ・ The Thilawa SEZ is close to a riverbed and there is a long-term potential that silica sand could be extracted there to be used in the production of glass products. ・ There is the potential for synergies with food and beverages manufacturers (bottles), carmakers and

construction companies operating within the Thilawa SEZ.

Source: JICA Study Team

Table 4.3.6 Opinions of company-related parties

Key Factors	Comments
Growth Potential	・ Domestic demand for cement products has grown quite fast these past few years on the construction of new urban clusters and an increase in productive activity. ―**Manager, Company L**
Issues	・ Poor road and railway infrastructure is slowing down the transportation of cement from northern and central Myanmar to Yangon. – **Director, Company M**
Major Markets	・ Yangon, Mandalay and Naypyitaw have become the center of real-estate development in Myanmar. They are also key markets for construction materials. – **Distributor of Company L**
Infrastructure	・ There are issues with power and transportation infrastructure, while the lack of technological knowhow is also worrying. – **Manager, Company M**
Opportunities	・ There is a mismatch in the supply and demand of construction materials. This provides a big opportunity. –**Distributor of Company L**

Source: JICA Study Team

(4) Automobiles

1) Overview

Production activity in the automobile industry is split into upstream, midstream and downstream sectors. The upstream sector deals with press working, metalworking and painting, etc., while the midstream sector deals with parts assemblage and the downstream sector with vehicle assemblage.

The industry is also split into three groupings: Tier 1 and Tier 2 parts manufacturers and automobile manufacturers. Tier 2 manufacturers produce small parts and sub-modules. Tier 1 manufacturers take these parts and manufacture modules. The automobile manufacturers then use this equipment to assemble the final products. Automobile manufacturers and Tier 1 parts manufacturers are global companies who have expanded across the globe. In contrast, Tier 2 parts manufacturers are mainly localized firms.

2) The automobile industry in Myanmar

Two-wheeled and three-wheeled vehicles account for 82% of total automobile sales in Myanmar, with passenger vehicles accounting for a further 13% and commercial vehicles 4%. Most passenger vehicles are used in Yangon, where there are restrictions on two-wheeled and three-wheeled vehicles.

Imports of second-hand vehicles have soared since import regulations were liberalized in 2011, though domestic production remains limited. There are few manufacturing facilities, so the automobile industry only employs 1.3% of Myanmar's total work force. The government is

trying to stimulate domestic production by allowing direct investment (100% ownership), extending tax breaks and promoting the regional supply of parts.

For automobile manufacturers, this sector offers many opportunities in terms of both manufacturing and sales. These include Myanmar's cheap labor force, its strategic location next to Thailand, India and China, expected demand for commercial vehicles following infrastructure development, a rise in disposable incomes on the back of Myanmar's high GDP growth rate, and the expected increase in automobile penetration rates.

At this moment in time, services like automobile repair and maintenance are mainly concentrated in the Yangon and Mandalay regions. The merits of setting up in Yangon include its proximity to ports; its urban population and the expected rise in car ownership rates, and the road network connecting the region with other major cities.

3) Opportunities in the automobile industry

Based on global trends in the automobile industry and the situation in Asia, it seems Myanmar will be able to leverage its low labor costs and its geographically strategic location. Foreign automobile manufacturers have expressed an interest in setting up assembly lines in Myanmar. Furthermore, though vehicle penetration rates are low in Myanmar, GDP growth is relatively high, so demand for vehicles is expected to increase from here on.

An overview of this prognosis is outlined below. Company-related parties have pointed to a number of issues involving technological knowhow, employee skill levels and infrastructure, for example. However, they have also pointed to growing demand for low-cost vehicles and the Yangon-Mandalay region's potential development into a major market. They also discussed the space needed for industrial sites.

Table 4.3.7 Opportunities for attracting the automobile industry

[The manufacture of passenger, commercial and two/three-wheeled vehicles]
○ Current situation: There is a certain level of industrial activity. There are also assembly units. ○ Prospects: Short to medium term ○ Opportunities: ・ There is growing demand for automobiles. ・ Japanese and Indian carmakers (Nissan and Tata) have set up or are planning to set up assembly lines. These could also attract other companies. ・ Many two-wheeled vehicles are used in Myanmar
[Manufacture of automobile parts]
○ Current situation: There is a certain level of industrial activity. There are a few factories run by the government and the private sector. ○ Prospects: Short to medium term ○ Opportunities: ・ The government of Myanmar is promoting domestic parts production. Its goal is to have 35% of the components of each vehicle sourced locally

[Pressing work, metalwork and body manufacturing, etc.]

○ Current state: There is a certain level of industrial activity. There is an automotive body manufacturing sector.
○ Prospects: Short to medium term
○ Opportunities:
・ The expansion of Suzuki and other major automobile makers into the Thilawa SEZ will probably help to invigorate the upstream sector.

Source: JICA Study Team

Table 4.3.8 Opinions of company-related parties

Key Factors	Comments
Growth Potential	・ Demand for automobile parts is expected to grow in line with rising automobile imports. – **Country head, Company N** ・ Demand for tyres has risen sharply over the last two to three years. Local firms have established an edge through their ability to develop products suited for local conditions. – **Director, Company O**
Issues	・ There is a shortage of the technological knowhow and skills needed to build up manufacturing facilities. Other major issues include poor infrastructure and difficulties in sourcing materials locally. – **Country head, Company N**
Major Markets	・ The major markets are probably Yangon and Mandalay, where vehicle penetration rates are high and disposable incomes are also relatively large. – **Director, Company P**
Infrastructure	・ Assembly lines typically use around 4–4.8 ha of land. – **Director, Company P** ・ Vehicle manufacturers usually use plots between around 0.8–1.6 ha in size, with large manufacturers using 3.2–4 ha. Manufacturers also need a stable power supply, developed industrial sites, and excellent connectivity/proximity to ports. – **Director, Company O**
Opportunities	・ Myanmar is becoming a low- to medium-income nation, so there is strong demand for low cost vehicles. – **Director, Company O** ・ The automobile industry can develop on the back of low labor costs, though this will also require vocational training and the development of an automobile parts sector. – **Country Head, Company N**

Source: JICA Study Team

(5) Chemical

1) Overview

Manufactures in the chemical industry can broadly be divided into four categories: Basic chemical products, petrochemical products, fertilizers & nitrogen compounds, and other chemical products. These sectors support the development of industry and agriculture. Developed nations traditionally accounted for the lion's share of production, but in recent years production has increased in the emerging economies too. In the past five to eight years in particular, supply and demand growth has centered around South Asia and Southeast Asia. Be aware that industry classifications in Myanmar's chemical sector differ from international classifications, with Myanmar's classifications spanning several sectors.

2) The chemical industry in Myanmar

Myanmar's chemical industry is still at an early stage of development, with high-added-value production virtually non-existent. Raw materials for production in Myanmar or finished products are mainly imported from China at present. Soap & detergents, coating materials and fertilizers are mainly produced in Myanmar.

The production value of general consumer goods (like soap & detergent or plastic goods) has increased sharply in recent years to rise by an annual average of 23% from 2009 to 2013. Yangon accounts for around 58% of this figure. Soap and detergents are products within the price range of Yangon's rapidly growing middle-income group, so consumption continues to expand.

Though demand for coating materials is growing, there is a limit to the amount of utilizable raw materials, so production has not shifted significantly. It seems the coating material sector is growing on the back of infrastructure upgrading and real-estate development in Yangon's downtown/CBD area, but it faces fierce competition from low-cost imports from China and Thailand, etc. Yangon is home to 80% of Myanmar's large factories. On a monetary basis, Yangon accounts for approximately 86% of Myanmar's coating material production.

Fertilizers and other industrial products are only produced in small quantities in government-owned factories. Most of the fertilizers used in Myanmar's agricultural sector are imported from China, Thailand, Vietnam, India and so on.

3) Opportunities in the chemical industry

With regards to the chemical industry, short-term prospects for attracting companies and factories to the Thilawa SEZ center mainly on firms involved in the production of plastic products, fertilizers, agro-chemicals, soap, detergents and coating materials. Myanmar relies on its agricultural sector, so there is room to grow when it comes to fertilizers, and agro-chemicals. As for plastic products, one merit of the Thilawa SEZ is its location next to a refinery.

An overview of opportunities in the chemical industry is outlined below. Company-related parties have voiced positive opinions about future growth in this sector.

Table 4.3.9 Opportunities for attracting the chemical industry

[Plastic products] ○ Current situation: Myanmar has a number of SMEs. Imports provide the raw materials. ○ Prospects: Short term ○ Opportunities: ・ The Thilawa SEZ lies next to the Tanlyin refinery, so it is likely to attract manufacturers of chemicals and chemical products. ・ Plastic products will probably be used as packaging for processed foods and so on.
[Fertilizers & agrochemicals] ○ Current situation: There is a small level of industrial activity. ○ Prospects: Short term

○ Opportunities: ・ Agriculture accounts for 33% of Myanmar's GDP, so there is expected to be demand. ・ Organic fertilizers are not used at present, but the sector is expected to grow from here on thanks to government policies. ・ The government has launched a program to train farmers in the usage and effects of fertilizers.
[Soap & detergents] ○ Current situation: Myanmar has a number of medium-sized enterprises. They mainly cater to domestic demand. ○ Prospects: Short term ○ Opportunities: ・ As Yangon's middle-income group grows, this will lead to a growing interest in hygiene. ・ Myanmar relies on imports for high-priced articles, but production could be shifted locally. ・ International personal and household goods manufacturers are focusing more on Myanmar.
[Coating materials] ○ Current situation: Myanmar has a number of medium-sized enterprises. They mainly cater to domestic demand. ○ Prospects: Short term ○ Opportunities: ・ Infrastructure development and real-estate construction is well under way in Yangon, next door to the Thilawa SEZ. ・ The emergence of acrylic coating and other new, high-price products presents an opportunity. ・ There is a potential for synergies with other industries such as automobiles, and machinery and equipment.

Source: JICA Study Team

Table 4.3.10 Opinions of company-related parties

Key Factors	Comments
Growth Potential	・ The production of chemical products is expected to increase on an expected surge of demand in the construction and infrastructure sectors. – **Promoter, Company Q** ・ The agricultural sector accounts for over 50% of Myanmar's economy, so there are huge opportunities for the fertilizer sector. – **Managing Director, Company R**
Issues	・ The main issues are under-developed power and distribution infrastructure and a lack of technical knowhow. – **Promoter, Company Q** ・ Fertilizer imports are increasing year on year, with cut-price competition growing more fierce. – **Managing Director, Company R**
Major Markets	・ Yangon is becoming Myanmar's main market for coating materials on the back of a real-estate boom. – **Managing Director, Company S** ・ The neighboring countryside areas can be considered the main market for fertilizers. – **Managing Director, Company R**
Infrastructure	・ Fertilizer factories usually require around 0.8 ha, while organic fertilizer plants need 2.4–3.2 ha. – **Managing Director, Company R**
Opportunities	・ The government has started to teach farmers about the benefits of using organic fertilizers. This could provide a development opportunity for the organic fertilizer market. – **Managing Director, Company R**

Source: JICA Study Team

(6) Wood and Wood related products

1) Overview

The wood and wood related products industry relies on natural resources, with the wood itself produced in countries blessed with large tracts of forest. The wood then passes through the semi-processing and final-processing stages, where it is transformed into a variety of different products to meet a variety of end needs. Production activity is carried out by small enterprises. They cater to demand from a number of sectors, including housing, construction, furniture, packaging and papermaking.

2) The wood and wood related products industry in Myanmar

The wood and wood related products industry can use the raw materials produced in the forests that cover around half of Myanmar's territory. Production activity is mainly carried out by state-owned enterprises and small- and mid-sized companies in each region, with the aim of exporting raw wood or timber.

Value-added manufacturing is quite limited at present. The lion's share of manufacturing activity takes place in the value chain upstream segment. This is due to a lack of investment and infrastructure development; high transportation costs, a shortage of warehouses, and the use of old, outdated technology. In order to prevent deforestation and stimulate activity in the domestic wood and wood related products industry, the government is considering banning exports of lumber or logs. If this does come to pass, it will probably help Myanmar's downstream segment to grow.

The raw materials produced in Myanmar's northern region are transported along roads and waterways to Yangon and Mandalay, where they are processed.

3) Opportunities in the wood and wood related products industry

When it comes to attracting companies and factories involved in the wood and wood related products industry, the Thilawa SEZ could be attractive to firms wanting to produce industrial-use lumber to meet domestic demand in the construction and industrial sectors. Other candidates include companies wanting to produce furniture for Myanmar's real-estate market or for export to Europe.

An overview of opportunities in the wood and wood related product industry is outlined below. Company-related parties are confident that demand exists both within Myanmar and overseas (especially in Europe).

Table 4.3.11 Opportunities for attracting the wood and wood related products industry

[Lumber for industrial usage] ○ Current situation: There are some mid-sized operators. ○ Prospects: Short-term ○ Opportunities: ・ Growth in the construction and industrial sectors is likely to lead to demand for industrial-use lumber products. ・ There will probably be ample opportunities in the Thilawa SEZ to sell products to the electricity industry, the packaging sector or the construction industry.
[Furniture] ○ Current state: There is a small level of industrial activity. There are some mid-sized operators. ○ Prospects: Short-term ○ Opportunities: ・ A considerable opportunity will be provided by the growth of real-estate development in Yangon. ・ There is demand in Europe for high-quality, Myanmar teak or wood related products, so there will be an opportunity to export wood flooring and tiles, etc. ・ Government initiatives are expected to lead to an increase in the manufacture of furniture products.

Source: JICA Study Team

Table 4.3.12 Opinions of company-related parties

Key Factors	Comments
Growth Potential	・ There is strong global demand for teak, so there is ample growth potential when it comes to furniture produced in Myanmar. – **Managing Director, Company T**
Issues	・ Lack of policy transparency and the government's past monopoly both present challenges when engaging in the wood and wood related products industry. – **CEO, Company U** ・ The main issues are a lack of skilled workers, frequent blackouts, and substandard tools and instruments. – **Managing Director, Company V**
Major Markets	・ Europe is becoming the major market for wooden flooring and teak. – **Managing Director, Company T** ・ Yangon is becoming the largest consumer market for furniture products. – **Managing Director, Company T**
Infrastructure	・ Blackouts in industrial zones and the under-developed railway network are both worries. – **Managing Director, Company W**
Opportunities	・ Myanmar currently has no value-added product sector, but restrictions on exports of teak and logs are creating opportunities in this area. – **Managing Director, Company V**

Source: JICA Study Team

(7) Electrical and Electronics

1) Overview

Products in the electrical and electronics industry can be divided into three categories: radio, television and telecommunications equipment; electrical equipment; and office and computer equipment. The industry structure is divided into: upstream, which involves R&D and the production of diodes, plastics and metal sheets, etc.; mid-stream, which involves the production

of CPUs, hard discs and LCD monitors; and downstream, which involves the production of PCs, mobile phones, converters and voltage regulators, etc.

2) The electrical and electronics industry in Myanmar

Myanmar's electrical and electronics industry is at an early stage of development. There are some large enterprises producing car batteries and cables, small computer parts, converters and voltage regulators, etc. Most electrical and electronics equipment is imported from neighboring countries, with the majority of production activities within Myanmar geared towards domestic demand. The level of production was also quite low before the economy was liberalized, which partially explains why the value of production grew by an annual average of 50% from 2009 to 2012. In future, demand for converters, cables and voltage regulators is likely to pick up as the government pushes forward with plans to develop electricity infrastructure, but there remain issues when it comes to a shortage of industrial infrastructure, technology and skilled workers.

Foreign companies are starting to participate in the ICT sector in line with government reforms, with Microsoft and Google also entering the market.

3) Opportunities in the electrical and electronics industry

When it comes to attracting companies and factories involved in the electrical and electronics industry, from now to the medium term the Thilawa SEZ could be attractive to firms involved in the manufacture of converters, testers and switchboards (products that are already being produced in Myanmar). In the long term, the Thilawa SEZ could be attractive to firms producing high-value-added products (which are not currently being manufactured in Myanmar). Furthermore, as Myanmar accumulates technology and skilled staff, the Thilawa SEZ could attract manufacturers in the hi-tech sector.

Table 4.3.13 Opportunities for attracting the electrical and electronics industry

[Electrical equipment] ○ Current situation: ・ There are quite a few units engaged in the assembly of convertors. ・ Myanmar relies on imports and there is no high-value-added industrial production. ○ Prospects: ・ Converter assemblage: Present to medium term ・ High-value-added production: Medium to long term ○ Opportunities: ・ Converter assemblage: Efforts will be required to keep assembly operations going. ・ High-value-added production: It will be important to carve out new opportunities while diversifying existing operations.
[Electronic parts] ○ Current situation: ・ Myanmar is extremely reliant on exports and there is next-to-no industrial production. ・ The lack of resource production is impeding the manufacture of electronic parts. ○ Prospects:

・ Industrial activity: Present
・ Shortage of natural resources: Long term
○ Opportunities:
・ Industrial activity: Companies can create opportunities by importing raw materials and engaging in basic production (of testers and switchboards).
・ Shortage of natural resources: Once technologies and trained workers are available, companies will be able to pursue diversification when it comes to industrial production in the hi-tech sector.

Source: JICA Study Team

Table 4.3.14 Opinions of company-related parties

Key Factors	Comments
Growth Potential	・ With the recent liberalization of telecommunications, a number of new participants are starting to invest in infrastructure construction. This trend is likely to lead to increased demand for telecommunications wires, circuits and switches, etc. – **Managing Director, Company X** ・ Ongoing improvements in the electricity sector and growth in real-estate construction and industrial production are expected to lead to growing demand for electrical equipment like convertors and switches. – **Chairman, Company Y**
Issues	・ Blackouts and difficulties with recruiting middle managers and highly-skilled technicians pose challenges when engaging in industrial production. Furthermore, only a few companies are involved in downstream sectors, so Myanmar has to import materials from Japan, Indonesia, Malaysia and Thailand. – **Chairman, Company Y**
Major Markets	・ Imports are handled in the major domestic markets of Yangon and Mandalay. – **Managing Director, Company X**
Infrastructure	・ Medium-sized electronic parts manufacturers need around 2–3 ha of land. – **Secretary General, Association Z**
Opportunities	・ At the moment there are limits to raw materials sourcing, so the major opportunity lies in the assemblage of electronic equipment. – **Chairman, Company Y** ・ Samsung is looking for around 240 ha of land to set up a large-scale factory. – **Secretary General, Association Z**

Source: JICA Study Team

(8) Machinery and Equipment

1) Overview

The Machinery and equipment industry is divided into two sectors: specialist machinery and equipment; and general machinery and equipment. The former includes engines, turbines, bearings and gears, for example, while the latter includes agricultural machinery, metallurgy equipment and food processing equipment. Industry operators include raw materials manufacturers, assemblers, and manufacturers involved in the processing of final products.

2) The machinery and equipment industry in Myanmar

Myanmar's machinery and equipment industry is still at an early stage of development, with the industry only accounting for 0.17% of Myanmar's production value (2009–2011 average). Domestic production is limited, so Myanmar imports most of its machinery and equipment,

mainly from Asian nations like China, South Korea and Japan. There are shortages of industrial infrastructure and essential technologies/skilled workers.

The government is pushing forward with infrastructure development and this is expected to lead to growing demand for construction equipment. Industries like food and beverages, textile, and mining are also expanding, so there is likely to be growing demand for machinery and equipment for use in these sectors.

The production activity in Yangon centers around metalworking, so there also appears to be demand for machinery and equipment related to metalworking. Around 50% of domestic production facilities are located in Yangon, where products such as metal plates, casings, pipes, nuts and bottles are manufactured.

3) Opportunities in the machinery and equipment industry

When it comes to attracting companies and factories involved in the machinery and equipment industry, in the short to medium term the Thilawa SEZ could be attractive to firms wishing to manufacture metal products to meet domestic demand in place of imports. In the medium to long term, the Thilawa SEZ could prove attractive to manufacturers of both specialist and general machinery and equipment.

An overview of this prognosis is outlined below. Company-related parties have pointed to government-related issues and Myanmar's reliance on imports of raw materials.

Table 4.3.15 Opportunities for attracting the machinery and equipment industry

[Specialist machinery and equipment] ○ Current situation: There is only a very small level of production activity. Essential machinery equipment is imported. ○ Prospects: Medium to long term ○ Opportunities: ・ Industries with strong demand (Food processing, Textile, etc.) currently rely on imports for machinery and equipment. Substitute machinery and equipment could be manufactured in the Thilawa SEZ. ・ The government is pushing forward with infrastructure development and this is expected to lead to rising demand for machinery and equipment for construction.
[General machinery and equipment] ○ Current situation: There is only a very small level of production activity. Essential machinery equipment is imported. ○ Prospects: Medium to long term ○ Opportunities: ・ The upgrading of industrial infrastructure is expected to lead to rising demand for general machinery to aid logistics, such as lifts and loading machinery. ・ The development of supply chains is expected to lead to derived demand for components for specialist machinery facilities.
[Metal products] ○ Current situation: Production activity is starting to pick up. ○ Prospects: Short to medium term

○Opportunities:
・ Assembly and production activities are expanding to replace imports.
・ There has been remarkable growth in the machinery, construction and electricity sectors. This provides an opportunity for domestic production and supply.

Source: JICA Study Team

Table 4.3.16 Opinions of company-related parties

Key Factors	Comments
Growth Potential	・ The Thilawa SEZ is expected to prove a representative example of an area impacted by increasing demand due to robust industrial activity in Yangon. **– Director, Company AA**
Issues	・ The newest industrial zone, Myaun Da Kar, was formed with the aim housing all of Yangon's ironworks. Refineries that do not move to the zone are not having their operating licenses renewed. – **Managing Director, Company BB** ・ High-quality raw materials cannot be sourced locally. Iron and steel is mainly imported from South Korea, Taiwan and China. – **Managing Director, Company CC**
Infrastructure	・ Steel fabrication factories require around 0.8–1.6 ha of land. There also needs to be a highly-reliable supply of electricity and gas. – **Managing Director, Company CC**
Opportunities	・ Myanmar has no iron & steel manufacturing machinery at present, so this could provide an opportunity from here on. **– CEO, Company DD**

Source: JICA Study Team

4.4 Analysis of project site potential demand

An examination of potential demand at the project site was carried out based on the study results up until the previous section. The section below presents an outline of the results of potential demand analysis as well as a detailed account, including the analysis method.

(1) Outline of the analysis results

1) Analysis objectives

The analysis looked into the potential demand for land in the Thilawa SEZ among all the candidate industries examined up until the previous section (Textiles, Food and Beverages, Construction materials, Automotive Manufacturing, Chemical, Wood and Wood related products, Electrical and Electronics, and Machinery and Equipment). It also looked at how much employment these candidate industries were expected to create and it analyzed how much demand for residential or commercial facilities this was expected to lead to.

[Objective of the potential demand analysis]

- Examination of the demand for land among each of the candidate industries
- Examination of the number of land plots needed to meet the demand of each industry sector
- Examination of (expected) levels of employment generated within the SEZ by the candidate industries; and the subsequent population size
- Examination of real-estate demand and expected land allocation with regards to housing, offices, commercial and retail facilities.
- Examination of other factors necessary for SEZ's development

2) Analysis results

The results of the potential demand analysis are outlined below. The analysis revealed that the eight candidate industries would require a total of 1,300 ha, with logistics facilities requiring 75 ha, housing 131 ha, commercial/retail facilities, office and hotels 15 ha, and other related facilities (hospitals, schools, etc.) 16 ha.

The next section onwards will look at the analysis process and the detailed results for industries and other supporting facilities.

Table 4.4.1 Outline of the results of the potential demand analysis in Thilawa SEZ

	Total
Industrial	1,300
Logistics	75
Residential	131
Commercial -Convenience shopping area: 2.25 ha	15

-retail mall: 4 ha -Office space: 5.25 ha -hotel: 3.5 ha	
Support Segment -Healthcare: 4 ha - Hospitals, nursing home, dispensary, etc. -Education: 8 ha – Primary, Secondary schools, vocational colleges, etc. -Other support: 4 ha - Community Room, Community Hall, Library, Recreational Club, etc.	16

Source: JICA Study Team

(2) Potential demand analysis of each industry

1) Analysis method and process

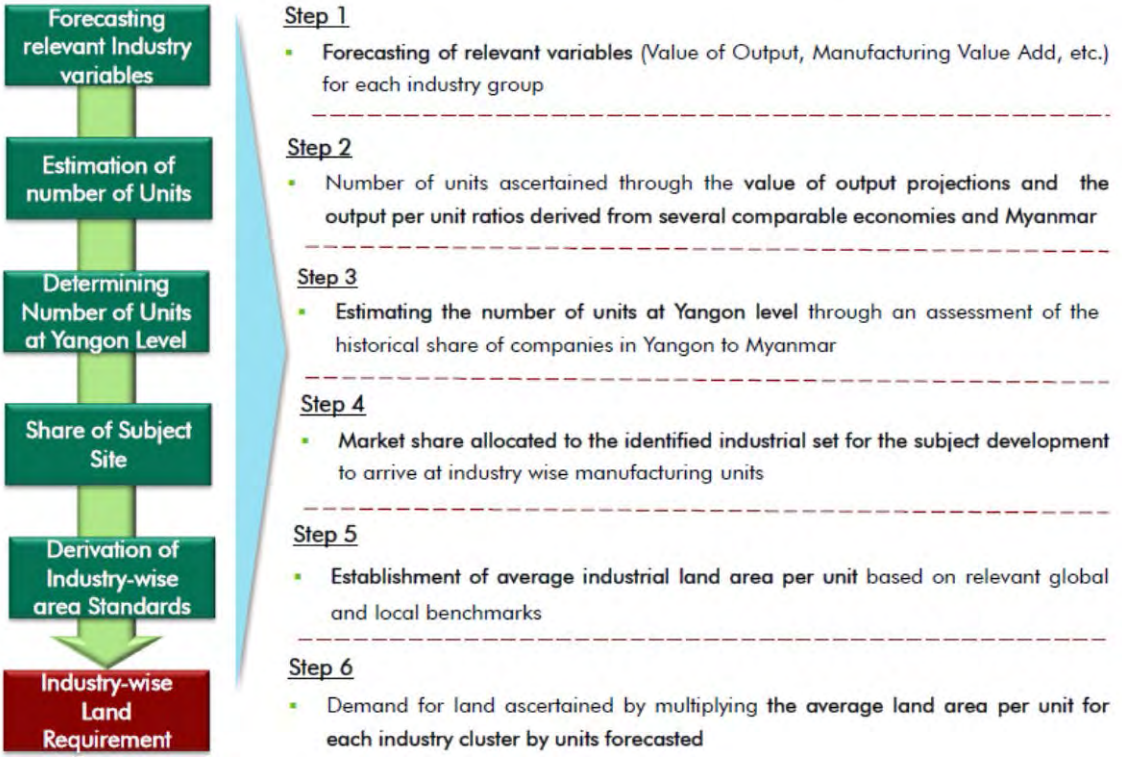
2017 was set as the start year for the analysis of potential demand. An examination of expected demand was then carried out based on the market trends and growth potential of each industry sector. The examination was based on the premise that the Thilawa SEZ would be able to provide: high-quality services up to international standards; appropriate facilities; a sufficient electricity supply; a road network within the Thilawa SEZ; and connectivity to excellent port infrastructure, etc.

The analysis process is outlined below.

Firstly, the future value of industrial production in Myanmar was calculated based on the past value of industrial production. The number of production units was then calculated based on production per unit. The analysis of Automotive Manufacturing and other industries not currently present in Myanmar took into account past production trends in other Asian nations.

The increase in the number of units at the Yangon level was then calculated through an assessment of the share of the domestic market accounted for by Yangon's large enterprises. The expansion of production units in the Thilawa SEZ was then examined. This examination took into consideration the existence of other industrial zones in the Yangon Region, for example, and the results of interviews with company-related parties and the Myanmar government.

The expected demand for land (area) among each industry was then ascertained based on: the expected increase in the number of production units in the Thilawa SEZ; and the average area of land taken up by production units in each industry. The average area of land taken up by production units was calculated based on examples from Myanmar as a whole, the Yangon Region, and overseas industrial zones.



Source: JICA Study Team

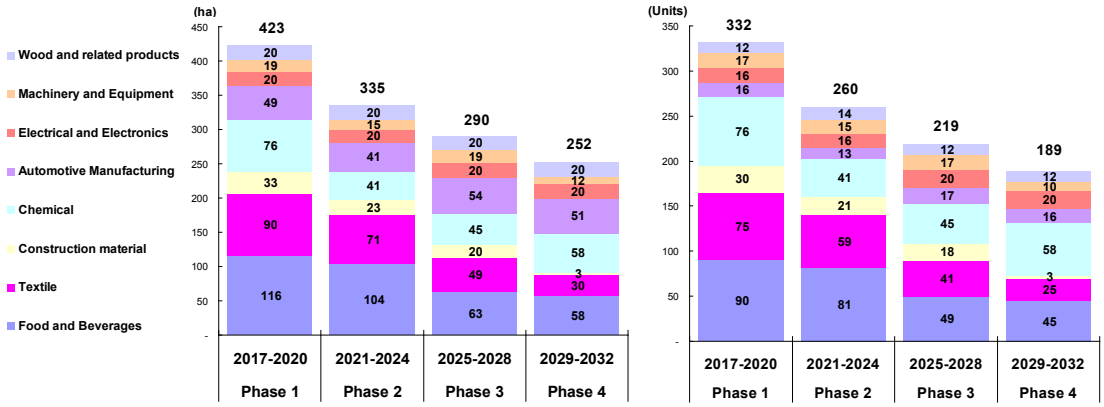
Figure 4.4.1 Process of potential demand analysis

2) Analysis results

The analysis results are as follows.

The analysis revealed a total potential demand of 1,300 ha within the Thilawa SEZ. By development phase, this breaks down as 423 ha in Phase 1 (2017–2020), 335 ha in Phase 2 (2021–2024), 290 ha in Phase 3 (2025–2028) and 252 ha in Phase 4 (2029–2032).

By industry (total up until 2023), it breaks down as 341 ha for Food and Beverages, 240 ha for Textiles, 79 ha for Construction materials, 220 ha for Chemical, 195 ha for Automotive Manufacturing, 94 ha for Electrical and Electronics, 63 ha for Machinery and Equipment, and 60 ha for Wood and Wood related products.



Source: JICA Study Team

Figure 4.4.2 Potential demand analysis results

Table 4.4.2 Demand forecast (Land Area and Unit Numbers)

[Land area (ha)]

	2017	2018	2019	2020	2021	2022	2023	2024
Food and Beverages	30	27	28	31	27	31	23	23
Clothing and wearing apparel	24	22	24	20	22	16	17	17
Construction materials	7	8	9	10	7	3	8	5
Chemical	20	22	16	18	10	12	7	12
Personal goods	14	16	12	13	7	8	3	8
Household goods	3	3	2	3	1	2	2	2
Industrial raw materials	3	3	2	2	2	2	2	2
Automotive Manufacturing	9.5	9.5	15	15	19	9.5	3	9.5
Electrical and Electronics	5	5	5	5	5	5	5	5
Machinery and Equipment (including fabrication)	10.5	2	3	3.5	3	4.5	3	4.5
Wood and Wood related products	5	5	5	5	5	5	5	5
Logistics (approx. 5 - 7% of industrial area)	3.75	3.75	3.75	3.75	5	5	5	5
Total	114	104	109	111	102	91	76	86
Total (Cumulative)	114	218	326	438	540	631	706	793

	2025	2026	2027	2028	2029	2030	2031	2032
Food and Beverages	24	13	13	13	14	14	14	15
Clothing and wearing apparel	25	8	7	8	8	7	7	7
Construction materials	7	7	3	3	3	0	0	0
Chemical	12	13	7	13	14	14	15	15
Personal goods	9	10	4	10	11	11	12	12
Household goods	2	2	2	2	2	2	2	2
Industrial raw materials	1	1	1	1	1	1	1	1
Automotive Manufacturing	9.5	9.5	16	19	13	13	13	12
Electrical and Electronics	5	5	5	5	5	5	5	5
Machinery and Equipment (including fabrication)	5	5.5	6.5	2	3	3	3	3
Wood and Wood related products	5	5	5	5	5	5	5	5
Logistics (approx. 5 - 7% of industrial area)	5	5	5	5	5	5	5	5
Total	98	71	68	74	71	66	67	68
Total (Cumulative)	891	962	1029	1103	1174	1240	1308	1375

[Units]

	2017	2018	2019	2020	2021	2022	2023	2024
Food and Beverages	23	21	22	24	21	24	18	18
Clothing and wearing apparel	20	18	20	17	18	13	14	14
Construction materials	6	7	8	9	6	3	7	5
Chemical	20	22	16	18	10	12	7	12
Personal goods	14	16	12	13	7	8	3	8
Household goods	3	3	2	3	1	2	2	2
Industrial raw materials	3	3	2	2	2	2	2	2
Automotive Manufacturing	3	3	5	5	6	3	1	3
Electrical and Electronics	4	4	4	4	4	4	4	4
Machinery and Equipment (including fabrication)	10	2	2	3	3	4	4	4
Wood and Wood related products	3	3	3	3	4	4	3	3
Total	89	80	80	83	72	67	58	63
Total (Cumulative)	89	169	249	332	404	471	529	592

	2025	2026	2027	2028	2029	2030	2031	2032
Food and Beverages	19	10	10	10	11	11	11	12
Clothing and wearing apparel	21	7	6	7	7	6	6	6
Construction materials	6	6	3	3	3	0	0	0
Chemical	12	13	7	13	14	14	15	15
Personal goods	9	10	4	10	11	11	12	12
Household goods	2	2	2	2	2	2	2	2
Industrial raw materials	1	1	1	1	1	1	1	1
Automotive Manufacturing	3	3	5	6	4	4	4	4
Electrical and Electronics	5	5	5	5	5	5	5	5
Machinery and Equipment (including fabrication)	4	5	5	3	2	2	3	3
Wood and Wood related products	3	3	3	3	3	3	3	3
Total	73	52	44	50	49	45	47	48
Total (Cumulative)	665	717	761	811	860	905	952	1000

Source: JICA Study Team

Table 4.4.3 Demand forecast (detailed results by industry)

[Food and Beverages]

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Value of Output (USDM)	9,459	10,594	11,865	13,289	14,617	16,079	17,285	18,582	19,975	20,974	22,023	23,124	24,280	25,494	26,769	28,107
Output Growth Ratio	14%	12%	12%	12%	10%	10%	8%	8%	8%	5%	5%	5%	5%	5%	5%	5%
CAGR (16yrs)	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Output per Unit (USDM)	2.90	3.00	3.10	3.21	3.32	3.41	3.49	3.58	3.67	3.76	3.86	3.95	4.05	4.15	4.26	4.36
# of Unit (Myanmar)	3,265	3,533	3,823	4,137	4,397	4,718	4,949	5,190	5,443	5,576	5,712	5,851	5,994	6,140	6,290	6,443
# of Unit (Yangon)	979	1,060	1,147	1,241	1,319	1,416	1,485	1,557	1,633	1,673	1,714	1,755	1,798	1,842	1,887	1,933
# of Unit (Thilawa, theoritical)	245	265	287	310	330	354	371	389	408	418	428	439	450	461	472	483
incre. # of Unit (Thilawa)	23	21	22	24	21	24	18	18	19	10	10	10	11	11	11	12
cumulative # of Unit (Thilawa)	23	44	66	90	111	135	153	171	190	200	210	220	231	242	253	265
Area (ha) pe Unit	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29
Thilawa Area (ha)	30	57	85	116	143	174	197	220	245	258	270	283	298	312	326	341

[Textile]

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Value of Output (USDM)	2,118	2,382	2,680	3,015	3,392	3,731	4,105	4,515	4,966	5,215	5,476	5,749	6,037	6,339	6,656	6,988
Output Growth Ratio	15%	13%	13%	13%	13%	10%	10%	10%	10%	5%	5%	5%	5%	5%	5%	5%
CAGR (16yrs)	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Output per Unit (USDM)	1.84	1.89	1.95	2.04	2.15	2.25	2.37	2.49	2.56	2.64	2.72	2.80	2.88	2.97	3.06	3.15
# of Unit (Myanmar)	1,154	1,260	1,376	1,475	1,580	1,655	1,734	1,817	1,940	1,978	2,016	2,055	2,095	2,136	2,177	2,220
# of Unit (Yangon)	865	945	1,032	1,106	1,185	1,241	1,301	1,362	1,455	1,483	1,512	1,541	1,571	1,602	1,633	1,665
# of Unit (Thilawa, theoritical)	199	217	237	254	273	286	299	313	335	341	348	355	361	368	376	383
incre. # of Unit (Thilawa)	20	18	20	17	18	13	14	14	21	7	6	7	7	6	6	6
cumulative # of Unit (Thilawa)	20	38	58	75	93	106	120	134	155	162	168	175	182	188	194	200
Area (ha) pe Unit	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Thilawa Area (ha)	24	46	70	90	112	127	144	161	186	194	202	210	218	226	233	240

[Construction materials]

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Value of Output (USDM)	663	796	955	1,146	1,318	1,515	1,743	1,917	2,109	2,320	2,494	2,681	2,882	3,026	3,177	3,336
Output Growth Ratio	20%	20%	20%	20%	15%	15%	15%	10%	10%	10%	8%	8%	8%	5%	5%	5%
CAGR (16yrs)	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Output per Unit (USDM)	0.75	0.79	0.83	0.87	0.91	0.96	1.00	1.05	1.11	1.16	1.22	1.28	1.34	1.41	1.48	1.56
# of Unit (Myanmar)	886	1,013	1,157	1,323	1,449	1,587	1,738	1,821	1,907	1,998	2,046	2,094	2,144	2,144	2,144	2,144
# of Unit (Yangon)	266	304	347	397	435	476	521	546	572	599	614	628	643	643	643	643
# of Unit (Thilawa, theoritical)	48	55	62	71	78	86	94	98	103	108	110	113	116	116	116	116
incre. # of Unit (Thilawa)	6	7	8	9	6	3	7	5	6	6	3	3	3	0	0	0
cumulative # of Unit (Thilawa)	6	13	21	30	36	39	46	51	57	63	66	69	72	72	72	72
Area (ha) pe Unit	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Thilawa Area (ha)	7	14	23	33	39	43	50	56	62	69	72	76	79	79	79	79

[Chemical]

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Value of Output (USDM)	481	571	649	739	813	894	984	1,082	1,184	1,296	1,418	1,552	1,699	1,860	2,026	2,209
Output Growth Ratio	*19%*	*19%*	14%	14%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	9%	9%
CAGR (16yrs)	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*
Output per Unit (USDM)	*0.33*	*0.34*	*0.36*	*0.38*	*0.40*	*0.41*	*0.44*	*0.46*	*0.48*	*0.50*	*0.53*	*0.56*	*0.58*	*0.61*	*0.64*	*0.68*
# of Unit (Myanmar)	1,583	1,786	1,931	2,088	2,187	2,291	2,401	2,515	2,618	2,725	2,837	2,954	3,077	3,204	3,318	3,437
# of Unit (Yangon)	911	1,041	1,140	1,249	1,308	1,371	1,436	1,504	1,576	1,651	1,729	1,812	1,898	1,988	2,083	2,182
# of Unit (Thilawa, theoritical)	163	185	201	218	229	240	251	263	275	287	299	312	326	341	355	369
incre. # of Unit (Thilawa)	20	22	16	19	9	12	7	12	13	14	8	14	15	15	16	16
cumulative # of Unit (Thilawa)	20	42	58	76	86	98	105	117	129	142	149	162	176	190	205	220
Area (ha) pe Unit	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Thilawa Area (ha)	20	42	58	76	86	98	105	117	129	142	149	162	176	190	205	220

[Automotive Manufacturing]

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Value of Output (USDM)	308	385	482	578	694	833	958	1,101	1,266	1,456	1,675	1,926	2,119	2,330	2,563	2,820
Output Growth Ratio	25%	25%	25%	20%	20%	20%	15%	15%	15%	15%	15%	15%	10%	10%	10%	10%
CAGR (16yrs)	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Output per Unit (USDM)	1.29	1.48	1.70	1.96	2.15	2.37	2.60	2.73	2.87	3.01	3.16	3.32	3.49	3.66	3.85	4.04
# of Unit (Myanmar)	240	261	283	296	322	352	368	403	441	483	529	580	607	636	666	698
# of Unit (Yangon)	120	130	150	168	193	204	206	217	229	242	265	290	304	318	333	349
# of Unit (Thilawa, theoritical)	15	33	38	42	48	51	51	54	57	60	66	72	76	80	83	87
incre. # of Unit (Thilawa)	3	3	5	5	6	3	1	3	3	3	5	6	4	4	4	4
cumulative # of Unit (Thilawa)	3	6	11	16	22	25	26	29	32	35	40	46	50	54	58	62
Area (ha) pe Unit	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15
Thilawa Area (ha)	9	19	35	50	69	79	82	91	101	110	126	145	157	170	182	195

[Electrical and Electronics]

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Value of Output (USDM)	289	361	451	541	636	747	860	989	1,137	1,307	1,503	1,699	1,920	2,150	2,408	2,697
Output Growth Ratio	30%	25%	25%	20%	18%	18%	15%	15%	15%	15%	15%	13%	13%	12%	12%	12%
CAGR (16yrs)	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Output per Unit (USDM)	2.52	2.65	2.78	2.92	3.07	3.22	3.38	3.55	3.73	3.92	4.11	4.32	4.53	4.76	5.00	5.25
# of Unit (Myanmar)	114	136	162	185	207	232	254	278	305	334	366	393	423	452	482	514
# of Unit (Yangon)	98	116	138	157	176	197	216	237	259	284	311	334	360	384	410	437
# of Unit (Thilawa, theoritical)	20	23	28	31	35	39	43	47	52	57	62	67	72	77	82	87
incre. # of Unit (Thilawa)	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5
cumulative # of Unit (Thilawa)	4	8	12	16	20	24	28	32	37	42	47	52	57	62	67	72
Area (ha) pe Unit	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Thilawa Area (ha)	5	10	16	21	26	31	36	42	48	55	61	68	74	81	87	94

[Machinery and Equipment (including fabrication)

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Value of Output (USDM)	19	24	30	38	47	59	71	85	102	123	147	162	178	196	216	237
Output Growth Ratio		25%	25%	25%	25%	25%	20%	20%	20%	20%	20%	10%	10%	10%	10%	10%
CAGR (16yrs)		17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%	17%
Output per Unit (USDM)	1.00	1.05	1.10	1.16	1.22	1.28	1.34	1.41	1.48	1.55	1.63	1.71	1.80	1.89	1.98	2.08
# of Unit (Myanmar)	19	23	27	33	39	46	53	61	69	79	90	95	99	104	109	114
# of Unit (Yangon)	19	23	27	33	39	46	53	61	69	79	90	95	99	104	109	114
# of Unit (Thilawa, theoritical)	10	12	14	16	19	23	26	30	35	40	45	47	50	52	54	57
incre. # of Unit (Thilawa)	10	2	2	3	3	4	3	4	4	5	6	2	2	2	2	3
cumulative # of Unit (Thilawa)	10	12	14	16	19	23	26	30	35	40	45	47	50	52	54	57
Area (ha) pe Unit	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Thilawa Area (ha)	11	13	15	18	21	26	29	33	38	44	50	52	55	57	60	63

[Wood and Wood related products]

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Value of Output (USDM)	237	284	341	392	451	519	570	628	690	759	812	869	930	995	1,065	1,140
Output Growth Ratio	20%	20%	20%	15%	15%	15%	10%	10%	10%	10%	7%	7%	7%	7%	7%	7%
CAGR (16yrs)	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Output per Unit (USDM)	0.27	0.29	0.32	0.33	0.35	0.37	0.38	0.40	0.42	0.44	0.45	0.46	0.48	0.49	0.51	0.52
# of Unit (Myanmar)	864	965	1,077	1,180	1,292	1,415	1,483	1,553	1,627	1,738	1,805	1,875	1,948	2,024	2,102	2,184
# of Unit (Yangon)	259	290	323	354	388	425	445	466	488	521	542	563	584	607	631	655
# of Unit (Thilawa, theoritical)	26	29	32	35	39	42	44	47	49	52	54	56	58	61	63	66
incre. # of Unit (Thilawa)	3	3	3	3	4	4	3	3	3	3	3	3	3	3	3	3
cumulative # of Unit (Thilawa)	3	6	9	12	16	20	23	26	29	32	35	38	41	44	47	50
Area (ha) pe Unit	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Thilawa Area (ha)	4	7	11	14	19	24	28	31	35	38	42	46	49	53	56	60

Source: JICA Study Team

(3) Potential demand analysis of other supporting facilities

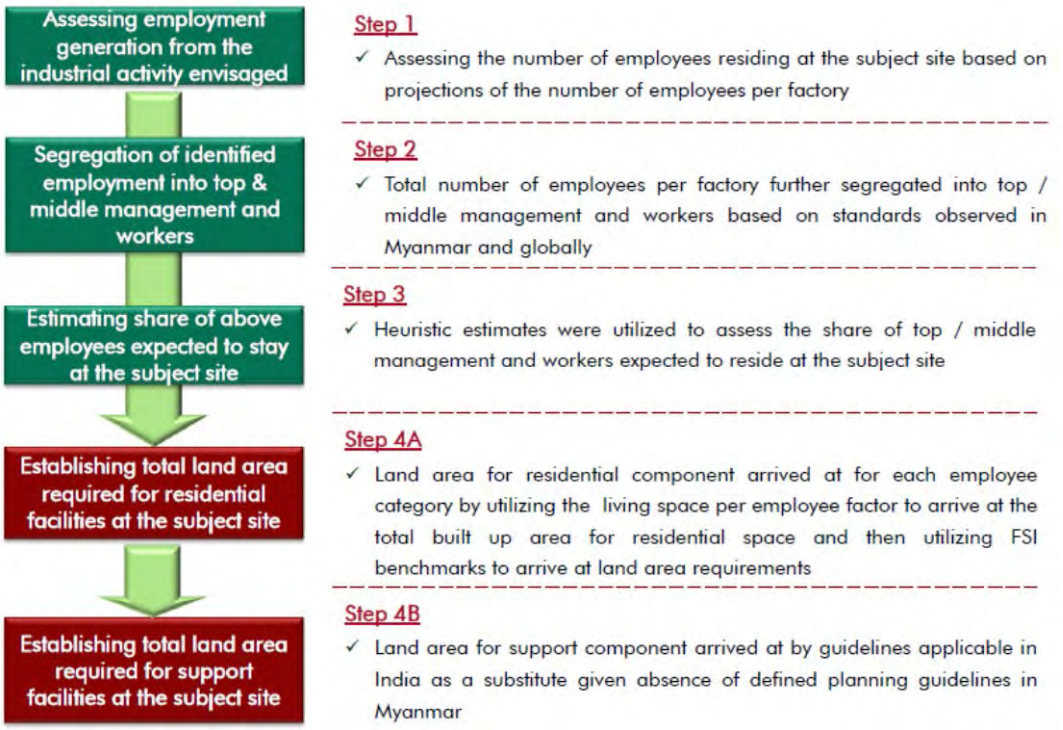
1) Analysis method and process

The analysis process is outlined below.

Firstly, the expected number of employees in the Thilawa SEZ was calculated by multiplying the number of production units (as derived from the potential demand analysis of each industry) by the projected number of employees per unit.

Employees were then categorized into top management, middle management and workers based on interviews with company-related parties from each industry. The categorization resulted in a projected workforce composition of 5% top management, 10% middle management and 85% workers. The share of employees expected to reside within the Thilawa SEZ was set for each employ categorization and the SEZ's projected working population was calculated. The Thilawa SEZ residential population was then worked out based on labor force participation ratios.

The average residential area for each employee category was determined based on 4-person households. This was then used to calculate demand for housing (land area) within the Thilawa SEZ. The total land area required for commercial facilities and social infrastructure (healthcare and educational facilities, etc.) was then calculated based on Indian Urban Development Plan Formulation and Implementations (UDPFI) guidelines and the projected residential population of the Thilawa SEZ.



Source: JICA Study Team

Figure 4.4.3 Analysis process of potential demand for other supporting facilities

2) Analysis results

The analysis results are as follows.

The analysis suggests a total of 161.9 ha will be required for supporting facilities up until 2032. Housing will account for 131 ha of the total (top management housing – 25.2 ha; middle management housing – 49.6 ha; worker housing – 56.2 ha). Commercial/retail facilities and hotels will account for a further 15 ha; healthcare facilities and hospitals for 4 ha; schools for 8 ha; and other community halls and so on for 4 ha.

Table 4.4.4 Change in land area of supporting facilities

Net Area (Hectares)	2017	2018	2019	2020	2021	2022	2023	2024
Residential	7.7	7.4	7.7	8.2	8.4	7.7	7.9	7.7
Top Management Housing	1.5	1.4	1.5	1.6	1.6	1.5	1.5	1.5
Middle Management Housing	2.9	2.8	2.9	3.1	3.2	2.9	3.0	2.9
Worker Housing	3.3	3.2	3.3	3.5	3.6	3.3	3.4	3.3
Commercial (including retail malls and hotels)	0.50	0.50	0.50	0.50	1.25	1.25	1.25	1.25
Healthcare	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Education	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Other Support *	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	9.1	8.9	9.2	9.7	10.7	9.9	10.2	10.0
Cumulative	9.1	18.0	27.2	36.9	47.6	57.5	67.7	77.7

Net Area (Hectares)	2025	2026	2027	2028	2029	2030	2031	2032
Residential	8.4	7.9	8.8	8.9	8.7	8.3	8.9	8.4
Top Management Housing	1.6	1.5	1.7	1.7	1.7	1.6	1.7	1.6
Middle Management Housing	3.2	3.0	3.3	3.4	3.3	3.1	3.4	3.2
Worker Housing	3.6	3.4	3.8	3.8	3.7	3.6	3.8	3.6
Commercial (including retail malls and hotels)	0.75	0.75	0.75	0.75	1.25	1.25	1.25	1.25
Healthcare	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Education	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Other Support*	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	10.1	9.7	10.5	10.6	11.0	10.5	11.1	10.7
Cumulative	87.8	97.5	108.0	118.6	129.6	140.1	151.2	161.9

* Other Support: Community rooms, community halls, libraries, recreational clubs, etc.

Source: JICA Study Team

Table 4.4.5 Basis for calculation of Housing Demand

○ Housing

Top management housing	Total area: 25 ha No. of units: 902 Average size : 3,000 sft Formats – Villas / Apartments
Middle management housing	Total area: 50 ha No. of units: 3,565 Average size: 1,500 sft Formats - Apartments
Worker housing	Total area: 56 ha No. of units: 15,110 Average size : 400 sft Format – Apartments

Parameters

	Ave. Employee per Unit		# Unit		# Employee
Food and Beverages	112	×	265	=	29,680
Textile	752	×	200	=	150,400
Construction material	58	×	72	=	4,176
Chemical	32	×	220	=	6,946
Automotive Manufacturing	189	×	62	=	11,718
Electrical and Electronics	86	×	72	=	6,192
Machinery and Equipment	43	×	59	=	2,537
Wood and related products	30	×	50	=	1,500
					213,149

	% in Employees		% Reside in SEZ		# Reside in SEZ		Labor Force Participation Rate		SEZ Population
Top Management	5%	×	10%	=	1,074	/	0.3	=	3,585
Middle Management	10%	×	20%	=	4,271	/		=	14,243
General Workers	85%	×	10%	=	18,127	/		=	60,429
					23,472				78,257

	SEZ Population		Household Size		# Units		Ave. space		Total Area (ha)
Top Management	3,585	/	4	=	902	×	3,000sqft *Villa/ Apartment*	=	25
Middle Management	14,243	/		=	3,565	×	1,500sqft *Apartment*	=	50
Workers	60,429	/		=	151	×	400sqft *Apartment*	=	56
									131

Source: JICA Study Team

5 Examination of Land Use Concepts and the Basic Development Plan

5.1 Overview

The basic development plan draws up a feasible plan for land usage (commercial and public facilities, housing, etc.) within the Thilawa SEZ. The final goal of the Thilawa SEZ is to entice global manufacturers to invest in the region. The basic development plan is a proposal put together by the JICA Study Team based on information available at the time of the study; it does not place any restrictions on developments by business entities. Each business entity will need to formulate specific development plans based on an examination of project feasibility, so actual development may differ from the basic development plan.

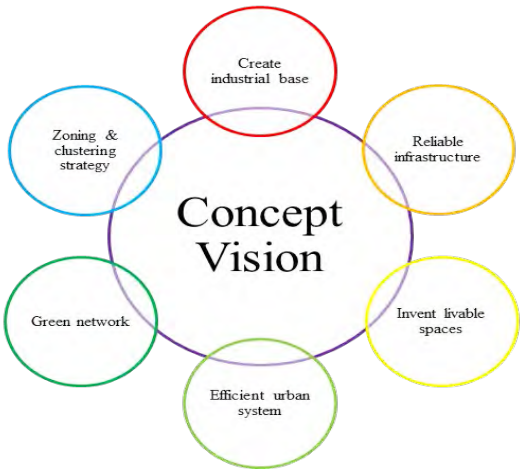
5.2 Concept

(1) The Thilawa SEZ concept vision

When formulating the basic development plan, it was assumed the Thilawa SEZ would serve as a new manufacturing hub in Myanmar that would bring new industrial and business activity to the region.

The idea is to distribute industrial sites in a way that brings about synergies between the various industrial clusters, with the Thilawa SEZ also appropriately furnished with essential infrastructure such as power stations and substations, reservoirs and drainage facilities. Furthermore, the installation of customs houses and access points between the Thilawa SEZ and outside is premised on the maintenance of an efficient road network connecting the Thilawa SEZ to the wider region.

The Thilawa SEZ development concept also involves the construction of a sustainable economic zone with new spaces for work, housing, education and entertainment. The plan also envisions the construction of residential zones within the Thilawa SEZ and the introduction of an efficient urban system.



Source: JICA Study Team

Figure 5.2.1 Concept vision of the Thilawa SEZ

(2) Development objectives and principles

Outlined below are the objectives and principles behind the proposal for the Thilawa SEZ's basic development plan

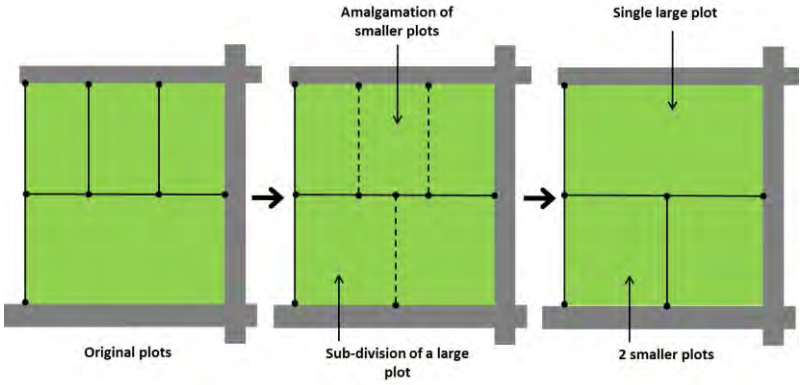
Objective 1	Formulation of a feasible basic development plan that accords with the development aims of the Thilawa SEZ
Principle	Land and infrastructure should be allocated in the most optimal way. Furthermore, part of the Thilawa SEZ is quite hilly, so it is important to propose a method of ensuring essential development can take place in a manner that keeps costs down.

Objective 2	Optimization of the usage of land and space within the Thilawa SEZ
Principle	Roads and infrastructure will need to meet the demands of industry. Furthermore, in order to meet the needs of participating companies, land plotting should take place in a flexible manner that allows for subdivisions and amalgamations, with rental factories also available to encourage the participation of small-sized tenants.

Objective 3	Development of land plots furnished with reliable infrastructure that is appropriate for the needs of each industry cluster
Principle	It is important to build a strong reputation for the Thilawa SEZ in order to attract and keep many companies from each strategic industry.

Objective 4	Development of efficient infrastructure with related facilities in a manner that ensures the smooth running of operations within the Thilawa SEZ
Principle	The plan will include the construction of 50MW-class gas-fired power stations. It will also tackle the electricity problems that stand in the way of investment. In order to enable the swift commencement of operations, the plan also envisages the construction of rental factories and the development of a transportation system that supports the distribution of employees and goods.

In order to optimize land usage within the Thilawa SEZ, the basic development plan envisages the development of standardized rectangular land plots that can be easily subdivided and amalgamated to meet the needs of participants. This will enable land plots to be allocated in a flexible manner.



Source: JICA Study Team

Figure 5.2.2 Subdivision/amalgamation of land plots

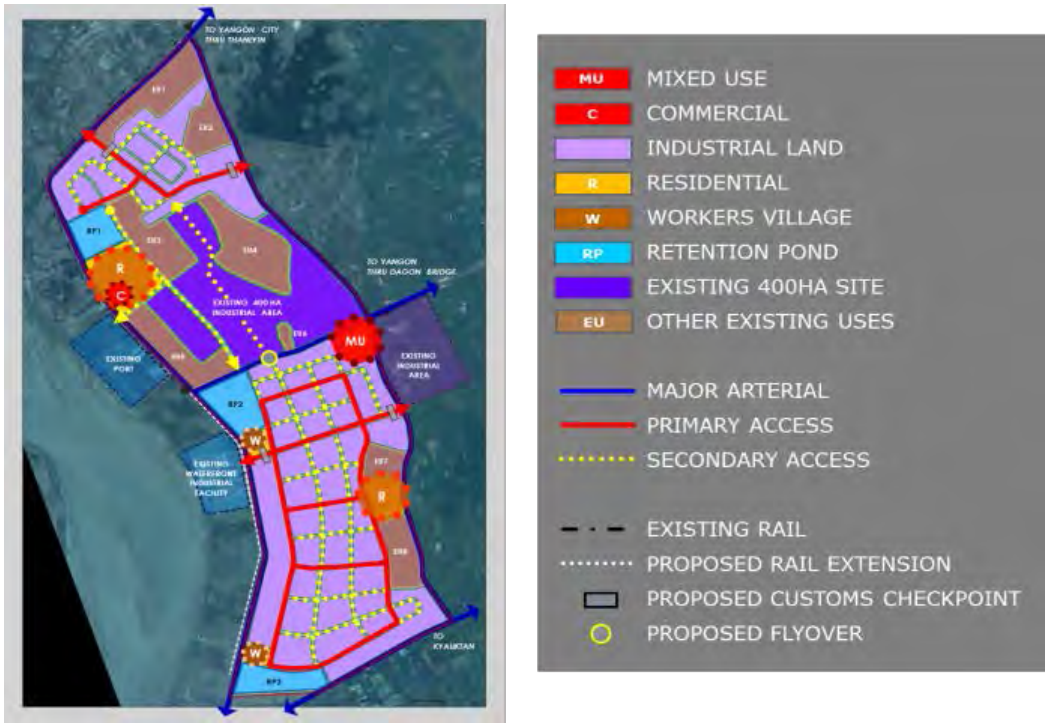
5.3 Approach

(1) Outline of basic development plan

Two options for the Thilawa SEZ's basic development plan were prepared based on the contents of a survey of the available literature.

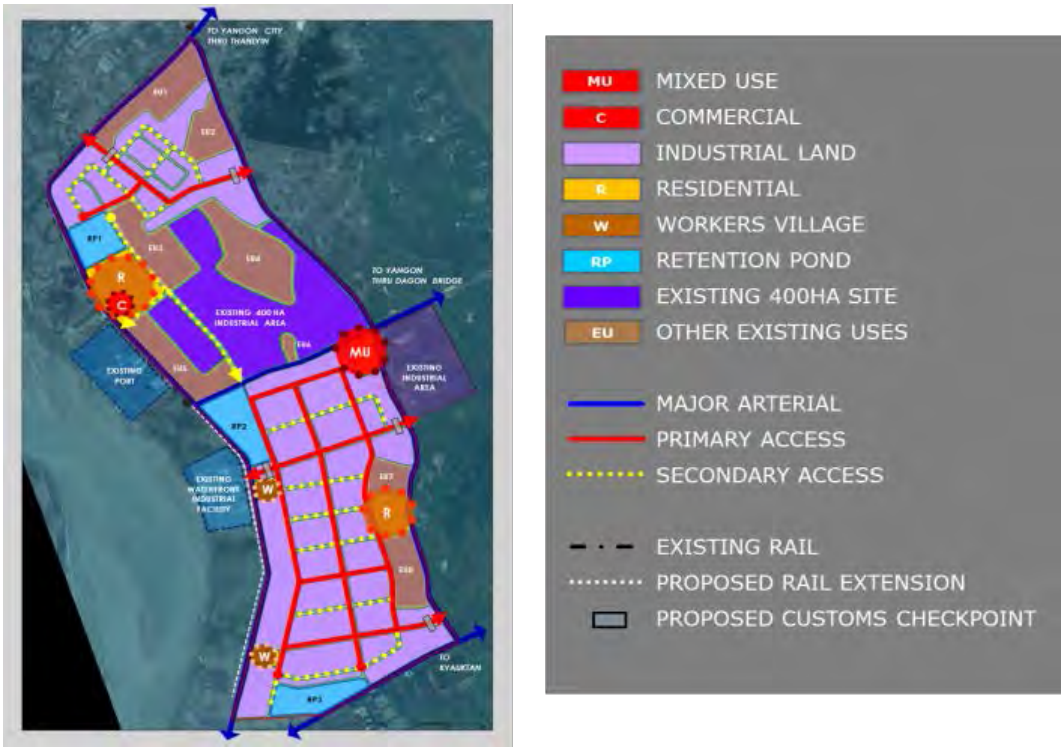
Both options place the main entrance to the Thilawa SEZ at the center of the development zone. Furthermore, they both locate industrial land in the northern part of the zone in order to enable integrated development with the advanced development area (400 ha). The Thilawa SEZ also contains rivers, streams and hilly lands, so both options feature three retention ponds to prevent flooding. Commercial facilities are also placed within the northern residential zones in order to meet the needs of the Thilawa SEZ's residents. Plot sizes in both options are adequate for the needs of the zone's residents.

As for differences, Option 1 ensures there is transportation connectivity between industrial sites and residential zones. In Option 2, meanwhile, the industrial transportation route does not pass through the residential zone in the advanced development area.



Source: JICA Study Team

Figure 5.3.1 Option 1

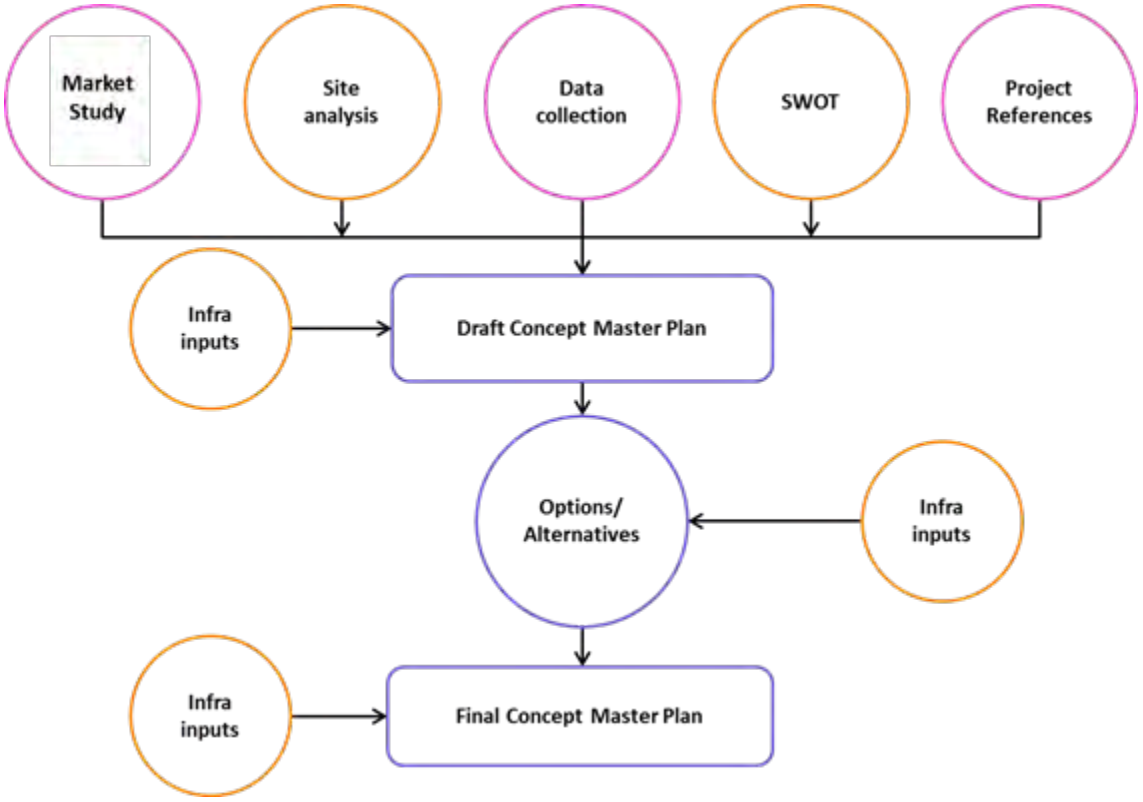


Source: JICA Study Team

Figure 5.3.2 Option 2

(2) Examination method for the basic development plan

Information was collected from various sources and analyzed when examining the basic development plan. Information was obtained through: field surveys within the Thilawa SEZ and discussions with related parties on the ground; a bibliographic survey focusing on preceding studies; and market research, etc. The basic development plan was then examined based on this information and on feasibility considerations.



Source: JICA Study Team

Figure 5.3.3 Examination process for the Thilawa SEZ

5.4 Presuppositions

5.4.1 Special economic zones (SEZ)

SEZ concepts will now be reviewed and good examples from other countries referenced from the perspective of contributing to the examination of the basic development plan for the Thilawa SEZ.

Special economic zones are characterized by streamlined bureaucratic procedures and good infrastructure. A further characteristic is the way special laws are passed to introduce preferential treatments and deregulation with regards to economic activity within the SEZs (especially when it comes to imports and exports). Countries across the world have set up SEZs as a way to entice investment and foreign capital, create jobs, promote technological innovation, and develop infrastructure. In many cases, the SEZs are surrounded by walls or wire netting, with access limited to certain points.

Other similar concepts include free trade zones (FTZ), export processing zones, free zones, industrial zones and free ports.

The following section will examine the ideas behind the management of the Thilawa SEZ's borders by referencing two case studies: the Jebel Ali Free Zone in Dubai, United Arab Emirates; and the Singapore Free Trade Zone in Singapore.

(1) Jebel Ali Free Zone (Dubai, United Arab Emirates)

The Jebel Ali Free Zone is a sealed off industrial zone handling tax-exempt reshipments and re-exporting. It faces Jebel Ali Port and has seven entry points. Located outside but close to the industrial zones are: the headquarters and offices of multinational corporations; SMEs that do not need to operate within the FTZ; and the Jebel Ali Free Zone Authority, etc. A feature of traditional FTZs like this is the way access is strictly controlled.

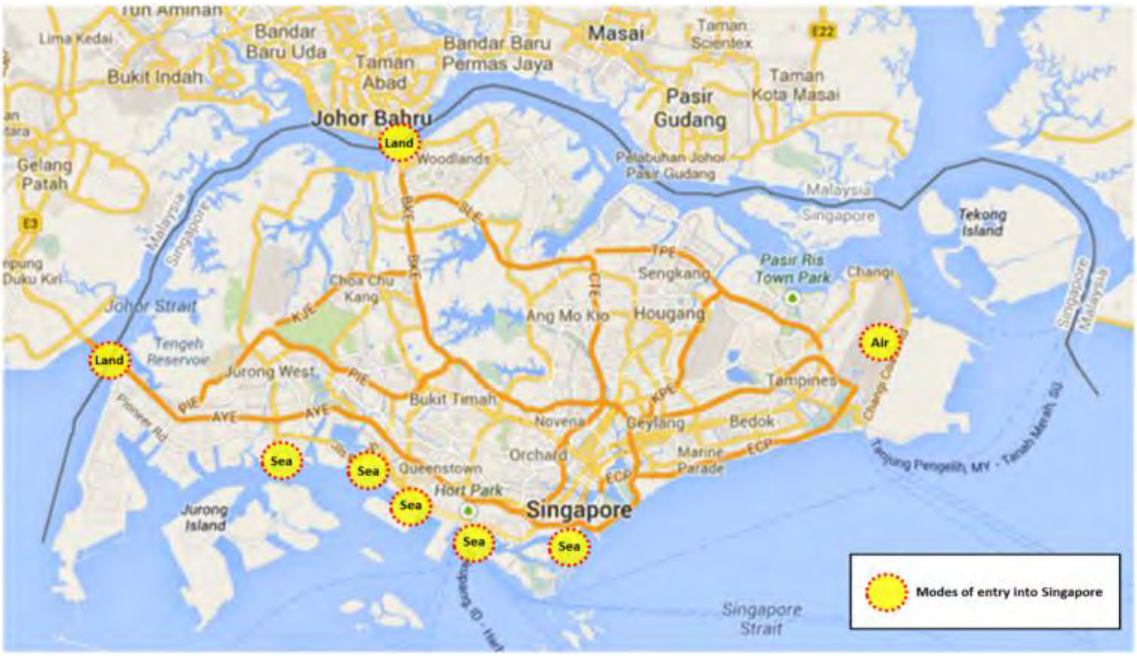
(* The seven entry points to and from the industrial zone are denoted by red circles.)

Source: JAFZA website

Figure 5.4.1.1 Jebel Ali Free Zone

(2) Singapore Free Trade Zone (Singapore)

In accordance with Singapore's Free Trade Zones Act, Singapore is a free port that supervises reshipments, imports and exports. Unlike regular SEZs, which are surrounded by walls, the Singapore Free Trade Zone has no physical barriers or borders. Access by land, sea or air is strictly controlled by the government.



(* The yellow circles within red dotted lines denote modes of entry into Singapore. Entry is monitered on land at the Woodlands and Tuas checkpoints; by sea at the ports of Jurong, Pasir Panjang, Keppel, Tanjong Pagar and Brani; and by air at Changi Airport.)

Source: JICA Study Team

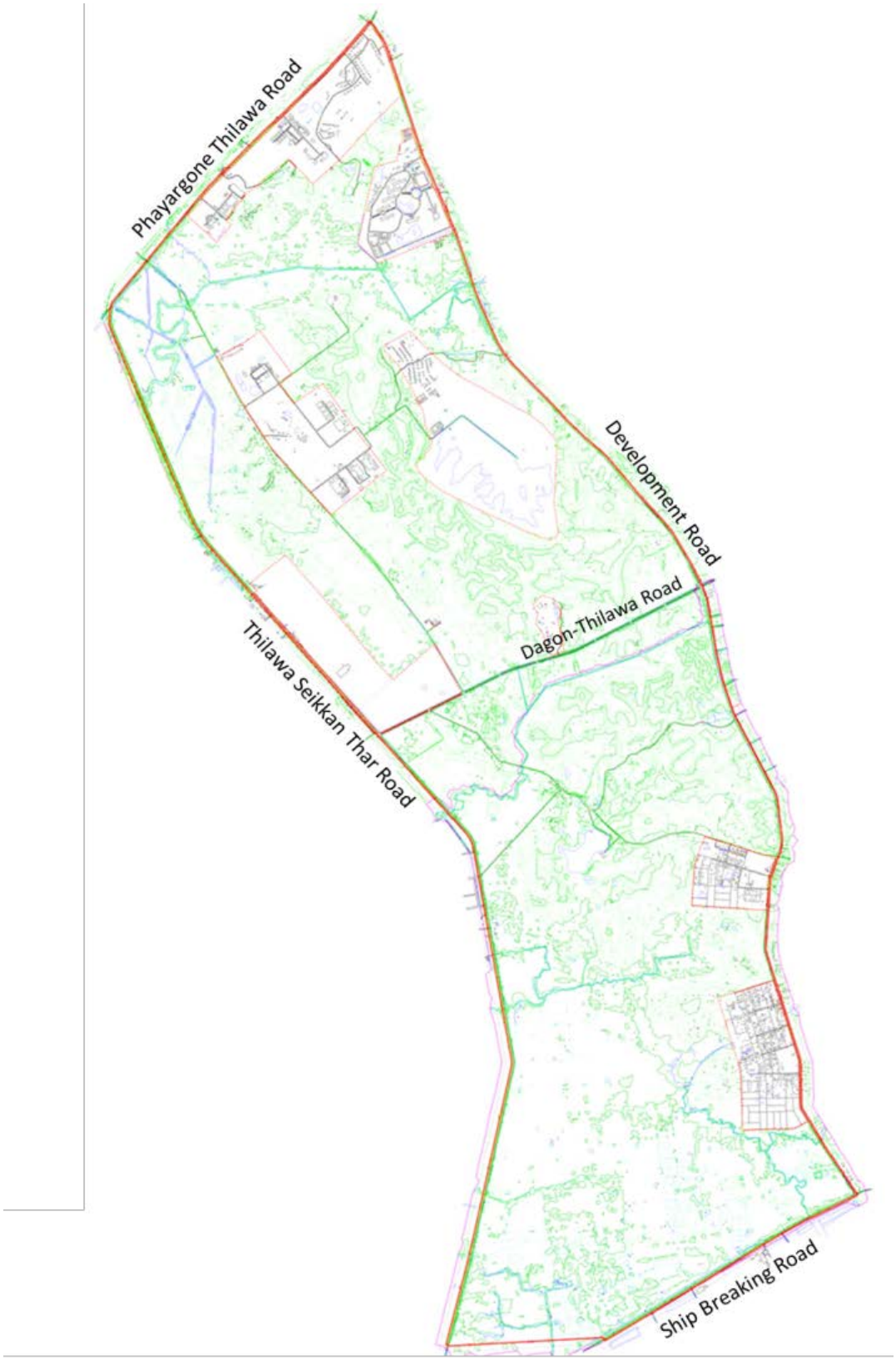
Figure 5.4.1.2 Singapore Free Trade Zone

(3) Ideas behind the management of the Thilawa SEZ's borders

In accordance with Ministry of Construction stipulations, the Thilawa SEZ's official borders are demarcated by five existing roads. As the diagram shows, these are the Phayargone Thilawa Road (north), the Development Road (east), the Ship Breaking Road (south), the Thilawa Seikkan Thar Road (west), and the Dagon Thilawa Road (central).

Of these, the Thilawa Seikkan Thar Road to the west is used for carrying containers to Thilawa Port. Field studies revealed that laborious customs clearance procedures are leading to heavy traffic jams. The other four roads are expected to be built up as part of the Thilawa SEZ and then used for public transportation.

In the basic development plan, the industrial zones are the only part of the Thilawa SEZ to be fenced off, with customs checkpoints set up accordingly. The plan took the Thilawa SEZ's residential zones and streams into account when ensuring that the Thilawa SEZ's other areas are not physically cut off from outside.



Source: JICA Study Team

Figure 5.4.1.3 The road network demarcating the Thilawa SEZ

5.4.2 Land usage

(1) Ideas behind land usage/facility layout within SEZs

It is important that a variety of different land usages are incorporated when developing SEZs. In this way, highly-profitable commercial and residential facilities can compensate for the relatively-low profitability of the industrial zones. This will also enable the needs of each industry to be catered for in a more professional manner.

On this point, so-called next-generation SEZs have started to provide business support services and specialist facilities, so these SEZs are often advanced than their more traditional counterparts. Examples of specialist facilities are outlined below.

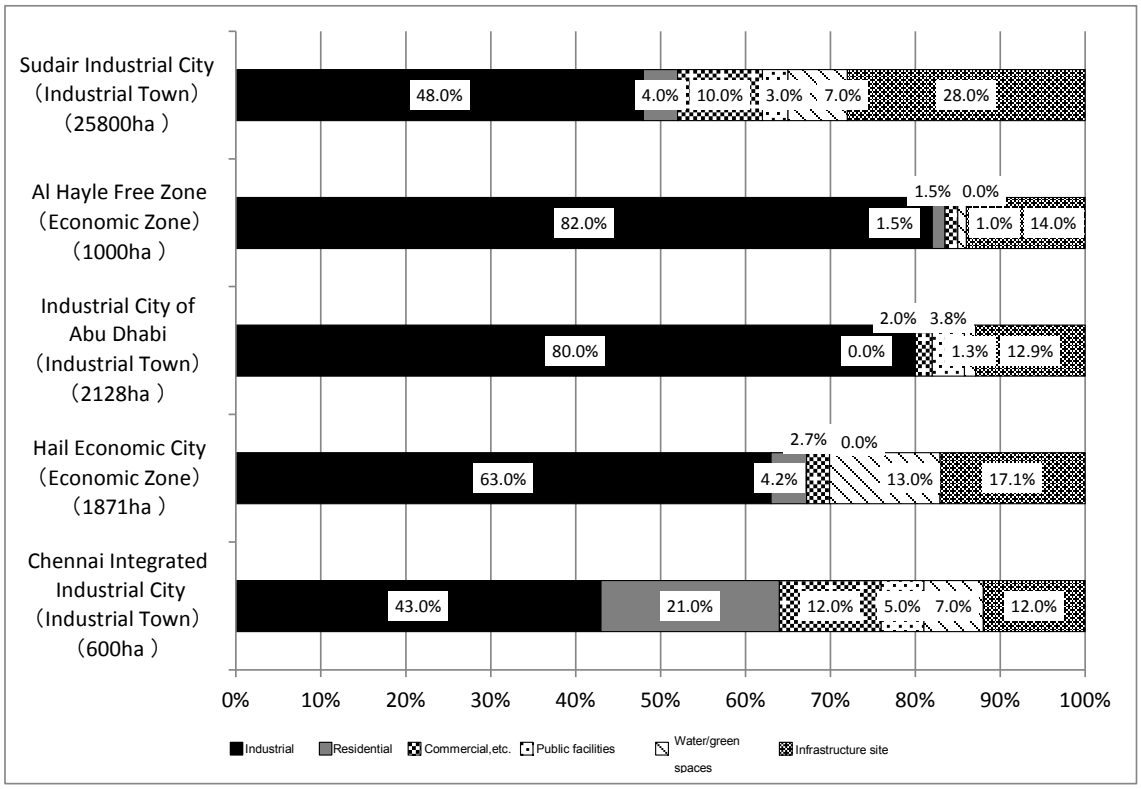
- Childcare facilities
- Healthcare facilities
- Meeting halls
- Exhibition halls
- Shopping centers
- Training facilities
- Emergency shelters
- Repair & maintenance centers
- Public facilities for vulnerable groups in society
- Incubation facilities
- Banks
- Housing
- Customs and trading logistics facilities
- Hi-speed telecommunications services; network facilities

Though the basic development plan for the Thilawa SEZ places manufacturing facilities within certain fenced-off areas, non-manufacturing and other facilities are not fenced off, thus enabling easier access to and from the SEZ.

Based on a specially-formulated law regarding Thilawa SEZ, foreign investors can lease land within the SEZ for a maximum of 75 years.

(2) An international comparison of SEZ developments

From the viewpoint of optimizing land usage within the Thilawa SEZ, the basic development plan analyzed foreign SEZs as benchmarks for land usage. The analysis looked at infrastructure, development areas, and the allocation of land plots according to usage. The following section looks at five comparative examples: the Industrial City of Abu Dhabi and Al Hayle Free Zone in the United Arab Emirates; the Chennai Integrated Industrial Township in India; and the Sudair Industrial City and Hail Economic City (Riyadh) in Saudi Arabia. Outlined below is a breakdown of the concepts, scale and land usage of each SEZ.



Source: JICA Study Team

Figure 5.4.2.1 Land usage at each SEZ

Based on these existing examples, it seems the optimal and most efficient land usage method is to allocate 70% of the land to industrial zones and the remaining 30% for roads, public facilities and green spaces, etc.

The Thilawa SEZ will need reservoirs to prevent flooding and help preserve the waterside environment. It will also need to set aside land for religious purposes. As a result, the basic development plan suggests the land allocated to industrial zones and other zones should be divided by around “6:4.”

(3) Location

The Thilawa SEZ is located next to Thilawa Port in Yangon's southeastern Kyauktan Township. The Strategic Urban Development Plan of Greater Yangon was devised by the Japan International Cooperation Agency (JICA) and the Yangon City Development Committee (YCDC). This plan targets Kyauktan for development and it envisages the upgrading of transportation infrastructure through the renewal of existing road networks and the introduction of an Urban Mass Rapid Transit (UMRT) system, for example. This is likely to have an impact on the Thilawa SEZ's development.

(4) Field survey results

The Thilawa SEZ can be accessed from Yangon via the Thanlyin Bridge and the Dagon Bridge. The Thilawa SEZ also lies next to the Thilawa container port and several existing private-sector industrial development zones. The existing facilities surrounding the Thilawa SEZ could have an impact on plans for the Thilawa SEZ's future expansion.

Several reservoirs and river tributaries are also located in the SEZ's northern portion, so it will be necessary to survey the local ecosystem and take appropriate conservation measures. Conditions in the areas surrounding the SEZ are outlined below.

(* The Thilawa SEZ is the area within the red line.)

Source: JICA Study Team

Figure 5.4.2.2 An overview of the Thilawa SEZ within Kyauktan

Kyauktan is a rural area, though its roads are paved with concrete. Its main industries are agriculture and fisheries.

Figure 5.4.2.3 Streets in Kyauktan today

The Thilawa SEZ area is home to the Myanmar Maritime University and four religious pagodas. The basic development plan also needs to consider traffic routes to these places.

Private-sector development and road construction is also being carried out within the area. There are also factories, though there appears to be no heavy industry.

(* The positioning of the roads in relation to the Thilawa SEZ is denoted by the yellow dotted circle in the box on the top right of the main picture.)

Figure 5.4.2.4 State of roads at the existing Thilawa industrial site on the outskirts of the Thilawa SEZ

Thilawa Bay lies along a river to the west of the Thilawa SEZ. Field surveys confirmed the existence of large-scale industrial facilities along the road running north to south. A 327-ha shipbreaking yard and a shrimp farm lie outside the Thilawa SEZ's southern border. Lumber exporting is also carried out nearby.

(* The positioning of the area relation to the Thilawa SEZ is denoted by the yellow dotted circle in the box on the top right of the main picture.)

Figure 5.4.2.5 Current situation in the Thilawa Bay area

Two 451-ha and 251-ha shrimp farms employing local residents lie alongside the Thilawa SEZ's southern border. The basic development plan for the Thilawa SEZ needs to ensure the Thilawa SEZ does not have a negative impact on these farms.

(* The positioning of the area relation to the Thilawa SEZ is denoted by the yellow dotted circle in the box on the bottom right of the main picture.)

Figure 5.4.2.6 Shrimp farms along the Thilawa SEZ's southern border

The following housing lots for the middle- and upper-classes are being sold in Kyauktan next to the Thilawa SEZ.

Figure 5.4.2.7 New housing in Kyauktan next to the Thilawa SEZ

(5) SWOT analysis

A SWOT analysis of the Thilawa SEZ was carried out. The results are as follows.

Source: JICA Study Team

Figure 5.4.2.8 SWOT analysis of the Thilawa SEZ

Outlined below are the “strengths” and “opportunities” identified by the Thilawa SEZ SWOT analysis.

Table 5.4.2.1 The Thilawa SEZ’s strengths and opportunities

Strengths	Good connectivity from Yangon	The Thilawa SEZ is connected to Yangon via the Kyauktan-Thanlyin Bridge and the Dagon Bridge
	Good alternative site from Yangon	The Thilawa SEZ is located approximately 20 km from central Yangon; it will help to disperse congestion from the central area
	Proximity to manpower & ready labor	The Thilawa SEZ will be able to obtain manpower (or potential manpower) from Kyauktan and Thanlyin
	Generally regular-shaped boundary	The Thilawa SEZ sits on a long, continuous stretch of land running north to south, so land plots can be developed
Opportunities	Future road and rail connectivity in the pipeline	Road networks are scheduled for an upgrade in the development plan for Yangon. Existing rail lines will also be upgraded in order to facilitate the transportation of passengers and freight to Thilawa Port and the Thilawa SEZ.
	UMRT system to be put in place	A UMRT system will be put in place in Kyauktan. This will improve connectivity between Kyauktan and the Thilawa SEZ.
	Existence of reservoirs	If developed properly, these could provide a green belt to Thilawa’s industrial zones

Source: JICA Study Team

Outlined below are the “weaknesses” and “threats” identified by the Thilawa SEZ SWOT analysis.

Table 5.4.2.2 The Thilawa SEZ’s weaknesses and threats

weaknesses	Landlocked location	The current location will not be able to meet demand for future expansion
	Bounded by existing developments	This could impede integrated development and connectivity between the SEZ and outside
	Located in low-lying flood prone areas	Expensive retention ponds will need to be built to prevent flooding
Threats	Competition may pose some threat to business.	The Thilawa SEZ will face competition from Yangon’s pre-existing industrial zones

Source: JICA Study Team

5.5 Examination process

This section will set out the process used to examine the basic plan for land usage / development in the Thilawa SEZ.

5.5.1 First proposition

When formulating the first proposition, the following points were considered as basic points of understanding with regards to the usage of the 2,000 ha of land in the Thilawa SEZ.

- Development should take into consideration the pre-existing industrial facilities outside the Thilawa SEZ's borders and the natural areas, rivers and streams in the northern part of the advanced development area, Zone A.
- The roads serving as the SEZ's borders should be developed from a medium- to long-term perspective that considers future development in the surrounding area.
- Roads within the SEZ should be developed in a manner that allows plot sizes to be adjusted to meet the needs of participating companies and investors, based on the results of market research.
- Related facilities should not merely be composite facilities furnished with commercial and residential functions; they should be set up to serve functions deemed essential for the SEZ. The basic development plan envisages the concentration of related facilities in two locations, so the proximity (distance) between these locations should be fully considered.
- For security reasons, residential zones should be gated and surrounded by fences. However, they should also have good access to other areas without needing to pass through customs checkpoints.

Based on these points, two basic options were considered with regards to the framework for the basic plan for land usage/development. The main differences between the two options are: the different degrees of land efficiency due to the layout of roads within the Thilawa SEZ; and features that occur due to various other considerations.

A review of the two options suggested that while Option 2 was preferable from the perspective of ensuring larger parcels of land for industrial use, Option 1 was preferable because of the way it allows for a road linkage between the northern and southern industrial zones via the advanced development area, Zone A.

As a result, it was concluded that a hybrid of Options 1 and 2 would provide the best basic framework for the Thilawa SEZ.

Outlined below is an outline of the comparative review of Options 1 and 2.

Option 1	Option 2
	
1. Land efficiency achieved: 70%	1. Land efficiency achieved: 72%
2. Wider Main Loop system: This is to accommodate roadside parking in the future.	2. Three Main Spine system: This is to channel and distribute the expected high volume of industrial traffic within the industrial zone.
3. There is flexibility for large MNCs or big investors to take up large parcels as big as 20 ha in size.	3. Larger parcels are purposely planned to allow for easier configuration for major investors and flexibility for internalized linkages to allow for SMEs.
4. Option 1 allows for a possible link through the 400 ha Zone A site and to the northern part of the TSEZ.	4. Option 2 conceptualizes two distinct parcels for the TSEZ, delineating a clear boundary between the northern and southern areas of the TSEZ.

Source: JICA Study Team

Figure 5.5.1.1 Thilawa SEZ land usage: Comparative review of Options 1 and 2

Table 5.5.1.1 Thilawa SEZ land usage: Comparative review of Options 1 and 2 (land area by usage)

Land Use	OPTION 1		OPTION 2	
	Area (ha)	%	Area (ha)	%
Overall TSEZ boundary	*2,887*	*100*	*2,887*	*100*
Bonded Zone	*1,508*	*52*	*1,500*	*52*
Industrial	1,209	42	1,223	42
Commercial	5	0	5	0
Mixed Use	23	0.8	23	0.8
Residential	110	3.8	110	3.8
Workers' village	22	0.8	23	0.8
Institutional	5	0	5	0
Civil Defence	1	0	1	0
Customs Checkpoints	16	0.3	9	0.3
Green & open space	63	2.2	47	1.6
Retention ponds	177	6	178	6
Roads	288	10	295	10
400-ha Industrial Park	443	15	443	15
Other Existing Use	525	18	525	18

Source: JICA Study Team

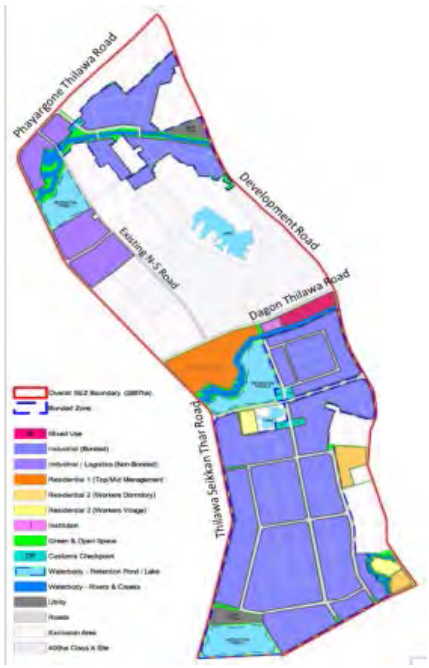
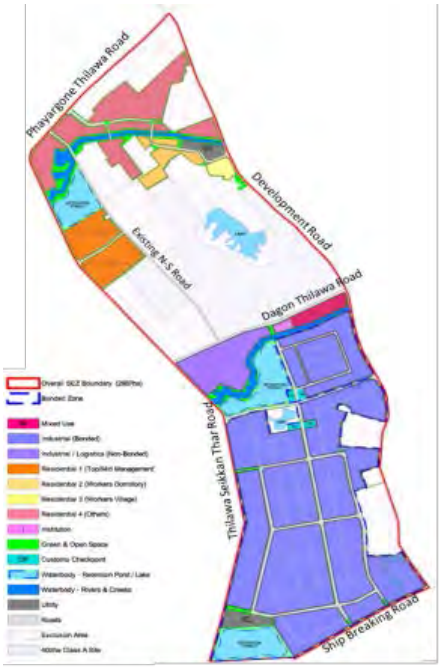
5.5.2 Revisions based on exclusion area stipulations and environmental preservation considerations

After reviewing the first proposition (Options 1 and 2), a survey of environmental and social considerations was then carried out. This confirmed that religious pagodas, river tributaries and local ecosystems exist in the area earmarked for the Thilawa SEZ. These are the kind of components that could have a major impact on the layout of the various facilities within the SEZ, so the first proposition was revised based on exclusion area stipulations and environmental preservation considerations.

Table 5.5.2.1 Revisions based on exclusion area stipulations and environmental preservation considerations in the Thilawa SEZ

[New exclusion area stipulations] ・ Ministry of Industry power distribution plant [0.849 ha] ・ Area appropriated for the factory construction by Ministry of Industry [15.39 ha] ・ Myanmar Economic Cooperation's galvanized iron sheet factory and shoe factory [42.26 ha] ・ Church [0.2998 ha] ・ Phalankanoo Monastery [1.091 ha] ・ Phalanywaroo Pahayalay Monastery [1.052 ha] [Revisions due to environmental preservation considerations] ・ Aiyun Zok C and the river tributary ・ Shwe byauk C and the river tributary ・ The south-most east corner river tributary off 'Thi da Maying' ・ South lake surrounding Site 13 – Phalankanoo Monastery

Source: JICA Study Team

REVISED OPTION 1	REVISED OPTION 2
	
1. Optimized as a 'Special Economic Zone'. • Efficiently allocates industrial plots in line with market study recommendations. • Areas are secured for essential supporting facilities (residential, commercial, education, medical etc.) • Industrial areas can be segregated by physical fences with controlled access via customs checkpoints.	1. Essentially, Option 2 comprises the same traits as Option 1 except that the residential areas are no longer decentralized but rather centralized into one location; i.e. located to the north of the TSEZ.
2. Water areas and public access areas are preserved. Locations of retention ponds are downstream of the TSEZ, with final discharge flowing to Yangon River to the west of the TSEZ. The reserved creeks are to be widened to act as main drainage route.	2. This arrangement resulted in reduction of industrial land area, while the number of residents in the TSEZ increased by 40,000.
3. Maximized rectangular-shaped plots for industry use. Utilizes residual areas for non-industrial usages.	
4. Can be bonded into three zones with controlled access via customs checkpoints while Residential and Mixed Use areas are out of bonding concepts for easier access.	
5. As the TSEZ is a longish site, the main spine road is designed based on North-South direction with a primary loop system, with parallel secondary roads to link up to smaller parcels.	

Source: JICA Study Team

Figure 5.5.2.1 Revisions based on exclusion area stipulations and environmental preservation considerations (Options 1 and 2)

Table 5.5.2.2 Thilawa SEZ land usage: Comparative review of Revised Options 1 and 2 (land area by usage)

Land Use	REVISED OPTION 1		REVISED OPTION 2	
	Area (ha)	%	Area (ha)	%
Overall TSEZ boundary	*2,887*	*100*	*2,887*	*100*
TSEZ excluding Exclusion Areas (671ha) & Zone A (400ha)	*1,819*		*1,819*	
Bonded Zone (including roads)	*1,229*	*68*	*1,060*	*58*
Industrial (Bonded)	856	47	766	42
Industrial (Non-bonded)	130	7	79	4
Mixed Use	21	1	21	1
Residential (Top/ Middle Management)	110	3.8	110	3.8
Residential (Workers' Quarters)	32	2	31	2
Residential (Workers' Village)	20	1	11	1
Residential (Others)	0	0	156	9
Institutional	5	0	5	0
Customs Checkpoints	12	1	8	0
Green & open space	140	8	143	8
Water body - Retention ponds	132	7	132	7
Water body – Rivers & creeks	65	4	65	4
Roads	295	16	287	16
Utilities	31	2	31	2

Source: JICA Study Team

After the revisions (due to exclusion area stipulations and environmental preservation considerations), an area of 986 ha and a total of 440 plots becomes available for industrial usage in Option 1 (the option with more land for industrial usage). It is envisaged that this will enable the Thilawa SEZ to meet the various needs of candidate companies and prepare large plots of land for core participating companies, while also allowing for the preparation of smaller plots and rental factories to enable small-sized tenants to swiftly commence operations.

Table 5.5.2.3 Option 1: Industrial land plot sizes and numbers (by industry)

Plot Size (in hectares)	No. of plots	Industry examples
Less than 1.5 ha	264	Food & Beverages, Construction materials, Chemicals, Electrical & Electronics, Machinery & Equipment, Wood and wood-related products and Logistics.
1.6 – 2.5 ha	95	Automotive, Logistics.
2.6 – 3.5 ha	25	Textiles, Construction materials, Electrical & Electronics, Machinery & Equipment, and Wood and wood-related products.
3.6 – 4.0 ha	13	Food & Beverage
4.1 – 8.0 ha	24	Automotive
8.1 – 10.0 ha	13	Automotive
More than 10.0 ha	6	Automotive
Total	440	

Source: JICA Study Team

5.5.3 Revisions following the examination of Zone B development

After the above-mentioned revisions were implemented, a proposal was made to set aside land for a Zone B as an area to be developed in advance, following on from the advanced development area, Zone A. Based on this, the basic plan for land usage/development across the entire Thilawa SEZ was reviewed. The opinions of the Ministry of Construction were also solicited with regards to the draft plan under consideration.

The main opinions of the Ministry of Construction and other related parties with regards to the draft plan under consideration are outlined below.

Table 5.5.3.1 Main opinions of related parties with regards to the draft basic plan for land usage/development

[Main opinions of the Ministry of Construction]

- Pay sufficient attention to the preservation of the Thilawa SEZ's rivers and the installation of functions to discharge water outside the SEZ.
- While aiming to minimize the land set aside for residential zones, potential demand for employee housing should be examined closely. Residential zones should also be constructed alongside rivers to create a pleasant living environment.
- Connectivity and proximity to ports should be considered when setting aside land plots for logistics purposes.
- The plan should consider infrastructure such as water treatment and drainage facilities.
- The railway network should be upgraded to serve as a transportation link between Yangon and Thilawa.

[Main opinions of other related parties]

- Following on from the advanced development area, Zone A, the plan should examine the idea of developing a new advanced development area Zone B in the northern part of the Thilawa SEZ's southern section.
- While re-examining residential density, revise the Thilawa SEZ employee forecast from 213,149 to 142,244.
- There is likely to be strong demand for housing development within the Thilawa SEZ, so set aside area for two residential zones within the Thilawa SEZ.
- There are discussions about building a coal-fired power plant next to the Thilawa SEZ, so land needs to be set aside for piling up the coal ash produced by the plant.

Source: JICA Study Team

When revising the draft plan based on these opinions, the following principles were confirmed with parties involved in the development of the Thilawa SEZ. Furthermore, the framework of the basic plan for land usage/development was also approved by related parties from Japan and Myanmar, provided that the plan: 1) Ensure the integration of the excluded zones with the overall SEZ; 2) Consider the development of a peripheral road around the Thilawa SEZ; 3) Examine the phasing of residential zone development with an eye on the progress of development in the advanced development areas (Zone A and Zone B).

Table 5.5.3.2 Basic principles with regards to the revisions to the draft basic plan for land usage/development

- Following on the advanced development area, Zone A, the new advanced development area, Zone B should be excluded from the basic development plan for the entire Thilawa SEZ.
- The logistics zone should be installed alongside the harbor in the southern part of the Thilawa SEZ's western section.
- All rivers within the Thilawa SEZ should be preserved.
- The northern section of the Thilawa SEZ should be set aside mainly for residential plots.
- The northern part of the Thilawa SEZ's southern section should be set aside as reserve site/mixed use area for logistics and transportation facilities. The area should also be considered as a potential transportation hub for the region around Thilawa or as land to be used for other complementary purposes.
- The residential zone for workers should be located on the eastern side of the Thilawa SEZ.
- Land for storing coal ash should be set aside on the Thilawa SEZ's southwestern tip.

Source: JICA Study Team

5.6 Outline of the basic development plan

The basic development plan was formulated based on the aforementioned review. The ideas behind the land-usage layout in the basic development plan are as follows.

Firstly, a clear distinction was made between industrial sites and residential lands, with residential areas (with some exceptions) essentially concentrated in the northern section of the SEZ.

Secondly, the commercial lands and residential lands for workers were located close to the eastern entrance to the SEZ with an eye on ensuring future connectivity with the area outside the Thilawa SEZ.

The industrial site was placed in the southern portion of Zone B. Roads were set out to enable the installation of a greater number of standardized plots within the SEZ.

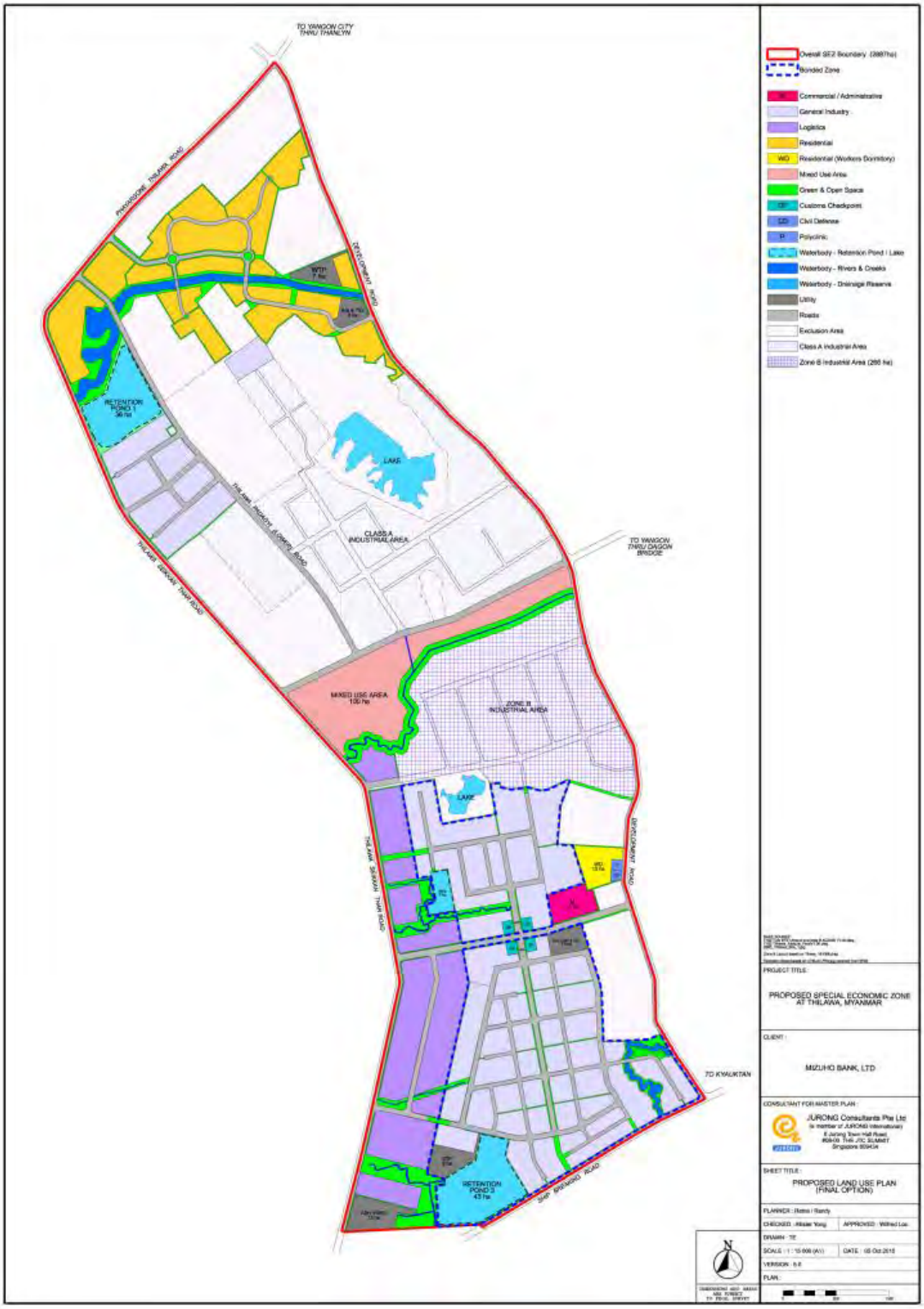
Reserve site for rail transportation facilities was placed in the mixed use area in the central part of the SEZ. It is envisaged that the area will be become a transportation hub for the surrounding region in future.

A polyclinic and private security facilities were installed on the eastern side of the SEZ, next to the residential land for workers. Based on a request from government officials in Thilawa, the polyclinic is also expected to be open to residents living in residential areas outside the SEZ (those set for development alongside Development Road on the SEZ's eastern side), rather than just for workers within the Thilawa SEZ. Furthermore, the private security facilities will be installed outside the customs checkpoints so they can reach anywhere within the Thilawa SEZ during emergencies.

Table 5.6.1 Land usage in the basic development plan (land area by usage)

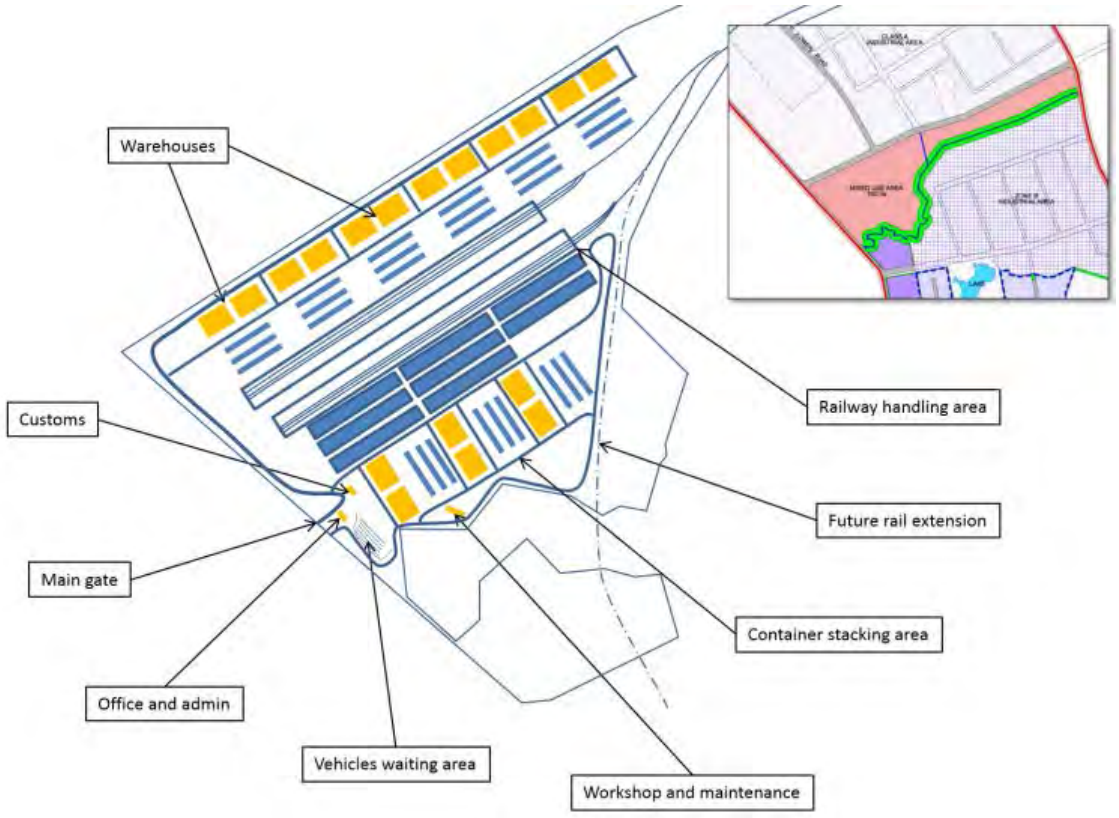
Land Use	FINAL OPTION	
	Area (ha)	%
Overall TSEZ boundary	*2,887*	-
TSEZ excluding Zone A, Zone B & Exclusion Area (net)	1,461	100
Industrial (General)	468	32
Industrial (Logistics)	171	12
Commercial/ Administrative Office	11	1
Mixed Use Area/ Reserve Site	100	7
Residential	185	13
Residential (Workers' Dormitory)	12	1
Customs Checkpoints	5	0
Green & open space (including rivers and creeks)	214	15
Civil Defence	1	0
Polyclinic	1	0
Retention Pond	85	6
Drainage Reserve	3	0
Major Utilities (including Ash Yard)	44	3
Roads (JURONG's proposed roads only)	161	11
Saleable Land	*948*	*65*
Non-saleable Land	*513*	*35*

Source: JICA Study Team



Source: JICA Study Team

Figure 5.6.1 Basic development plan: Land-usage layout



Source: JICA Study Team

Figure 5.6.2 Image of the layout of logistics facilities (railways) within the Thilawa SEZ

5.6.1 The industrial area

Land usage within the industrial area was categorized by industry sector while taking into account the candidate industries examined through market research.

The layout within the industrial area needs to be harmonized in a manner that takes into account the characteristics of each industry. Based on Singapore's example, industry can generally be divided into three categories: 1) Light industry, 2) general industry and 3) special industry. The Thilawa SEZ's eight candidate industries fall under the headings of either light industry or general industry.

- Light industry: Industry that does not produce large volumes of discharge or waste; does not produce loud, continuous noise; or does not use large amounts of harmful substances (solvents, acids or other chemicals). This includes textiles and clothing manufacturing that does not involve dyeing, bleaching or other finishing treatments.
- General industry: General manufacturing, including final-product manufacturing / assemblage and parts assemblage.
- Special industry: Industry that could cause heavy pollution (refineries, petrochemical / chemical factories, treatment facilities for harmful, industrial waste, etc.).

Light, general and special industry can generally be placed in close proximity to each other, though the food industry requires special handling in order to avoid any contamination from nearby manufacturing. In order to prevent such contamination, it is advisable that the food industry be located in a special zone of its own.

The food industry can be divided into three categories based on scale and business activity.

- Light food: Packaging of dried foods; preparation of food materials and ingredients; bottling of syrup/juices
- General food: Manufacturing of foodstuffs, including food processing
- Special food: Meat dressing, preservation and canning; seafood processing and preservation; dairy products

When allocating an area for the food industry, the first thing is to ensure it is not located near special industry. Furthermore, a distance of 50 m is advisable when locating the industry next to general industry. In general, it is possibly to maintain distance by setting back the roads and plots in SEZ.

5.6.2 Non-industrial area

The non-industrial area accounts for a total of 315 ha, or 21% of the Thilawa SEZ's total area, once exclusion areas are removed from the equation. At 185 ha, residential areas account for the lion's share of this land.

Table 5.6.2.1 Land usage by category in the non-industrial area

Land Use	FINAL OPTION	
	Area (ha)	%
Commercial/ Administrative Office	11	3
Mixed Use Area/ Reserve Site	100	32
Residential	185	59
Residential (Workers' Dormitory)	12	3.8
Customs Checkpoints	5	1.6
Civil Defence	1	0.3
Polyclinic	1	0.3
TOTAL	315	100

Source: JICA Study Team

(1) Residential areas

The residential areas are expected to include three types of housing.

It should be possible to create a pleasant living environment by locating family-type housing for managers or mid-ranking employees next to the river in the northern part of the SEZ. On the other hand, if single-occupancy apartments or dormitories for general workers are placed in the southern part of the SEZ, this will ensure easy access to the industrial site.

The residential capacity is expected to be between 33,000–82,000.

Table 5.6.2.2 Outline of residential areas

Residential typology	Land area (ha)	Storey Height	Capacity		Classification of occupants
			No. of Households	No. of residents	
Semi-Detached units	185	2 to 3 storeys per unit	5,310	21,240	Top/Middle Management
Apartments		12 to 15 storeys per block	15,930	63,700	
Apartments & Dormitory	12	Up to 6 storeys	-	12,000 to 18,000	General workers (singles)

Source: JICA Study Team

Source: Horizon Hills Singapore website; JICA Study Team

Figure 5.6.2.1 Image of housing for managers or mid-ranking employees

Source: JICA Study Team

Figure 5.6.2.2 Image of housing for general workers

Source: JICA Study Team

Figure 5.6.2.3 Concept of residential area for general workers

(2) The commercial area

11 ha in the center of the Thilawa SEZ's southern part has been set aside for the commercial area. It is envisaged that the zone will feature one large building that houses commercial facilities, corporate headquarters and the head office of the SEZ management company; or that the zone will be divided up into office buildings and shopping malls, etc.

Source: URA Singapore website; JICA Study Team

Figure 5.6.2.4 Images of commercial facilities and shopping malls

(3) The mixed use area/reserve site for rail transportation facilities

It is thought the central part of the Thilawa SEZ would be an effective location for the mixed use area/reserve site for rail transportation facilities. 100 ha has been set aside, with the existing railway network expected to grow in future and the area expected to become a transportation hub. It also faces the Dagon-Thilawa Road, which cuts through the center of the SEZ from west to east. This is expected to increase connectivity with subsequent commercial area developments.

Source: JICA Study Team

Figure 5.6.2.5 Location of the mixed use area

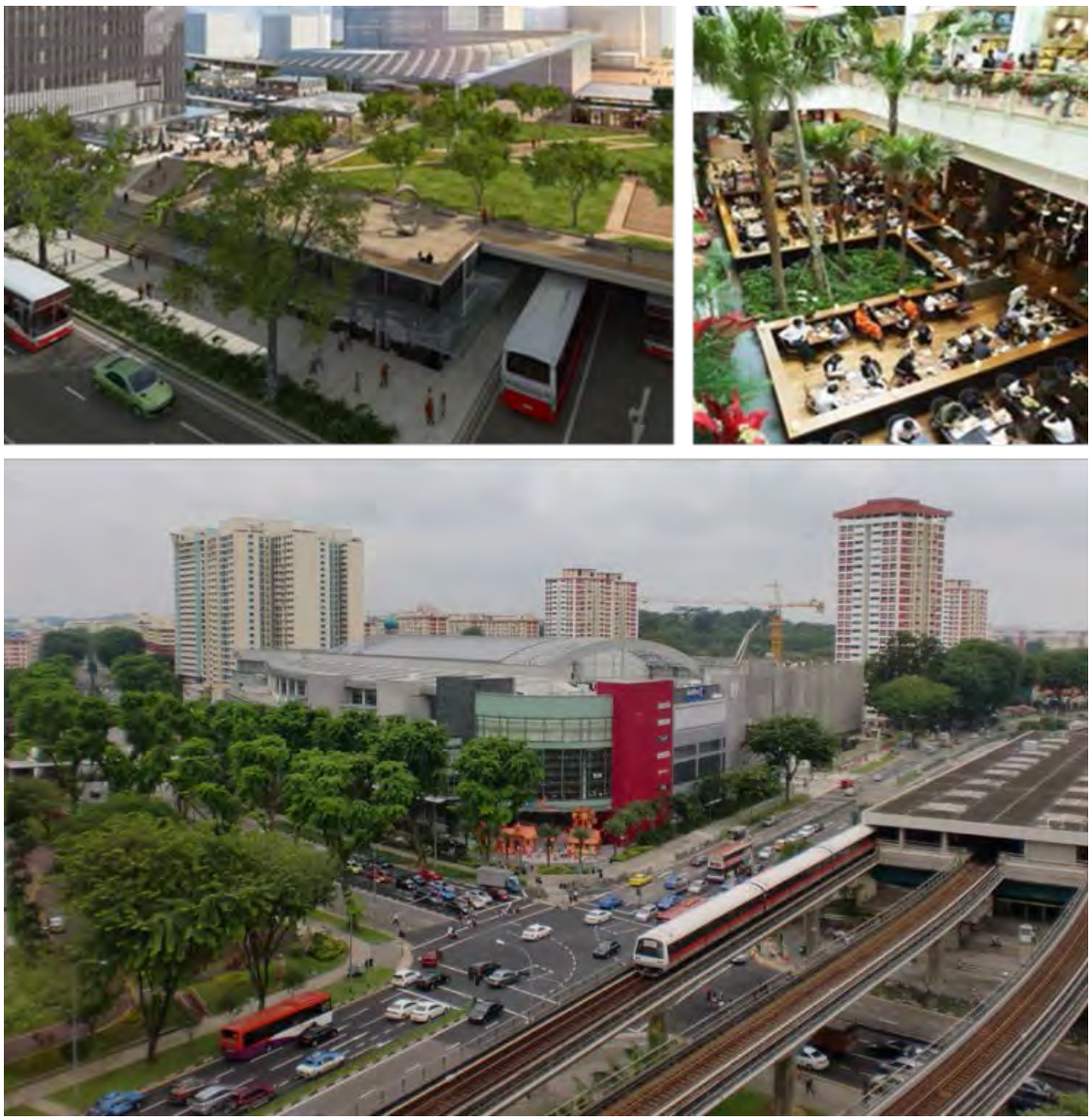


Figure 5.6.2.6 Image of the Thilawa SEZ transportation hub (Example: Singapore)

(4) Green spaces/water bodies

The Ministry of the Environment has requested that the natural ecosystem be preserved, so it will probably be effective to conserve and maintain the green spaces and water bodies using the Thilawa SEZ's existing nature and rivers. Based on the topography of the land earmarked for the SEZ, it will also be important to maintain reservoirs in order to prevent flooding.

214 ha have been set aside for the preservation and maintenance of green spaces and water bodies. This is equivalent to around 15% of the SEZ's area, once exclusion areas are removed from the equation.

Source: URA Singapore website

Figure 5.6.2.7 Image of green spaces within the Thilawa SEZ

Source: JICA Study Team

Figure 5.6.2.8 Location of green spaces/water bodies

5.6.3 Transportation infrastructure

The basic development plan for the Thilawa SEZ envisages the integrated use and development of land for industrial, commercial and residential purposes. It is expected to attract 213,000 workers. 77,000 of these are expected to live within the SEZ, with the remainder of just under 140,000 workers living in nearby Thanlyin and Kyauktan. The population of Thanlyin is expected to surge from 181,000 at present to 785, 000 by 2030, with Kyauktan's population expected to swell from 48,000 to 108,000 during the same period. As a result, it seems some public transport facilities connecting the Thilawa SEZ to these residential areas will need to be developed.

A bridge across the Bago River will also be needed to connect the Thilawa SEZ with Yangon. The shortest journey between Yangon and the Thilawa SEZ involves crossing Thanlyin Bridge (rail and road). This only has one lane on each side and can only carry up to 30 tons. As a result, freight transportation vehicles need to use the Dagon Bridge, located 6.5 km east of Thanlyin Bridge. Routes across the Bago River will need to be developed and upgraded in advance of the development/opening of the Thilawa SEZ.

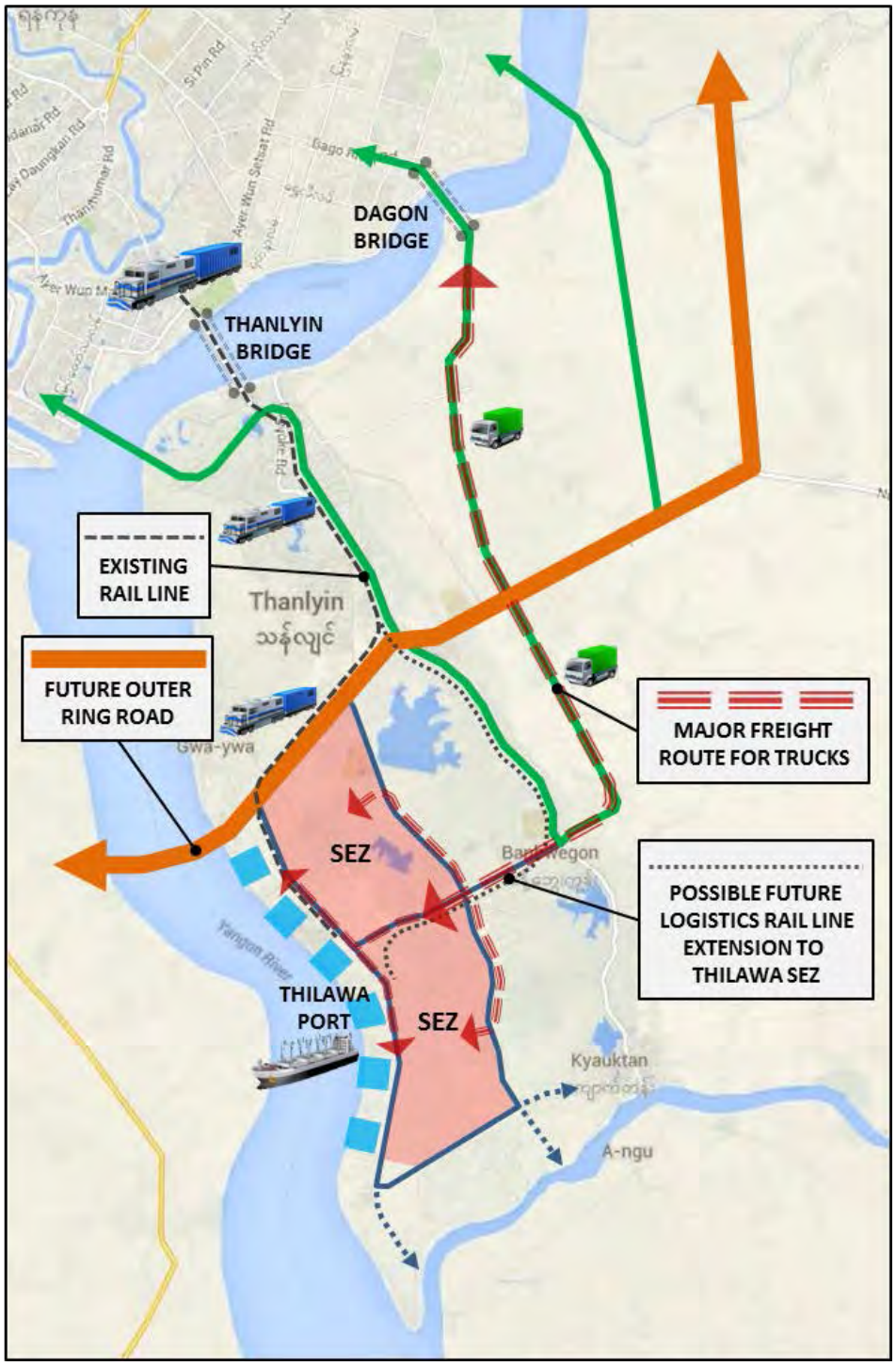
Furthermore, Thilawa Seikkan Thar Road, located on the Thilawa SEZ's west side next to the harbor, is heavily congested, so it will need to be expanded.

Figure 5.6.3.1 Traffic congestion on Thilawa Seikkan Thar Road

(1) Concept of transportation routes to the Thilawa SEZ

Freight is mainly expected to be delivered by truck between the Thilawa SEZ, the harbor and Yangon. In the short to medium term, the main route is likely to be along Dagon Bridge. In the long term, though, road infrastructure is expected to be upgraded due to the development of the outer ring road. Furthermore, the further development of rail routes to the harbor will boost passenger and freight transportation between the SEZ, the harbor and Yangon.

The Thilawa SEZ's freight transportation system will mainly center on trucks in the short to medium term, though rail transportation routes are expected to be developed in the long term.

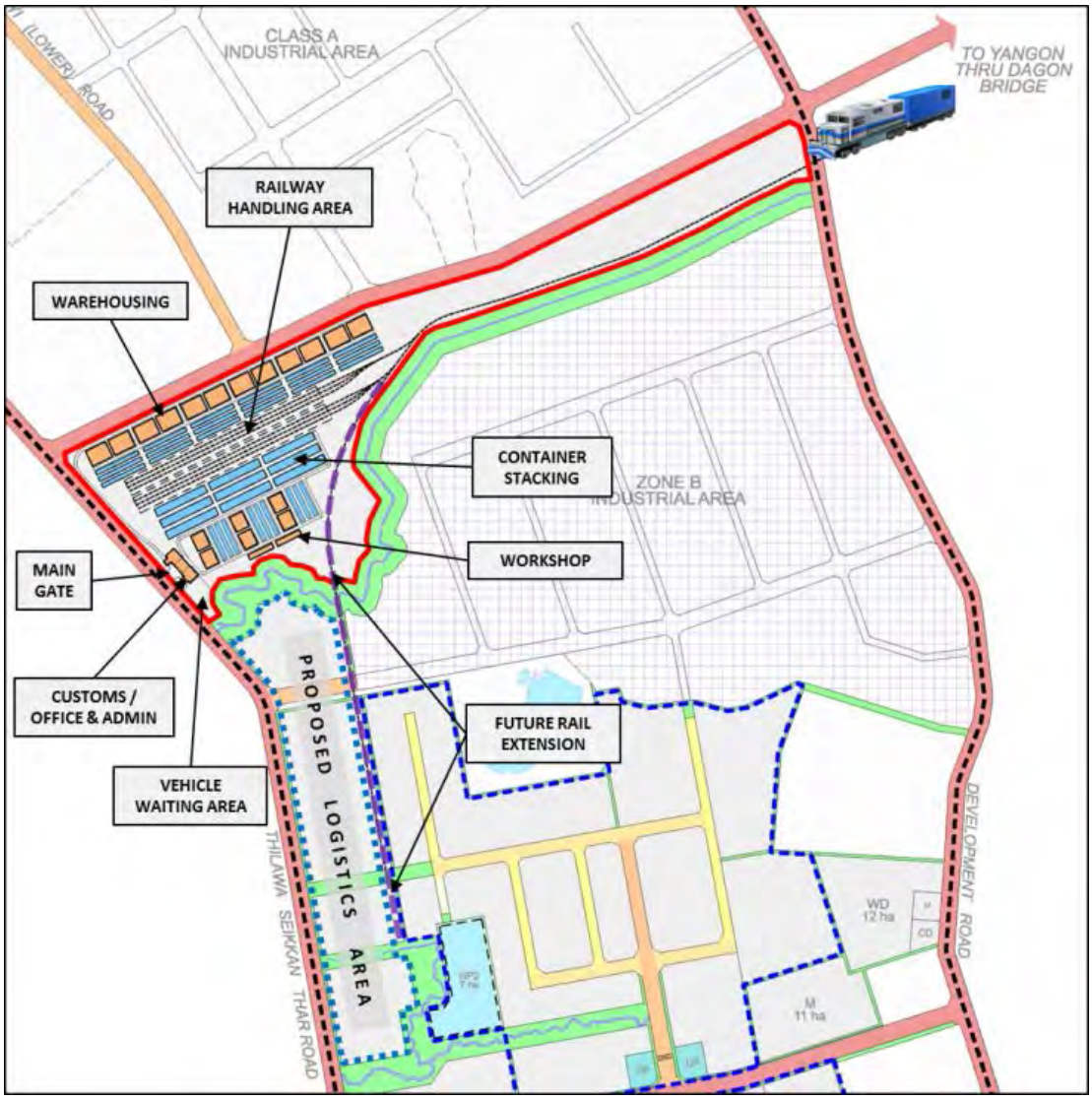


Source: JICA Study Team

Figure 5.6.3.2 Concept of transportation routes to the Thilawa SEZ

(2) Development of the Thilawa SEZ's railway infrastructure

The mixed use area/reserve site for rail transportation facilities is expected to serve as the arrival/departure area for trucks carrying freight along Thilawa Seikkan Thar Road. It will also be fitted with a rail freight handling area, warehouses, container terminals, customs offices and administration facilities. It will also be possible to extend the rail line to the southern logistics area.



Source: JICA Study Team

Figure 5.6.3.3 Image of the Thilawa SEZ's railway infrastructure

(3) The Thilawa SEZ's road network

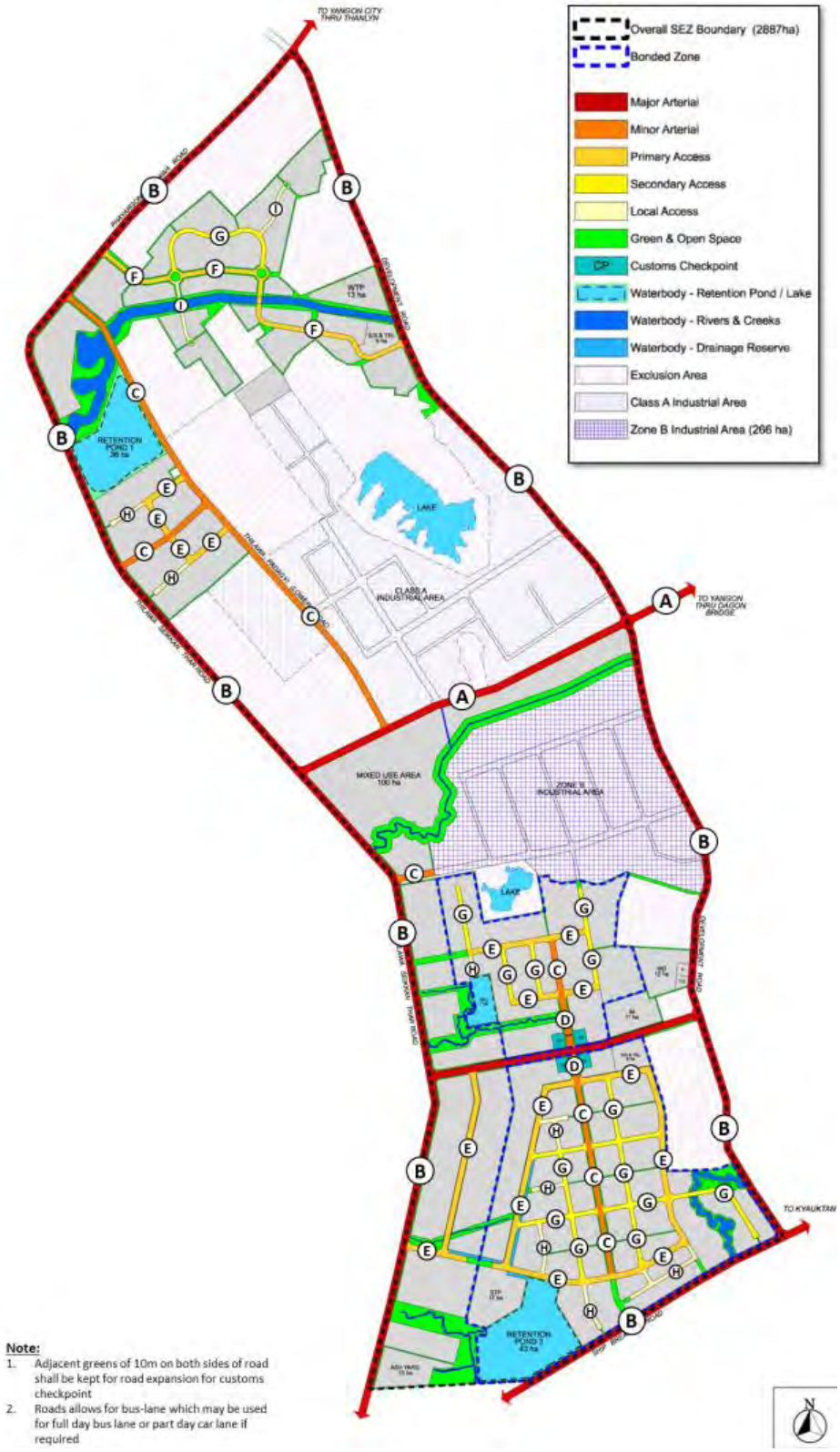
Thilawa SEZ workers are expected to commute by public transport, with executives and managers also coming to work in passenger vehicles. As a result, the basic development plan envisages the development of five categories of roads within the SEZ, from major arterial roads to minor roads connecting each individual zone. All the roads will feature automobile lanes 2.5 m wide, with roads in the industrial zone also equipped with parking.

Table 5.6.3.1 Road categories in the Thilawa SEZ

ROAD CATEGORIES	REF	TYPE	RIGHT OF WAY RESERVE (M)	LANES PER DIRECTION
Major Arterial	**A**	Dual 3 with BRT	60	3
Major Arterial	**B**	Dual 4 with Bus Lane	60	4 + Bus lane
Minor Arterial	**C**	Dual 3	47	3
Minor Arterial	**D**	Dual 3 with Bus Lane	59.4	3 + Bus lane
Primary Access	**E**	Dual 2 with Parking	46.8	2 + Parking
Primary Access	**F**	Dual 2	39.8	2
Secondary Access	**G**	Undivided 4 Lanes	35.8	2
Local Access (Industry)	**H**	Undivided 2 Lanes	31	1
Local Access (Res)	**I**	Undivided 2 lanes	28.4	1

Source: JICA Study Team

Figure 5.6.3.4 Image of roads in the Thilawa SEZ (Example: The road next to Singapore's container terminal)



Source: JICA Study Team

Figure5.6.3.5 The Thilawa SEZ's road network

(1) The placement of green reserves to allow for road expansion

The basic development plan envisages the development of green reserves running alongside roads passing thought the bonded area's gate. These will allow for an expanded number of lanes should trucks end up queuing to pass through the gate.

Source: JICA Study Team

Figure 5.6.3.6 Green reserves will be placed alongside the road heading to the bonded area's gate

Source: JICA Study Team

Figure 5.6.3.7 Image of the bonded area's gate

Green reserves will also be placed in each location to allow for road lengthening or expansion should the need arise for improved connectivity and access between each zone in the Thilawa SEZ in future.

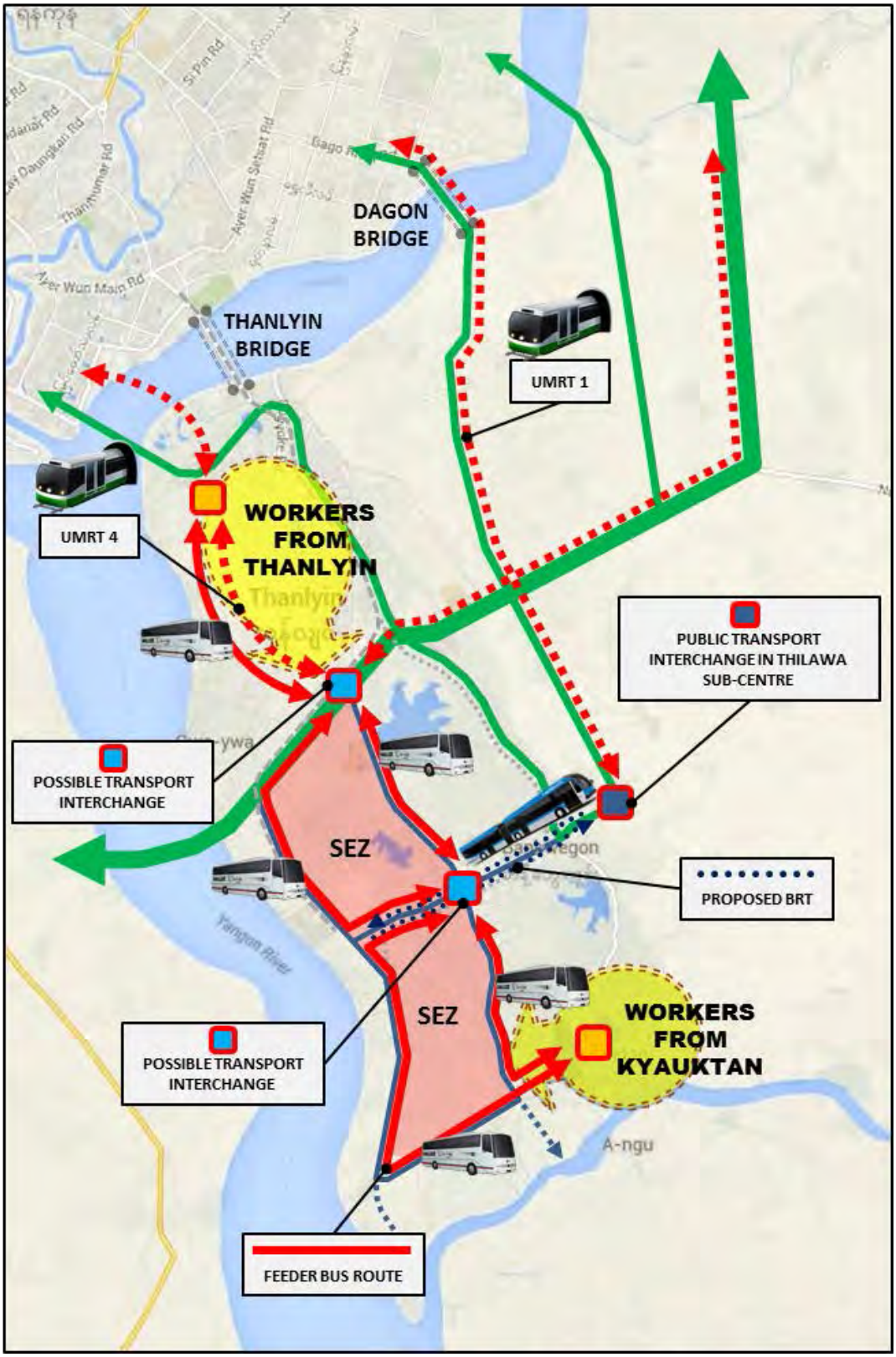
Source: JICA Study Team

Figure 5.6.3.8 Placement of green reserves should the need arise for improved connectivity and access between each zone

(5) Public transport to the Thilawa SEZ

The basic development plan envisages the connection of two UMRTs to the Thilawa SEZ. UMRT1 will terminate at the Thilawa Sub-center, with a Bus Rapid Transit (BRT) system then providing transportation between the Thilawa Sub-center and the SEZ. The other UMRT is expected to connect to the Thilawa SEZ's northern section.

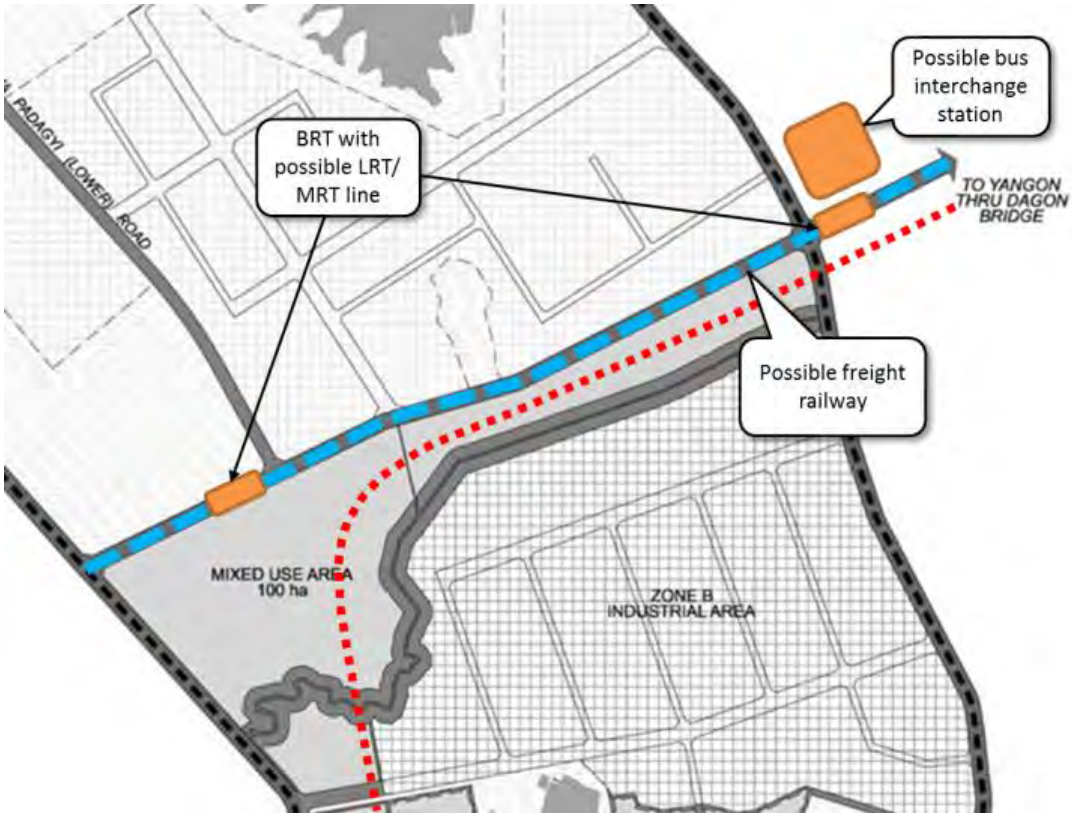
The UMRT stations are expected to serve as interchanges for buses and other forms of public transport travelling within the SEZ.



Source: JICA Study Team

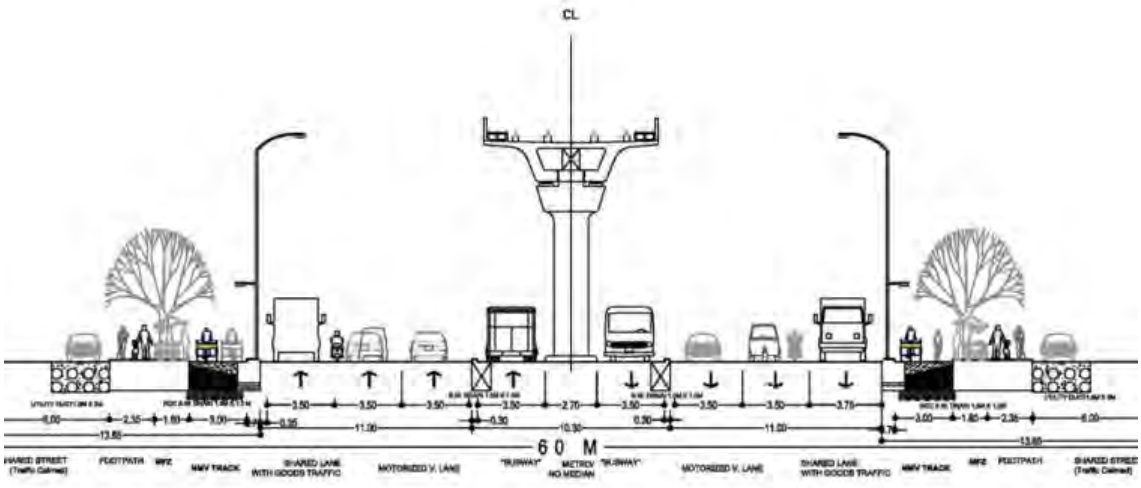
Figure 5.6.3.9 Public transport to the Thilawa SEZ

The BRT lanes are designed to allow for a future extension of the UMRT1 from the Thilawa Sub-center to within the Thilawa SEZ.



Source: JICA Study Team

Figure 5.6.3.10 BRT expansion



Source: JICA Study Team

Figure 5.6.3.11 Introduction of LRT/MRT using the BRT lanes

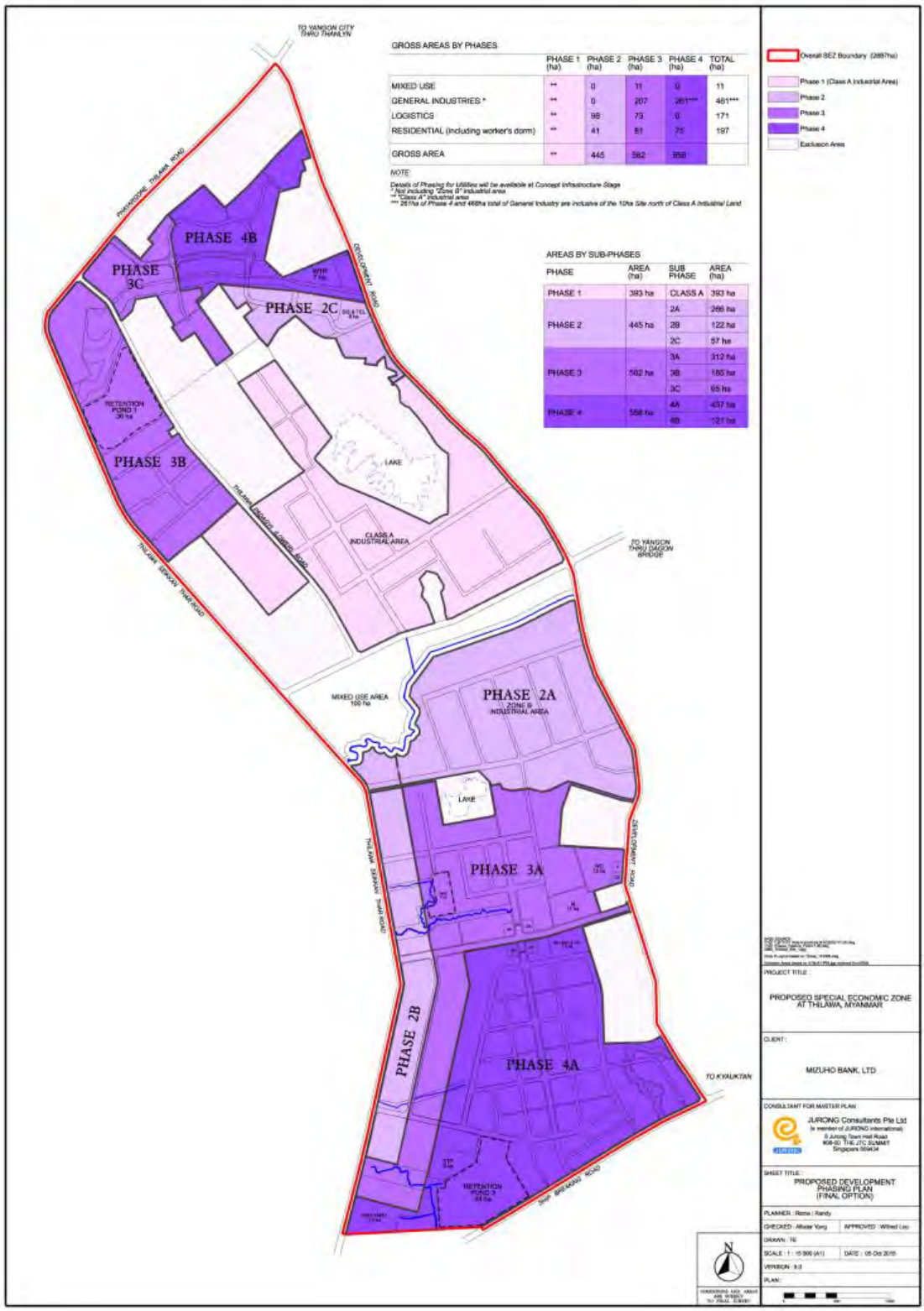
5.6.4 Phasing

The Thilawa SEZ covers a large area, so from the perspective of controlling development costs, it would be rational to develop the Thilawa SEZ in phases. The basic development plan proposes that the area (apart from 100 ha of the mixed use area/reserve site for rail transportation facilities and the exclusion areas) be developed in four phases, as outlined below.

Table 5.6.4.1 Phasing of Thilawa SEZ development

Phase	Area (ha)	Sub phase	Area (ha)
Phase 1	393	Zone A	393
Phase 2	445	2A	266
		2B	122
		2C	57
Phase 3	562	3A	312
		3B	185
		3C	65
Phase 4	558	4A	437
		4B	121

Source: JICA Study Team



Source: JICA Study Team

Figure 5.6.4.1 Phasing of Thilawa SEZ development

6 Environmental Impact Assessment (EIA)

6.1 Outline of the EIA work

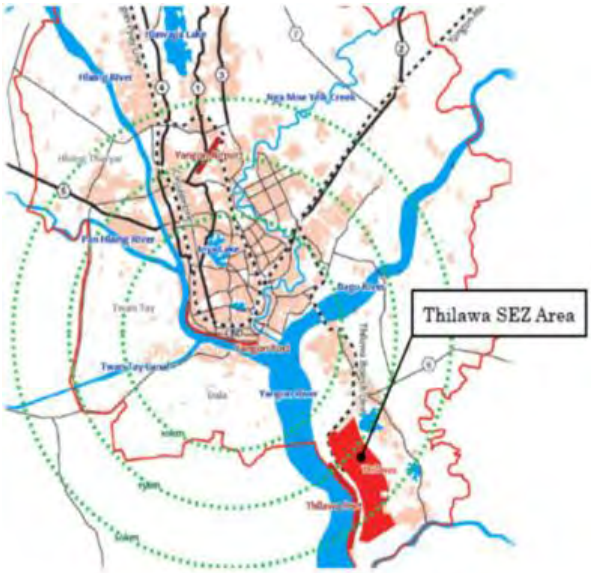
A baseline study of environmental and social conditions and an examination of alternative options for land use plans were carried out as this study's environmental impact assessment work. This study is not aimed at formulating a plan at the master-plan level, so unlike a general strategic environmental assessment (SEA), this work does not present an EIA or any mitigation measures. For the sake of convenience, though, it will be called an SEA.

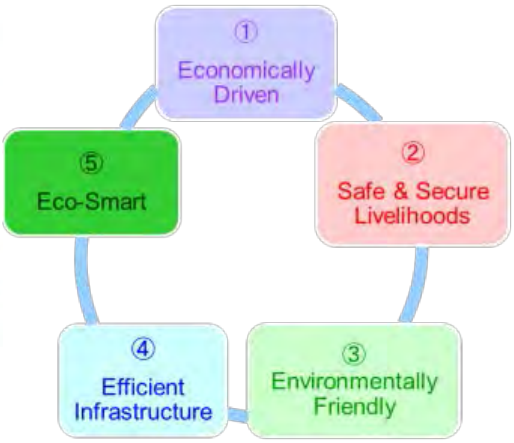
6.2 Outline of the strategic environmental assessment (SEA)

JICA Guidelines for Environmental and Social Considerations (April 2010) defines a strategic environmental assessment (SEA) as "an assessment that is implemented at the policy, planning, and program levels." These levels include master-plan-level or regional-level development plans, with SEAs carried out to encourage project proponents, etc. to consult with local residents and disclose information about environmental and social considerations from an early stage. In case of the Thilawa SEZ development project (2,000 ha) ("this project" or "the 2,000 ha"), the decision to go ahead with the project was decided by the governments of Myanmar and Japan before the formulation of this SEA, so the SEA was prepared not to present several development scenarios but rather to contribute to an individual project. Therefore, this SEA was prepared as a record of the sequence of events pertaining to environmental and social considerations at the policy level of this project, and a reference material for stakeholders. This SEA presents two alternative options in addition to the zero option, but it does not present an EIA or any mitigation measures. See Appendix A for the text of this SEA.

6.2.1 Project outline

This project targets the Thilawa SEZ (total area: 2,400 ha) in the Thanlyin and Kyauktan Townships, around 20 km southeast of Yangon, specifically the around 2,000 ha that lie outside the early development area (Zone A, 400 ha) (Figure below: Project area location map). The upper-level goals of the project are the establishment of a "trigger for the future of Myanmar" and the promotion of economic development to raise national living standards. The governments of Myanmar and Japan aim to create an environment that encourages the participation of foreign capital in the project. The development concepts are outlined in the figure below, Project development concepts.





Source: Ministry of Economy, Trade and Industry (Japan), Project for Promoting Export of Infrastructure System (2013)

Figure 6.2.1.1 Project area location map

Figure 6.2.1.2 Project development concepts

6.2.2 Legal and administrative framework

The most important part of Myanmar's legislation regarding environmental conservation is the Environmental Conservation Law (2012). This law consists of 14 chapters, and stipulates that the Myanmar Government will establish an Environmental Conservation Committee (Chapter 3, Article 4) that will be charged with determining Myanmar's basic environmental policy and other environmental policies (Chapter 3, Article 6). It also sets down the different roles of each ministry that implements the basic environment policy when it comes to devising and implementing environmental measures (state or regional environmental planning, standards setting, monitoring programs, environmental impact assessment (EIA)/social impact assessment (SIA) approval processes, etc.) based on the basic environmental policy determined by the Committee (Chapter 4, Article 7). The Foreign Investment Law and related ordinances (Notification No. 11/2013) mention EIA/SIAs, while a separate ordinance (Notification No. 1/2013) mentions the types of projects requiring EIAs. The EIA Procedures in Myanmar was officially approved on 29 December 2015 by the Environmental Conservation Department (ECD). Myanmar's main environmental and social laws and regulations are outlined below.

Table 6.2.2.1 Main environmental and social laws and regulations of Myanmar

Category	English Title
Environmental law	Environmental Conservation Policy (1994)
	Environmental Conservation Law (2012)
	Environmental Conservation Rules (2014)
	EIA Procedures (2015)
	Draft EIA Guidelines
Industrial law	Myanmar Special Economic Zone Law (2014)
	Foreign Investment Law (2012)
	Factory Act (1951)
Forestry law	Forestry Law (1992)
Biodiversity law	Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994)
Water resources and rivers law	Conservation of Water Resources and Rivers Law (2006)
	Underground Water Act (1930)
	Canal Act (1905)
Land law	Vacant, Fallow and Virgin Lands Management Act (2012)
	Farmland Law (2012)
	Land Acquisition Act (1894)
Fisheries law	Freshwater Fisheries Law (1991)
	Marine Fisheries Law (1990)
	Law on Aquaculture (1989)
Cultural heritage law	Protection of Cultural Heritage Sites Law (1998)
Public health law	Public Health Law (1972)
Human rights	* Notice to Ensure the Responsible Investment in the Thilawa SEZ (2015)

* The "Notice to Ensure the Responsible Investment in the Thilawa SEZ" is not a law.

Source: JICA Study Team

6.2.3 Basic information

Outlined below is basic information related to environmental and social conditions in the project area.

(1) Anti-pollution measures

Air quality

Air quality standards are met on the whole. Above-standard levels of total suspended particles (TSP) and nitrogen dioxide (NO_2) have been recorded at some monitoring points in the dry season.

Water quality

Dry-season surface water was found to contain excess levels of copper and massively-excessive levels of arsenic and chrome at all surveyed areas. Excess levels of mercury, lead and nickel were also recorded at several points. Dry-season ground water was also

found to contain excess levels of arsenic, mercury, chrome and nickel. Excess levels of cyanide were found in surface water during the rainy season, though not in ground water. People do not live in the target area at present and there are no pollution sources, so the excess levels are believed to be due to natural causes.

Waste

A treatment plant for all the waste generated in the project area is currently being built on the western side of Zone A. This plant will handle industrial waste, hazardous waste and recyclable waste. Yangon city will dispose of general waste.

Soil pollution/substratum

All standards under each monitoring heading are being met. Levels of chrome, zinc and cadmium are quite high, though not excessive. It has been reported that the concentration of heavy metals (copper and nickel) in the substratum in the nearby Yangon River has exceeded standard levels[1].

Noise/vibrations

All standards under each monitoring heading are being met.

Subsidence

There is no recorded subsidence.

Bad odors

No specific sources of bad odors have been found.

(2) Natural environment

Nature reserves

There are no nature reserves in the area planned for the project.

Ecosystem

Field studies by experts have observed 91 species of bird, 31 species of fish, 20 species of reptile, 38 species of insect, 71 species of tree and 9 types of mangrove in the area planned for the project. The IUCN Red List is a list of threatened species. When it came to flora, the field studies found one species on the Red List's Endangered IB-class (EN) list (Dipterocarpus alatus Roxb) and one species on the Near Threatened (NT) list (Dalbergia cultrata Grah). As for fauna,

[1] Source: 〃The Enhancement of the Efficient Operation of Thilawa Area Port and Logistics Depot Project〃

the studies found no species designated as “Endangered” on the Red List, though it did find one NT bird species (Ploceus hypoxanthus) and three NT fish species (Labeo nandina, Anguilla bicolor and Wallago attu). Separately from the Red List, the surveys also uncovered a white-throated babbler (Turdoides gularis), an endemic species protected in Myanmar, in the area planned for the project. The area’s mangroves and waterside areas provide an important habitat for these protected species.

Hydrological phenomena

The Yangon and Hmawwun Rivers are the largest water flows near the area planned for the project. Major reservoirs within and close to the site include the Zarmani Dam, Thilawa Dam and the Bant Bway Kone Dam. There are also six streams within the site.

Topography/geological features

The area planned for the project is a broadly-flat plain that lies an average of 6.6 m above sea level. The southern part is lower that the northern part.

(3) Social environment

Involuntary resettlements

The government of Myanmar is currently drawing up a separate resettlement plan with the support of JICA.

Lifestyles/livelihoods

Agriculture, factory work and fishing provide a living for the people living in and around the area planned for the project.

Minorities/aboriginal peoples

There are no minorities or aboriginal peoples in the area planned for the project.

Land usage/water usage

Land is mainly used for agriculture, though there is unused land too. Lake and well water is used for drinking, etc.

Existing social infrastructure and services

There are schools (including elementary, junior-high and high schools, kindergartens and monastery schools), clinics and police stations in the townships where the area planned for the project is located. Some new roads are under construction within the planned area. Residents living around the area planned for the project also travel around by boat on some of the local streams.

Misdistribution of benefits and damages/local conflicts of interest

Water from lakes and streams is shared without any conflicts of interest. No particular misdistribution of benefits and damages has been observed.

Cultural heritage

There are 126 pagodas, 177 Buddhist temples, five Christian churches, ten mosques and two Chinese temples in the Thanlyin and Kyauktan Townships including the area planned for the project, though there is no valuable cultural heritage within the planned area.

Scenery

The scenery in and around the area planned for the project is rural in nature and features water paddies, livestock, streams, temples, lakes, dams and some small-scale infrastructure, for example. Some factories and so on are being built as part of the Zone-A development, so the scenery is being altered in some areas.

Gender

Myanmar's constitution espouses non-discrimination when it comes to skin color, sex, age, religion or race.

Children's rights

Most children receive some form of elementary or religious education.

Infectious diseases (HIV/AIDS, etc.)

Diarrhea is the most common infectious illness in the area.

Transport

Traffic congestion frequently occurs around the Thanlyin Bridge.

6.2.4 Examination of alternative options

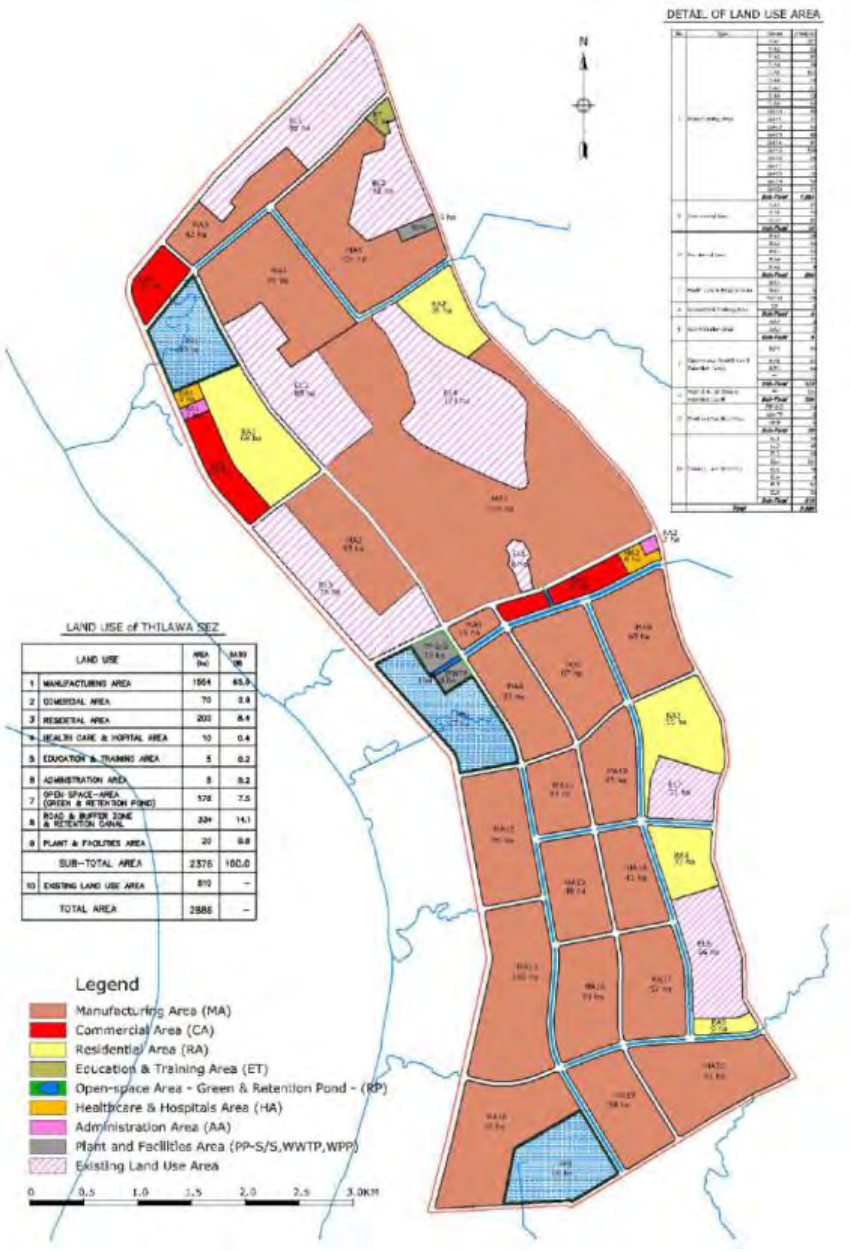
(1) Zero option

The zero option describes the case if this project does not go ahead. In this scenario, the 2000-ha SEZ development will not take place and there will probably not be any changes to environmental and social conditions for a while. However, when it comes to responding to Myanmar's breakneck pace of development and rising demand for industrial development, the target area lies in an advantageous geological location close to Yangon, Myanmar's economic heartland, so even if the SEZ project does not go ahead, the area will still remain an attractive location to foreign capital such as companies, investors and developers. As a result,

development may well go ahead outside of an SEZ framework, with no overarching management of environmental and social conditions in the area.

(2) Alternative option 1 (original plan)

Alternative option 1 was proposed in a METI study (2013) and it has been approved by the governments of Myanmar and Japan. The illustration below shows alternative option 1's land usage plan.

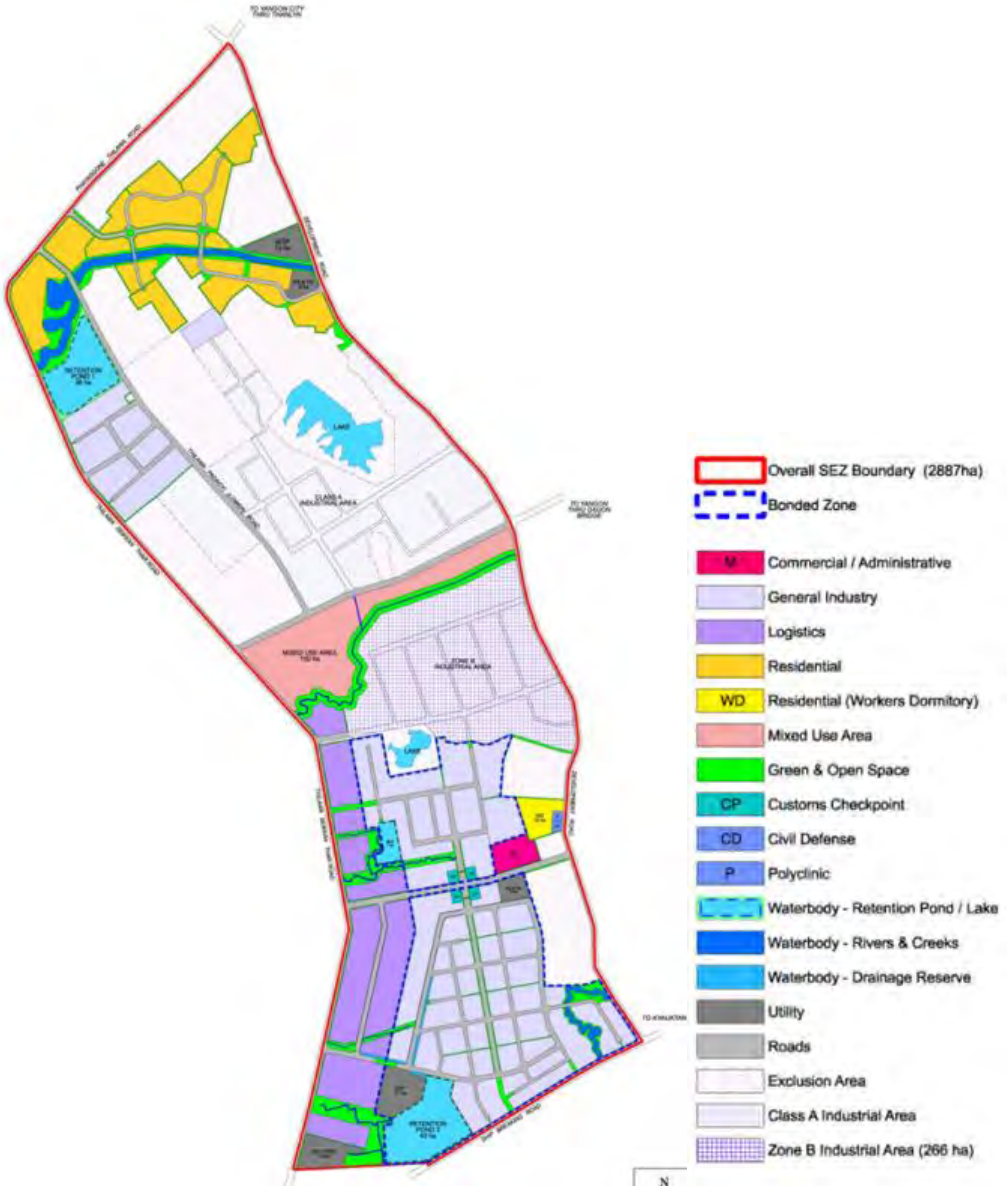


Source: Ministry of Economy, Trade and Industry (2013), Project for Promoting Export of Infrastructure System

Figure 6.2.4.1 Alternative option 1 land usage plan

(3) Alternative option 2 (updated plan)

Based on the exclusion areas and consultations with stakeholders, Alternative option 2 pays more attention to the existing natural environment and social conditions. The illustration below shows alternative option 2's land usage plan.



Source: JICA Study Team

Figure 6.2.4.2 Alternative option 2 land usage plan

(4) Comparative review of the alternative options

The table below compares the aforementioned alternative options 1 and 2. Based on the results of the comparative review and the non-commercial benefits of the project, it was adjudged that the alternative option 2 was the preferable plan.

Table 6.2.4.1 Comparison of alternative options

Item		**Alternative option 1 (Original plan)**		**Alternative option 2 (Updated plan)**	
Land usage plan	**Total area**	**2,886ha**	**100.0%**	**2,887ha**	**100.0%**
	General industrial area	1,554ha	53.8%	1,119ha	38.8%
	Logistics area	0ha	0.0%	170ha	5.9%
	Residential area	200ha	6.9%	191ha	6.6%
	Commercial and administrative area	75ha	2.6%	11ha	0.4%
	Mixed use area	0ha	0.0%	100ha	3.5%
	Roads	334ha	11.6%	261ha	9.0%
	Green space, ponds	178ha	6.2%	301ha	10.4%
	Public facilities	20ha	0.7%	54ha	1.9%
	Other	15ha	0.5%	13ha	0.5%
	Exclusion area	510ha	17.7%	767ha	23.1%
Measures at the planning stage (as of April 2014)		[Policy level] - Environmentally-friendly - Eco/smart [Land usage plan considerations] - Rainwater reservoirs - Waste water treatment facilities		[Policy level (draft)] - Environmentally-friendly - Eco/smart [Land usage plan considerations] - Rainwater reservoirs - Streams - Surface water (ponds) - Trees - Waste water treatment facilities - Cultural heritage	
Anti-pollution measures					
Air quality, noise, vibrations, bad odors and soil		Though the project is expected to have some kind of impact, each tenant can take the necessary countermeasures under the supervision of the One-stop Service Center.			
Water quality		Waste water can be treated at treatment facilities.			
Subsidence		It is not envisaged that ground water will be used for public water supplies after this project in service though it may be used for some purpose both during the construction and after this project in service.			
Natural environment					
Nature reserves		There are no nature reserves in the area planned for the project.			

Ecosystem	It could have a harmful impact on mangroves.	It preserves mangroves. A pond next to a monastery in the center of the project area is also preserved.
Hydrological phenomena (flooding countermeasures)	The plan places rainwater reservoirs in three locations. Major streams will be changed to concreted waterways.	The plan places rainwater reservoirs in three locations. The path of major streams will be left unaltered, though they will be widened to ensure water flow.
Topography/geological features	The area planned for the project has no unique geological features; it is generally flat.	
Social conditions		
Resettlement	Some people living within the area planned for the project will need to be resettled.	
Livelihoods	Retailing, commerce, agriculture, factory work and fishing provide a living for the people living in and around the area planned for the project.	
Cultural heritage	The plan could have a detrimental impact on cultural heritage.	Cultural heritage is protected in accordance with the law.
Minorities/aboriginal peoples	There are no minorities or aboriginal peoples in the area planned for the project.	

Source: JICA Study Team

6.2.5 Consultation with local residents

(1) First stakeholder consultation

The first stakeholder consultation regarding this project's SEA was held at TSEZMC's temporary office on June 30, 2014. A total of 453 stakeholders attended, including government officials, local residents, the media and NGOs. The event was promoted in advance through newspapers, invitation letters and a notification issued by the General Administration Department (GAD). Transportation services were provided on the day to help participants come from far and wide. The consultation was carried out in Burmese on the whole. After opening greetings by a TSEZMC representative, details of the project and the EIA process were announced, with comments then received from participants during a Q&A session. Outlined below are the main comments heard during this consultation together with the replies issued by TSEZMC and so on.

Table 6.2.5.1 Outline of comments and replies from the first stakeholder consultation

Category	Comments	Speaker	Replies from TSEZMC (MC), ECD, etc.
Anti-pollution measures, etc.	・Differences between EIAs and	Alwan Sut Village, Thilawa Social	・The difference between the 2,000-ha site's EIA and SEA

Category	Comments	Speaker	Replies from TSEZMC (MC), ECD, etc.
	SEAs ・Countermeasures in the event that air or water pollutants in the SEZ exceed standards	Development Group	was explained. The second chapter of the SEA lists the details that should be included in the SEA. ・An explanation was given about waste water treatment methods. An explanation was also added to the SEA.
Health of local residents	・Health service plan for project-affected persons	Thida Myaing village	・Infectious disease experts from the International HIV/AIDS Alliance will be consulted about measures to deal with health problems after the completion of the project. The area has many healthcare facilities, as listed in section 4.1.3 of the SEA. The capacity of these facilities, etc. will be investigated in detail in the EIA.
Ecosystem	・Wetland technologies should be used ・An ecosystem management plan should be included in the environmental management plan	Myanmar Bird and Nature Society	・Existing streams will be preserved. When expansion is necessary, methods will be considered to preserve mangrove habitats as much as possible. ・The EIA environmental management plan will include measures to preserve and monitor ecosystems.
Regional planning, employment opportunities	・The area needs a multi-modal transport system ・Questions were asked about employment opportunities for local residents in the SEZ	Myanmar Maritime University	・This project is one of many underway in the region and it is part of the Yangon Tranport Master Plan. Relevant matters added to the SEA. ・With regards to employment, the TSEZMC is gathering baseline data as part of a separate study. The results will be included in the EIA's social conditions section.
Information disclosure, public participation	・The study report should be released to the public at the same time as it is submitted to the environmental authorities ・How can we	Shwe Pyouk Village/ Alwan Sut Village, Thilawa Social Development Group	・The final report will be released to the general public (via the internet or GAD) at the same time as it is submitted to the environmental authorities. ・The public will be consulted prior to the implementation of the boring survey, with the

Category	Comments	Speaker	Replies from TSEZMC (MC), ECD, etc.
	adjudge if the report is in line with the facts? The public should also be involved in research and monitoring in order to ensure the report is prepared to international standards.		survey carried out while gaining the understanding of residents. Opinions from the public will be welcomed during the survey.
Ecosystems, lifestyles/ livelihoods	・We are concerned about the impact on the flow of the six streams within the SEZ and we hope the streams will be managed in an appropriate way ・Many residents are poor and have a low level of education, so we hope the project provides training opportunities	Yangon regional parliament	・The final land usage plan essentially leaves the six streams unchanged. If some expansion is needed, it will be done in an environmentally-friendly way. ・When it comes to companies participating in the Thilawa SEZ, the TSEZMC will give priority to those firms that contribute to providing more local employment opportunities. Vocational training will also be provided.
Applicable standards	・What are the international standards?	Thida Myaing village	・IFC Guidelines will be adopted as international standards. See the SEA for details.
Resettlement	・We hope those residents targeted for non-voluntary resettlement will be compensated in line with international standards	Save the Children NGO	・The SEA will not undertake a resettlement survey, but the basic stance is to adopt international standards, as listed in section 1.3 of the SEA.

Source: JICA Study Team

(2) Second stakeholder consultation

The second stakeholder consultation with regards to this project's SEA was held at TSEZMC's temporary office on August 26, 2015. A total of 303 stakeholders attended, including government officials, local residents, the media and NGOs. The event was promoted in advance through newspapers, invitation letters and a notification issued by the General Administration Department (GAD). Transportation services were provided on the day to help participants come from far and wide. The consultation was carried out in Burmese on the whole. After opening greetings by a TSEZMC representative, an announcement was made about the

results of the SEA survey, with comments then received from participants during a Q&A session. Outlined below are the main comments heard during this consultation together with the replies issued by TSEZMC and so on.

Table 6.2.5.2 Outline of comments and replies from the second stakeholder consultation

Category	Comments	Speaker	Replies from TSEZMC (MC), ECD, etc.
Survey targets	We should be targets of the survey. Could you check again?	Alwan Sut Villager residents	We will check again.
Stakeholder consultations	You should send out notifications about stakeholder consultations one week earlier	Alwan Sut Village residents	
Zone A	We are worried about waste management in Zone A	Alwan Sut Village residents	Essential facilities will be built to deal with population increases. Security guards will also be installed at the borders.
Environmental impact	Questions were asked about measures to mitigate the environmental impact and the permissible impact levels for each factory	Community Relationship Officer, MJTD	It depends on the business. The TSEZMC will check that each factory is meeting the standards of the Thilawa SEZ and will issue penalties or admonishments if standards are not being met.

Source: JICA Study Team

In addition to the aforementioned stakeholder consultations, numerous other consultations (preliminary/initial meetings) have been held with stakeholders (including NGOs, the private sector and government bodies) during the study with the aim of obtaining information and comments that will help with the implementation of the SEA.

The Republic of the Union of Myanmar

Preparatory Survey on Thilawa SEZ Development Project (2,000 ha)

Strategic Environmental Assessment (SEA)

January 2016

Thilawa SEZ Management Committee

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Figures

Tables

Acronyms

Acronym	Definition
ASEAN	Association of Southeast Asian Nations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
ECR	Environmental Conservation Rules
ECL	Environmental Conservation Law
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESC	Environmental and Social Considerations
HIV/AIDS	Human immunodeficiency virus / acquired immunodeficiency syndrome
IFC	International Finance Corporation
JICA	Japan International Cooperation Agency
MOAI	Ministry of Agriculture and Irrigation (Myanmar)
MOC	Ministry of Construction (Myanmar)
MDA	Ministry of Development Affairs (Myanmar)
METI	Ministry of Economy, Trade, and Industry (Japan)
MOECAF	Ministry of Environmental Conservation and Forestry (Myanmar)
MOI	Ministry of Industry (Myanmar)
MOST	Ministry of Science and Technology (Myanmar)
NGO	Non-Governmental Organization
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
STD	sexually transmitted disease
TSP	Total Suspended Particles
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
YCDC	Yangon City Development Committee

1 Introduction

1.1 Project Background

Thilawa Special Economic Zone (SEZ) Development Project (2,000ha) ("the Project" or "2,000ha area") is the second Phase of a two-phase SEZ of an area of 2,400ha located about 20km southeast of Yangon in the Townships of Thanlyin and Kyauktan.[1]

Figure 1-1 shows the details of the Thilawa SEZ location relative to the greater Yangon City area. The area was selected due to several factors including but not limited to availability of a workforce, pre-existing industrial activity, proximity to a seaport, and easy road access into Yangon. The area has been planned for development by the Myanmar Government since 1997 but has not been developed for industrial use in a planned manner to date.

Source: Ministry of Economy, Trade, and Industry (METI) (2013) *Project for Promoting Export of Infrastructure System*

Figure 1-1 Location of Thilawa SEZ

1.2 Project Proponent Description

Currently the Project Proponent for the Thilawa SEZ Development Project (2,000 ha) is the Thilawa SEZ Management Committee. The Project Proponent may be changed in the future to a consortium of public-private sector companies that would invest in the Project development.

1.3 Application of International and Domestic Guidelines

The Project will apply international guidelines for development of the present SEA and the eventual EIA. The guidelines followed will be reflective of domestic guidelines such as the Environmental Impact Assessment Rules of the Government of the Union of Myanmar, which may include such guidelines as World Bank Safeguard Policies, IFC Performance

[1] Source: Ministry of Economy, Trade, and Industry (METI) (2013) Project for Promoting Export of Infrastructure System

Standards and JICA's Guidelines for Environmental and Social Considerations (April 2010) (hereinafter "the JICA Environmental Guidelines").

The domestic guidelines do not specify particular methods or requirements for an SEA. However, international best practice entails the preparation of an SEA developing a sectoral or regional cooperation program. Such standards apply an SEA when the preparatory surveys include not only project-level but also upper-stream-level studies, or Master Plan Studies. Since this present project is reflective of such a regional-level programmatic project, an SEA was developed. For instance, proposed projects are classified as Category A if they are likely to have significant adverse impacts on the environment and society. Projects with complicated or unprecedented impacts that are difficult to assess, or projects with a wide range of impacts or irreversible impacts, are also classified as Category A. According to the JICA Environmental Guidelines, category A projects require more diligence and planning, which include information disclosure, stakeholder meetings based on stakeholder analysis, alternative scenario analyses and so on. By involving stakeholders at the early stage of the project, the SEA helps identify possible constraints and mitigation measures to be incorporated into the project as environmental and social considerations.

1.4 Thilawa SEZ Objectives

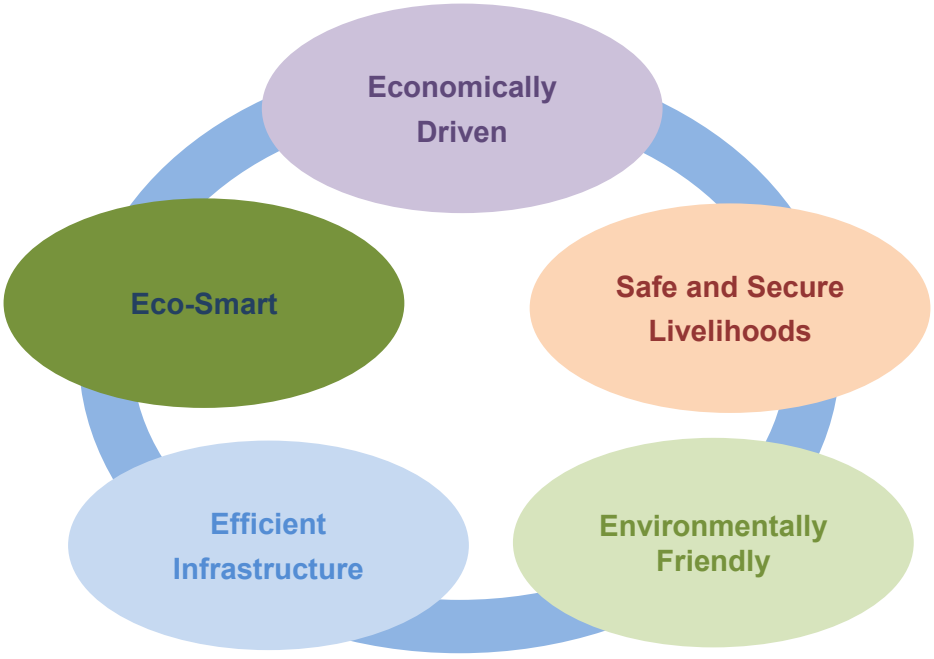
The land use plan for the entire development area of Thilawa SEZ has been examined based on the development concept and development framework defined in a previous strategic study approved at the Presidential level in Myanmar, "Project for Promoting Export of Infrastructure System". The development area is classified into Zone A (400ha) and a 2000ha area that will be further subdivided into different development phases that are not yet confirmed. These areas differ in development priority. The Zone A area being developed since 2013, before the Phase 2 area. Together those development areas are known as the Thilawa SEZ.

The high-level strategic objective for the Thilawa SEZ is to develop a "trigger for the future of Myanmar" and enhance the economic development of the country to contribute to the improvement of citizens' livelihoods. The governments of Myanmar and Japan have positioned the Thilawa SEZ project to help rapidly develop Myanmar by providing an environment for foreign investment.

The Thilawa SEZ is located close to Yangon City and therefore has a high potential for rapid growth and development given the abundant labor force in Myanmar's most populated area. Specific to the present document, in order to realize this growth in a healthy and sustainable way, it was agreed that the Thilawa SEZ should be promoted as a development project that is environmentally friendly.

Upon realizing these goals, it has been expected that the Thilawa SEZ will be more than just a manufacturing base and also serve as a leading model city for Myanmar as a whole.

The figure below presents the development concept diagram encompassing the five-pillared development strategy: Economically Driven, Safe and Secure Livelihoods, Environmentally Friendly, Efficient Infrastructure, and Eco-Smart.



Source: Ministry of Economy, Trade, and Industry (METI) (2013) *Project for Promoting Export of Infrastructure System*

Figure 2-1 Thilawa SEZ Development Concept

1.5 Potential Industrial Sectors

According to the survey conducted as a part of this project, the following markets are expected to grow in Myanmar in the near future considering the regional context. These industries will provide demand within the 2,000ha area. At present, significant demand in the Food and Beverage, Textiles, and Construction Material industries already exists, while demand in the Wood and Related Products, Machinery and Equipment, Electrical and Electronics, and Automotive Manufacturing industries will emerge in the near term.

1.6 Official Thilawa SEZ Designated Area and Exclusions

According to Government Notification (No. 65/2013), the Thilawa SEZ boundaries consist of

an area of 23.422148442 km^2 (5,787.718 acres) in the Southern District of Yangon Region, the boundaries of which are defined[2] as:

North: From the survey point-123 (N: 1847877.521, E: 205796.949) at the junction of the Phayargon-Thilawa Road and Thilawa Terminal Road, along with the boundary points of the west and north of the Phayargon-Thilawa Road, to the survey point-096 (N: 1850284.407, E: 207954.516) at the junction of Phayargone-Thilawa Road and Development Road, which is approximately 3.2 km away in north-eastern side.

East: From the survey point-096 at the junction of Phayargone-Thilawa Road and Development Road, along with the boundary posts installed at the eastern side of the Development Road, to the survey point-001(N: 1840511.149, E: 212015.422) at the junction of Development Road and Shipwreck Factory Road, which is approximately 10.6 km away in the south.

South: From the survey point-001at the junction of Development Road and Shipwreck Factory Road, along with the boundary posts installed at the southern side of the Shipwreck Factory Road, to the survey point-164 (N: 1839299.835, E: 209914.662) at the southern side of the Shipwreck Factory Road, which is approximately 2.4 km away, and continuously up to the survey point-163 (N: 1839326.265, E: 209898.928) at the northern side of the Shipwreck Factory Road, and from that point, along with the boundary posts installed to the western side, to the survey point-159 (N: 1839265.381, E: 208591.603) at the corner of Thilawa Terminal Road, which is approximately 1.3 km away.

West: From the survey point-159 at the corner of Thilawa Terminal Road, along with the boundary posts installed at the western side of Thilawa Terminal Road, to the survey point-123 at the junction of Thilawa Terminal Road and Phayargon-Thilawa Road, which is approximately 9.1 km away in the north.

In principal existing buildings and the associated infrastructure will be excluded from the zone. Specifically, an area with the cumulative equivalency of 1,345.644 acres is to be excluded (Government Notification No. 65/2013). The precise surveyed locations of these existing infrastructures are unknown and further studies are ongoing. The details of the exclusions are as follows:

[2] Coordinate System mentioned at the above survey points is the World Geodetic System 1984 (WGS 84).

Table 1-1 Exclusions for Existing Land Use Areas

Name	Area (acres)	Area (m2)
Myanmar Economic Cooperation glass factory and Ministry of Industry flask factory	237.515	961,189
Ministry of Industry power distribution plant	2.098	8,490
Area appropriated for the factory construction by Ministry of Industry	38.033	153,914
Myanmar Economic Cooperation's galvanized iron sheet factory and shoe factory	104.451	422,698
Ministry of Industry packaging factory and garment factories	204.608	828,019
Thilawa Dam	389.220	1,575,118
Maritime University	110.819	448,468
Hostel of Maritime University	2.033	8,227
Ayemyathida Ward	83.058	336,124
Shwepyitharyar Ward	145.361	588,255
Phanchat Monastery	4.918	19,902
Phalankanoo Monastery	2.697	10,914
Phalanywaroo Pahayalay Monastery	2.600	10,521
Thilawa Konetan Monastery	16.432	66,498
Church	0.741	2,998
Hindi Temple	1.060	4,289
Total	**1,345.644**	**5,445,632**

Source: The Republic of the Union of Myanmar. Union Government Notification (No. 65/2013). 4th Waning of Tawthalin 1375 ME (23rd September, 2013)

The pond near the Phalankanoo Monastery in the middle of the SEZ will also be voluntarily excluded in order to maintain green area in the SEZ keeping with the strategy of an environmentally friendly SEZ.

2 Strategic Environmental Assessment (SEA) Approach

International practice suggests that an SEA is conducted when Policy, Plan or Program is to be established. This may include Master Plan Studies or studies that have a regional-level impact, and the SEA is meant to encourage project proponents and related entities to ensure public participation and information disclosure in its environmental and social considerations from an early stage. In the present project, the Thilawa SEZ implementation has already been decided between the governments of Japan and the Republic of the Union of Myanmar. Therefore this SEA is not meant to be a document that propose multiple development scenarios, but that serves for this specific project. This document is meant to record the history of strategic and policy-level environmental and social considerations for the Project and serve as a stakeholder reference document. In the present SEA, 2 different alternatives plus a “without project” alternative are presented (Section 4). A separate Environmental Impact Assessment (EIA) document will be created following the SEA process in order to deeply analyze the quantitative and qualitative impacts of the project. The remainder of this chapter focuses on the structure of the present SEA.

2.1 Scoping

The SEA first and foremost is meant to delineate the impact of the project to serve as a base for further analytical work. This step, scoping, involved examining the socio-environmental aspects of the area in and around the Thilawa SEZ. The scope of consideration is generally delimitated to that area to which the project has a direct impact.

Scoping involved setting an environmental baseline condition—i.e., the present socio-environmental context of the Thilawa area—as well as identifying anticipated environmental problems and setting environmental objectives and standards for the Project development.

2.2 Stakeholder Meetings

The Project will be an integral part of the Thanlyin and Kyauktan townships as well as the greater Yangon area in the future. Therefore it is paramount that stakeholders have a voice in how environmental problems are identified and addressed. Stakeholder meetings were an important part of the SEA process to thoroughly identify environmental problems, identify mitigation measures for adverse impacts, and assign responsibility for implementation of mitigation measures where appropriate.

3 Environmental Laws, Regulations, and Policies in Myanmar

The following provides an abridged version of laws and policies in Myanmar relevant to the Project. Only elements of these laws that are specifically relevant to social and environmental aspects of the Project are summarized below.

3.1 Environmental Framework Legislation

Environmental Conservation Policy (1994)

This is a policy level document promulgated under Notification No. 26/94 dated 5 December 1994 proclaiming a policy to mainstream environmental considerations into natural resource development.

Environmental Conservation Law (2012)

The updated Environmental Conservation Law (ECL) was passed on 30 March 2012 prepared by MOECAF. The Environmental Conservation Law contains 14 chapters that define the rights and responsibilities of MOECAF, environmental standards, environmental conservation, management in urban areas, conservation of natural and cultural resources, process for businesses to apply for permission to engage in an enterprise that has the potential to damage the environment, prohibitions, offenses and punishments. In particular, Article 16 in the law stipulates responsibilities of business owners of industrial estate or business in the Special Economic Zone on environmental conservation.

Environmental Conservation Rules (2014)

The Environmental Conservation Rules (ECRs) are the detailed regulations set to implement the Environmental Conservation Law and highlight the creation of an EIA system as well as pollution prevention measures. The ECRs passed through parliament in August 2014. ECRs stipulate basic policy and concept on EIA application of the development of Projects (Article 55). In this connection, the Project Proponent shall adhere to the following policies based on ECL and ECRs:

- To have responsible to carry out by contributing the stipulated cash or kind in the relevant combined scheme for the environmental conservation including the management and treatment of waste including liquid, emission, solid (Article 16 (a) in ECL);
- To contribute the stipulated users charges or management fees for the environmental conservation Zone (Article 16 (b) in ECL)
- To comply with the directives issued for environmental conservation Zone (Article 16 (c) in ECL)

- To prepare the environment impact assessment report including EMP and submit to the Ministry (Article 55 (a) in ECRs); and
- To implement and carry out environmental management plan within the time stipulated by the Ministry and submit the performance situation to the Ministry (Article 55 (b) in ECRs).

EIA Procedures (2015) and Emission Guidelines(2015)

These procedures stipulate the procedures for completing an EIA in Myanmar including project categorization, responsibilities of project developers, responsibilities of ministries, procedures for EIA creation, and procedures for EIA review, among other issues. The procedures and Emission Guidelines are approved by ECD in December 2015.

Draft EIA Guidelines (draft stage)

The EIA Guidelines outline the expectations for creating the required environmental assessment documents under the laws of Myanmar. They provide a minimum requirement and a common framework for Project Proposal, Scoping Report and TOR, IEE, /EIA and EMP reporting, to present Project Proponents and their environmental consultants with clear the guidance on structure, content and scope of IEE/EIA reports and to ensure that IEE/EIA reporting is consistent with legal requirements, good practices and professional standards. There is currently no clear schedule regarding the drafting of the EIA Guidelines.

3.2 Industrial Law

Myanmar Special Economic Zone Law (2014)

The 2014 Myanmar SEZ Law rescinds and replaces the 2011 Myanmar SEZ law. This law provides the basis for the government's establishment of SEZs and is meant to "invigorate foreign investment into the country while safeguarding Myanmar's own interests". The law has provisions for: aligning SEZ development with national economic development plans, aligning SEZs towards the economic benefit of Myanmar, promoting balanced development, promoting international cooperation, encouraging international and domestic investors through good infrastructure, and encouraging industrial clusters. The law implements these objectives through several incentives such as providing an institutional structure for the operation of the law that includes such provisions as tax incentives and company forming procedures that are attractive to investors. Article 35 of this Law stipulates that investors shall abide by the environmental standards in the Myanmar Environmental Conservation Law, other existing laws and international standards.

Foreign Investment Law (2012)

The Foreign Investment Law is set up to delineate the statutory characteristics of investment into Myanmar. Specific to environmental aspects of the Project, there are specific requirements in the law that stipulates the protection of the environment. Furthermore, the

following types of investments are restricted or prohibited under the law:

- Business which can affect the traditional culture and customs of the national races within the Union;
- Businesses which can affect public health;
- Businesses which can cause damage to the natural environment and ecosystem;
- Businesses which can bring hazardous or poisonous wastes into the Union;
- Factories which produce or businesses which use hazardous chemicals under international agreements;

The law also sets out the powers of the Myanmar Investment Commission. This Commission is to permit investments including such aspects as changing elevation or topography of the land and approving types of business. EIA is required under this law when conducting an activity categorized as requiring an EIA under the EIA Procedures. This law is not directly applicable to the Thilawa SEZ as the Thilawa SEZ falls under the remit of the Myanmar Special Economic Zone Law. However, there are several efforts underway to harmonize industrial development with the institutional structures of the two laws.

Factory Act (1951)

The Factory Act is concerned with the operation of factories and specifically addresses labor issues and environmental pollution as regards hazardous chemicals, effluents, and others.

3.3 Forestry Law

Forestry Law (1992)

This law is implemented to promulgate forestry and related environmental policies in Myanmar. The law stipulates the legal framework for the prevention of destruction of forest and biodiversity and conservation of natural forests. The State, having been empowered by the Forest law 1992, declared all mangrove forests as protected areas[3]. Fishing within three hundred yards around mangrove areas is strictly prohibited. In order to ensure the sustainable development of aquaculture techniques and to promote mangrove-friendly aquaculture practices strict guidelines were laid down by the Department of Fisheries.

3.4 Biodiversity Law

Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994)

This law is under the jurisdiction of the Ministry of Environmental Conservation and Forestry. The law provides a framework for the protection of natural habitats and ecosystems as well

[3] The areas with mangroves in the present project are not considered to be mangrove forests by the Forest Department. Therefore, in practice only these designated areas are actively protected.

as wild plants and wild animals. It also establishes responsibility for protection of wild species with MOECAF. Any damage occurring to wild species will have to be permitted through MOECAF.

3.5 Water and Rivers Law

Conservation of Water Resources and Rivers Law (2006)

The aims of this law are: (a) to conserve and protect the water resources and rivers system for beneficial utilization of the public; (b) to enable smooth and safe waterways navigation along rivers and creeks; (c) to contribute to the development of State economy through improving water resources and river system; (d) to protect environmental impact. However, this law is under the jurisdiction of the Ministry of Transport, not the Ministry of Environmental Conservation and Forestry. This law puts its strength on transportation safety and its development. Also, it is lacking in actual numerical criterion concerning the natural environment.

Underground Water Act (1930)

This act deals with the conservation and protection of underground sources of water in Myanmar.

Canal Act (1905)

This law regulates the application of water for public purposes, the supply of water, and drainage works.

3.6 Land Law

Vacant, Fallow and Virgin Lands Management Act(2012)

This act stipulates the legal framework for persons or investors seeking to develop vacant land and prescribes processes for the applicant and the government to interface with one another. The act also specifies taxes, legal action, and protection and assistance for the persons that have been granted a license to operate on such land.

Farmland Law (2012)

This law establishes the rights of citizens to farmland and provides for a permitting (“Land Use Certificate”) system for the right to the land. The law provides that the Central Farmland Management Body must coordinate to arrange for compensation and indemnity in the case of repossession of farmland in the interest of the state or in the interest of the public. Confiscated farms are to be compensated without any loss. Moreover, if a farm is upgraded with a building, compensation for such buildings must also be provided.

Land Acquisition Act (1894)

The Act enables the State and companies to compulsorily acquire land where the State and companies assert that that such land is needed for 'public purposes.' The Act outlines relevant procedures, including notice periods, procedures for obligations to acquisition (Art 5), the method of valuation of land, the process for taking possession of land (Arts16 and 17), court processes and appeals (Arts 18 and 24), procedures for the temporary occupation of land (Art 35) and the acquisition of land for companies (Art 38). The Act requires that compensation 'at market value' is provided to those from whom land is acquired (Art 23).

3.7 Fishery Law

Freshwater Fisheries Law (1991)

This law is meant to establish the laws over designated freshwater fisheries. There are prohibitions in the law that prohibit cutting undergrowth or setting fire to a fish habitat and impairing the natural condition of the fishery so as to disrupt water flow to a main fishery. Moreover, there are prohibitions on polluting water in freshwater fisheries waters and/or altering the quality of water, volume of water or the water course of fisheries and contiguous water courses.

Marine Fisheries Law (1990)

The Marine Fisheries Law determines the areas determined to be marine fisheries and sets out the licensing requirements of these fisheries.

Law on Aquaculture (1989)

This law presents provisions for the operation and licensing of aquaculture facilities in Myanmar including provisions for wastewater treatment.

3.8 Cultural Heritage Law

Protection of Cultural Heritage Sites Law (1998)

The objectives of this law are to preserve and implement a conservation policy for cultural heritage (ancient monuments and ancient sites that have historical, cultural, artistic, or anthropological value). This law specifically prohibits destruction, construction, excavation, or destruction of cultural heritage.

3.9 Public Health Law

Public Health Law (1972)

This law provides the statutory structure for the protection of people's health by controlling the quality and cleanliness of food, drugs, environmental sanitation, epidemic diseases and regulation of private clinics.

3.10 Human Rights

Notice to Ensure the Responsible Investment in the Thilawa SEZ (2015)

Thilawa SEZ Management Committee issued the Notice to Ensure the Responsible Investment in the Thilawa SEZ (Notice 04/2015) in August 2015 as a general guidance. This guidance is provided for all companies investing and doing business in the Thilawa SEZ. This general guidance is not a law, but the Thilawa SEZ Committee expects that business investing and doing business in the SEZ will Respect human rights; Engage with stakeholders; Support the rights of workers; Build human capital; Ensure effective grievance mechanisms; Be transparent; Create shared value; and Support the communities in which they operate, as stated in the guidance.

3.11 International Environmental Laws, Standards, and Guidelines

As mentioned above, Myanmar guidelines and environmental regulations are still under development. This project will follow international best practice, while taking care to respect the laws of Myanmar where they are or will be applicable, the project will also need to fill any gaps in environmental legislation with internationally accepted standards and guidelines. The following paragraphs summarize international agreements, standards, and guidelines that should serve as supporting best practices in case Myanmar law does not meet international standards. A short gap analysis follows.

JICA's Guidelines for Environmental and Social Considerations (ESC) (April 2010)

These guidelines form an integral part of all JICA assistance. If a significantly adverse impact on the environment or society has been identified during JICA-assisted project planning, JICA must take the necessary measures to ensure that the appropriate environmental and social considerations are given. The guidelines stipulate requirements to respect human rights for inclusive development, avoid adverse environmental and social impacts, secure local stakeholder consultation, provide disclosure to the public about ESCs, and respect host country laws, standards, policies, and plans. Furthermore, the guidelines provide guidance on project impact categorization and types of analysis and reporting (EIA, Resettlement Action Plan, Indigenous Peoples Plan) that are required to achieve JICA assistance.

In the JICA Environmental Guidelines it is stipulated that:

> *JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies, and refers as a benchmark to the standards of international financial organizations; to internationally recognized standards, or international*

standards, treaties, and declarations, etc.; and to the good practices etc. of developed nations including Japan, when appropriate. When JICA recognizes that laws and regulations related to the environmental and social considerations of the project are significantly inferior to the aforementioned standards and good practices, JICA encourages project proponents etc., including local governments, to take more appropriate steps through a series of dialogues, in which JICA clarifies the background of and reasons for the inferior regulations and takes measures to mitigate the adverse impacts when necessary.

World Bank Environmental and Social Safeguard Policies

The World Bank Operations Manual is a document detailing international best practice in operations of an international loan project along, including specific guidance on dealing with environmental impacts. Particular to the present project, in this manual it is noted that mangrove swamp areas should be considered as important habitat as referenced in World Bank Operations Policies 4.04. Specific requirements are described in separate operational policies such as OP4.01 Environmental Assessment, OP4.04 Natural Habitat, OP4.03 Performance Standards for Private Sector Activities and so on.

International Environmental Law, Conventions, and Agreements

Myanmar is a signatory to the following international laws, protocols, conventions, and agreements:

- Air and Atmospheric Emissions:
    - Vienna Convention for Protection of the Ozone Layer
    - Montreal Protocol on Substances that Deplete the Ozone Layer
    - London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer
    - Copenhagen Amendment to the Montreal Protocol on Substances that deplete the Ozone Layer
    - United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol
    - ASEAN Agreement on Transboundary Haze
- Hazardous Waste and Toxic Substances
    - Stockholm Convention on Persistent Organic Pollutants
- Land Agreements
    - United Nations Convention to Combat Desertification
- Biodiversity, Forests, and Cultural Heritage
    - Convention Concerning the Protection of the World Cultural and Natural Heritage
    - Convention on Biological Diversity
    - Cartagena Protocol on Biosafety

- o International Tropical Timber Agreement
- o Ramsar Convention on Wetlands
- o Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- o Association of Southeast Asian Nations (ASEAN) Agreement on the Conservation of Nature and Natural Resources

3.12 Myanmar and International Guideline Gap Analysis

Gaps between requirements of the above international standards and Myanmar domestic law are presented in the table below. This table is not necessarily complete and only serves to fill in those gaps that are relevant to the present project. It must be noted that the Draft EIA Procedure and the EIA Guidelines have not been implemented as of the time of writing. These documents may go a significant way towards filling the gaps identified. For gaps identified, to the extent possible the Project will use international standards[4] to strengthen the environmental protection already afforded under Myanmar law.

Table 3-1 Gaps between Myanmar Law and International Guidelines.

JICA ESC Guidelines (April 2010) / World Bank Operations Manual and Operational Policies	Environmental Law	Gaps between International Standard and Laws of Myanmar	Methods for Implementing Best Practice
Basic Principles Regarding Environmental and Social Considerations			
Strategic Environmental Assessment (SEA) shall be applied when conducting a Master Plan Study, etc.	none	The laws of Myanmar do not have a provision for the creation of an SEA-like document for master plan type projects.	Implement an SEA as stipulated in the JICA Guidelines for Environmental and Social Considerations (April 2010), Section 3.1.2, para. 4.
Stakeholder participation and responsibility sharing	Draft EIA Procedure (24 December 2013 Draft) Paras. 2, 6, 28, 39, 50, 55	The Draft EIA Procedure has detailed processes for stakeholder participation and also rules for engaging with stakeholders. The Draft EIA Procedure does not put any particular responsibility on the stakeholder side.	Encourage stakeholders to take responsibility for their respective areas of concern during and after project building and implementation. JICA Guidelines for Environmental and Social Considerations (April 2010), Section 1.1/1.4 and relevant sections of the World Bank Operations Manual.
Environmental and Social Consideration Process			
Concern about Social Environment and Human Rights	Draft EIA Procedure (24 December 2013 Draft) *partial*	There are various general mentions of the need to include social considerations in the Draft EIA Procedure. However, there are no detailed guidelines	Implement best practice according to JICA Guidelines for Environmental and Social Considerations (April 2010), Section 3 and World Bank Operations Manual Series 4.00.

[4] In principal, international standards referenced might include the JICA Guidelines for Environmental and Social Considerations (April 2010) and the related World Bank Operations Manual.

JICA ESC Guidelines (April 2010) / World Bank Operations Manual and Operational Policies	Environmental Law	Gaps between International Standard and Laws of Myanmar	Methods for Implementing Best Practice
		stipulating how these processes should be carried out.	
Social acceptability	Draft EIA Procedure (24 December 2013 Draft) *partial*	There is some mention of the need to protect vulnerable groups such as indigenous people and women, but there are no detailed procedures for analyzing such impacts.	Implement best practice per World Bank Operations Manual Series 4.10.
Protected natural areas and ecosystems	Draft EIA Procedure (24 December 2013 Draft) Annex 1	There are provisions for the analysis of impacts to sensitive ecosystems as defined under relevant legislation and Government Notices. However, the Draft EIA Procedure only references existing definitions of natural areas and ecosystems without providing extended coverage for *ad hoc* inclusion of sensitive area impacts.	Implement preventative measures for sensitive ecosystems according to JICA Guidelines for Environmental and Social Considerations (April 2010), Appendix 1 and World Bank Operations Manual Series 4.04.
Advisory Committee for Environmental and Social Considerations	none	There is no independent committee reviewing EIAs in Myanmar.	Implement the provisions of JICA Guidelines for Environmental and Social Considerations (April 2010), Sec. 1.10.

4 Baseline Scoping

This scoping section will set out the baseline socio-environmental conditions, identify possible environmental issues/impacts related to changes in land use and Project implementation, review domestic Myanmar rules and regulations, and review the international guidelines that are applied to this project.

4.1 Baseline Information

The following section sets out the baseline—i.e. current—socio-environmental conditions of the Project. The information presented is intentionally brief and to the point and is meant to summarize the characteristics of the target site. Full data will be presented in Appendix D.

4.1.1 Pollution Control

In Myanmar there are currently no nationally required ambient environmental regulations. However, there are currently regulations under debate between MOECAF, Ministry of Industry (MOI), Ministry of Science and Technology (MOST) (and MOST's ESQ subcommittee), etc. As an interim measure before the national environmental regulations are implemented, it is proposed that the EIA for a new project will need to specify an Environmental Management Plan (EMP) with ambient and emissions standards set for the SEZ that are equivalent to the provisional Draft Domestic Pollution Control Standards. The various national environmental standards to be implemented on a rolling basis will take precedence and form the new minimum standard for the SEZ environmental regulations.

For the Project, it is proposed that environmental standards for the entire Thilawa SEZ including the 2,000ha area and 400ha Zone A area will be set in coordination. However, at a minimum the standards set for the 2,000ha area will conform to IFC standards and/or any Myanmar interim standards that are published before the SEA for the 2,000ha area is finalized. These zone-wide standards will also be backed up by factory-based ambient and emissions standards. For example, a factory will be required to meet a certain minimum standard for wastewater effluent before discharging that effluent to the SEZ-wide wastewater processing facilities.

1) Air

The Project area is overwhelmingly dominated by agricultural land and as such air pollution on site is relatively minimal. The data collected and the results indicate that the air quality survey in the Thilawa area is generally good in the rainy season but worsens during the dry season, particularly for particulate parameters. The baseline survey was conducted in both the dry season and the rainy season. 24 hour data was taken twice on consecutive days at 6 different air quality monitoring (AQM) points. The AQM points were chosen to provide a

comprehensive evaluation of the general air quality of the area including existing potentially significant air emissions sources and roads. As air quality is affected by moisture in the air and temperature, days for measurement were chosen according to being hot and dry during the dry season and relatively wet during the rainy season. These points are presented in the figure below.

Source: SEZ Management Committee

Figure 4-1 Air Quality Sampling Points

Table 4-1 Ambient Air Quality Survey Results

		Quantitative Target	Rainy Season Average	Dry Season Average
AQM-1	PM10	24 hr ave < 150 μg/m^3	24.1	71
	TSP	24 hr ave < 260 μg/m^3	35.6	145
	CO	1 hr ave < 9 ppm	0.108	0.094
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.059	0.087
AQM-2	PM10	24 hr ave < 150 μg/m^3	11.5	108
	TSP	24 hr ave < 260 μg/m^3	14.8	308
	CO	1 hr ave < 9 ppm	0.017	0.022
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.045	0.068
AQM-3	PM10	24 hr ave < 150 μg/m^3	16.4	81
	TSP	24 hr ave < 260 μg/m^3	29.8	175
	CO	1 hr ave < 9 ppm	0.015	0.367
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.059	0.059
AQM-4	PM10	24 hr ave < 150 μg/m^3	13.9	108
	TSP	24 hr ave < 260 μg/m^3	21.2	237
	CO	1 hr ave < 9 ppm	0.053	0.114
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.057	0.096
AQM-5	PM10	24 hr ave < 150 μg/m^3	9.3	34
	TSP	24 hr ave < 260 μg/m^3	10.8	61
	CO	1 hr ave < 9 ppm	1.426	0.818
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.051	0.038
AQM-6	PM10	24 hr ave < 150 μg/m^3	16.1	54
	TSP	24 hr ave < 260 μg/m^3	24.2	97
	CO	1 hr ave < 9 ppm	0.017	ND
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.058	0.330

PM10=Particulate Matter; TSP=Total Suspended Particulates; CO=Carbon Monoxide; SO2=Sulfur Dioxide; NO2=Nitrogen Dioxide; ND=Not Detected at lower detection limit.
Notes: Data taken over the period from 29 May 2014 to 06 June 2014 for the rainy season and March 30-April 4, 2015 for the dry season.

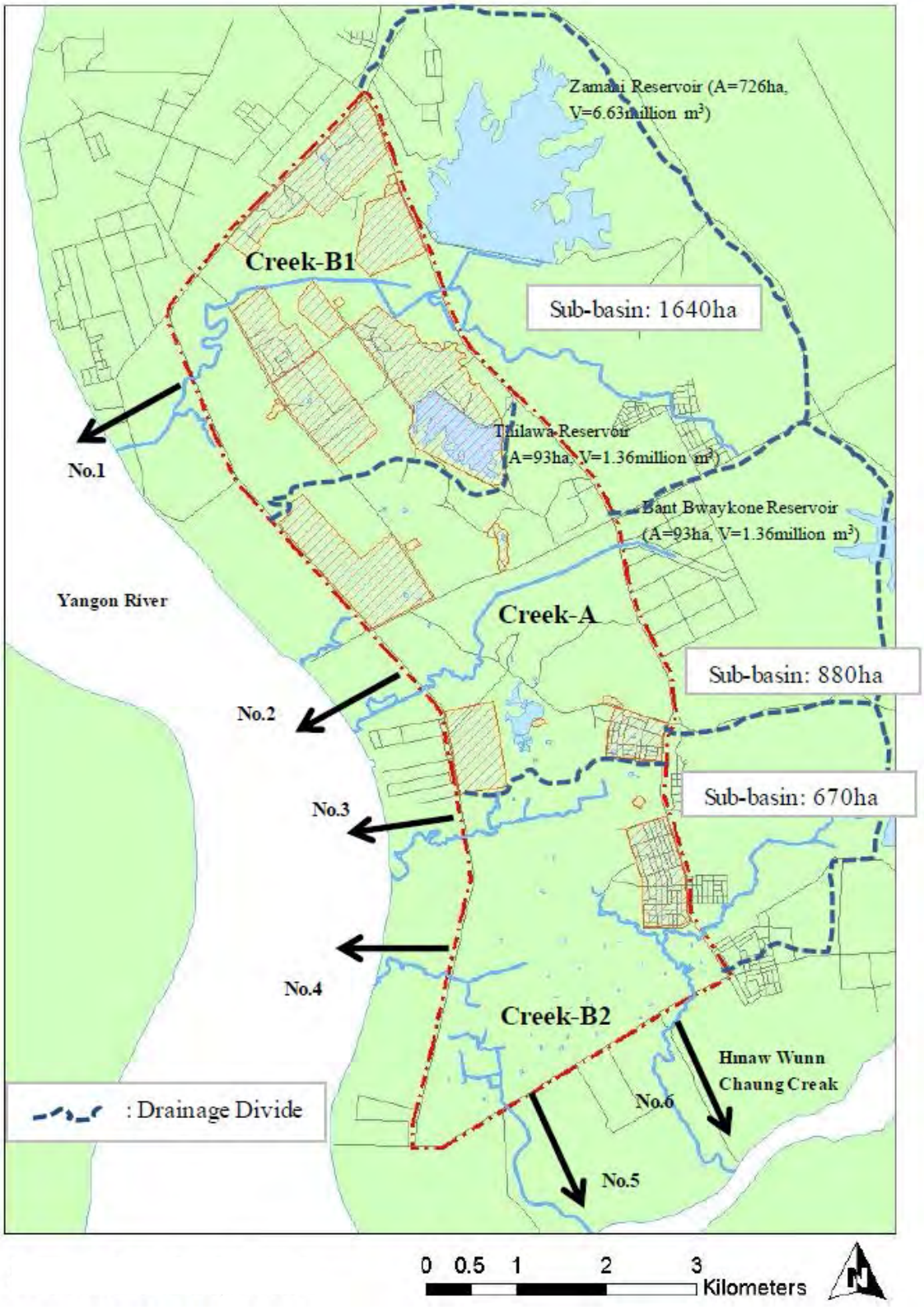
Source: SEZ Management Committee

It should also be noted that there are surrounding commercial and industrial developments, such as the Myanmar Port Authority, the towns of Thanlyin/Kyauktan, etc. that are considered to be existing contributors to the air-shed quality.

2) Surface and Groundwater

There are two main bodies of water near to the site. The site is proximate (~700m) to the right bank of the Yangon River, which flows from north to south, and the right bank of the Hmawwun River, which flows from east to west and drains into the Yangon River. There are four streams on the site that flow east to west into the Yangon River and two streams that flow north to south into the Hmawwun River. Roughly 21km downstream of the bank closest to the southwestern tip of the 2,000ha area the Yangon River flows into the Gulf of Martaban and the Indian Ocean.

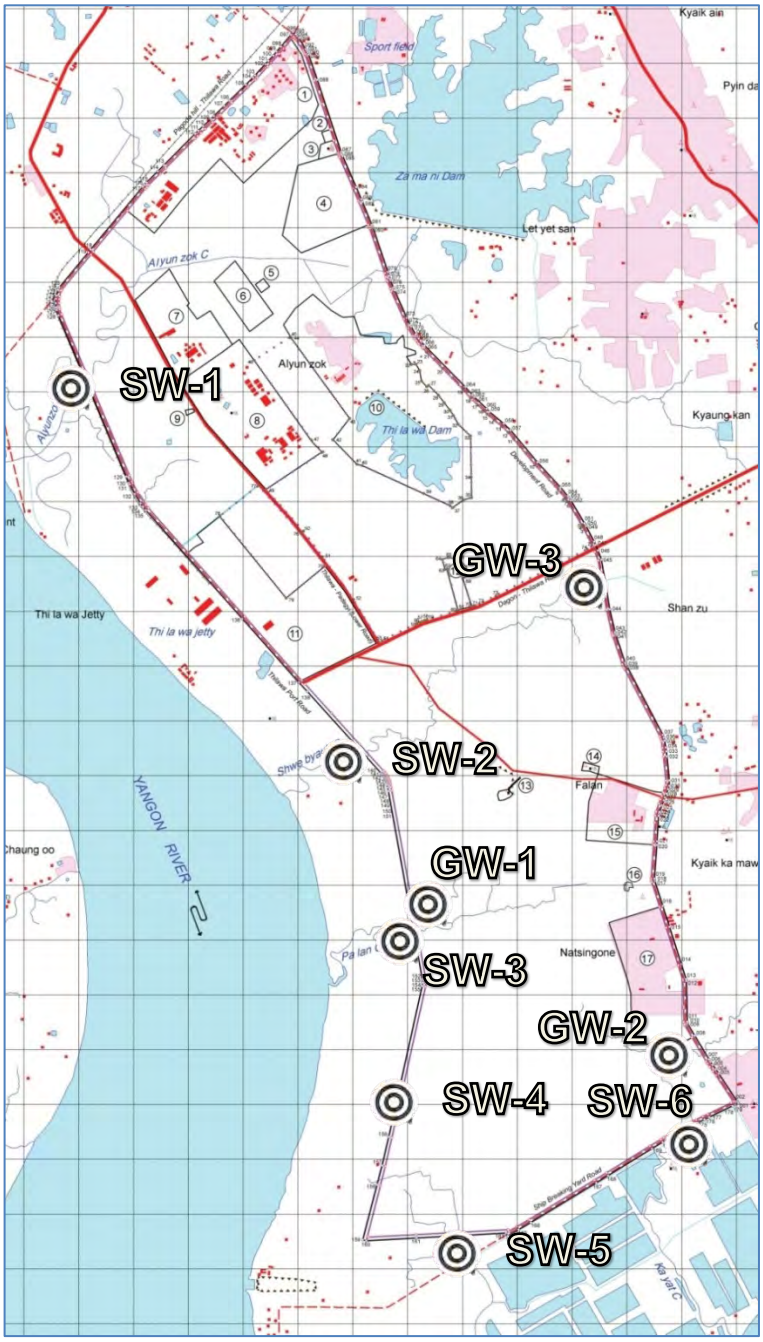
As for water resources directly in the 2,000ha area there are the six on-site streams mentioned above and two permanent bodies of water: the Thilawa Reservoir in the north-central area and the Bant Bway Kkone Reservoir in the south-central area. There are two additional permanent bodies of water directly to the east of the site: the Zarmani Reservoir to the northeast and the Bant Bway Kone Reservoir to the east. The two northern-most streams exiting from the western border of the 2,000ha zone are fed from these latter two reservoirs and rainwater catchment. The two remaining southern streams exiting the western border as well as the two streams exiting the southern border are fed by rainwater catchment on and off the site. All reservoirs in and around the site are in turn fed by rainwater catchment. In the rainy season the water flowing off site is significant, but in the dry season the streams experience tidal intrusion with most of the water in the streams immediately around the borders consisting of brackish seawater.



Source: JICA (2013) *Preparatory Study on Thilawa Special Economic Zone (SEZ) Infrastructure Development in the Republic of the Union of Myanmar*

Figure 4-2 Bodies of Water in the Vicinity of the 2,000ha Zone

The water quality survey was conducted with a limited parameter set monthly for one year with an additional extended parameter set. Six surface water (SW-1 to SW-6) points and three groundwater (GW-1 to GW-3) were selected as representative samples of surface and groundwater quality in the area.



Source: SEZ Management Committee

Figure 4-3 Surface and Groundwater Monitoring Points

The results of the monitoring are as below.

Table 4-2 Surface and Groundwater Sampling Results (Limited Parameter Set)

Parameter	Unit	Sample Date											
		18/12/2013	2014/1/7	2014/1/30	2014/2/18	2014/3/14	2014/4/1	2014/4/25	2014/5/16	2014/6/3	2014/6/24	2014/7/15	2014/8/5
SW-1													
Temp	**°C**	25.3	23.9	24.8	26.2	35.3	31.2	33.4	29.6	31.7	28.4	28.7	27.4
Flow*	**m^3/s**	-	-	-	-	-	-	-	-	-	-	-	-
Level/Depth	**m**	- /0.12	- /0.13	- /0.14	- /0.2	- /0.1	- /0.2	- /0.2	- /0.2	- /0.2	- /1.6	4 /-	3 /-
Odor	**-**	muddy	muddy	muddy	muddy	muddy	muddy	muddy	muddy	muddy	muddy	muddy	muddy
Color	**TCU**	-	45	130	50	20	10	10	10	40	60	100	50
EC	**µs**	1956	142	223	1735	21.67	23.01	20.61	20.61	659	226.1	82.9	51.4
pH	**-**	7	6.9	7.1	7.1	8.66	7.7	7.32	7.32	6.57	6.38	6.39	6.13
BOD	**mg/L**	3.2	1	2.5	2.5	2	2	2.5	2	2	2.5	2	1.5
SS	**mg/L**	540	1068	1035	1912	110	36	36	36	68	382	172	92
DO	**mg/L**	5.2	4	5	4.5	10.36	4.12	4.12	4.12	46.6	3.08	50.5	39.6
SW-2													
Temp	**°C**	23.6	24.2	24.6	26.4	33.3	30.8	33.9	27.1	31.3	28.2	28	27.4
Flow*	**m^3/s**	0.141	0.129	0.102	0.085	0.083	0.089	0.083	0.083	-	-	-	-
Level/Depth**	**m**	-	-	-	-	-	-	-	-	-	-	-	-
Odor	**-**	muddy	muddy	muddy	muddy	muddy	nil	nil	nil	nil	nil	nil	nil
Color	**TCU**	20	80	95	90	25	50	80	80	120	90	160	80
EC	**µs**	1792	411	293	1086	21.47	25.95	22.03	22.03	6.74	325.9	211.1	42.6
pH	**-**	6.8	6.7	7.2	7.1	8.37	7.39	7.98	7.98	7.81	6.73	7.25	6.39
BOD	**mg/L**	0.5	2	2	2	1.5	2	2.5	2	1.5	2	2	1
SS	**mg/L**	526	1052	505	1983	103	95	95	95	388	1320	300	188
DO	**mg/L**	5	4	4.5	4	8.96	4.01	4.01	4.01	3.93	4.23	58	43.2
SW-3													
Temp	**°C**	25.3	24.8	23.8	27.3	34.5	31.8	34.3	29.6	30.2	28.5	27.7	27.1
Flow*	**m^3/s**	-	0.105	0.089	0.068	0.058	0.056	0.051	0.051	-	-	-	-
Level/Depth**	**m**	- /0.12	-	-		-	-	-	-	-	-	-	-
Odor	**-**	muddy	muddy	muddy	muddy	muddy	nil	nil	nil	nil	nil	nil	nil
Color	**TCU**	-	90	75	55	60	40	70	70	80	60	190	60
EC	**µs**	1956	283	765	965	26.52	26.88	20.22	20.22	8.49	1486	495.4	150.2
pH	**-**	7	6.8	7.1	7.1	8.5	7.73	7.76	7.76	7.73	7.08	7.19	6.7
BOD	**mg/L**	3.2	3	2.5	2.1	1.5	1.5	1	1.5	1.5	2.2	1.5	1
SS	**mg/L**	540	584	1403	1739	549	78	78	78	136	136	422	118
DO	**mg/L**	5.2	5	5	4	7.57	4.5	4.5	4.5	3.46	4.68	60.5	52.9
SW-4													
Temp	**°C**	25.9	25.3	26.1	30.2	34.4	31.1	36	29.5	30.4	29.2	28.1	27
Flow*	**m^3/s**	0.078	0.067	0.055	0.055	0.046	0.041	0.042	0.042	-	-	-	-
Level/Depth**	**m**	-	-	-		-	-	-	-	-	-	-	-/2

Parameter	Unit	Sample Date											
		18/12/2013	2014/1/7	2014/1/30	2014/2/18	2014/3/14	2014/4/1	2014/4/25	2014/5/16	2014/6/3	2014/6/24	2014/7/15	2014/8/5
Odor	-	muddy	muddy	muddy	muddy	muddy	nil	nil	nil	nil	nil	nil	nil
Color	TCU	20	180	35	50	35	70	40	40	140	220	120	90
EC	µs	1669	189	297	951	29.74	26.93	22.92	22.92	13.63	5.26	900	291.3
pH	-	7.2	7	7.2	7.1	8.67	7.46	8.05	8.05	7.44	7.08	7.33	7.11
BOD	mg/L	3.2	3	2.7	2.1	2	2	2	1.5	2	2.5	2	1.5
SS	mg/L	615	571	1043	1615	190	128	128	128	385	1930	188	152
DO	mg/L	5.2	4	5.2	4	5.57	4.11	4.11	4.11	4.27	62.4	79.3	54.1
SW-5													
Temp	°C	25.1	25.7	26.4	31	30.4	31	33	29.5	30.8	29.9	28.2	27.3
Flow*	m^3/s	-	-	-	-	-	-	-	-	-	-	-	-
Level/Depth	m	- /0.2	- /0.23	- /0.22	- /0.2	- /0.18	- /0.28	- /0.8	-/0.3	-/0.4	-/2.4	-/0.7	-/2
Odor	-	foul	foul	muddy	foul	foul	nil	nil	nil	nil	nil	nil	nil
Color	TCU	40	110	280	70	25	90	30	30	60	130	40	70
EC	µs	1666	252	1344	713	14.92	31.95	33.95	33.95	151.6	4993	1611	300.8
pH	-	7.1	6.8	6.8	7.1	7.23	7.23	7.57	7.57	7.58	7.24	7.19	6.94
BOD	mg/L	1	3	2	2.5	1.5	2.5	2	1	2	2.5	2.5	1.5
SS	mg/L	1253	710	1354	1442	102	147	147	147	160	1460	92	195
DO	mg/L	5	4	5	4.5	5.4	4.73	4.73	4.73	4.22	52.8	55.2	43.5
SW-6													
Temp	°C	25.5	26.1	25.6	29.7	29.7	29.9	34.2	28.3	30.5	29.1	28.1	28.1
Flow*	m^3/s	-	-	-	-	-	-	-	-	-	-	-	-
Level/Depth	m	- /0.25	- /0.29	- /0.28	- /0.3	- /0.25	- /1.5	- /1.0	- /1.5	- /0.9	- /2.2	- /1.0	- /1.2
Odor	-	foul	foul	foul	foul	foul	fishy	fishy	fishy	fishy	fishy	fishy	fishy
Color	TCU	40	50	40	15	10	30	10	10	20	80	70	45
EC	µs	1891	262	1523	836	25.85	30.03	35.25	35.25	19.95	1405	568	80.3
pH	-	7.2	6.9	6.9	7.1	7.04	7.36	7.95	7.95	7.49	7.1	7.18	6.72
BOD	mg/L	2.2	3	2	2.5	2	1.5	2	1	2	2.5	2.5	1.5
SS	mg/L	1213	1477	998	1749	45	52	52	52	58	1220	116	98
DO	mg/L	5.2	4	4	4.5	4.01	3.8	3.8	3.8	54.6	50.2	50.8	43.5
GW-1													
Temp	°C	25.9	25.2	27	28.7	29.6	28.4	29.6	29.1	29.5	28.6	29.1	28.5
Water level	m	2.1/2.3	2.5/1.8	2.8/1.5	2.7/1.6	3.6 /0.9	4.3/2.7	4.3/3.1	4.3/3.0	2.5/1.5	1.2/4.3	1.1/4.4	1/4.3
Odor	-	rusty	rusty	nil	nil	nil	rusty	rusty	rusty	rusty	rusty	rusty	rusty
Color	TCU	5	20	nil	nil	nil	nil	nil	nil	nil	nil	nil	5
EC	µs	1478	110	256	974	98	87	79.9	79.9	124.4	95.7	102.3	58.8
pH	-	6.8	6.8	4	4	4.73	4.65	4.96	4.96	5.06	4.65	4.53	5.57
GW-2													
Temp	°C	26.2	25.9	27	27.2	28.6	28.8	29.9	29.2	28.8	28.8	28.7	28.8
Water level	m	3.8/2.5	2.9/2.4	2.7/2.9	3.1/2.4	6.4/2.1	6.4/2.1	6.4/1.4	6.4/1.8	3.2/1.5	1.8/4.7	1.5/4.0	1.1/4.1

Parameter	Unit	Sample Date											
		18/12/2013	2014/1/7	2014/1/30	2014/2/18	2014/3/14	2014/4/1	2014/4/25	2014/5/16	2014/6/3	2014/6/24	2014/7/15	2014/8/5
Odor	**-**	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
Color	**TCU**	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	10
EC	**µs**	1461	101	105	653	54	50.8	68	68	59	67.4	62.7	58.6
pH	**-**	6	6	4.5	6	4.85	5.04	5.29	5.29	5.13	5.07	4.98	5.07
GW-3													
Temp	**°C**	25.8	24.8	27	26.1	29.3	28.4	31	29.3	29.6	29.3	29.2	28.9
Water level	**m**	2.5/3.5	2.3/3.5	3.5/2.8	3.3/3.0	4.2/2.2	4.2/1.6	4.2/1.7	4.2/3.7	0.6/5.6	1.1/5.2	0.7/5.3	0.8/5
Odor	**-**	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
Color	**TCU**	30	25	5	nil	nil	nil	nil	nil	nil	nil	nil	nil
EC	**µs**	1492	90	454	640	124.5	141.3	223.5	223.5	219.1	89.7	68.7	106.6
pH	**-**	6	6.2	5.5	4	4.85	6.37	6.82	6.82	6.05	5.8	5.53	4.6

Note: flow and depth measurements were taken at low tide to identify off-site flow and to minimize the impact of tidal fluctuations on measured values.
*Flow measurements were only able to be taken intermittently due to blockage of rivers by local residents for agricultural activities.
**Depth measurements were nil at low tide.
Source: SEZ Management Committee

Table 4-3 Surface Water Sampling Dry Season Results (Extended Parameter Set)

Parameter	Unit	Quantitative Target	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6
Total Coliform	**cfu/100mL**	**-**	$3.5x10^3$	$2x10^3$	$1.5x10^3$	$8x10^3$	$2.3x10^3$	$6x10^3$
COD	**mg/L**	**-**	1.84	1.104	ND	2.208	3.680	0.368
Total Nitrogen	**mg/L**	**-**	6.3	3.5	19.6	7.7	21.00	7.70
Total Phosphorous	**mg/L**	**-**	0.004	0.028	0.036	0.044	0.028	0.084
Turbidity	**NTU**	**-**	171	1220	1310	1450	2250	13
Arsenic (As)	**mg/L**	**0.340**	10.9	7.4	9.5	8.2	8.6	7.838
Mercury (Hg)	**mg/L**	**0.0014**	ND	ND	0.003	0.004	0.006	0.007
Lead (Pb)	**mg/L**	**0.065**	0.025	0.017	0.034	0.03	0.12	0.065
Cadmium (Cd)	**mg/L**	**0.002**	ND	ND	ND	ND	ND	ND
Chromium (Cr)	**mg/L**	**0.016**	1.75	1.67	1.81	1.48	1.45	3.8
Copper (Cu)	**mg/L**	**0.0023**	0.018	0.017	0.017	0.016	0.02	0.022
Zinc (Zn)	**mg/L**	**0.12**	0.01	0.013	0.007	0.015	0.03	0.075
Nickel (Ni)	**mg/L**	**0.47**	0.18	0.17	0.181	0.185	0.283	0.95
Iron (Fe)	**mg/L**	**-**	0.88	2.20	2.60	3.72	4.6	0.58
Cyanide (CN)	**mg/L**	**0.022**	0.002	0.009	0.006	0.005	0.002	0.008

ND=Not Detected
Source: SEZ Management Committee Study

Table 4-4 Groundwater Sampling Dry Season Results (Extended Parameter Set)

Parameter	Unit	Quantitative Target	GW-1	GW-2	GW-3
Total Coliform	**cfu/100mL**	**ND**	1 x10^2	2 x10^2	5 x10^2
Arsenic (As)	**mg/L**	**0.01**	3.682	ND	6.9
Mercury (Hg)	**mg/L**	**0.006**	0.019	0.033	0.093
Lead (Pb)	**mg/L**	**0.01**	ND	ND	ND
Cadmium (Cd)	**mg/L**	**0.003**	ND	ND	ND
Chromium (Cr)	**mg/L**	**0.05**	1.07	0.998	1.43
Copper (Cu)	**mg/L**	**2**	0.002	0.002	0.002
Zinc (Zn)	**mg/L**	**-**	0.04	0.029	0.003
Nickel (Ni)	**mg/L**	**0.07**	0.093	0.065	0.061
Iron (Fe)	**mg/L**	**-**	0.20	0.22	0.28
Cyanide (CN)	**mg/L**	**-**	0.002	0.005	0.004
Fluoride	**mg/L**	**1.5**	ND	ND	ND
Hardness	**mg/L**	**-**	6	6	20
Nitrates (NO3-N)	**mg/L**	**50**	0.104	0.120	0.98
Nitrites (NO2-N)	**mg/L**	**3**	0.01	ND	ND
Ammonium Nitrogen (NH4)	**mg/L**	**-**	ND	ND	ND

ND=Not Detected
*WHO and USEPA do not specify specific targets for these items.
Source: SEZ Management Committee Study

3) Wastewater

In industrial parks both in Myanmar and in other countries, it is now a common practice to establish a two-step effluent quality checkpoint system whereby wastewater effluent standards are set both at the individual factory level and further on at the SEZ-wide level. The 2,000ha area standards will reflect those employed in the Zone A while also taking care to adopt national standards as they come into force as a minimum. The table below shows various standards available for consideration, including the MOI standards adopted in the Zone A .

Table 4-5 Allowable Wastewater Discharge to Water Body (National Wastewater Effluent Standards under Consideration Applicable to SEZ)

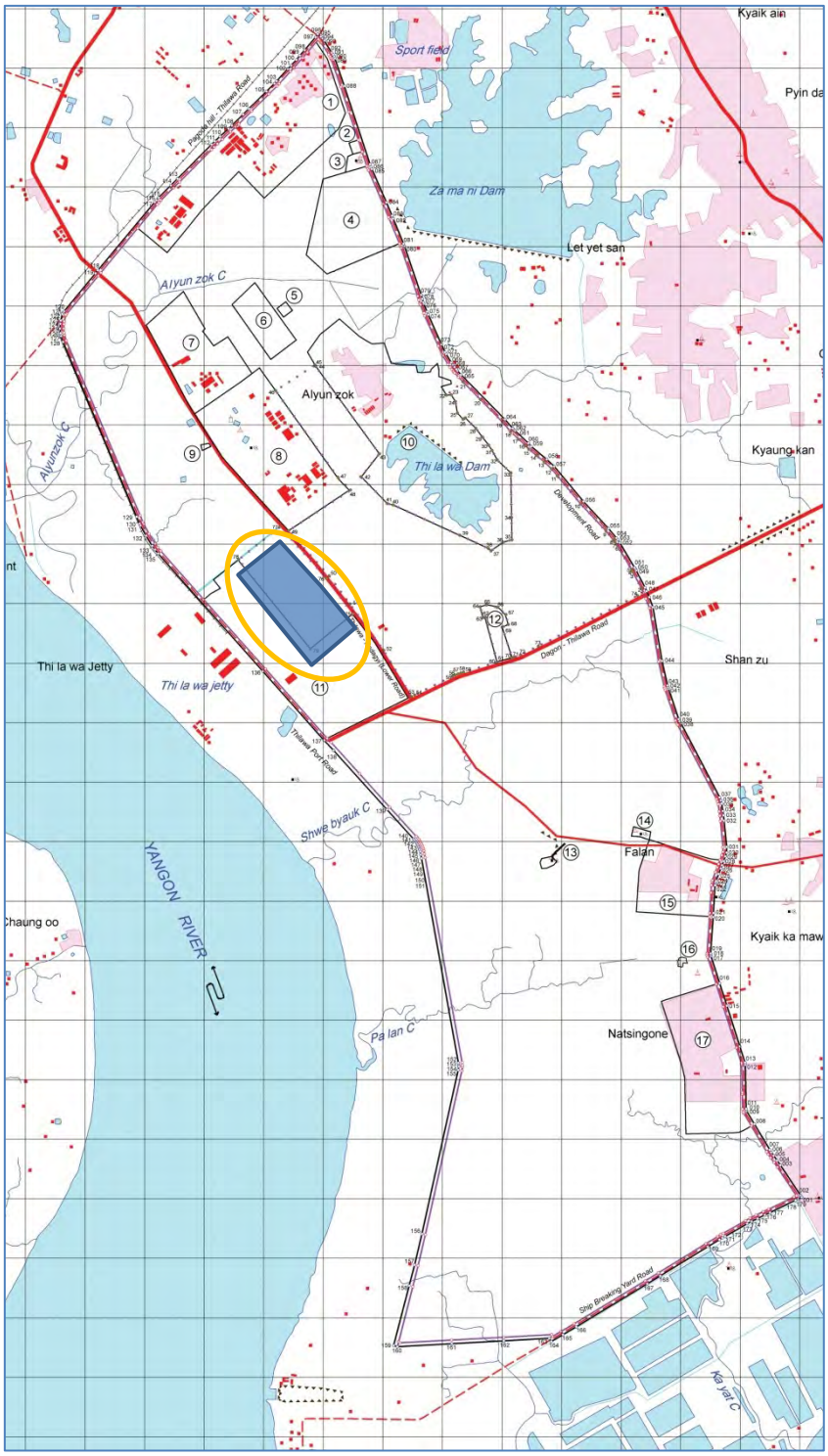
Parameter	Unit	Zone A	Dowa Waste Facility	IFC	China	Vietnam	MEP	MOI	MOM	YCDC
Physical										
Temperature	°C	**35**	40	-	-	40-45	-	40	-	-
Temp. ∆@zone of discharge	°C	-	-	**<3**	-	-	-	-	-	-
Dissolved Solids	mg/L	**2,000**	**2,000**	-	-	-	-	**2,000**	-	-
Suspended Solids	mg/L	**30**	**30**	50	20-800	50-200	50	**30**	-	<500
Coliform Bacteria	MPN/ 100ml	**<400**	-	**<400**	-	5-10,000	**<400**	-	-	-
Color/Odor	Co-Pt	**150**	Not objectionable	-	-	-	-	-	-	-
Chemical										
pH	units	**6.5-8.5**	5-9	6-9	6-9	5-9	6-9	5-9	6-9	6-9
Total Heavy Metals	mg/L	-	-	10.0	-	-	**10.0**	-	-	-
Iron (Fe)	mg/L	-	-	**3.5**	-	1.0-10.0	**3.5**	-	-	-
Zinc (Zn)	mg/L	5.0	5.0	**2.0**	2.0-5.0	1.0-5.0	**2.0**	5.0	-	-
Copper (Cu)	mg/L	1.0	1.0	**0.5**	0.5-2.0	0.2-5.0	**0.5**	1.0	-	-
Silver (Ag)	-	-	-	**0.5**	**0.5**	-	**0.5**	-	-	-
Chromium (Cr)	mg/L	0.5	0.5	**0.1**	0.5	0.05-0.5	**0.1**	0.5	-	-
Cadmium (Cd)	mg/L	**0.03**	**0.03**	0.1	0.1	0.01-0.5	0.1	**0.03**	-	-
Total Mercury (Hg)	mg/L	**0.005**	**0.005**	0.01	0.05	0.005-0.01	0.01	**0.005**	-	-
Barium	mg/L	**1.0**	**1.0**	-	-	-	-	**1.0**	-	-
Nickel (Ni)	mg/L	**0.2**	**0.2**	0.5	1.0	0.2-2.0	0.5	**0.2**	-	-
Phosphate (PO_4-P)	mg/L	-	-	**2.0**	-	-	-	-	-	-
Lead (Pb)	mg/L	0.2	0.2	**0.1**	1.0	0.1-1.0	**0.1**	0.2	-	-
Arsenic (As)	mg/L	0.25	0.25	**0.1**	0.5	0.05-0.5	**0.1**	0.25	**0.1**	-
Selenium (Se)	mg/L	**0.02**	**0.02**	0.1	-	-	0.1	**0.02**	-	-
Cyanide	mg/L	**0.2**	**0.2**	1.0	0.5-1.0	-	1.0	**0.2**	-	-
Sulfide (S)	mg/L	1.0	1.0	1.0	1.0	**0.2-1.0**	1.0	1.0	-	-
Fluoride	-	-	-	20.0	10.0-30.0	**1.0-5.0**	20.0	-	-	-
Chlorine (Cl_2)	mg/L	1.0	1.0	**0.2**	-	-	-	1.0	-	-
Formaldehyde	mg/L	**1.0**	**1.0**	-	-	-	-	**1.0**	-	-
Permanganate	mg/L	-	**60**	-	-	-	-	-	-	-
Oxygen Demand										
Biological (BOD)	mg/L	**20**	20-60	50	20-600	20-100	50	20-60	-	20-60
Chemical (COD)	mg/L	**60 (Cr)** 35 (Mn)	-	250	60-1,000	50-400	250	-	150	<200
Free Ammonia (NH3-N)	mg/L	-	-	-	-	**0.1-10.0**	10.0	-	-	-
Total Nitrogen (T-N)	mg/L	**5.0**	-	10.0	-	**-**	-	-	-	-
Other										

Parameter	Unit	Zone A	Dowa Waste Facility	IFC	China	Vietnam	MEP	MOI	MOM	YCDC
Phenols / cresols	mg/L	1.0	1.0	**0.5**	0.5-2.0	0.001-1.0	**0.5**	1.0	-	-
Mineral Oil (hydrocarbons)	mg/L	**5**	**5**	10	20-100	-	10	**5**	15	-
Tar	-	**ND**	**ND**	-	-	-	-	**ND**	-	-
Radioactivity and insecticides	-	**ND**	**ND**	-	**ND**	-	-	**ND**	-	-

Acronyms: ND=non-detected; IFC=International Finance Corporation; MEP=Ministry of Electrical Power; MOI=Ministry of Industry; MOM=Ministry of Mines; YCDC=Yangon City Development Committee
Notes: Bolded items represent the strictest standards for each regulation.
Source: Referenced from consultation with MOECAF ESQ Subcommittee #17 on Air Quality Standards, Water Quality Standards, Drinking Water Standards, and Pesticide Residue Specifications.

4) Solid Waste

Dowa Eco-System Ltd., a Japan-based company, has received approval for and is constructing a solid waste treatment facility in the western portion of the Zone A area. This facility will receive solid waste from the entire SEZ area as a priority. The location of this facility vis-à-vis the project is outlined in the figure below.



Source: Dowa Eco-System Ltd. (2015). Project on Construction of Solid Waste Management Facilities in Thialwa SEZ Zone A Area

Figure 4-4 Location of Solid Waste Management Facility

According to the EIA report for this facility, the facility will receive industrial non-hazardous, hazardous and recyclable waste. The proposed capacity for the project is as follows:

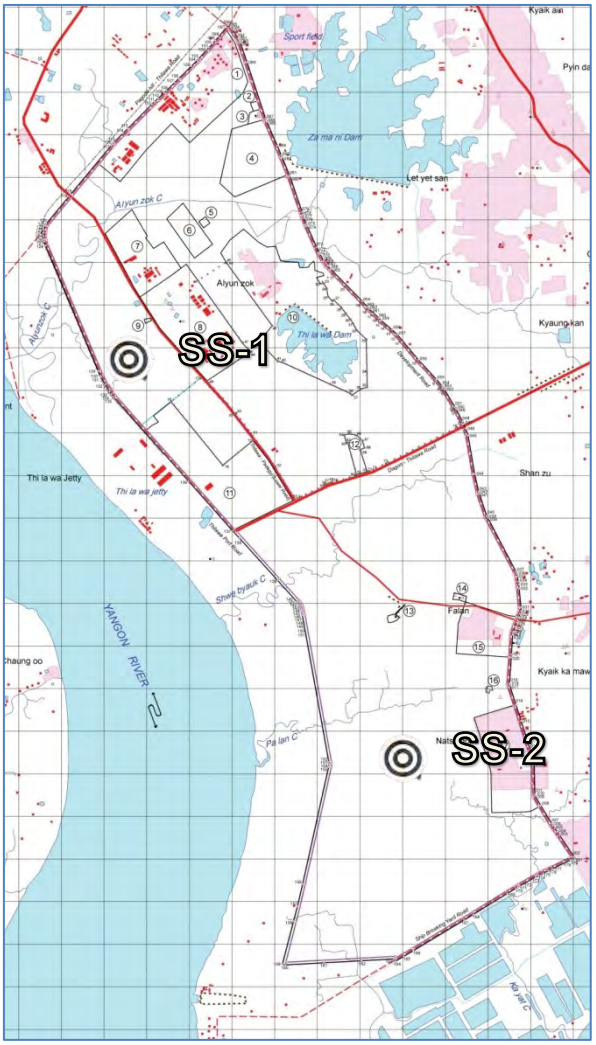
(i) Recyclables, hazardous and non-hazardous waste disposal (including

incineration/landfilling): 10,000-30,000 tons/year (30-80 tons/day)
(ii) Non-hazardous waste incineration: 20 tons/day (<1 ton/hr)

Organic waste will be collected by YCDC and taken off site to existing YCDC facilities in order to prevent vermin being attracted to the Dowa site. In addition to the Solid Waste Management Facility in the Zone A area, according to the Yangon City Development Committee (YCDC), there are currently plans to build a new incinerator with capability for 100 tons/day capacity for industrial hazardous waste coming out of the Thilawa SEZ. There are furthermore two additional landfills being set aside. The first landfill has an area of 30 acres and the land for this landfill has already been secured. The second landfill is planned to be 200 acres but the land for this landfill has not been secured yet. According to YCDC, the existing capacity for solid waste management in Thilawa is around 500 tons/day for non-industrial waste.

5) Soil

A soil contamination survey was undertaken at two points as shown in the figure below.



Source: SEZ Management Committee

Figure 4-5 Baseline Soil Sampling Points

The Project area is green-field. Given the past activity of the area, agricultural and

residential with some light industry, a limited parameter set was evaluated for naturally occurring metals. When compared to WHO threshold levels, the soil samples taken from each of these sample points did not show any contamination beyond guideline values. However, there were slight elevations in Chromium, Lead, and Cadmium that are possibly a result of natural lateritic soil content.

Table 4-6 Baseline Soil Contamination

Parameter	Unit	WHO Recommended Maximum Soil Concentrations for Agricultural Purposes	Measured result	
			SS-1	SS-2
Cadmium	mg/kg	<4.0	1.35	1.65
Chromium	mg/kg	-	47.12	63.75
Lead	mg/kg	<84.0	13.97	25.8
Arsenic	mg/kg	<8.0	ND	ND
Mercury	mg/kg	<7.0	ND	ND
Copper	mg/kg	-	7.6	17.12
Zinc	mg/kg	-	28.95	155.85

Source: SEZ Management Committee

6) Noise and Vibration

There are no regulations requiring a certain noise threshold currently under Myanmar domestic law. In April (dry season) and June (rainy season) of 2013, there was a noise survey conducted in the Moekyoswan Monastery compound and on a road in front of the Maritime University near Zarmani Dam. The baseline noise levels measured consistently exceeded IFC guideline noise levels (55dB daytime, 45dB nighttime) for residential/institutional/educational areas. IFC guidelines stipulate that the project noise levels at operation should not result in an increase above 3dB greater than background levels or a total of 70dB in industrial and commercial areas.

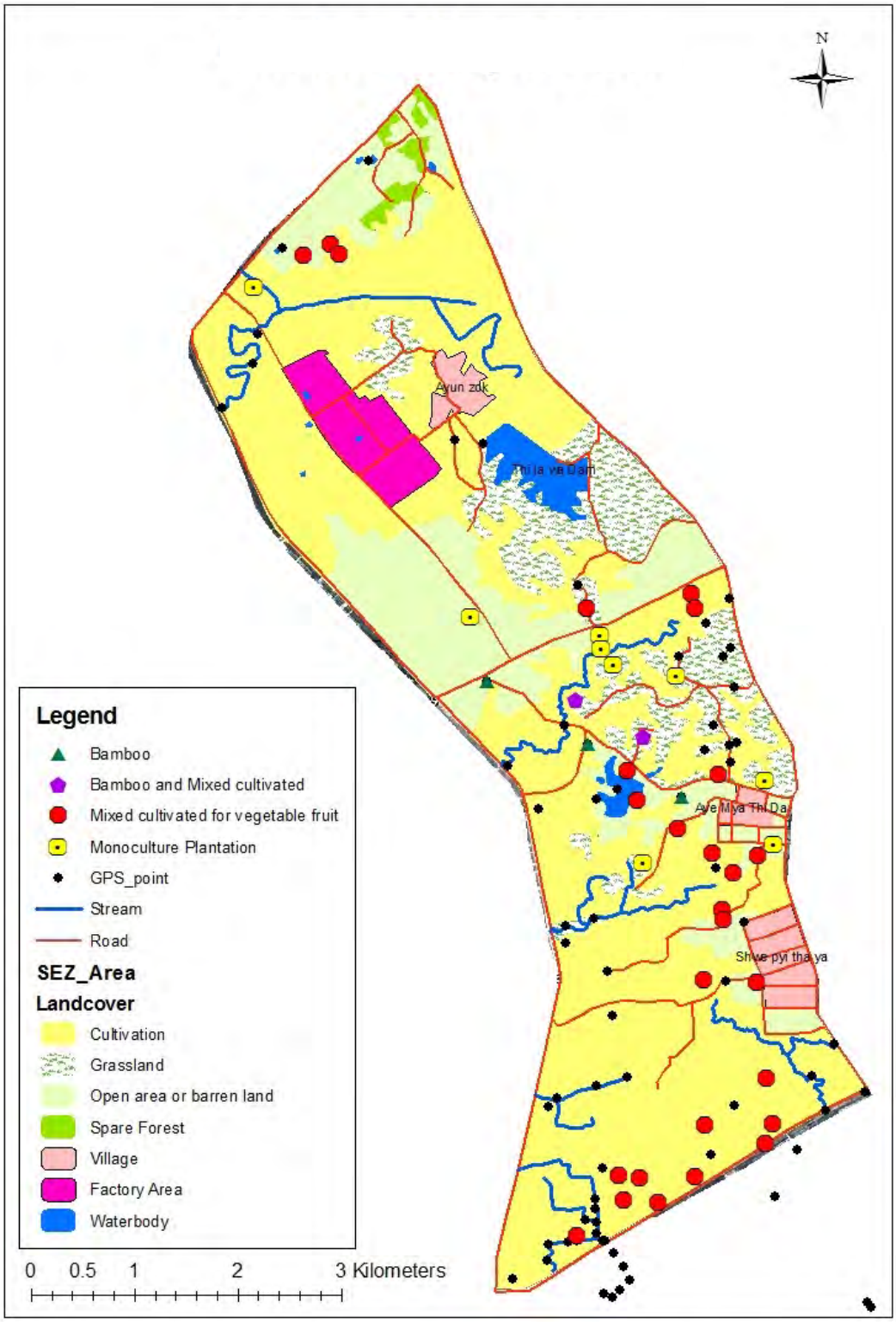
4.1.2 Natural Environment

The environment in the area is almost entirely converted from the native forest habitat and is presently dominated by agricultural use with some mixed industrial use. The table and figure below give an overview of current habitat typology in the area.

Table 4-7 Existing Habitat Typology

	Land Use Type	Area (km^2)
1	commercial area	0.139
2	cultivated land	12.389
3	education and culture facilities	0.500
4	grass land	5.975
5	industrial area	0.771
6	open space	4.911
7	residential area	1.693
8	swamp area	0.315
9	under developing area	1.002
10	water surface	0.752
	Total	**28.447**

Note: The type and data are based on the report of The Project for the Strategic Urban Development Plan of the Greater Yangon modified in association with the satellite image of Thilawa SEZ area.
Source: SEZ Management Committee Consultants



Source: SEZ Management Committee Consultants

Figure 4-6 Existing Habitat Typology

1) Biodiversity (Fauna)

The apparent fauna on and around the 2,000ha site is of a wide variety. A total of 180 fauna species representing 91 birds (70 species present in cool dry season and 55 species

present in rainy season), 31 fishes (16 species present in cool dry season and 27 species present in rainy season), 20 amphibians and reptiles (14 species present in cool dry season and 20 species present in rainy season) and 38 insect species (14 species present in cool dry season and 37 species present in rainy season) were recorded. No endangered species[5] have been identified on site. There was one bird species *Ploceus hypoxanthus* identified on site that is classified as Near Threatened on the IUCN Redlist. There were three fish species, *Labeo nandina*, *Anguilla bicolor,* and *Wallago attu* that are classified as Near Threatened on the IUCN Redlist.

Apart from the IUCN Redlist classification, there are some domestically protected[6] bird species that have been identified within the 2,000ha zone, namely the white-throated babbler (*Turdoides gularis*), which is endemic to Myanmar. Avian wildlife is particularly concentrated in and around water habitats. The mangrove embankments and onsite ponds/lakes provide a habitat for domestically protected birds. Of the 91 unique bird species identified on site, there were 35 bird species were identified in the water and marshland habitat.

Likewise, for aquatic species, the tidal influence on the streams on site and calm waters sheltered by mangrove river embankments may be a relatively important water area in the Yangon River deltaic sub-region that might provide shelter for fish spawning.

2) Biodiversity (Flora)

The flora in the project area belongs to Asia tropical coastal tidal region. According to WWF Eco-regions (Figure below), the study area is situated in the Myanmar coastal mangroves and Myanmar coastal rain forest. Mangrove species grow only in the brackish or salty water and are sensitive to the changes of ecosystem. Since at least colonial times, forest lands in the Project area have been converted to agriculture land and other development activities. The mangroves lining the banks of the rivers and creeks are subject to severe degradation because there is no clear-cut land-use system in the past and mangrove resources have most likely been used in an informal way over the past. Mangroves today are found only in small patches along the creek and river banks.

Today, dominant mangrove species are *Sonneratia caseolaris (L.) Engl., Avicennia spp., Sonneratia apetala Buch.-Ham.,* and *Excoecaria agallocha L.*, which are Irrawaddy Mangroves according to WWF. These species are growing wild in patches along the bank of Yangon River and the creeks which drain into it. Only 9 mangrove species (7 species in direct impact zone and 9 species in indirect impact zone) and 27 mangrove associate species are extant in summer with 4 additional mangroves associate species extant in the rainy season are growing in patches along the bank of creeks and Yangon River.

There were two IUCN Redlist endangered or near threatened species found in the area, *Dalbergia cultrate* Grah. and *Dipterocarpus alatus* Roxb. They do not occur naturally here and are both cultivated *ex situ* at monasteries or village homesteads. The location of the *Dipterocarpus alatus* Roxb. specimen may be within the project area itself nearby Phalan village. Steps should be taken to avoid the destruction of this specimen.

Table 4-8 Endangered or Near Threatened Flora Species

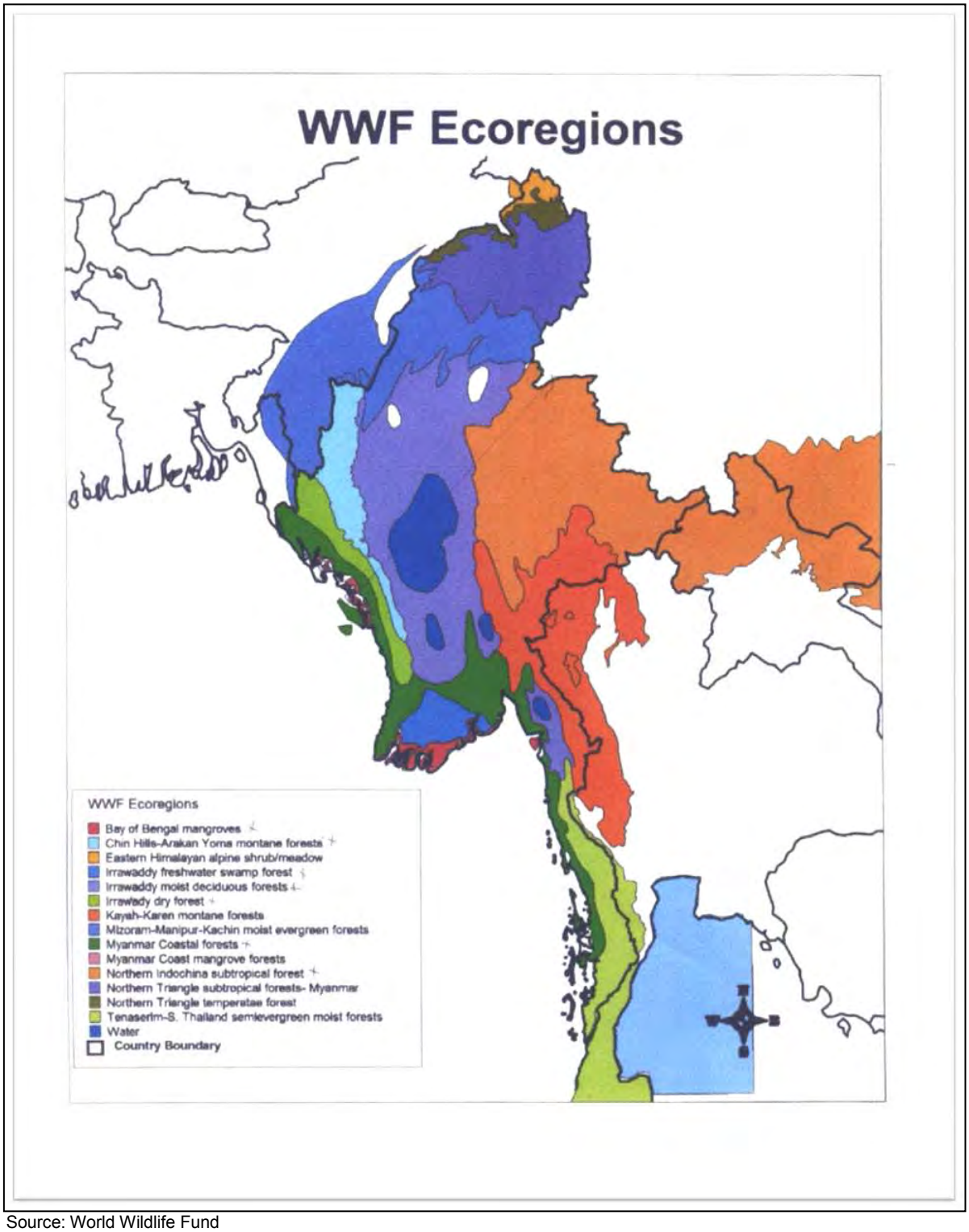
	Scientific Name	Family Name	Vernacular Name	IUCN criteria	Place	Location
1	*Dalbergia cultrata* Grah.*	Fabaceae	Yin-daik	NT	Moekyoswum Monastery	N16° 40' 24.8" E96° 16' 30.9"

[5] Status as determined under the International Union for Conservation of Nature's (IUCN) Red List.
[6] Protected under the Forest Department Notification No. 583/94 (http://www.esabii.org/database/others/documents/Myammer_NoticeNo583_94.pdf)

2	*Dipterocarpus alatus* Roxb.	Dipterocarpaceae	Kanyin-phyu	EN A1 cd +2cd, B1 +2c	Phalan old village near Thidarmyaing	N16° 38' 20.2" E96° 17' 26.7"

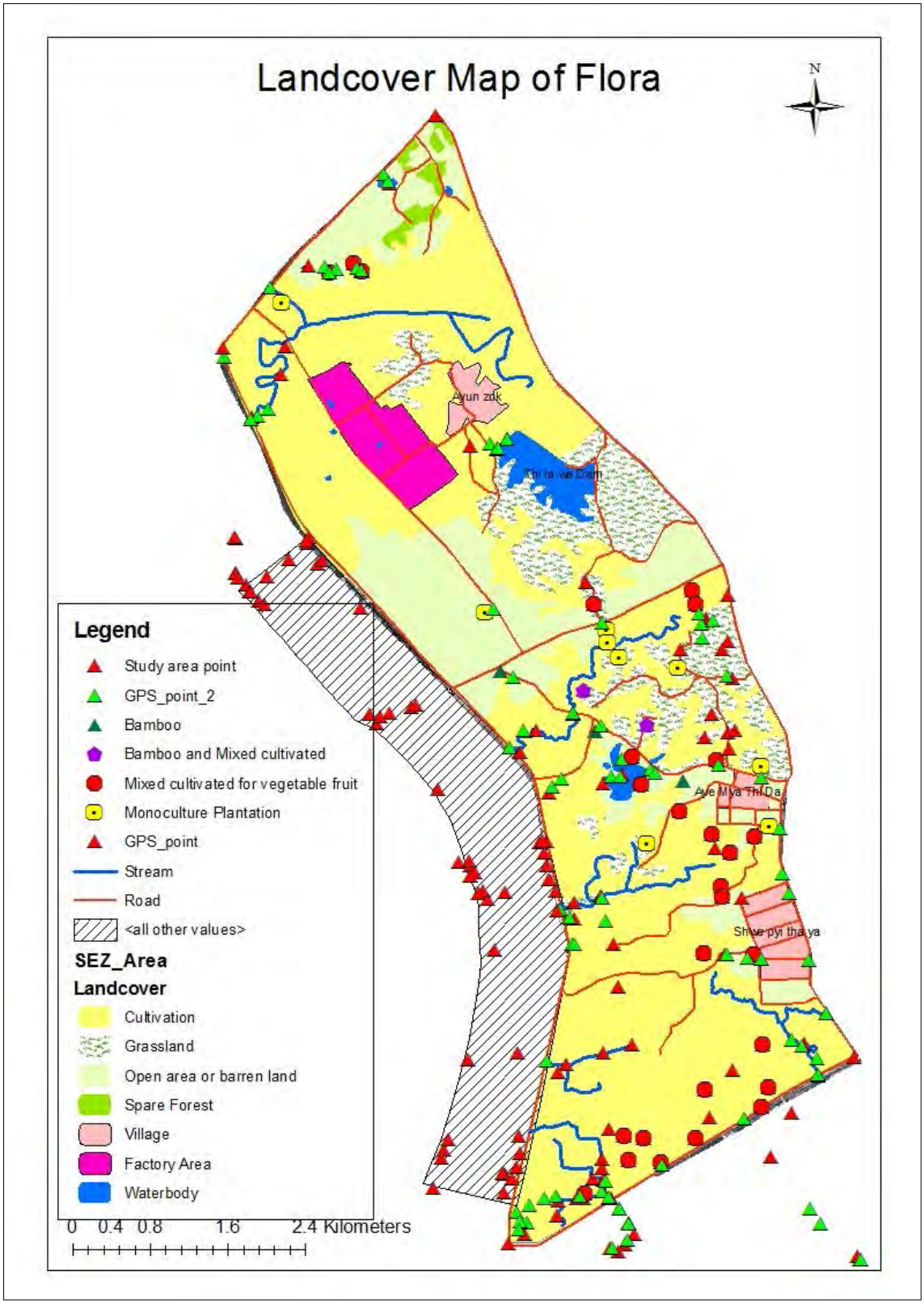
**Dalbergia cultrata* Grah. is listed in the World List of Threatened Trees as Endangered (A1cd).

Source: SEZ Management Committee study



Source: World Wildlife Fund

Figure 4-7 WWF Ecoregions of Myanmar



Source: SEZ Management Committee study

Figure 4-8 Area of Study and Landcover

As indicated in the landcover map above, almost all of the terrestrial ecosystem in the Project area is covered by agriculture lands. There are also monoculture plantations of

Acacia auriculiformis A.Cunn., and some bamboo patches as well as a mixed plantation of fruit trees like *Anacardium occidentale* L., found in large patches in the studied area. Ornamental flower cultivation in private orchards is also common in the Project area.

4.1.3 Social Environment

Thilawa SEZ overlaps both the Thanlyin and Kyauktan Townships south of Yangon with the northern half of the Project in Thanlyin and the southern half in Kyauktan. Thanlyin as a whole has an area of 143.982mi^2 (372.912km^2) with a population of 210,838 people in 2015. Kyauktan as a whole has an area of 325.76mi^2 (843.715km^2) with a population of 170,844 people in 2015[7]. In the Thilawa SEZ itself, there seems to be a number of households in the 2,000ha area of the SEZ with the highest population density in the northern area of the SEZ zone.[8] The ethnic make-up of the population is overwhelmingly Bamar (95%+) with Kayin, Rakhine, Indian and other smaller ethnicities also represented.[9] Income sources in the area are predominately income from casual labor, agricultural activities, and other trades such as fishery and skilled labor.

1) Cultural Heritage

Significant cultural heritage in the site itself was not identified. There are however significant cultural heritage assets around the Thilawa SEZ including numerous pagodas such as the Kyaik Kyauk Pagoda, monasteries, and the remnants of the ancient Mon kingdom of Pada Gyi located around the Pardagyi Pagoda. The Pada Gyi Kingdom was a so-called 'laterite' kingdom in that the principal building materials used were laterite. The Ministry of Culture confirmed that laterite in the region is mostly situated 15m+ above sea level and the ground at lower elevations is generally silty and inappropriate for the type of construction conducted by these 'laterite' kingdoms. Therefore, it is highly unlikely that any archaeological remnants of the Pada Gyi Kindgom exist directly in the 2,000ha SEZ area. However, it is thought that some archaeological remnants of the Pada Gyi Kingdom might be located proximate to the route leaving the Thilawa SEZ and going to Dagon Bridge.

2) Water Use

The Township Development Committees of Kyauktan and Thanlyin have responsibility for providing water in their respective areas. At present, water sources for Thilawa area are underground water and surface water which is stored by three water storage reservoirs: Zarmani, Thilawa, and Bant Bwekone in Thanlyin and Kyauktan Townships. The water rights for underground water belong to the Ministry of Development Affairs (MDA) and the rights to surface water belong to the Ministry of Agriculture and Irrigation (MOAI). Therefore, Zarmani and Bant Bwekone reservoirs are controlled by MOAI. However, the Thilawa Reservoir is managed by MOI and Ministry of Construction (MOC).

Presently Zarmani Reservoir is used mainly for irrigation purposes. Thilawa Reservoir is utilized for industrial and irrigation water. The water supply from the Thilawa Reservoir is purified at 2 purification plants and sent to the various industries and facilities around the Thilawa SEZ area. Likewise, the Bant Bwekone Reservoir supplies water to the ship breaking facility and to the Kyauktan area.

In addition to these surface water sources, there are also a number of groundwater wells

[7] General Administrative Department, Thanlyin, and General Administrative Department, Kyauktan

[8] JICA (2013b). Resettlement Work Plan (RWP) for Development of Phase 1 Area Thilawa Special Economic Zone (SEZ)

[9] JICA (2013). Preparatory Study on Thilawa Special Economic Zone (SEZ) Infrastructure Development in the Republic of the Union of Myanmar

found on site. Wells on site are used for both drinking water and miscellaneous domestic use.

3) Fisheries

There is commercial fishing activity around the mangrove-lined streams exiting the SEZ from the western border and emptying into the Yangon River, although technically it is prohibited by law to fish within 300m of mangrove forest, the mangroves around the zone are not classified as mangrove forest by the Forestry Department of the Ministry for Environmental Conservation and Forestry. Commercial fishing occurs in the main Yangon River to which the subsidiary streams flow. There are also artisan fishing activities around various man-made ponds within the SEZ. These communities include fishermen dependent on fisheries activities and aquatic products for income and food security. The fisheries depend on the mangroves that line the banks of the streams and the brackish tidal flows that characterize the water quality and content. It is also considered likely that these small streams might provide a spawning ground for larger fish in the greater Yangon River system.

4) Health

The disease prevalence as reported by the respective GADs of Thanlyin and Kyauktan is as follows.

Table 4-9 Disease Prevalence in Thanlyin and Kyauktan

Township	Disease Type											
	Malaria		Diarrhoea		Tuberculosis		Dysentery		Hepatitus		HIV / AIDS	
	Afflicted	Deaths	Afflicted	Deaths	Afflicted	Deaths	Afflicted	Deaths	Afflicted	Deaths	Afflicted	Deaths
Thanlyin	11	-	1013	2	259	-	239	-	4	-	60 (2015) 63 (2014)	4 (2015) 2 (2014)
Kyauktan	5	-	728	-	258	-	471	-	14	-	10 (2015) 33 (2014)	0 (2015) 4 (2014)

Source: General Administrative Department, Thanlyin and Kyauktan

Table 4-10 Availability of Health Care

	Township	Name of Hospital / Health Facility	Type	Comment
1	Thanlyin	Thanlyin Hospital	Government hospital	200 beds
2	Thanlyin	Township Hospital	Government hospital	16 beds
3	Thanlyin	Chan Myae Myitta Hospital	Government hospital	20 beds
4	Thanlyin	Swan	Private clinic	General admission
5	Thanlyin	Aung (24) Hours	Private clinic	General admission
6	Thanlyin	Win	Private clinic	General admission
7	Thanlyin	Hlaing	Private clinic	General admission
8	Thanlyin	Myat Thukha	Private clinic	General admission
9	Thanlyin	Win Myittar	Private clinic	General admission
10	Thanlyin	Linn	Private clinic	General admission
11	Thanlyin	Kyaw	Private clinic	General admission
12	Thanlyin	That Thar Aung	Private clinic	General admission
13	Thanlyin	Aung Chann Myae	Private clinic	General admission
14	Thanlyin	San Mya Thidar	Private clinic	General admission
15	Thanlyin	Myitta Yait	Private clinic	General admission
16	Thanlyin	Kan Kaw Shwe Yee	Private clinic	General admission
17	Thanlyin	Moe	Private clinic	General admission
18	Thanlyin	Aung Thapyay	Private clinic	General admission
19	Thanlyin	Moe Thet	Private clinic	General admission
20	Thanlyin	Shwe Thet Lone	Private clinic	General admission
21	Thanlyin	Htet	Private clinic	General admission
22	Thanlyin	Myittar	Private clinic	General admission
23	Thanlyin	Taw Win	Private clinic	General admission

24	Thanlyin	Myitta Mon	Private clinic	General admission
25	Thanlyin	Aung	Private clinic	General admission
26	Thanlyin	Health Clinic	Private clinic	General admission
27	Thanlyin	Shwe	Private clinic	General admission
28	Thanlyin	Linn	Private clinic	General admission
29	Thanlyin	Nway Moe Saung	Private clinic	General admission
30	Thanlyin	Kyaw	Private clinic	General admission
31	Thanlyin	Parami	Private clinic	General admission
32	Thanlyin	Lamin	Private clinic	General admission
33	Thanlyin	Maristoke	Private clinic	General admission
34	Thanlyin	Free clinic	Private clinic	General admission
35	Thanlyin	Thitsar clinic	Private clinic	General admission
36	Thanlyin	Satku Yarzar	Private clinic	General admission
37	Thanlyin	Yuzana	Private clinic	General admission
38	Thanlyin	Family Care Fcc	Private clinic	General admission
39	Thanlyin	Linn Lat	Private clinic	General admission
40	Thanlyin	Aye Chan (24)	Private clinic	General admission
41	Thanlyin	Hlaing Myitta	Private clinic	General admission
42	Thanlyin	Lwin	Private clinic	General admission
43	Thanlyin	Laesar	Private clinic	General admission
44	Thanlyin	Han Thazin	Private clinic	General admission
45	Thanlyin	May	Private clinic	General admission
46	Thanlyin	Myat Thiri	Private clinic	General admission
47	Thanlyin	Depoler	Private clinic	General admission
48	Thanlyin	Diamond	Private clinic	General admission
49	Thanlyin	Lat Yat San	Rural health center	-
50	Thanlyin	Phayar Kone	Rural health center	-
51	Thanlyin	Kalar Wae	Rural health center	-
52	Thanlyin	Thapyay Kan	Rural health center	-
53	Thanlyin	Day Zat	Rural health center	-
54	Kyauktan	Kyauk Tan Hospital	Government hospital	25 beds
55	Kyauktan	Tatar Sub-township Hospital	Government hospital	16 beds
56	Kyauktan	Meepya Village Tract	Government hospital	16 beds
57	Kyauktan	Leprosy Clinic	Government clinic	Treatment of Leprosy
58	Kyauktan	Malaria Clinic	Government clinic	Treatment of Malaria
59	Kyauktan	Tuberculosis Clinic	Government clinic	Treatment of Tuberculosis
60	Kyauktan	Doctor Aung Clinic	Private clinic	General admission
61	Kyauktan	Doctor Kyi Htoo Clinic	Private clinic	General admission
62	Kyauktan	Athawka Clinic	Private clinic	General admission
63	Kyauktan	Doctor Tin Maung Thein Clinic	Private clinic	General admission
64	Kyauktan	Woman Affairs Association	Rural health center	-
65	Kyauktan	Tatar Sub-Township	Rural health center	-
66	Kyauktan	Meepya	Rural health center	-
67	Kyauktan	Mingalon	Rural health center	-
68	Kyauktan	Kyonekan	Rural health center	-
69	Kyauktan	Kamarkalote	Rural health center	-
70	Kyauktan	Potetalote	Rural health center	-
71	Kyauktan	Myaingtharyar	Rural health center	-
72	Kyauktan	Khanaung	Rural health center	-
73	Kyauktan	Shan Chaung	Rural health center	-

Source: General Administrative Department, Thanlyin and Kyauktan

According to the International HIV/AIDS Alliance there are a number of sexually transmitted disease (STD) and Human immunodeficiency virus / acquired immunodeficiency syndrome (HIV/AIDs) clinics/programs run by government organizations and NGOs that would be willing to establish activities during construction and project implementation to deal with the influx of workers to the area.

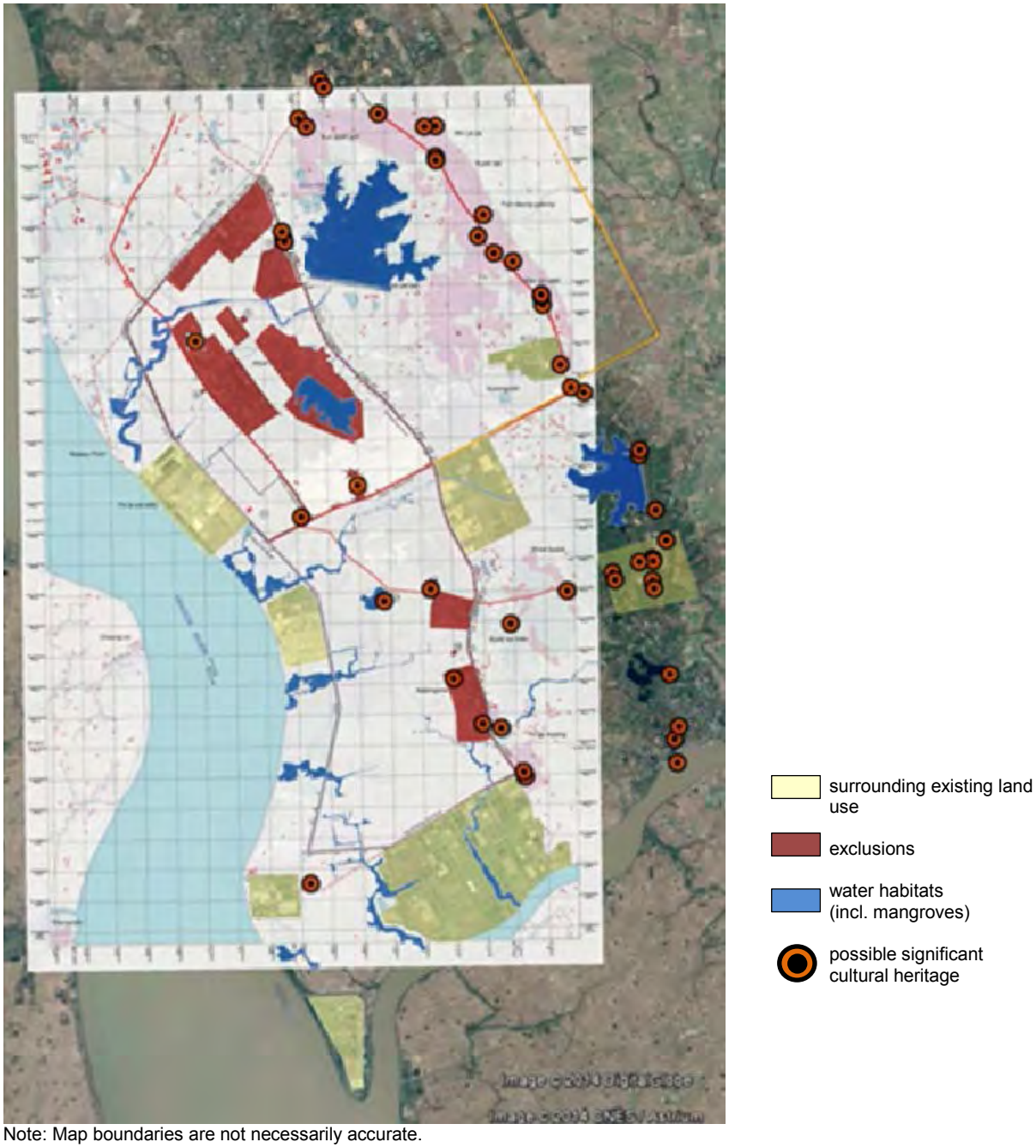
5) Transportation and Access

Waterways are used for transportation between the western area of the SEZ and the Yangon River villages. Foot and bullock cart paths crisscross the SEZ throughout to provide

access to homesteads, farmland, and social facilities. Motorized land vehicles use the dirt roads within the SEZ. Outside of the SEZ the two large bridges (Thanlyin Bridge and Dagon Bridge) that are currently used as the access points from the Thanlyin side of the Bago River to the Yangon City area.

4.1.4 Environmental Sensitivity

The following figure provides a summary of the potential socio-environmental sensitivities as described in the sections above.



Note: Map boundaries are not necessarily accurate.

Source: SEZ Management Committee using Google Earth imagery

Figure 4-9 Environmentally Sensitive Areas

5 Description of Project Alternatives

Project alternatives defined in this section represent different iterations of the development of the Project. The first alternative is a “Without Project” case. This involves projecting what is likely to occur if proposed investment projects are not undertaken and this case is meant to serve as a baseline that is equivalent to business-as-usual in the SEZ without development of the remaining 2,000 ha.

This case is used to compare the implemented versions under consideration: Alternative 1 and Alternative 2, presented thereafter. Both Alternative 1 and 2 consist of an SEZ that consists of mixed development of industrial, commercial, residential, and public space, with industrial zoning making up the majority of the area.

5.1 “Without Project” Case

The “Without Project” Case represents the case where there is no Thilawa SEZ 2,000ha development.

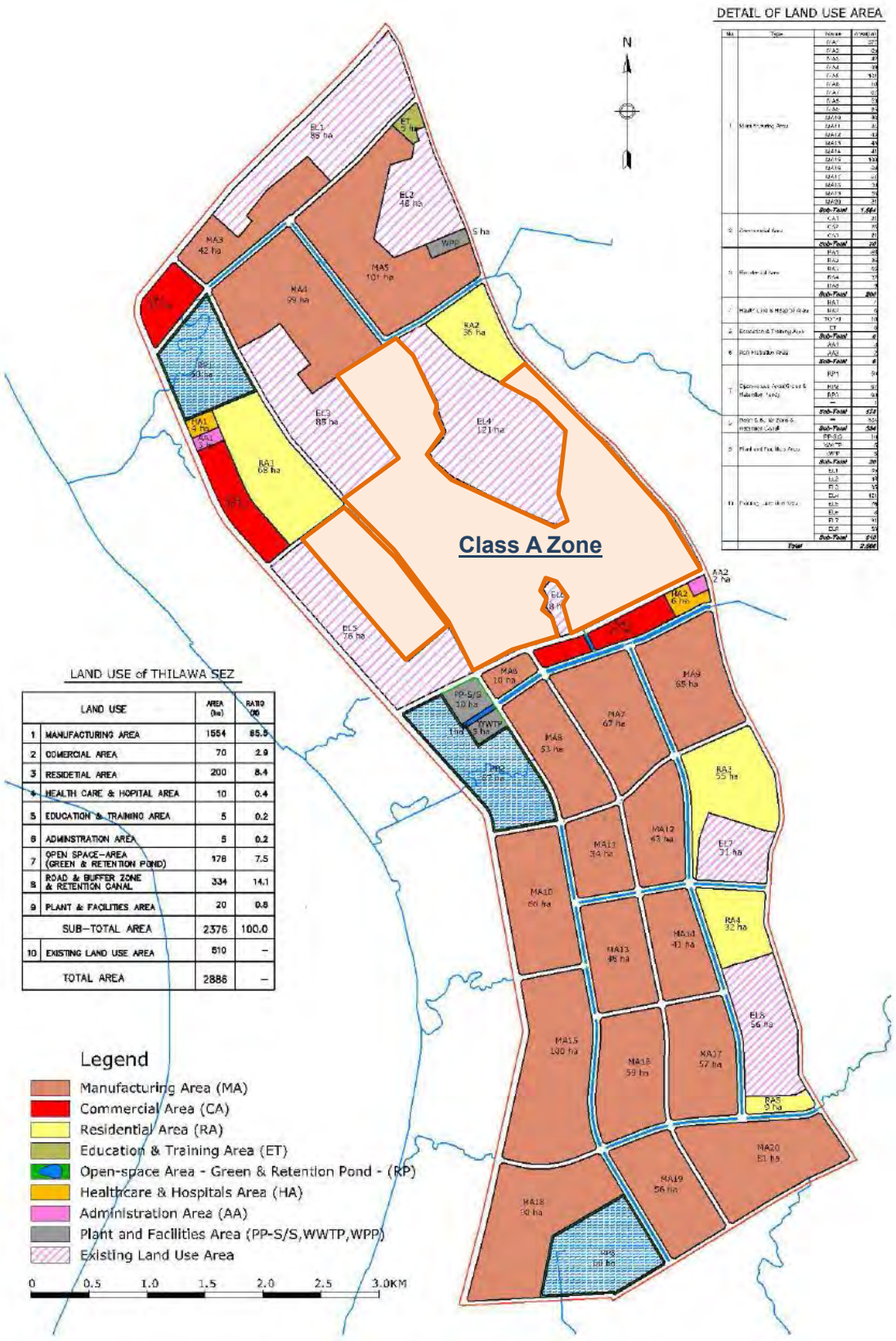
Myanmar is rapidly developing and demand forecasts have demonstrated high demand for industrial areas. It is necessary to meet that demand in an efficient and coordinated manner that meets economic needs while reducing impacts on the environmental and social issues. The best way to achieve this goal in a coordinated way is through an SEZ.

The land for the Thilawa SEZ 2,000ha development is situated in a flat area next to the Zone A area and is proximate to both the Thilawa Port and Yangon. The benefits for this area are an abundant labor force in Myanmar’s most populated area and accessibility to Yangon, the largest market in the country. The logistics benefits to having a port proximate to the SEZ makes it a very attractive place for foreign enterprise to establish manufacturing in Myanmar to develop industrial activities in Myanmar and provide good job opportunities for Yangon residents. Other than Thilawa, there are no places which have such conditions.

Ultimately, an SEZ provides an area where companies can coordinate private investment with provision of land and infrastructure that is well managed economically and environmentally. Without the additional 2,000ha, the Yangon region will not have enough industrial land capacity to meet the forecasted industrial demand. Since the demand is there, the result of a “without project” scenario would be uncoordinated land use as companies build to meet their business needs but without the support that an SEZ provides. This would in turn result in increasing strain on already poor infrastructure in the Yangon region. It is also likely that haphazard building of industrial facilities would result in sub-optimal creation of investment and job opportunities since more private sector resources would need to be spent on capital and operational costs instead of job creation. The SEZ is therefore the most environmentally and economically sound method for meeting industrial growth in the Yangon region.

5.2 Alternative 1 (Original Plan)

Alternative 1 is the alternative that has been approved on a bilateral basis between the relevant governmental parties of Myanmar and Japan. The land use plan of Alternative 1 is presented in the figure below.



Source: adapted from METI (2013) *Project for Promoting Export of Infrastructure System.*

Figure 5-1 Alternative 1 Land Use Plan

As is evident from the figure above, the land use plan of Alternative 1 consists of a prioritized

central area (Zone A area) that began construction in November of 2013. The 2,000ha Zone that is proposed in this Project will developed in four stages in the remainder of the colored area in the figure above and have in effect two industrial zones that are separated to the north and south of the Zone A.

Additionally, there are three retention ponds that are to be constructed in the northwest, central west, and southwest areas of the Thilawa SEZ in this alternative. In this alternative all streams would be normalized into the drainage systems of the SEZ. Treated sewage would be discharged into a stream before being ejected into the Yangon River.

Residential areas (in yellow) would be scattered about the northwest, northeast, and southeastern portions of the SEZ in between industrial areas.

This alternative would also backfill the southern pond next to a monastery.

Following the general master plan developed under this plan, it should be noted that the specific necessary exclusions were identified afterwards with a detailed land survey. Therefore, existing land use area (pink-stripes) have been updated to reflect the actual conditions on the ground based on Government Notification (No. 65/2013) that specifies excluded areas as described in Chapter1**.**. The amendment meets the original plan's goals while developing them in a more precise manner..

From environmental point of view, the following considerations could be taken to realize "environmentally friendly" development as in the Development Concept.

1) Preservation of natural streams and water surface within the project site; and

2) Preservation of cultural heritage within the project site.

5.3 Alternative 2 (Upgraded Plan)

The land use plan of Alternative 2 is more considerate of existing natural and social resources in the area and reflects exclusion zones decided since the initial conceptualization of Alternative 1 as well as the integration of ecologically and community friendly water areas are preservation of mangroves as proposed in the stakeholder meetings.

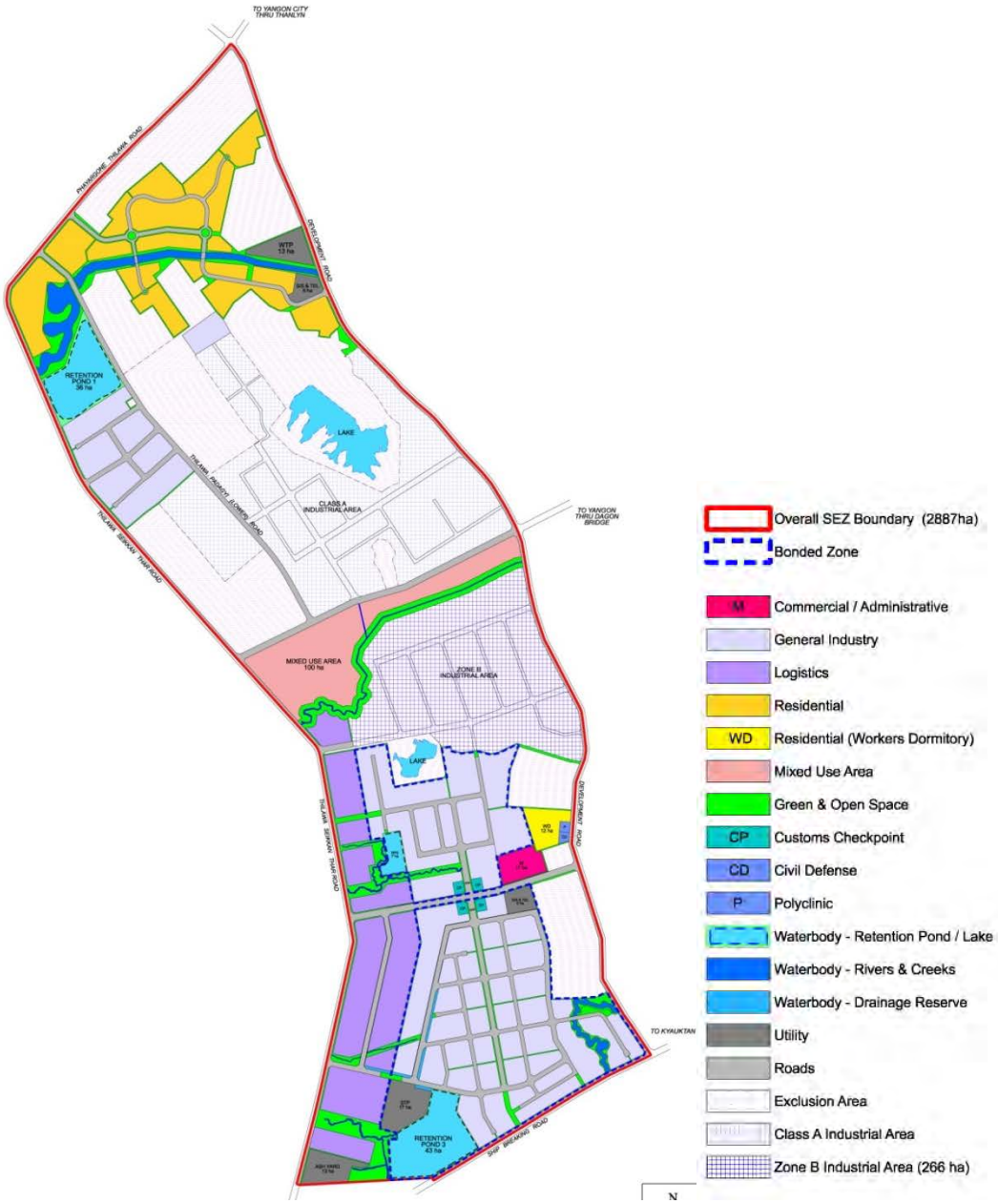


Figure 5-2 Alternative 2 Land Use Plan

Like Alternative 1, Alternative 2 reflects the master plan adopted by the Government of Myanmar and consists of the Zone A prioritized zone bordered to the north and south by the 2,000ha zone—that is, the present project.

Alternative 2 can be thought of a more socio-environmentally sensitive option to Alternative 1. Alternative 2 would seek to maintain natural streams and water surface including the freshwater pond next to the monastery in the middle, which will serve for conservation of birds, fish, and wildlife habitats. The main body of the streams running through the zone will be kept as-is with the aim to preserve water habitat, as far as is possible from a flood prevention standpoint.

The land use distribution is planned based on demand and minimization of backfilling operations during construction.

5.4 Comparison between Alternative 1 and 2

The following table summarizes the differences between Alternative1 (Original) and 2 (Upgraded). The major differences in environmental and social issues will be in the Natural Environment, Hydrology and Cultural Heritage as mentioned above. Major changes in the two land use plans are shown below.

1) Total Area:
   The total area was decreased due to the expanded exclusion zone and set asides for environmental and social facilities.
2) Common Area:
   Common area was increased due mainly to the preservation of existing creeks and a pond.
3) Commercial and residential areas:
   Commercial and Residential areas were decreased.

Because of the non-commercial benefits in achieving the ultimate goals of the SEZ as explained in Chapter 1, Alternative 2 is considered to be a more desirable alternative.

Table 5-1 Comparison between Alternative 1 and 2

Major Items		Alternative 1 (Original Plan)		Alternative 2 (Upgraded Plan)	
Land Use Plan	**Total Area**	**2,886ha**	**100.0%**	**2,887ha**	**100.0%**
	General Industries	1,554ha	53.8%	1,119ha	38.8%
	Logistics	0ha	0.0%	170ha	5.9%
	Residential (incl. dormitories)	200ha	6.9%	191ha	6.6%
	Commercial/ administrative	75ha	2.6%	11ha	0.4%
	Mixed use	0ha	0.0%	100ha	3.5%
	Roads	334ha	11.6%	261ha	9.0%
	Green space/ ponds	178ha	6.2%	301ha	10.4%
	Utility	20ha	0.7%	54ha	1.9%
	Other	15ha	0.5%	13ha	0.5%
	Excluded areas	510ha	17.7%	767ha	23.1%
Measures considered in the planning stage (As of April, 2014)		[Policy level] -Environmentally Friendly -Eco-Smart [Considerations in land use plan] -Retention Ponds -WWTP		[Policy level(Draft)] -Environmentally Friendly -Eco-Smart [Considerations in land use plan] -Retention Ponds -Natural Streams -Water Surface (Pond) -Use of greenery -WWTP -Cultural Assets	
Pollution Control					
Air/Noise/Vibration/odor/Soil		There might be some impacts regarding those items, which should be controlled by each tenant under the supervision of a one-stop service center.			
Water		Wastewater will be collected and treated at WWTP.			
Ground Subsidence		Underground water use for public water supply is not planned during operation, but groundwater might be used during construction or operation for various purposes.			

Natural Environment		
Protected Area	There is no protected area within and around the project site.	
Ecosystem	There is a risk of Mangrove habitat (Water streams)	Mangrove habitats (Water streams) will remain. One pond located next to the monastery in the center of the project site will remain.
Hydrology(Flood Control)	Three Retention ponds are to be constructed. Main streams will be altered to concrete water channel.	Three Retention ponds are to be constructed. Main streams will be expanded to allow more flow rate, keeping the current routes.
Topography and Geology	The area is generally flat without any distinctive geologic features.	
Social Environment		
Resettlement	There are settlers who live in the project site and need relocation.	
Livelihood	There are settlers who live within or outside the project site making their living by selling goods and/or doing commercial, agriculture, factory worker, and subsistence fishing.	
Cultural Heritage	There is a risk of Cultural Heritage.	Cultural Assets are avoided and kept as it is based on the relevant laws and regulations.
Indigenous People	There are no indigenous people.	

6 Environmental Studies

In order to gauge the magnitude of impacts, the studies as described in the table below have been or are being developed as a part of EIA.

Table 6-1 Investigation of Environmental Impact Assessment

Category	Item	Survey Item	Survey Method	Quantity
Pollution Control	Air Quality	Local pollutant indicators: NO_2/NO_x, SO_2, CO, SPM, PM10	Air quality measurement by instrument	6 locations, 2 days/time, 2 times per year (both rainy and dry season)
	Water Quality	Surface water: Temperature*, flow rate*, odor*, color*, electrical conductivity*, pH*, BOD5*, SS*, DO*, total coliform, COD, total nitrogen, total phosphorous, oil and grease, turbidity, arsenic (As), mercury (Hg), lead (Pb), cadmium (Cd), hexavalent chromium (Cr(VI)), copper (Cu), zinc (Zn), nickel (Ni), iron (Fe), cyanide (CN) Underground water: Temperature*, odor*, color*, electrical conductivity*, hardness, pH*, arsenic (As), mercury (Hg), led (Pb), cadmium (Cd), hexavalent chromium (Cr(VI)), copper (Cu), zinc (Zn), nickel (Ni), iron (Fe), cyanide (CN), oil and grease, fluoride, nitrates (NO_3-N, NO_2-N), ammonium nitrogen (NH_4-N), total coliform, water level*	Sampling and measurement by field equipment and laboratory analysis	Surface water: 6 locations, 2 times (both rainy season and dry season). Asterisked items are measured monthly at the 6 locations. Underground water: 3 locations, 2 times (both rainy season and dry season). Asterisked items are measured monthly at the 3 locations.
	Waste	Amounts of construction waste, amount of operational (industrial/household) waste, location/method for final disposal, capacity for final disposal, responsible authority for waste disposal	Interviews with relevant authorities, reference to construction planning data.	N/A
	Soil Contamination	Mercury (Hg), arsenic (As), lead (Pb), cadmium (Cd), copper (Cu), zinc (Zn), hexavalent chromium (Cr(VI))	Sampling and measurement by laboratory analysis	1 time, 2 locations
	Noise &Vibration	Traffic volume, noise level	Vehicle survey and noise survey	Vehicle survey: 2 intersections and 2 road sections Noise survey: 24 hr continuous monitoring in 6 locations @15-20 seconds/record
	Land Subsidence	Construction water demand	Interviews with relevant authorities Possible water sources in and around the project site.	N/A
	Offensive Odor	Identification of potential sources and receptors in and around the site (residences, social infrastructure, etc.)	Examination of possible odor sources and vectors through the interviews	N/A
	Sediment	Engineering and construction plans for 2,000 ha site.	Confirmation of engineering and construction plans	N/A
Natural Environment	Protected Area	Nationally and internationally important areas in terms of flora, fauna, cultural heritage, etc.	Identification of protected areas in and around the site	N/A
	Ecosystem	Water and land ecosystems on the site	Flora/Fauna (mammal, bird, reptile, fish, amphibian, plants/tress)	Flora and Fauna survey conducted once during dry

Category	Item	Survey Item	Survey Method	Quantity
			survey, site walk, identification of sensitive habitats in and around site	season and once during rainy season
	Hydrology	Surface and underground hydrology	Confirmation of Construction and water course engineering plans and plans for operational water provision	N/A
	Topography and Geology	Elevation and geology in and around site	Boring study on a 100ha basis throughout the remaining 2,000ha area.	20 boreholes every 100ha.
Social Environment	Involuntary Resettlement	Location and number of people in existing households within the 2,000 ha area that are to be moved	Resettlement Work Plan (RWP) (performed separately from the present document)	N/A
	Impacts on the Poor	Status of the living situation of the poor as well as integration opportunities with the new SEZ	Review of social statistics applicable to the area, reference to RWP-related documentation, interviews with local persons, host communities will be surveyed for consideration of impacts of inward migration	N/A
	Ethnic Minorities and Indigenous Peoples	Status of ethnic minorities and indigenous persons in the site	Review of social statistics applicable to the area, interviews with local persons	N/A
	Living and Livelihood	Status of major livelihoods in the area	Review of social statistics applicable to the area, interviews with local persons	N/A
	Land use and use of local resources	Status of current and future land use including availability and access to resources such as land, roads, aquatic, and water	Examination of land use plans, evaluation of current local resource use through interviews with local persons, reference to the RWP	N/A
	Water availability	The sustainability of and access to water resources	Examination of water use plans in the construction and operation phases	N/A
	Existing social infrastructure and services	Identification of social infrastructure including community centers, education, health and religious facilities	Field survey and information available from project resources	N/A
	Uneven distribution of benefits and damages	Socio-economic status of local people and potential changes as a result of the project	Field survey interviews with local persons, reference to the RWP	N/A
	Conflict of interest in the area	General investigation of potential conflicts of interest in project operation and implementation	N/A	N/A
	Cultural Heritage	Identification of cultural heritage in and around the site	Field survey, interviews with government officials, reference to historical documents	Conducting 1 field survey to verify findings in documentation.
	Landscape	Identification of landscape impacts	Field survey	N/A
	Gender	Identification of impacts on gender equality	Review of gender statistics by industry	N/A
	Children's Rights	Identification of child vulnerabilities as a result of this project	Review of Myanmar law implementation, data and info by UNICEF and other experts	N/A

Category	Item	Survey Item	Survey Method	Quantity
	Infectious Disease such as HIV/AIDS	Identification of prevalence and potential spread of infectious disease as a result of project construction and operation	Review of infectious disease statistics and HIV/AIDs related activities in the area during construction and plans after operations commence.	N/A
	Working conditions (including occupational safety)	Issues surrounding working conditions including non-compliance with international and national conventions and laws and occupational safety	Review of laws and regulations applicable to the project	N/A
	Accidents	Probability of increased accidents on site	Confirmation of engineering plans for pedestrian and motorways	N/A
	Transboundary impacts or Climate Change	Identification of possible sources of GHGs as a result of project implementation	Documentary review	N/A

7 Public Consultation

7.1 Preliminary Meetings with Stakeholders

Preliminary meetings with NGOs, private companies and relevant government authorities were conducted to understand the current environmental and social issues in Myanmar. . The major findings are as summarized in the tables below.

Table 7-1 Record of Significant Meetings During Initial Stakeholder Consultations

Date	Stakeholder Representation	Nature of Consultation
07 October 2013	ECODev (Environmental NGO)	• Explanation of TOR and project • Recommendations for laboratory analysis of water and soil samples • Natural environment issues
08 October 2013	Friends of Wildlife (Environmental NGO)	• Explanation of project • Forestry Law • Protected Areas Law • Species conservation regulations • Biodiversity in Thilawa
09 October 2013	FREDA (Environmental NGO)	• Explanation of TOR and project • Mangrove issues in the Thilawa area
09 October 2013	Swanyee Foundation (Environmental NGO)	• Explanation of TOR and project • Environmental and social policy in Myanmar • Mangrove issues in the Thilawa area • Livelihood issues in the Thilawa area
10 October 2013	Myanmar Centre for Responsible Business (Environmental NGO)	• Explanation of project • General EIA issues
11 October 2013	HIV/AIDS Alliance (Social NGO)	• Explanation of project • HIV/AIDS issues in Myanmar • Infectious disease prevention measures
28 November 2013	Ministry of Environmental Conservation and Forestry, Environmental Conservation Department, Yangon Region	• Explanation of project • EIA Guidelines • Capacity building activities in the context of this project
29 November 2013	Yangon University, Archaeological Department	• Explanation of project • Cultural heritage issues in Thilawa
02 December 2013	General Administrative Department of Thanlyin and Kyauktan	• Explanation of project • Methods for sampling in the area • Stakeholder meeting issues • Improved list of relevant government stakeholders
02 December 2013	Yangon University, Archaeological Department Ministry of Culture, Department of Historical Research	• Cultural heritage issues in Thilawa • Identification of cultural heritage sites
02 December 2013	YCDC, Pollution Control Department	• Explanation of project • Environmental standards in the Yangon Region • Solid waste management issues
03 December 2013	Myanmar Bird and Nature Society (Environmental NGO)	• Explanation of project • Ornithology data in Thilawa • Discussed important birds
04 December 2013	Ministry of Environmental Conservation and Forestry, Pollution Control Division	• Explanation of project • Environmental standards in Myanmar • Potential new environmental standard development
04 December 2013	Ministry of Environmental Conservation and Forestry, Environmental Conservation Department	• Explanation of project • Draft EIA Guidelines
05 December 2013	Settlement and Land Record Dept. (Thanlylin township) Agricultural Dept. (Thanlyin Township) Fishery and Livestock Department Let Yet San Rual Health Centre	• Explanation of project

Date	Stakeholder Representation	Nature of Consultation
	(Thalyin township) Settlement and Land Record Dept. (Kyauktan township) Health Department (Kyauktan township) Agricultural Department (Thanlyin township) General Administrative Dept. (Thanlyin township) General Administrative Dept. (Kyauktan township) Planning Dept. (Thanlyin township) Immigration Dept. (Kyauktan township) Housing Department Military Security Water Ways Dept. Myanmar Port Authority	
05 December 2013	Myanmar Centre for Responsible Business (Environmental NGO)	• Explanation of project • Draft EIA Guidelines • Coordination of activities with other donors • Development of SEA • Stakeholder communication
11 December 2013	ADB Environmental Specialist for Environmental Standards	• Environmental standard setting in Myanmar
05 March 2014	Glass factory on site	• Explanation of project
05 March 2014	Galvanized roofing factory on site	• Explanation of project • Current environmental management practices in Thilawa
05 March 2014	Thanlyin Waste Collection Department	• Explanation of project • Waste collection and disposal practices in Thilawa area
06 March 2014	Myanmar Development Resources Institute (NGO)	• Explanation of TOR and project • SEA development • Stakeholder involvement
06 March 2014	Ministry of Environmental Conservation and Forestry, Environmental Conservation Department, Yangon Region	• New SEZ Law and Foreign Investment Law • Draft EIA Guidelines
06 March 2014	Ministry of Environmental Conservation and Forestry, Forest Department, Yangon Region	• Mangrove issues • Protected species issues
07 March 2014	Mingaladon Industrial Park	• Explanation of project • Environmental management practices in Myanmar
30 June 2014	SEA Stakeholder Meeting	• 353 attendees (93 government officials, 229 local persons, and 31 members of the media) • Presentation led by SEZ Management Committee • Contents of the presentation included a technical presentation of SEA methodology, the legal and environmental framework of the project in Myanmar, and construction and operational scenario planning issues.
24 November 2014	Mercy Corp	• Information about Mercy Corp's activities in Myanmar • Information sharing about the Thilawa SEZ development
26 November 2014	Myanmar Japan Thilawa Development (MJTD)	• Discussed how to harmonize the development of Zone A and the remaining SEZ area. • Discussed harmonizing wastewater processing and standards
26 January 2015	Myanmar Centre for Responsible Business (Environmental NGO)	• Discussed environmental management institutional structures for the SEZ. • Discussed stakeholder engagement processes.
28 January 2015	MJTD	• Discussed implementation issues • Discussed environmental standard implementation • Discussed solid waste handling issues
30 January 2015	YCDC	• Discussed solid waste handling issues
13 February	Boring Survey Explanatory Meeting	• Explain about the boring survey to affected persons

Date	Stakeholder Representation	Nature of Consultation
2015		• Explain about accessibility and safety issues in conducting a boring survey in order to reduce harm to local persons.
26 August 2015	SEA Stakeholder Meeting	• 292 attendees (including 51 government officials, 196 local persons, 15 members of NGOs and 25 members of the media) • Presentation led by SEZ Management Committee • Contents of the presentation included summary of the draft SEA with alternative analysis, possible impacts and environmental management scheme.

Table 7-2 Comments from Stakeholders during Initial Consultation

Topic	Comment
General	• Essential to hold stakeholder meetings in an open and forthright manner with proper notice. • The project should have 5 stakeholder meetings. • Necessary to involve media in stakeholder meetings. • Environmental standards are being decided under the Science and Technology Technical Standards Committee under the 19th subcommittee for Environmental Quality Standards. ADB is assisting with this activity. • Ambient standards would initially be based on regional good practice and then revised to reflect country context. New industry would be expected to comply with interim ambient standards. • Draft EIA Guidelines from ECD should be followed. • Lessons should be learned from the poor stakeholder consultation process at the Letpadaung copper mine. • SEZ Law exempts each individual factory from undertaking an EIA process separate to the SEZ as a whole. • Zones should be established in the SEZ by factory type. • Construction inspector should be involved in factory development to ensure each factory follows regulations. • Differences between SEA and EIA. • All documents should be disclosed to the local people at the same time they are disclosed to authorities. • Local people should be able to participate in environmental surveys. • International rules and regulations should be strictly abided by. • Request for environmental education to better understand the implications of the SEA and EIA documents
Air Quality	• Air emissions monitoring is generally difficult in Myanmar due to lack of equipment. • Environmental parameters should be set to, at a minimum, IFC standards. • Myanmar domestic parameters will be implemented by type in the next years. Wastewater will be first followed by others. It will be necessary for applicable facilities to adhere to these domestic standards once established.
Water Quality	• Environmental parameters should be set to, at a minimum, IFC standards. • Myanmar domestic parameters will be implemented by type in the next years. Wastewater will be first followed by others. It will be necessary for applicable facilities to adhere to these domestic standards once established. • Yangon only has 5 environmental parameters items for wastewater that they implement. They do not really have very strict standards. • Wastewater on the site is currently infiltrated to the ground in some factories. • Water is supplied to military factories cheaply. • How wastewater will be treated. • Water resources should be secured for local persons since they rely on these sources for drinking and farming.
Waste	• There will be new solid waste processing facilities for Thilawa. • There will be a new incinerator with a 100 ton/day capacity for industrial hazardous waste. • There will be 2 new landfills, one of 30 acres (land already purchased) and one of 200 acres (land not yet purchased). • Waste is currently collected in the Thanlyin area with 5 vehicles each collecting 1 ton/day. • There is one surface landfill site at Ngapa serving Thanlyin.
Soil Contamination	• Environmental parameters should be set to, at a minimum, IFC standards. • Myanmar domestic parameters will be implemented by type in the next years. Wastewater will be first followed by others. It will be necessary for applicable facilities to adhere to these domestic standards once established.
Noise &Vibration	• Environmental parameters should be set to, at a minimum, IFC standards.

Topic	Comment
	• Myanmar domestic parameters will be implemented by type in the next years. Wastewater will be first followed by others. It will be necessary for applicable facilities to adhere to these domestic standards once established.
Land Subsidence	• No comment
Offensive Odor	• Environmental parameters should be set to, at a minimum, IFC standards. • Myanmar domestic parameters will be implemented by type in the next years. Wastewater will be first followed by others. It will be necessary for applicable facilities to adhere to these domestic standards once established.
Sediment	• No comment
Protected Area	• There are no formally protected areas such as national parks or forest areas in the site. • The mangroves on the site are not legally protected as forested areas. However, it is necessary to maintain the mangrove areas to preserve biodiversity. Particularly as habitats for protected bird species. • Necessary to maintain water areas in the southern pond area next to a monastery to preserve bird habitat.
Ecosystem	• Very little biodiversity data in Thilawa. • Land mostly converted to agriculture, so very little native habitat left. • There are no endangered species of birds in Thilawa. • However there are some endangered migratory species in areas of Myanmar south of Thilawa (about 100km) in Martaban including the Spoon billed sandpiper and other shore birds. The spoon billed sandpiper flies from Siberia. • In Ledkokegone there are gulls, Caspian terns, Little Terns, etc. • They expressed the desire to improve conservation efforts through Thilawa. • In Myanmar there are 1,096 species of birds identified, there were 2 species newly identified in 2013. • There are no threatened species in Thilawa, but the white-throated babbler is an important endemic species. • Desire to carry out conservation activities as part of the Thilawa development. • Wish to have a biodiversity management plan at the operational stage.
Hydrology	• Need to maintain all creeks to prevent flooding.
Topography and Geology	• The area is made up of silty soil and not of laterite. • Ministry of Construction has a topographic survey of the 2,000 ha area.
Involuntary Resettlement	• Involuntary resettlement issues are difficult in Thilawa and stakeholder considerations need to be taken into account early and with great care. • International standards should be followed in resettlement activities.
Impacts on the Poor	• Need to consider carefully resettlement issues as impacts to poor could be great.
Ethnic Minorities and Indigenous Peoples	• No comment
Living and Livelihood	• Livelihood assistance will be required after project is implemented. • Potential possibility to do livelihood development through mangrove conservation through micro grants for income substitution activities. • Employment and training opportunities should be reserved for local persons in new industries coming to the area.
Land use and use of local resources	• No comment
Water availability	• Water availability issues need to be coordinated in an effective manner. • Not possible to drill new tube wells in the area or the underground water will become brackish. Might be possible to drill tube wells from nearby locations. • The Bant Bwe Gone dam is supplying water to the Kyaikyauk area as well as the ship breaking area. • Water supply is the responsibility of the YCDC and Ministry of Irrigation/Ministry of Agriculture.
Existing social infrastructure and services	• Necessary to provide proper and sufficient educational facilities within the site and for resettled persons. • Need to make sure that health services are provided and improved in the area. • Transportation to and from Yangon City proper needs to be established through a multimodal transport system.
Uneven distribution of benefits and damages	• No comment
Conflict of interest in the area	• No comment
Cultural Heritage	• The riverine geology in that area of Myanmar from 0-25ft (0-7.62m) above sea level is “new alluvial” (less than 10,000 years old silt deposit), 25-50ft (7.62-15.24m) above sea level is “old alluvial” (meaning more than 10,000 years old silt), and anything greater than 50ft (15.24m+) above sea level is generally laterite.

Topic	Comment
	• The ancient kingdom of Pada Gyi was a laterite kingdom that used laterite as their principal building material. • According to previous geological surveys of the Thilawa area, there is not much laterite apart from some ridges on the border of Thanlyin and Kyauktan townships and this is not proximate to the assumed boundaries of the Pada Gyi kingdom. • It is very unlikely that there are archaeological assets related to the Pada Gyi kingdom on the site. • The known locations are not close to the main roads and areas of the site, so it is thought that the impact to ancient cultural assets is unlikely if construction and traffic is focused on the main road leaving the middle eastern portion of the site and continuing left to Dagon bridge.
Landscape	• No comment
Gender	• No comment
Children's Rights	• No comment
Infectious Disease such as HIV/AIDS	• Construction workers might be highly vulnerable to HIV/AIDS • Population Services International (PSI) gives free condoms. PSI also provides an STD/communicable disease (malaria/TB/etc.) clinic called "Sun Clinics". These clinics are preferred by most to the national clinics usually. • National AIDS Program (NAP), part of the Department of Health within the Ministry of Health. NAP has STD clinics around the country and in Thanlyin. NAP also provides AIDS counseling and testing (counseling is always given before testing in Myanmar to prevent suicide in case of a positive result). NAP gives anti-retrovirals for free. • Myanmar Business Coalition – provides businesses education on AIDS awareness to reduce stigma of AIDS. • AZG (the Netherlands Branch of Medicins Sans Frontieres) – provides some assistance to HIV/AIDS patients for transportation and nutrition supplements. • Mentioned that there is a Marie Stopes International Clinic in Thanlyin that provides women's health and HIV testing. Appropriate contact point for sex worker. • JOICFP is a Japanese organization working for family planning and HIV/AIDS • Mentioned that you have to register any HIV/AIDS clinic that you open. • Worth it to also provide services for Hepatitis B/C • UMFCCI (Chamber of Commerce) is interested in HIV/AIDS prevention
Working conditions (including occupational safety)	• Poor safety standards at existing factories in the Thilawa area.
Accidents	• Fire breaks should be established between factories through proper building regulation.
Transboundary impacts or Climate Change	• No comment

7.2 SEA Stakeholder Meeting (1)

The first official stakeholder meeting for the SEA was held on 30 June 2014. The purpose of the meeting was to introduce the planned SEA study to the public and to obtain the people's understanding and opinions on the study. The meeting was held at the temporary office of SEZ Management Committee, Branch Office of Land Use(2), Department of Human Settlement and Housing Development (Thanlyin) from 10.00am till 12.45pm. In total 354 persons participated, including government officials, private companies, and project affected peoples. Presentation materials, notifications and list of attendees are presented in Appendix A.

7.2.1 Announcement

Public announcements were made in two newspapers that are distributed throughout Myanmar. The language of the announcement was Myanmar. For English speaking NGOs, a separate English invitation letter was distributed via email. The two newspapers were Myanma Alin Daily and The Mirror.

Additionally announcements were made through the local General Administrative Departments (GAD) to concerned villagers, including the Thilawa Social Development Group.

7.2.2 Presentation Reference Materials

Materials, in this case the presentation, were provided upon request to participants.

7.2.3 Transportation

As a rural area, there are no appropriate venues available directly in the zone. The venue used was the Temporary Office of the SEZ Management Committee, which is roughly 1km to the East-Northeast of the SEZ area on the Thilawa/Dagon road cutting through the middle of the SEZ area from the port and going onto Dagon Bridge. To ease access to this venue, transportation options were provided to stakeholders.

1. From Yangon: A bus and van were provided from Yangon. Roughly 50-60 persons were transported in this manner from Yangon.

2. From Thanlyin and Kyauktan: 6 buses (3 for Thanlyin and 3 for Kyauktan) were provided to ease access for villagers. About 30-40 people per bus.

7.2.4 Record of Discussion

1. Representative of Alwan Sut Village, Thilawa Social Development Group first asked about the difference between EIA and SEA terms and methods for controlling air and water pollution from the zone if they exceed the standards. The Consultant Team responded that the implementation of a regional policy and plan is called an SEA and the plan for pollution control is called an environmental management plan (EMP), which will be discussed later on in detail in the presentation. Regarding penalties, they will be enacted in compliance with laws for pollution emission in addition of monitoring the natural environment of the zone and surrounding area by expert groups on an ongoing basis. Following this, the questioner asked about the wastewater discharges into the river noting that "since there are 6 streams in the designated zone and all empty into the Yangon River, he wants to know the methods for handling wastewater effluent from industries including whether there will be a treatment system or not". The Consultant Team answered that there is a plan to construct a wastewater treatment plant before discharging into the river or streams with potential use of grey water for landscape irrigation.

2. Representative of Thida Myaing village made an inquiry about health services plan for the affected local people that may become necessary due to potential pollution from the industries. The Consultant Team replied that baseline data of local air and water quality are being collected at present.

3. Representative of Myanmar Bird and Nature Society stressed the importance of the Consultant Team recommendation to use wetland technology. He also suggested including a biodiversity management plan in the EMP to prevent degradation of mangrove habitat.

4. Rector of Myanmar Maritime University asked about the development of a multimodal transport system in the region. TSEZMC explained that there has a plan to extend the road from Thanlyin bridge to the zone with a Japanese loan however the development of multimodal transport system requires the agreement of several ministries and departments. The Consultant Team added that currently Ministry of Construction is conducting the master plan to upgrade the roads. Then, the questioner quizzed about the employment opportunity for local people at the zone. The speaker responded that since this is one of the most important issues for the project, the SEZ Management Committee has another dedicated team assisting to conduct baseline data collection in tandem with the ongoing RAP. The Consultant Team requested to the guests to give suggestions and comments upon the project.

5. Representative of Shwe Pyouk Village requested to disclose the survey report to local people at the same time of submitting to the authorities. He then asked how stakeholders would know whether the report represents the true situation or not. Moreover, he asked that the Consultant Team allow local people participation in conducting the surveying and monitoring in order to ensure that the report is prepared according to international standards. The Consultant Team replied that civil society and independent organizations are warmly welcome to monitor and review the report and activities. Then Representative of Alwan Sut Village, Thilawa Social Development Group) requested the Consultant Team to carry out the project by strictly abiding to rules and regulations as a third party.

6. Representative of Yangon regional parliament expressed his worries relating to the hydrological pattern of six streams and three creeks (*sic)* including in the zone and appealed to manage these water sources properly since many people are relying on those resources. Moreover, he asked about employment opportunities for local people in new industries since most are very poor and have a low level of education. The Consultant Team responded that “we are planning to hold a meeting with Department of Water Resources and Improvement of River System of Ministry of Transport and Irrigation Department of Ministry of Agriculture and Irrigation to find the most appropriate way to deal with the water body issues and we also have a plan to meet local people to understand the real situation of those streams and creeks during the pre-construction phase”. Concerning employment opportunities, TSEZMC explained that the SEZ Management Committee will choose business types to operate in the economic zone while prioritizing those that bring in good employment opportunities. Moreover, there is an arrangement to offer vocational training to improve local human resources.

7. Consequently, the representative of Thida Myaing village asked about the international standards and the Consultant Team explained about the different effluent quality standards which are currently being considered for the 2,000ha area, including those of the Ministry of Mining, Ministry of Electrical Power, Ministry of Industry, and the Yangon City Development Committee (YCDC). The Consultant Team mentioned that international standards such as WHO, China and IFC guidelines are also being

considered to create the most appropriate pollution control mechanisms for the area.

8. Representative of Save the Children, NGO, questioned about the social impact standard and compensation for the involuntary resettlement according to the international standards. Moreover, he urged the SEZ Management Committee to perform transparent project activities. The Consultant Team clarified that there is another study team focusing on the assessment of social impacts for this project. Therefore they will respond to questions regarding to involuntary resettlement issues at their meeting.

The comments and the response within the SEA are summarized in the table below.

Table 7-3 SEA Stakeholder Meeting (1) Comments and Response

	Commenter	Comment received	Response
1	Representative of Alwan Sut Village, Thilawa Social Development Group	• The difference between EIA and SEA. • Methods for controlling air and water pollution from the zone if they exceed the standards and wastewater discharges into the river.	• Explained the difference between an EIA and an SEA at the stakeholder meeting, and provided explanation of what an SEA should be was added in Chapter 2 of this report. • Explained the basic concept of wastewater treatment at the stakeholder meeting and also added a detailed explanation in Section 4.1.1, above.
2	Representative of Thida Myaing village	• Health services plan for the affected local people.	• Conferred with infectious disease experts such as the International HIV/AIDS Alliance to understand the appropriate mitigation measures for health issues in the area post construction. As outlined in Section 4.1.3, above, there are a number of clinics available in the area to deal with infectious disease issues and the capacity of these will be analyzed further in the EIA.
3	Myanmar Bird and Nature Society	• Need to use wetland technology. • Including a biodiversity management plan in the EMP	• As explained in the presentation, the creeks will be left as is to the extent that it is possible. Where creeks require widening, the creeks will be widened only on one side and left as-is to prevent mangrove habitat degradation. The widened side will replant mangroves after widening works are completed. • As explained at the stakeholder meeting, a biodiversity management plan will be included as part of the EIA.
4	Rector of Myanmar Maritime University	• Development of a multimodal transport system in the region. • Asked about the employment opportunities for local people	• This project is one of many ongoing projects in the region and will be part of the Yangon Transport Master Plan. Dr. Than Than Thwe

		at the zone.	discussed the general plans at that point regarding transport options in the region. Including the expansion of a road from the SEZ area to Thanlyin Bridge. A further section was added to the SEA in Section 4.1.3, above. • At the meeting, Dr. Than Than Thwe responded that since this is one of the most important issues for the project, the SEZ Management Committee has another dedicated survey team assisting to conduct baseline data collection in tandem with the ongoing RAP. The results of that survey will be included in the EIA as part of the social data.
5	Representative of Shwe Pyouk Village Representative of Alwan Sut Village, Thilawa Social Development Group	• Request to disclose the survey report to local people at the same time of submitting to the authorities. • How would stakeholders know whether the report represents the true situation or not. Moreover, he asked that local people should participate in conducting the surveying and monitoring in order to ensure that the report is prepared according to international standards.	• The timing of the final report submission to government authorities is the same as the publication on the internet and distribution of paper copies at the GAD offices in Thanlyin and Kyauktan. • The local people have been consulted for surveys such as the boring survey beforehand so that they understand what kind of survey they will do and the timing. The local persons are welcome to comment during the development of the surveys and survey reports.
6	Representative of Yangon regional parliament	• Expressed worries relating to the hydrological pattern of six streams in the zone and appealed to manage these water sources properly since many people are relying on those resources. • Training opportunities for local people in new industries since most are very poor and have a low level of education.	• In the final version of the proposed land use plan, all 6 creeks will be kept as is where possible or expanded in an ecological way. • Concerning employment opportunities, Dr. Than Than Thwe explained that the SEZ Management Committee will choose business types to operate in the economic zone while prioritizing those that bring in good employment opportunities. Moreover, there is an arrangement to offer vocational training to improve local human resources.
7	Representative of Thida Myaing village	• The meaning of international standards.	• As a result of ongoing discussions around this topic, IFC Guidelines were officially adopted as the working framework for the Thilawa SEZ project in the Central Working Body. There is an additional

			discussion of the details in Section 1.3.
8	Save the Children, NGO	• Social impact standard and compensation for the involuntary resettlement according to the international standards.	• As discussed at the meeting, in principle this is an issue for the resettlement study team and not the SEA. However as discussed in the previous item, international standards are adopted as per Section 1.3.

7.3 SEA Stakeholder Meeting (2)

The second official stakeholder meeting for the SEA was held on 26 August 2015. The purpose of the meeting was to present draft SEA and to obtain the people's comments on the SEA. The meeting was held at the temporary office of SEZ Management Committee, Branch Office of Land Use (2), Department of Human Settlement and Housing Development (Thanlyin). The meeting had two sessions: morning session (10am – 12am) and afternoon session (1:30pm – 3pm). In total 303 persons participated, of which 233 in the morning session and 70 in the afternoon session. The participants included government officials, private companies, NGOs and project affected peoples. Presentation materials, notifications and list of attendees are presented in Appendix B.

7.3.1 Announcement

Public announcements were made in two newspapers that are distributed throughout Myanmar. The language of the announcement was Myanmar. For English speaking NGOs, a separate English invitation letter was distributed via email. The two newspapers were Myanmar Alin Daily and The Mirror.

Additionally announcements were made through the local General Administrative Departments (GAD) to concerned villagers, including the Thilawa Social Development Group.

7.3.2 Presentation Reference Materials

Materials, in this case the presentation, were provided upon request to participants.

7.3.3 Transportation

As a rural area, there are no appropriate venues available in the zone. The venue used was the Temporary Office of the SEZ Management Committee, which is roughly 1km to the East-Northeast of the SEZ area on the Thilawa/Dagon road cutting through the middle of the SEZ area from the port and going onto Dagon Bridge. To ease access to this venue, transportation options were provided to stakeholders.

1. From Yangon: A bus and van were provided from Yangon. Roughly 50-60 persons were transported in this manner from Yangon.

2. From Thanlyin and Kyauktan: 6 buses (3 for Thanlyin and 3 for Kyauktan) were provided to ease access for villagers. About 30-40 people per bus.

7.3.4 Record of Discussion

Morning Session

1. Representative of Alwan Sut Village made an inquiry about when the survey would be reported. As he explained, he said he arrived at Alwan Sut Village in 2010. Before the contractor had arrived, he had built his own house and on January 4th, he was still living at Alwan Sut Village. However, he and his family are not in the survey list, so he would like to know when he and his family would be listed. Dr. Than Aung explained that he would have to report to the leader of his mobile worker group or he can report to clerk or manager to check whether or not he is in the list with his leader. If he is still not on the list, it means he is originally not listed in this particular mobile worker group.

2. Representative of Alwan Sut Village suggested that it would be better to announce the meeting one week earlier. He also asked whether or not local people would be included in the five developments mentioned by TSEZMC. TSEZMC replied that when there

were developments within the local area, it would be the same as developing the country. Therefore, when the country becomes develop, individual household in local area becomes developed.

3. Representative of Alwan Sut Village argued that because of the 400 hectares development, there were a problem regarding the waste management since the area was too narrow. He pointed out that it would be better in Thilawa industrial development zone. He said that there were housing for people in economic development zone due to high population density, houses were not enough. The road of resettlement area was too narrow. He also enquired that for the religious architectures located near the industrial area, how those architectures would be managed. Dr. Than Aung, answered that shopping mall, restaurant and dormitories would be all included in 28 hectares area and there would be fencing and boundaries along with the entry and exit points at which security gates and guards would be deployed as in other countries. If he was still not satisfied with this answer, it was recommended that he discussed this matter directly with the Japan Organization which was responsible for all these strategic planning.

Afternoon Session

1. Community Relationship Officer, MJTD said that when the factories operate, there would be pros and cons due to the process of mitigation measure for any impacts. However, she would like to know how much the impact could be reduced and how to know the limitation of impact will be allowed. TSEZMC answered that all environmental impact of factories would be different by the type of business. For example, the wastewater from dried noodle production factory and garment factory would be every different and there would be a different way of analyzing environmental impact and monitoring process. Accordance of internal rules and regulation of TSEZ, TSEZMC would check the primary treatment of a factory first and compare with TSEZ standards. If unsatisfactory operating process existed, TSEZMC would penalize and make a factory to satisfy standards. Also, TSEZMC does not accept a printing factory to establish in SEZ area because it would have more impact to environment. The Consultant Team advised that wastewater treatment plant for each factory would have to be built and one central wastewater treatment plant would be required. Even IFC international standard is being used. National Standard will be issued by ECD.

The comments and the response within the SEA are summarized in the table below.

Table 7-4 SEA Stakeholder Meeting (2) Comments and Response

	Commenter	Comment received	Response
1	Representative of Alwan Sut Village	• He should have been on the survey list but was not. Need check.	• This matter will be checked.
2	Representative of Alwan Sut Village	• Suggested it would be better to announce the meeting one week earlier	
3	Representative of Alwan Sut Village	• Concern on the problem of waste management in Zone A, high population in the area and religious buildings	• Shopping mall, restaurant and dormitories were all included in 28 hectares area and there would be fencing and boundaries along with the entry and exit points at which security gates and guards will be deployed

4	Community Relationship Officer, MJTD	• Want to know how much the impact could be reduced and how to know the limitation of impact will be allowed for each factory	• All environmental impact of factories will be different by the type of business. Accordance of internal rules and regulation of TSEZ, TSEZMC will check first the primary treatment of factory measured by TSEZ standards. If there is not satisfied on that in operation process, TSEZMC makes penalty and try to push this factory to meet with standards.

7.4 Other Comments on the SEA

Other comments than those raised in the stakeholder meetings above are listed with the project proponents' response in Appendix C.

8 Environmental Objectives and Management of Environmental Issues

8.1 Identification of Environmental Problems Related to Change in Land Use

Identifying environmental problems is an opportunity to define key issues and improve the SEA objectives. It is essential to identify general impacts caused by the development and its associated land uses. The issues and problems should be useful for the improvement of the project itself or implementation of the project (e.g., by avoiding future conflicts). Environmental issues will be identified as a subset of the environmental objectives. Environmental issues will be based on the actual implementation of the project and will be defined in the scoping matrix accompanying the final EIA.

8.2 Environmental Objectives

The project has set environmental objectives that will serve to reduce environmental impacts to the Thilawa SEZ regional area. Based on stakeholder consultation combined with environmental findings in the studies conducted and respecting the original strategy for the Thilawa area, the following environmental objectives were defined.

Table 8-1 Environmental Objectives

SEZ Strategy	SEZ Strategy Detail	Resulting Environmental Objective
Economically driven	To Increase value added products & bring “Myanmar Brand”, “Production”, “Education” & “Research & Development” will be enhanced	Ensure that the economic benefits of the project reach the people in the area through training and employment opportunities.
Safe and Secure Livelihoods	Built the SEZ not only a space “Where you want to go to work” but also “Where you want to live in the future”	Ensure that infrastructure (transportation, water, electricity, schools, hospitals, etc.) is improved within the SEZ for companies and also for the communities living in the SEZ.
Environmentally Friendly	To realize healthy & comfortable city life to environment as well as to humans, existing roads & rivers will be kept to the extent possible	Employ environmentally friendly engineering in SEZ development and ensure that environmental quality is managed to minimize impacts on those living in and around the SEZ.
Efficient Infrastructure	To meet the demand of the SEZ, develop the infrastructure as an off-site system of high performance & low environmental impact	Make sure that infrastructure uses resources efficiently and does not contribute to the deterioration of environmental quality.
Eco-Smart	Apply Eco-Smart technology that can reduce the load on the environment & households	Use infrastructure that meets international standards to maintain environmental quality.

Source: SEZ Management Committee

8.3 Managing Pollution and Environmental Conservation in the SEZ

Based on the environmental problems identified and the associated environmental objective section, it is important that an environmental management plan (EMP) is established for the SEZ under the EIA in order to coordinate pollution control efforts and limited impacts from the cumulative accretion of low-level pollution (i.e., cumulative impacts). The EMP will

establish rules and regulations that conform to national regulations and regulations similar to the Zone A area. The final EMP should be reviewed and agreed upon by all relevant stakeholders including affected persons and entities around the site as well as governmental stakeholders such as MOECAF.

For pollution control, the EMP will seek to limit impacts to the environment via setting environmental policy and regulations for air quality, water usage, wastewater effluent, soil quality, and groundwater and surface water quality. These regulations will be followed up with a monitoring and reporting regime in coordination with governmental policy on a forward-looking basis. To create an environmentally-friendly SEZ, the SEZ Law requires the adoption of International Standards. Therefore, the SEZ will take direction from the Central Working Body (the entity with the power to determine standards for the SEZ) and adopt minimum standards based on international best practice. Emissions standards to be referenced will be based on the IFC Environmental, Health, and Safety (EHS) Guidelines. When national standards are issued, the SEZ will meet the national standards.

8.4 Institutional Structure of SEZ Environmental Management

It is noted that the SEZ law stipulates the responsibilities of the management committee will be clarified later by the relevant rules/regulations. It is also noted that the SEZ Management Committee is not under the remit of the Myanmar Investment Commission (MIC) and Foreign Investment Law and therefore the relevant EIA procedures normally done by MIC in conjunction with MOECAF may not be applicable in the context of the SEZ. Additionally, Article 35 of the SEZ Law stipulates that investors shall abide by the environmental standards in the Myanmar Environmental Conservation Law, other existing laws and international standards. This is interpreted to mean that the SEZ managing body should conduct some sort of EIA procedures for the tenants, which will be managed through the SEZ Management Committee's One-Stop Service Center, reflecting practices in the Zone A area.

The implementation and ongoing monitoring of this EMP will be implemented under an organizational structure under the managerial body of the SEZ and matching the structure that is adopted in the Zone A.[10]

The current organizational structure for the EMP operation in Zone A is described in the figure below. The said structure for other zones shall be stipulated in EIA of each zone referring to the structure of Zone A.

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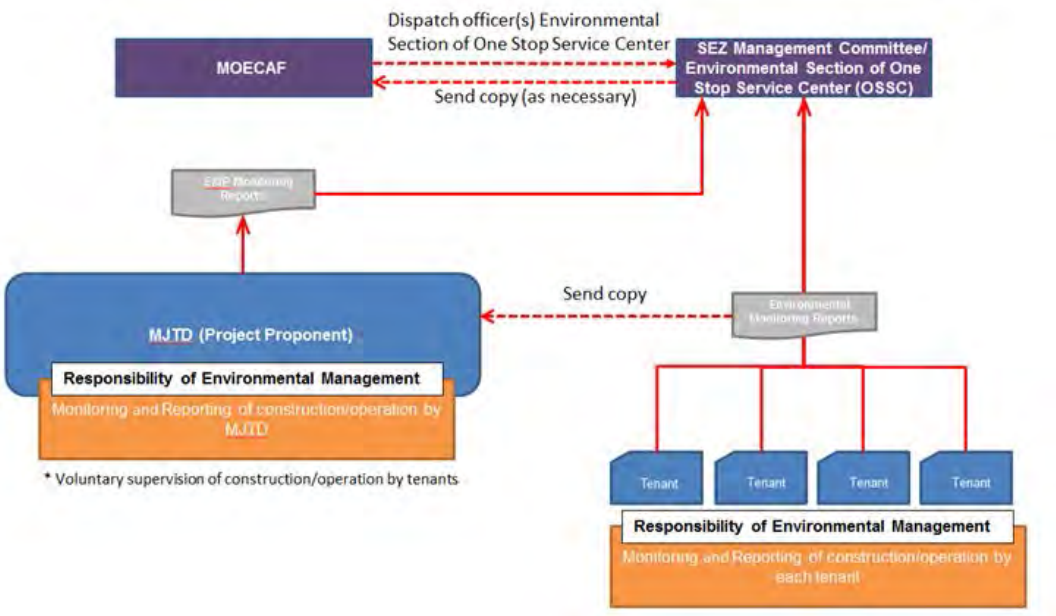
[10] The managerial body for the SEZ may be the SEZ Management Committee and/or the Myanmar-Japan Consortium.



Note: O&M=Operation and Management
Source: SEZ Management Committee

Figure 8-1 Implementation and Monitoring of Environmental Management Plan

8.5 Grievance Mechanism

A grievance mechanism has been established by TSEZMC for Thilawa SEZ Zone. That is, a representative from GAD that has been seconded to the SEZ Management Committee will reside in the project proponent office on site and process grievances when and as they come up. Table below shows the grievance mechanism. TSEZMC expects that complaints should be solved in an amicable way between the parties concerned by taking the following steps.

Table 8-2: Grievance Redress Mechanism

Step	Action
Step 1	TSEZMC assigns one person (Community Engagement Officer, CEO) in charge of Grievance Redress in the SEZ.
Step 2	Project proponents/Investors and GADs shall report all the complaints to CEO.
Step 3	CEO will collect all the complaints and report to TSEZMC and TSEZMC will solve the problems with project proponents/Investors.
Step 4	If not settled, the complaint will be sent to Regional Government (Yangon Region) and Regional Government will solve the problem with related ministries.
Step 5	If not settled, the complaints will be sent to the Central Government and Central Government will solve the problem
Step 6	If not settled, the complaints may be lodged to National Court.

Appendix List

Appendix A: SEA Stakeholder Meeting (1)

Appendix B: SEA Stakeholder Meeting (2)

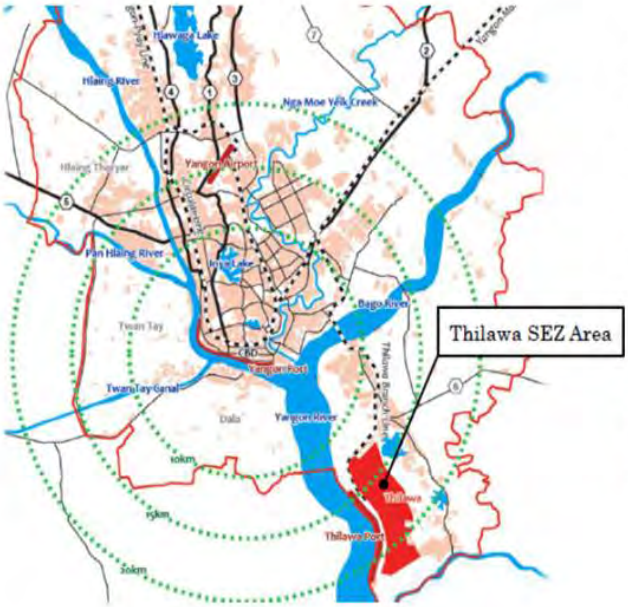
Appendix C: Comments to draft SEA

Appendix D: Baseline data (Detailed)

Appendix A: SEA Stakeholder Meeting (1)

1. An English Version of Presentation given at the Stakeholder Meeting

1. Project Description



Project Objectives :
Development of **2,000ha** in Thilawa SEZ, (Except about 400 ha ("Class A zone"))

Project Location :
20km southeast of Yangon in the Townships of Thanlyin and Kyauktan

Project Proponent :
The Thilawa SEZ Management Committee

2. SEA Approach

- Stakeholder Identification
- Baseline Condition (Sensitive Issues)
- Legal Framework
- Development Concept Analysis
- Development/Operation Scenarios
- Possible Constraints
- Possible Mitigation Measures

3. Baseline Condition (Sensitive Issues)

◆ Natural Environment
- Natural Habitat (Mangrove, Stream, Ponds)
- Protected Species.
- Yangon River, Hmawwun River
- Streams, Reservoirs, and Ponds

◆ Social Environment
- Fisheries & Agriculture
- Sensitive Areas, Properties in/around the Project Sites
  - Cultural Assets: Pagodas & Hindu Temples
  - Existing facilities (Universities, Community Facilities) and others
  - Adjacent Village



4. Legal Framework

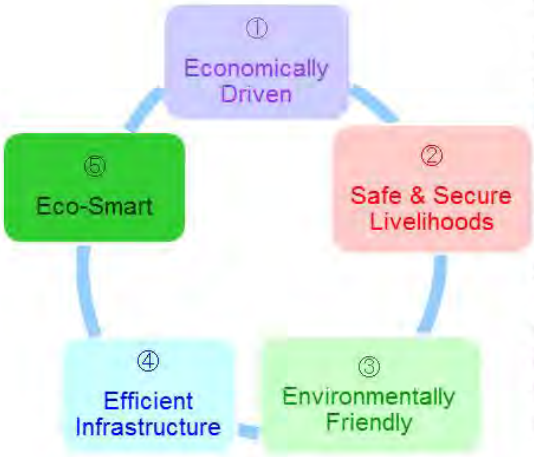
[Laws & Regulations on EIA/SEA]
- Environmental Conservation Law (2012) & Environmental Conservations Rules (2014)
- EIA Procedures (Draft stage)

⇒ NO Specific Environmental Standards/Guidelines/Regulations in Myanmar

[Other Laws & Regulations]
- Myanmar Special Economic Zone Law (2014)

Stipulates that **investors shall abide by the International Standards**
- Effluent Standards by Ministry of Industry


5. Development Concept - METI Study -



① To Increase value added products & bring "Myanmar Brand", "Production", "Education" & "Research & Development" will be enhanced

② Build the SEZ not only a space "where you want to go to work" but also "where you want to live in the future"

③ To realize healthy & comfortable city life to environment as well as to humans, existing roads & rivers will be kept to the extent possible

④ To meet the demand of the SEZ, develop the infrastructure as an off-site system of high performance & low environmental impact

⑤ Apply Eco-Smart technology that can reduce the load on the environment & households.

6. Conflictions of Development Concept

	Economically Driven	Safe & Secure Livelihood	Environmentally Friendly	Efficient Infra-structure	Eco-Smart
Economically Driven "Myanmar Brand Products" →enhance "Production", "Education" & "Research & Development"		×	×	●	▲
Safe & Secure Livelihood Develop the SEZ as "Where you want to live in the future"			◎	◎	●
Environmentally Friendly Existing roads & rivers will be kept to the extent possible				●	◎
Efficient Infrastructure Develop the infrastructure as an off-site system of high performance & low environmental impact					●
Eco-Smart Apply Eco-Smart technology that can reduce the load on the environment & households					

◎: Good match ● : Match ▲: Not Match × : Conflict

What environment should be retained/created?

Identified Major Conflicts

Environmentally Friendly
Existing roads & rivers will be kept to the extent possible

×

Economically Driven
Making more space for sellable area.

Safe & Secure Livelihood
Develop the SEZ as "Where you want to live in the future", not only for work.

×

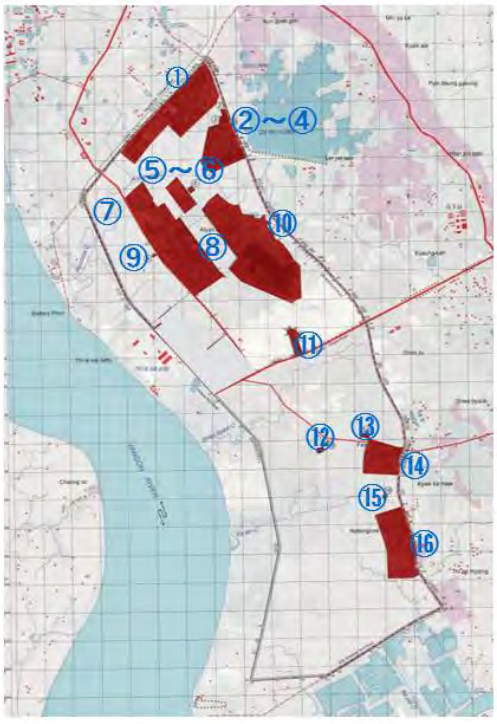
Economically Driven
Making more space for sellable area.

Considering the development in the region and Natural Environment, Cultural and Historical Background:

What environment should be created and/or retained for the future?

8

7. Development Scenario - Key Point 1: Excluded Area



①	Myanmar Economic Cooperation Grass Factory & Ministry of Industry (MoI) Flask Factory
②	Hostel of Maritime University
③	Phanchat Monastery
④	Maritime University
⑤	MoI Power Distribution Plant
⑥	Area for the Factory construction by MoI
⑦	Myanmar Economic Cooperation's Galvanized Iron Sheet Factory & Shoe Factory
⑧	MoI Packaging Factory & Garment Factories
⑨	Church
⑩	Thilawa Dam
⑪	Thilawa Konetan Monastery
⑫	Phalankanoo Monastery
⑬	Phalanywaroo Pahayalay Monastery
⑭	Ayemyathida Ward
⑮	Hindu Temple
⑯	Shwepyitharyar Ward

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7. Development Scenario - Key Point 2: Creek -

Environmentally Friendly
Existing roads & rivers will be kept to the extent possible

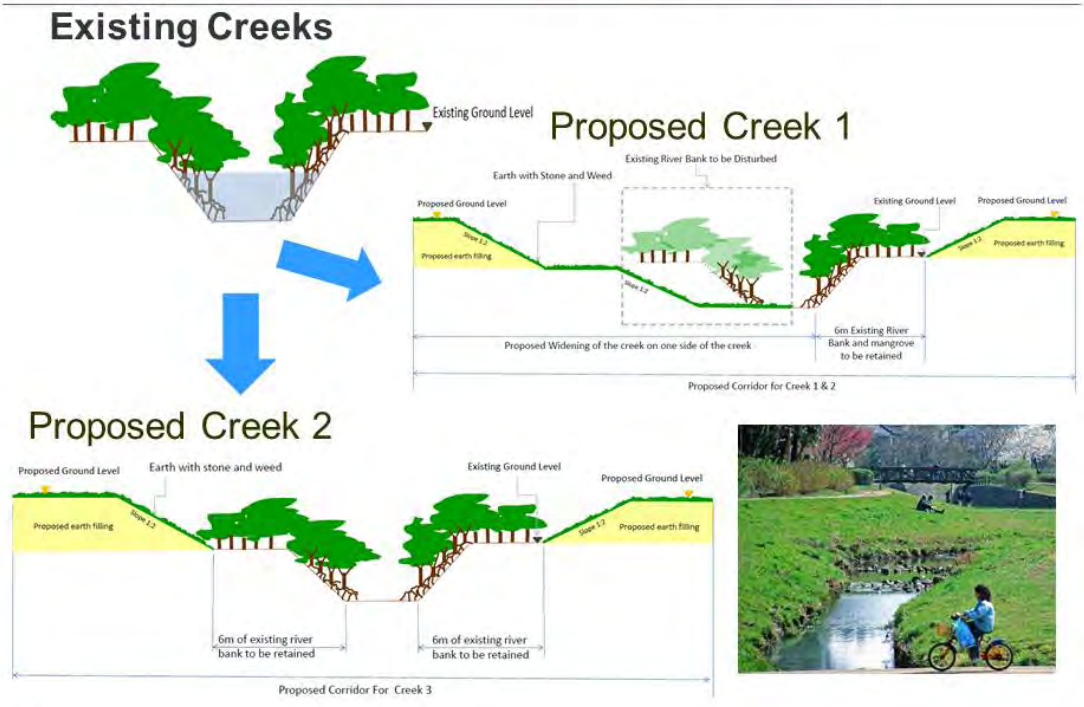
×

Economically Driven
Making more space for sellable area.

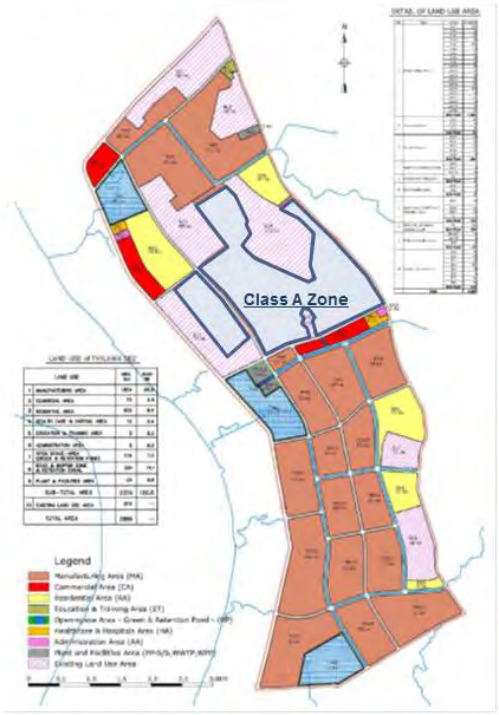
Natural Bank Protection

Bank Protection with Concrete Wall

7. Development Scenario - Key Point 2: Creek -



7. Development Scenario - Original Plan -



7. Development Scenario - Alternative Plan -

Major Items	Alternative 1 (Original Plan)	Alternative 2 (Upgraded Plan)
Land Use Plan	Total Area: 1,980a Industrial Area: 1158ha Residential Area: 200ha Commercial Area: 70ha Common Area: 552ha	Total Area: 1,819ha Industrial Area: 986ha Residential Area: 131ha Commercial Area: 15ha Common Area: 687ha
Natural Environment		
Ecosystem	Mangrove habitat (Water streams) will be lost.	Mangrove habitats (Water streams) will remain. One pond located next to the monastery in the center of the project site will remain.
Hydrology (Flood Control)	Three Retention ponds are to be constructed. Main streams will be altered to concrete water channel.	Three Retention ponds are to be constructed. Main streams will be expanded to allow more flow rate, keeping the current routes and ecology
Social Environment		
Resettlement	There are settlers who live in the project site and need relocation.	
Cultural Heritage	The conservation of cultural assets is not considered well.	Cultural Assets are avoided and kept as it is based on the relevant laws and regulations.

8. Possible Constraints in Development Phase

1) What impacts are anticipated by the development?

2) How to protect the natural environment?

- Loss of mangrove
- Loss of natural habitat for fish and birds
- Possibility of floods

3) How to reduce impacts on local people?

- Impacts on Livelihood of Farmers and Fishermen
- Impacts on Cultural Assets/ Adjacent Villages/ Universities, Community Facilities in Excluded Areas and surrounding areas, etc.
- Impacts related to HIV/AIDs and communicable disease

9. Operational Scenario

Potential Industrial Sectors
[Significant Current Demand]

Food and Beverage, Textiles, Chemicals, and Construction Material

[Emerging Industries]

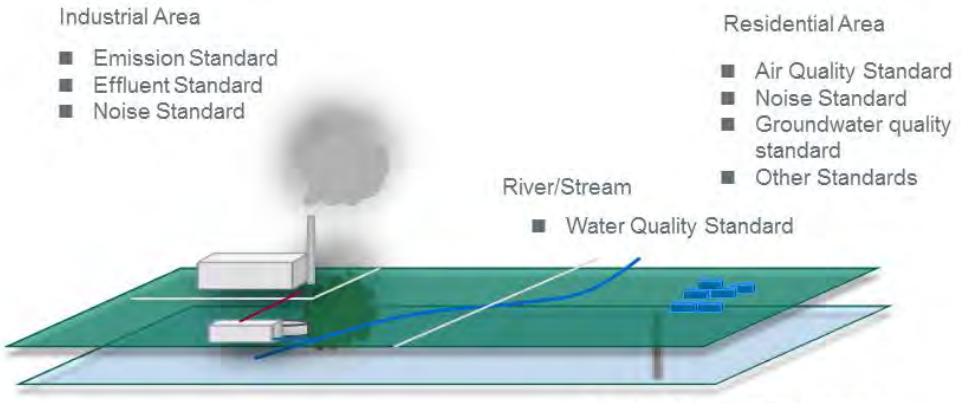
Wood and Related Products, Machinery and Equipment, Electrical and Electronics, and Automotive Manufacturing

10. Possible Constraints in Operation Phase

How to Control Impacts/Pollutants?

- Impact on water resources (streams/rivers)
- Impact on ambient Air, noise & vibration
- Generation of waste
- Impacts related to Land Subsidence due to the use of underground water
- Impacts on fauna & flora (pollution in soil and water environment)
- Social Impacts such including safety, landscape, community and so on
- Cumulative Impacts by accumulation of factories
- Complaints from the surrounding communities and others
- Response to the local authorities, change in environmental and social laws and regulations

11. Key Point Environmental Standards



12. Key Point - Environmental Management -

Environmental Impacts as a result of Daily Industrial Activities in SEZ

- Industries in SEZ are related to air pollution, water pollution, noise and vibration, odor and waste. As the number of factories increase, *cumulative impacts* will occur.

Possible Measures: EMP

- Comprehensive Management System for Thilawa SEZ
- Individual Management System by each Tenant
- WWTP

[Key Issue]

- Environmental Permit and Monitoring Mechanism with Responsible Partiers

18

What is an Environmental Management Plan (EMP)?

An instrument that details (a) the measures to be taken during the implementation and operation of a project to eliminate or offset adverse environmental impacts, or to reduce them to acceptable levels; and (b) the actions needed to implement these measures.

EMP is an on-going document prepared as a part of EIA and used throughout the project cycle.

Contents of EMP

- Summarize environmental impacts identified in the EA report
- Identify impacts that must be mitigated
- Describe mitigation measures
- Describe monitoring and reporting arrangements including Grievance Redress
- Describe assignment of responsibilities and schedules
- Provide costs estimates for mitigation and monitoring measures

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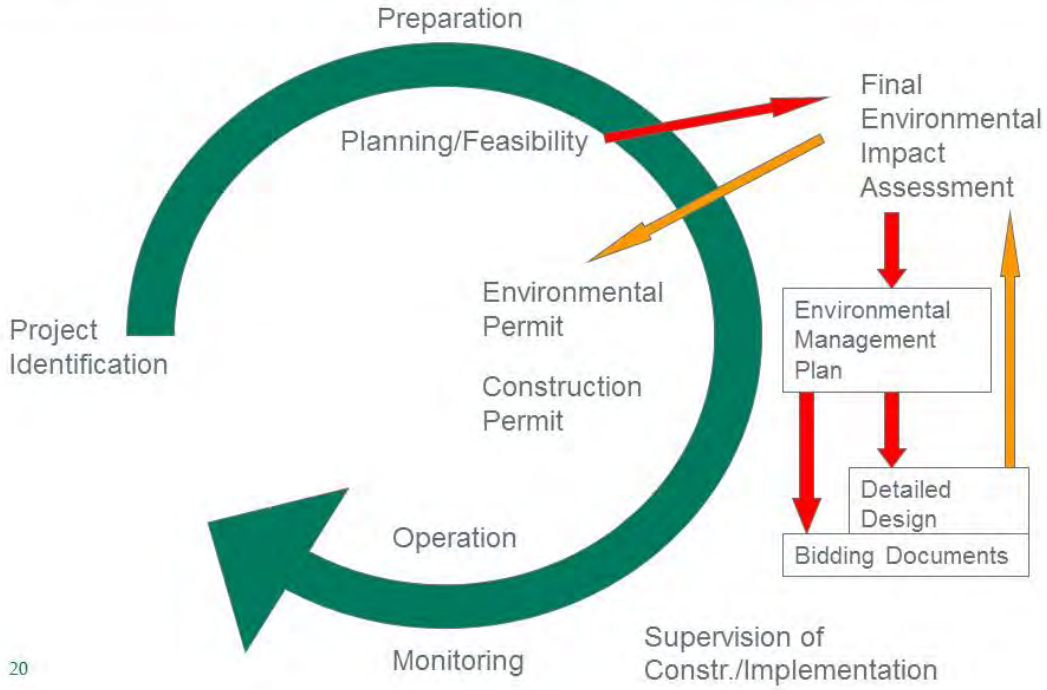
Integration of EMP into Standard ECA Practice



Thank you!

General stakeholder comments can be directed to:
Thilawaygn@gmail.com (SEZ Management Committee)

2. Attendance List

Government and Private Business Stakeholders

No.	Name	Position	Department
1	U Soe Than	ACE	YCDC
2	Daw Khaing Cho Win	Staff Officer(DICA)	TSEZ
3	Daw Mya Myat Chal	SAE	Public Work /TSEZ
4	U Zaw Win Myint	Assistant Driector	Immigration & National Registration Dept.
5	U Win Swe	Assistant Driector	Custom
6	U Thein Zaw	Staff Officer	Internal Revenue
7	U Soe Thein	Dupty Chief Engineer (Civil)	Myanmar Port Authority
8	Daw Thandar Oo	Surveyor	MKI
9	U Min Zaw	Village GAD	Nyoung Wine Village
10	U Thein Han	Member	Landuse Committee
11	U Thein Win	GM	Top-Food (HlaingTharYar)
12	Daw Thida Sein		
13	U Min Tala Nyan	Country Manager	Ball Asia Pacific Limited
14	U Myo Naing	Staff Officer	Dept. of Labour
15	U Thein Zaw	Staff Officer	Internal Revenue
16	U Tin Oo	Professor	Co-operative University (Thanlyin)
17	Daw Hnin Wutt Yee	Manager	Myanmar Center for Responsible Business,MCRB
18	U Win Ko	Staff Officer	Ministry of Commerce
19	Dr.Sapal Phyu Lwin	Assistant Driector	Ministry of Construction
20	U Aye Lwin	GAD	Shwe Phi Thar Quatar
21	U Zaw Myo Naing	Member of GAD	Shwe Phi Thar Quatar
22	U Tin Latt Yee	Village GAD	Shwe Pyouk Village
23	U Kyaw Myin	Member of GAD	Shwe Pyouk Village
24	U Linn Aung Htike	Member of GAD	Shwe Pyouk Village
25	U Ko Ko Naing	Staff Officer	Immigration & National Registration Dept.(Kyouk Tann)
26	U Htain Linn	GAD	A Lwam Sweet Village
27	U Win Naing	Police Officer	Police Station (Thilawa)
28	Daw Sandar Min	Head of Corp.	Yoma Bank
29	U Htun Htun	Driector	Yoma Bank
30	U Sa Myint Swe	ATEO	ThanLyin
31	U San Hla Zaw	AMA	Yangon
32	U Thet Zaw Oo	AMA	Yangon

33	Dr.Thida Htwe	Staff Officer	
34	Daw Ei Ei Khaing	Staff Officer	GAD (South)
35	U Soe Ko Ko	GM	P.P.Committee
36	U Myint Thu	GAD	AyeMyaThidar
37	U Sun Tint	GAD	AyeMyaThidar
38	U Tin Ohn	GAD	AyeMyaThidar
39	U Than Lwim	GAD	AyeMyaThidar
40	U Hla Thann	GAD	AyeMyaThidar
41	U Ohn Myint	GAD	AyeMyaThidar
42	U Kan Thar	GAD	AyeMyaThidar
43	U Sein Htay	GAD	AyeMyaThidar
44	U Htay Aung	Staff Officer	Dept. of Agriculture (Kyouk Tann)
45	Daw Aye Aye Than	Staff Officer	Dept. of Planning
46	U Aye Cho	Development GAD	Kyoung Kone Gyi Village
47	U Myint Lwim	Quatar GAD	Thida Mying Quatar
48	U Soe Win	Member of Quatar GAD	Thida Mying Quatar
49	U Mya Aye	Member of Quatar GAD	Thida Mying Quatar
50	U Hla Myint	PR Officer	Development Fondation
51	U Win Myint	Staff Officer	SLRD
52	U Zaw Zaw	Manager	Dagon International
53	Daw Khin Htwe Phyu	Staff Officer	Dept. of Agriculture
54	Daw Nyo Nyo Than	Assistant Driector	Dept. of Archaeology, National Museum & Library
55	U Khaing Lay	Regional Staff Officer	Directorate of Industrial Supervision and Inspection
56	Daw Hnin Hnin Yee		Directorate of Industrial Supervision and Inspection
57	Daw Cho Cho Win	Assistant Driector	Directorate of Industrial Supervision and Inspection
58	U Myint Hlaing	Village GAD	Kyoung Kone Gyi Village
59	U Myint Naing	Member of Village GAD	Kyoung Kone Gyi Village
60	U Win Htay	Village GAD	Phayar Gone Village
61	U Soe Win	Member of village GAD	Phayar Gone Village
62	U Myo Tint	Menber of village GAD	Phayar Gone Village
63	Daw Ohmar Aung	Dupty Driector	Dept. of Archaeology, National Museum & Library
64	U Myint Aung	EC	FREDA
65	U Aye Htun	Farmers' Representative	Thilawa
66	U Kyaw Zaw	Officer	MTSH

67	Dr. Toe Toe	Staff Officer	Thanlyin Hospital
68	U Zaw Khaing	Ranger	Forest Dept.,Kyouk Tann
70	U Kyaw Swar Min	Staff Officer	SLRD
71	U Aye Min Naing	Staff-4	SLRD
72	U Htun Hla Shwe	Regional Representative	
73	U Myo Myint	Regional Representative	
74	U Aung Nyein	KTW Developmet Chairman	
75	U Tin Soe	Chairman(DC)	DC Committee (Kyouk Tann)
76	U Thoung Win	Development City Committee	Kyouk Tann
77	U Thein Zaw Lay	Chairman(DC)	DC Committee (Thanlyin)
78	U Myint Thein	Member of DC	Thanlyin
79	U Tin Win	Member of DC	Thanlyin
80	U Aung Aung Toe	Member of DC	Thanlyin
81	Gen: Aung Nyint	Member of DC	Thanlyin
82	Capt: Chit Nyint	Member of DC	Thanlyin
84	U Kyaw Linn Than	Staff Officer	Thanlyin
85	U Ko Ko Naing		Bogyoke Village
86	U Swe Lwin Htun	Township Lawyer	Dept. of Law (Thanlyin)
87	U Soe Tint	Distinct Staff Officer	Ministry of Industry (Thanlyin)
88	U Aung Phae Kyin	Assistant Professor	Dagon University
89	U Aye Kyuu	Village GAD	Latt Yate San Village
90	U Myint	Member of Village GAD	Latt Yate San Village
91	U Myint Oo	Member of Village GAD	Latt Yate San Village
92	Daw Khin Ma Ma	Planning Officer	Thanlyin
93	Dr.Thein Thein Oo	Staff Officer	Livestock Breeding & Veterinary Dept. (Thanlyin)
94	Dr.Myat Lwin	Rector	Myanmar Marine Time University
95	U Myo Lwin	Staff Officer	Dept. of Human Settlement & Housing Development

Local Stakeholders including Project Affected Persons (PAPs)

No.	Name	Address	Occupation
1	U Soe Thein	Thilawa	Farmer
2	U Kyaw Kyaw	Kayat Thidar Myaing	Farmer
3	Daw Sandar Myint	Alwinsweet	Dependence
4	U Maung Ko	Alwinsweet	Farmer
5	Daw Than Than Nu	Thilawa	Farmer
6	Daw Hla Oo	Alwinsweet	

7	Daw Maw	Alwinsweet	Dependence
8	U San Lwin	Alwinsweet	Carpenter
9	U Htun Wai	Alwinsweet	Fire Fighter
10	Daw Mya Sein	Alwinsweet	Casual
11	Daw Myo Myo	Alwinsweet	Dependence
12	Daw Myint Myint Htay	Alwinsweet	Seller
13	Daw Khin That Maw	Alwinsweet	Casual
14	Daw Khiw Htwe	Alwinsweet	Seller
15	Daw San Yu	Alwinsweet	Dependence
16	Daw Kyin O	Alwinsweet	Dependence
17	Daw Lat Lat War	Alwinsweet	Casual
18	U Ye Lwin Oo	Alwinsweet	Casual
19	U Kyaw Linn Naing	Alwinsweet	Casual
20	U Ko Aung	Alwinsweet	Casual
21	U Thein Zaw	Alwinsweet	Casual
22	U Kyaw Thin	Alwinsweet	Carpenter
23	Daw Myint Myint San	Alwinsweet	Seller
24	Daw San Tint	Alwinsweet	
25	Daw Pa Pa Htwe	Alwinsweet	Dependence
26	Daw Aye Nyein		Seller
27	Daw Than Sint	Alwinsweet	Seller
28	Daw Ohn Myint	Alwinsweet	
29	Daw Hla Myint	Alwinsweet	Seller
30	Daw San Lwin	Alwinsweet	Seller
31	Daw Moe Swe	Alwinsweet	Dependence
32	Daw Than Aye	Alwinsweet	Seller
33	Daw Thin Thin Mar	Alwinsweet	Mason worker
34	Daw Cho Mar Linn	Alwinsweet	Tailor
35	Daw Thin Kyi	Alwinsweet	
36	U Tun Yee	Nyaung Wine Group	Carpenter
37	Daw Than Than Soe	Ahtut Taw	Casual
38	Daw Maw	Alwinsweet	Mason worker
39	Daw Yin Shwe	Alwinsweet	Dependence
40	U Maung San Maw	Alwinsweet	Farmer
41	Daw Soe	Alwinsweet	Seller
42	U Maung Zaw	Alwinsweet	Mason worker
43	U Maung Myint	Alwinsweet	Seller
44	U Soe Min Htet	Alwinsweet	Mason worker

45	Daw Khaing	Alwinsweet	Farmer
46	U Nyain Pyae Sone	Alwinsweet	Mason worker
47	Daw Kyi Kyi Aye	Alwinsweet	Mason worker
48	Daw Kyi Kyi	Alwinsweet	Retired
49	U Kalar	Alwinsweet	Water Seller
50	Daw Zin Thein	Thilawa,Shwepyithawar3	Farmer
51	U Aye Hlaing	Thilawa,Shwepyithawar3	Farmer
52	U Win Thant	Thilawa,Shwepyithawar3	Farmer
53	U Win Khaing	Alwinsweet	Casual
54	U Thein Htun	Alwinsweet	Casual
55	Daw Khin Soe Mar	Aye Mya Thidar	Farmer
56	U Kyin O		Farmer
57	U Zaw Win Oo		IT
58	Daw Su	Alwinsweet	Casual
59	Daw San New	Alwinsweet	Casual
60	Daw Yee Yee Mya	Alwinsweet	Dependence
61	Daw Khin Aye Kyu	Alwinsweet	Mason worker
62	Daw Khin Win Kyi	Alwinsweet	Dependence
63	Daw Lone Chit	Alwinsweet	Dependence
64	Daw San San Aye	Alwinsweet	Dependence
65	Daw Thin Thin Aye	Alwinsweet	Dependence
66	Daw Ohn	Alwinsweet	
67	U Zaw Myo Thein	Alwinsweet	Seller
68	Daw Hla Yee	Alwinsweet	
69	Daw Khin	Alwinsweet	
70	U Thein Aung	Alwinsweet	Construction
71	U Than Htate	Alwinsweet	Casual
72	Daw Than Than Htwe	Thilawa Monastery	Dependence
73	Daw Htae	Thilawa	Dependence
74	Daw Tin Ohn	Alwinsweet	Dependence
75	Daw Win Marlar	Alwinsweet	Dependence
76	Daw Aye Htae	Alwinsweet	Dependence
77	Daw Aye Cho	Alwinsweet	Dependence
78	Daw Thay Thay	Alwinsweet	Seller
79	U Ko Naing	Alwinsweet	Mason worker
80	Daw Aye Su Latt	Moekyoswam Monastery	Mason worker
81	Daw Khin Htwe Yee	Thilawa	Casual
82	U Htay Oo	Thilawa	Casual

83	U Khin Oo	Thilawa	Mason worker
84	Daw Khin San Myint	Thilawa	Casual
85	U Khin Zaw	Thilawa	Farmer
86	Daw Theingy Wai	Thilawa	Casual
87	Daw Thi Thi Swe	Alwinsweet	Dependence
88	U Zon Win Mg	Alwinsweet	
89	U Htay Lwin	Thilawa	Farmer
90	Daw Thin Thin Maw	Alwinsweet	Casual
91	U Kyaw Htwae	Thilawa	Casual
92	Daw Win Win Cho	Alwinsweet	Dependence
93	Daw San	Alwinsweet	Farmer
94	U Aung Htun	Thilawa Kone Lam	Farmer
95	U Htay Aung	Tarmwe	Trader
96	Daw Nan Ngwe Kyi	Tarmwe	Dependence
97	Daw San Win	Alwinsweet	Dependence
98	Daw San		Farmer
99	U San Win	Thida Myit	Farmer
100	Daw Kyamar	Alwinsweet	Seller
101	Daw Myint Shwe	Alwinsweet	Carpenter
102	Daw Nan Ei Mon	Alwinsweet	Mason worker
103	Daw Nyein Nyo San	Alwinsweet	
104	U Chin Nartipi	Pilasat Village	Farmer
105	Daw Nwae Yee		Casual
106	U San Win	Middle Village,Thilawa	Seller
107	U Kanar Sar	Shwe Pyithar Village	Farmer
108	Daw Narari	Shwe Pyithar Village	Farmer
109	U Zaw Lwin	Kontan	Farmer
110	U Kyi Khaing	Alwinsweet	Casual
111	Daw Than Aye	Alwinsweet	Agriculture
112	U Than Zaw Oo	Shwe Pyauk	Agriculture
113	U Myint Aung	Shwe Pyauk	Agriculture
114	U Tint Lwin	Shwe Pyauk	Seller
115	U Thein Lwin	Alwinsweet	Taungyar
116	Daw Thuzar Min	Shwe Pyauk	Taungyar
117	U Aye Lwin	Alwinsweet	Carpenter
118	U An Kyaw Myint	Shwe Pyithar Village	Casual
119	U Kantayar	Tharyar Kone	Farmer
120	U Kyaw Kyaw	Alwinsweet	Farmer

121	U Putar Kyar	Tharyar Kone	Farmer
122	U Tin Myint	Shwe Pyitharyar	Farmer
123	U Win Naing	Shwe Pyithar Village	Farmer
124	U Sarmi	Shwe Pyitharyar	Farmer
125	U Myint Shwe	Alwinsweet	Farmer
126	U Gaw Bar Lu	Shwe Pyitharyar	Farmer
127	U Mg Myint	Shwe Pyitharyar	Farmer
128	U Kanasar	Shwe Pyitharyar	Farmer
129	U Buki	Shwe Pyitharyar	Farmer
130	U Than Soe	Shwe Pyitharyar	Casual
131	U San Tin	Alwinsweet	Casual
132	U Tin Naing Htun	Alwinsweet	Driver
133	U Myo Min Htun	Thilawa	Casual
134	U Moe Zaw Htwe	Thilawa	Casual
135	U Kyaw Kyaw	Thilawa	Casual
136	U Zaw Htun Naing	Alwinsweet	Casual
137	U Nyin Myint	Thilawa	Casual
138	U Mya Soe	Alwinsweet	
139	Daw Khin Cho Win	Alwinsweet	General
140	Daw San Win	Moekyoswam	Seller
141	Myint Ko	Moekyoswam	Seller
142	Wai Zin Oo	Moekyoswam	Seller
143	Daw Aye Myint	Moekyoswam	Dependence
144	Ma Wai	Alwinsweet	
145	Ma New	Alwinsweet	
146	U Han Sein	Alwinsweet	
147	Daw Khin Mar Kyi	Alwinsweet	
148	That Lwin Oo	Alwinsweet	
149	U Kyaw Hlaing	Alwinsweet	
150	Ma Kyaut Ei Ei Lin		
151	Daw Malar		Dependence
152	Daw Thaw Larsi		
153	Hnin New	Alwinsweet	
154	Aung Kyi Lwin	Alwinsweet	
155	U Karlipar		
156	U Kanaysar		
157	Daw Oo Oo		
158	U Nay Myo Aung	Moekyoswam	Seller

159	U Mya Than	Alwinsweet	
160	U Myint Naing	Alwinsweet	Mason worker
161	Daw San	Alwinsweet	Seller
162	Daw May That Khaing	Alwinsweet	Construction
163	Daw Than Htay	Alwinsweet	Construction
164	Daw Nan Theingy Htwe	Alwinsweet	Casual
165	U Phat Ti	Shwe Pyitharyar	Farmer
166	U Kyaw Swar	Shwe Pyitharyar	Farmer
167	U Myint Soe	Alwinsweet	Construction
168	U Yanshin	Alwinsweet	Construction
169	U Khin Mg Aye		
170	U Darmu	Shwe Pyitharyar	
171	U Mg Zaw	Shwe Pyitharyar	
172	U Than Soe	Thilawa Kontane	
173	UTin Hlaing	Thilawa	
174	Daw Nwae Nwae Yee	Thilawa	
175	U Win	Thilawa	
176	U Moe Kyaw	Thilawa	
177	U Kyaw Win	Thilawa	
178	U Aung Aung	Thilawa	
179	Daw Cho	Thilawa	
180	Daw Khin Hla	Thilawa	
181	Daw Aye Gyi	Thilawa	
182	U Dar Gyar	Thilawa	
183	U Chit Ko	Alwinsweet	
184	U Hla Kyaing	Thilawa	Farmer
185	Daw Saturi	Thilawa	General
186	Daw Aye Mar	Alwinsweet	
187	Daw Than Tint	Alwinsweet	General
188	Daw Htay Myint	Alwinsweet	Dependence
189	Daw Muhtuma	Thilawa Konetam	Dependence
190	Daw Yeshwe	Alwinsweet	Dependence
191	Daw Zar Zar Thein	Thilawa	Dependence
192	Daw San Wai Oo	Thilawa	Dependence
193	Daw Bomi	Thilawa	Dependence
194	Daw Sanda Myo	Alwinsweet	Dependence
195	Daw Khin Aye	Alwinsweet	Dependence
196	U Ko Ko Min	Alwinsweet	Dependence

197	Daw Par Par Thi	Phalan Village	Dependence
198	U Bo Tun	Alwinsweet	Construction
199	Daw San Ngwe	Alwinsweet	Mason worker
200	Daw Than Htae	Thilawa	Casual
201	Daw Tin Tin Nyo	Alwinsweet	Mason worker
202	Daw Mya Thandar Win	Alwinsweet	Mason worker
203	Daw Yee Myint	Alwinsweet	Mason worker
204	Daw Moe Thu	Alwinsweet	Mason worker
205	Daw Khaing	Alwinsweet	Mason worker
206	U Zaw Oo	Alwinsweet Konetane	Carrier
207	U Zaw Win Htate	Alwinsweet	
208	U Zaw Myo Oo	Alwinsweet	
209	U Tin Mg Tun	Alwinsweet	
210	U Saing Aung Aung	Alwinsweet	
211	U Aung Tin Win	Alwinsweet	Casual
212	U Khin Marlar	Alwinsweet	Casual
213	U Tin Myint	Alwinsweet	Casual
214	Daw Cho	Alwinsweet	Machine Assist
215	U Win Thaw	Alwinsweet	Mason worker
216	Daw Myint Khaing	Thilawa	Casual
217	Daw Htay Win	Moekyoswam	Seller
218	U Chit Moe	Moekyoswam	Casual
219	U Min Naung	Moekyoswam	Mason worker
220	Daw Khin Khin Thein	Moekyoswam	Seller
221	Daw San Kyi	Moekyoswam	Seller
222	Daw Nwae Yee Win	Moekyoswam	Seller
223	Daw Yin Nu	Moekyoswam	Seller
224	U Wai Linn	Moekyoswam	Casual
225	Daw Zarni Hlaing	Moekyoswam	Seller
226	U Myint Hlaing	Moekyoswam	Seller
227	U Zaw Myo Thant	Moekyoswam	Seller
228	U Win Khaing	Moekyoswam	Casual(MRT)
229	U Myo Min Htun	Moekyoswam	Casual

Media and NGOs

No	Name	Position	Media
1	U Nyein Zin Soe	Reporter	MRTV-4
2	U Saw Hti	Cameraman	MRTV-4

3	U Myat Thiha Tun	Cameraman	MRTV-4
4	U Tun Myint	Reoorter	RFA
5	Daw Khin Yadanar Tun	Reporter	The New Light of Myanmar
6	U Tin	Myitsone Agriculture	Myitsone Agriculture
7	Daw Shwe Lay	Reporter	Modern Journal
8	U Phoe Pyone	Cameraman	MRTV
9	Hong Sar	Cameraman	MIZZIMA
10	U Aung Kyan	Retire	
11	Daw Ohmar Han	Cameraman-level 1	MRTV News
12	Daw Mya Thin Khing	Cameraman-level 1	MRTV News
13	U Sithu Aung	Reporter	MIZZIMA-TV
14	U Aung Thura	Senior Reporter	MIZZIMA-Business
15	U Sithu Zayar	B.J	DVB
16	U Soe Win	Reporter	The Mirror News
17	U Htin Linn Aung	Senior Reporter	MIZZIMA
18	U Aung Myo Kyaw	Reporter	MWD NEWS Daily
19	U Aung Myint Htay	Reporter	City News
20	U Kaung Sat Naing	Reporter	The Voice
21	U Ko Ko Gyi	Reporter	MIZZIMA Bussiness Weekly Magazine
22	U Zaw Htike	Senior Reporter	Myanmar Times
23	Dr Thein Aung	Vice Chairman	Myanmar Bird and Nature Association
24	Ma Lai Lawn Sanga	Manager	Alpha & Omega
25	U Thein Htike Oo	PO	Vermont Law School
26	Daw May Thazin Aung	Project Specilist	VLS
27	Yen Snaing	Reporter	Irrewaddy
28	U Ye Nandar Lin Myint	Reporter	City FM
29	U Pyae Song Aung	Reporter	Eleven
30	Daw May Oo Kyin Nar Naing	Reporter	Modern / Dana Journal

3. Public Announcement

The Mirror (27 June 2014)

ဖိတ်ကြားခြင်း

သီလဝါအထူးစီးပွားရေးဇုန် စီမံခန့်ခွဲမှုကော်မတီအနေဖြင့် သီလဝါအထူးစီးပွားရေးဇုန် စီမံကိန်းဇုန်ဧရိယာအဆင့် ဧရိယာဟက်တာ (၂၀၀၀) အကောင်အထည်ဖော်ရန် အတွက် မဟာဗျူဟာမြောက် ပတ်ဝန်းကျင် ဆန်းစစ်ခြင်း (Strategic Environmental Assessment - SEA) နှင့် ပတ်သက်၍သက်ဆိုင်သူများနှင့်တွေ့ဆုံပွဲ (Stakeholder Meeting) ကို ၂၀၁၄ ခုနှစ်၊ ဇွန်လ(၃၀) ရက်နေ့ (တနင်္လာနေ့) နံနက် (၁၀:၀၀နာရီမှ ၁၁:၀၀ နာရီအထိ) မြို့ရွာနှင့်အိုးအိမ်ဖွံ့ဖြိုးရေးဦးစီးဌာန မြေယာရုံးခွဲ (၂)၊ သန်လျင်မြို့နယ် (သီလဝါအထူးစီးပွားရေးဇုန် စီမံခန့်ခွဲမှု ကော်မတီ ယာယီရုံး) ၌ကျင်းပသွားမည် ဖြစ်ပါသဖြင့် စိတ်ပါဝင်စားသူများ တက်ရောက်နိုင်ပါရန် လေးစားစွာဖြင့် ဖိတ်ကြားအပ်ပါသည်။ တက်ရောက် လိုသူများသည် Email: thilawaygn@gmail.com သို့ (၂၈-၆-၂၀၁၄) ရက်နေ့ နောက်ဆုံးထား၍ ပေးပို့ ဆက်သွယ်ပေးနိုင်ပါရန် အကြောင်းကြားအပ်ပါသည်။

သီလဝါ အထူးစီးပွားရေးဇုန် စီမံခန့်ခွဲရေးကော်မတီ

Myanma Alinn Daily (27 June 2014)

International Outbound Roaming Service

ဖိတ်ကြားခြင်း

27-6-2014 (Friday)

(Strategic Environmental Assessment - SEA) (Stakeholder Meeting)

Email: thilawaygn@gmail.com

4. **English invitation letter – distributed throughout the week of 23 June 2014**

Recipients:

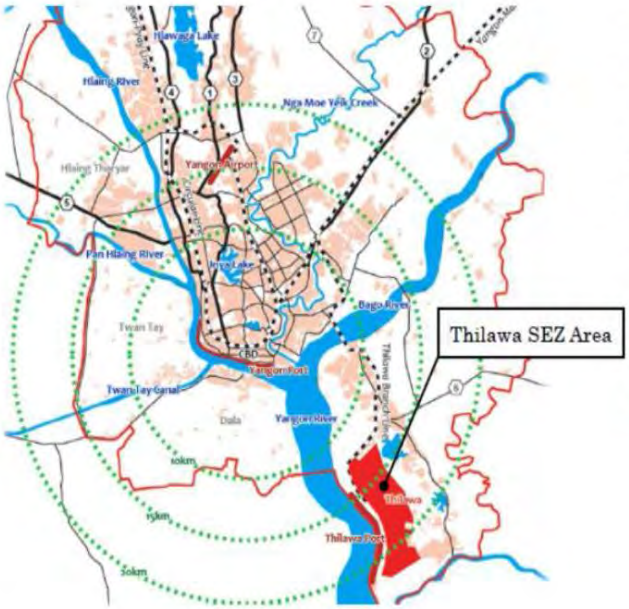
- Myanmar Bird and Nature Society

- International HIV/AIDS Alliance in Myanmar
- Swanyee Development Institute
- Myanmar Centre for Responsible Business
- International Commission of Jurists
- Vermont Law School Myanmar Program
- EcoDev
- Spectrum Consulting
- Freda Myanmar
- Friends of Wildlife

Appendix B: SEA Stakeholder Meeting (2)

1. Presentation given at the Stakeholder Meeting

1. Project Description



Project Objectives :
Development of Thilawa SEZ

Project Location :
20km southeast of Yangon in the Townships of Thanlyin and Kyauktan

Project Proponent :
The Thilawa SEZ Management Committee

2. SEA Approach

- Stakeholder Identification
- Baseline Condition (Sensitive Issues)
- Legal Framework
- Development Concept Analysis
- Development/Operation Scenarios
- Possible Constraints
- Possible Mitigation Measures
- EIA

3. Baseline Condition (Sensitive Issues)

◆ Natural Environment
- Natural Habitat (Mangrove, Stream, Ponds)
- Protected Species.
- Yangon River, Hmawwun River
- Streams, Reservoirs, and Ponds

◆ Social Environment
- Fisheries & Agriculture
- Sensitive Areas, Properties in/around the Project Sites
  - Cultural Assets: Pagodas & Hindu Temples
  - Existing facilities (Universities, Community Facilities) and others
  - Adjacent Village



4. Legal Framework

[Laws & Regulations on EIA/SEA]
- Environmental Conservation Law (2012) & Environmental Conservations Rules (2014)
- EIA Procedures (Draft stage)

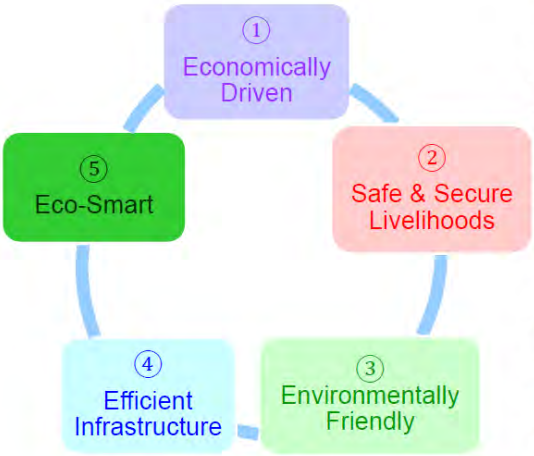
⇒ **NO Specific Environmental Standards/Guidelines/Regulations in Myanmar**

⇒ **National Environmental Standards under development.**

[Other Laws & Regulations]
- Myanmar Special Economic Zone Law (2014)

Stipulates that investors shall abide by the International Standards
- Interim environmental standards (based on IFC EHS Guidelines)


5. Development Concept - METI Study -



① To Increase value added products & bring “Myanmar Brand”, “Production”, “Education” & “Research & Development” will be enhanced

② Build the SEZ not only a space “where you want to go to work” but also “where you want to live in the future”

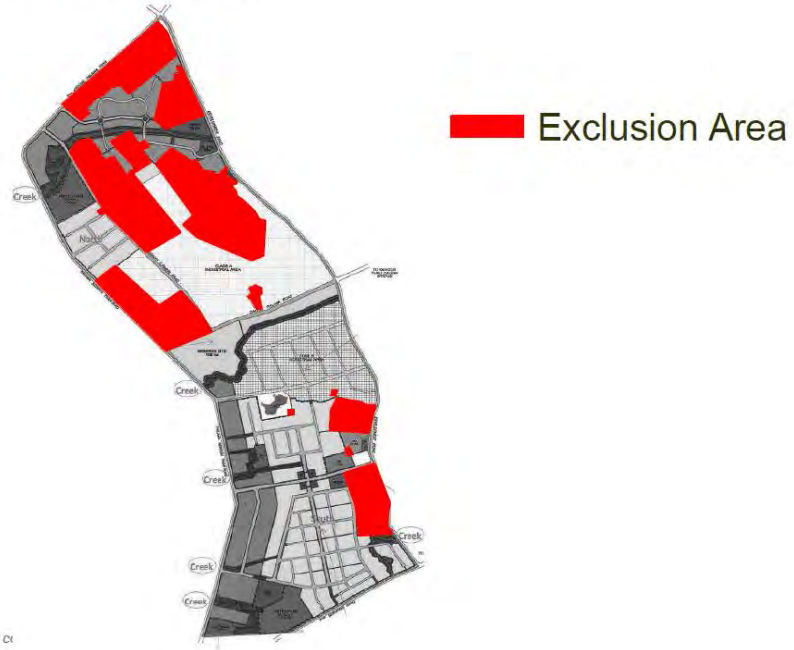
③ To realize healthy & comfortable city life to environment as well as to humans, existing roads & rivers will be kept to the extent possible

④ To meet the demand of the SEZ, develop the infrastructure as an off-site system of high performance & low environmental impact

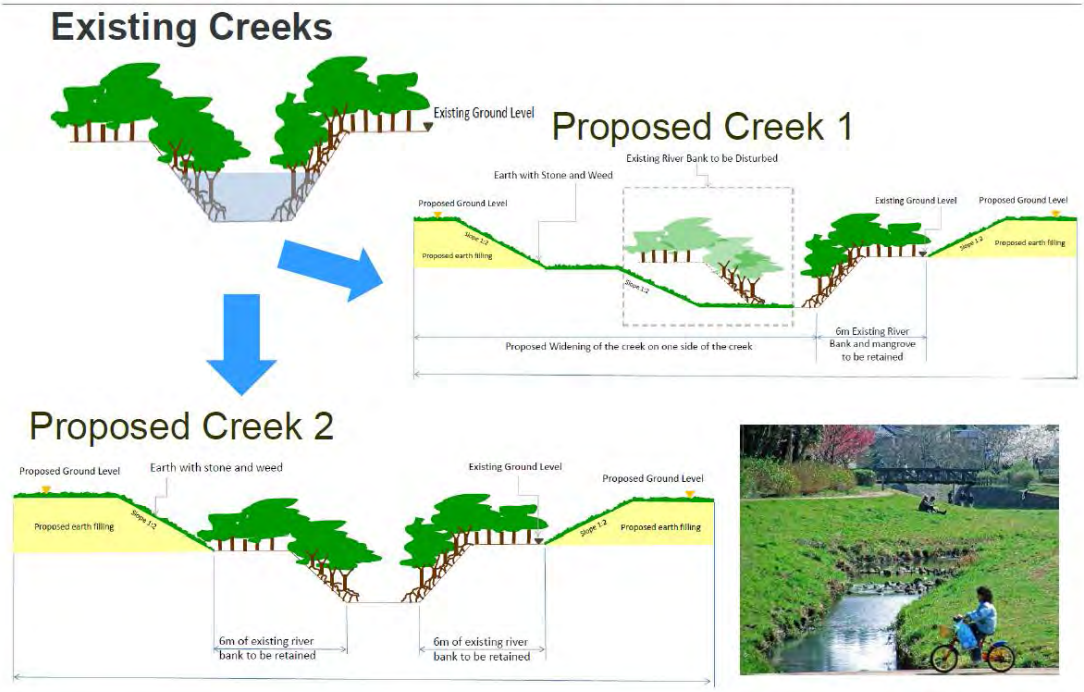
⑤ Apply Eco-Smart technology that can reduce the load on the environment & households.

6. Development Scenario - Key Point 1: Excluded Area

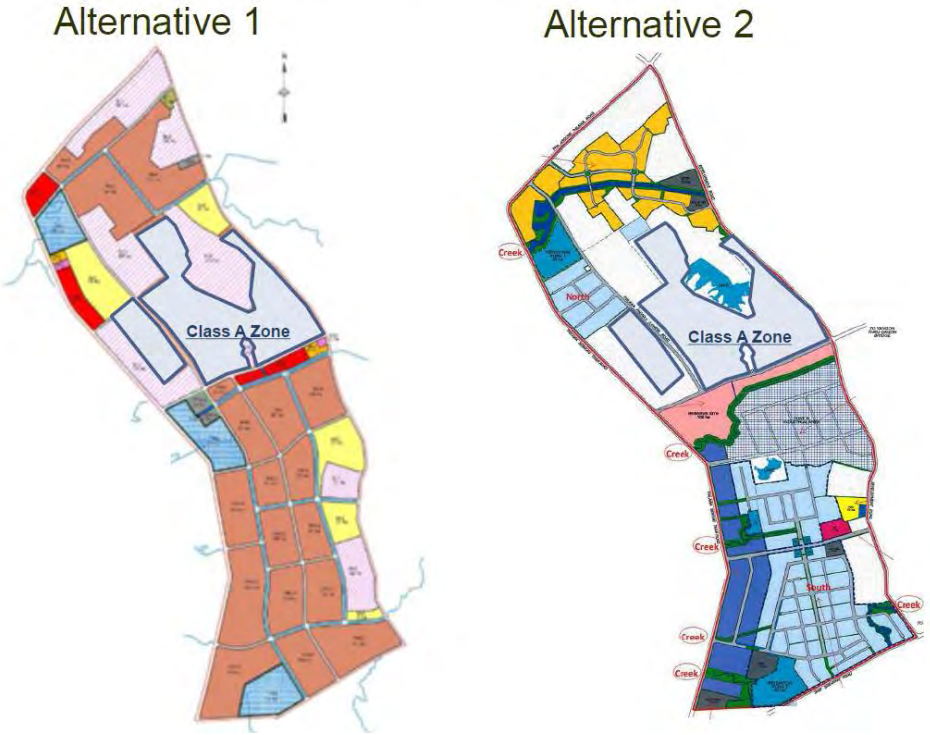
Need to confirm the area.



7. Development Scenario - Key Point 2: Creek



7. Development Scenario - Original Plan -



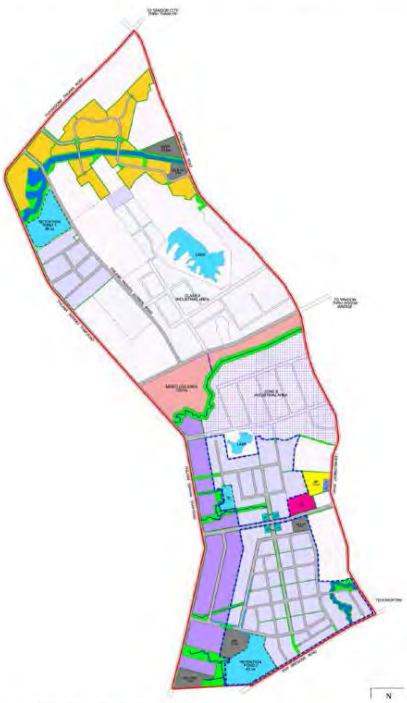
7. Development Scenario - Alternative Plan -

Major Items	Alternative 1 (Original Plan)	Alternative 2 (Upgraded Plan)
Land Use Plan	Developable Area: 2,376ha Industrial Area: 1,554ha	Developable Area: 2,120ha Industrial Area: 1,119ha
Natural Environment		
Ecosystem	There is a risk of Mangrove habitat (Water streams)	Mangrove habitats (Water streams) will remain. One pond located next to the monastery in the center of the project site will remain.
Hydrology (Flood Control)	Three Retention ponds are to be constructed. Main streams will be altered to concrete water channel.	Three Retention ponds are to be constructed. Main streams will be expanded to allow more flow rate, keeping the current routes and ecology
Social Environment		
Resettlement	There are settlers who live in the project site and need relocation.	
Cultural Heritage	There is a risk of Cultural Heritage.	Cultural Assets are avoided and kept as it is based on the relevant laws and regulations.

7. Development Scenario – Stakeholder's Comments

	Comment received	Response
General	What is the difference between an EIA and an SEA ?	EIA is a compulsory assessment for all large-scale projects to discuss specific impacts, and SEA is about the strategic thinking of the environmental impacts on a general planning scale.
	Worries about the hydrological pattern of six streams and appealed to manage these properly since many people are relying on them.	All 6 creeks will be kept as is where possible or expanded in an ecological way.
Explanations	Request to disclose the survey report to local people at the same time of submitting to the authorities.	Final report will be publicized on the internet and distribution of paper copies at the GAD offices in Thanlyin and Kyauktan at the same timing.
Anti-pollution Measures	How TSEZMC measure air pollution and water pollution?	During project construction and operation, further data will be collected on an ongoing basis to compare against the baseline data.
	What is the plan for reporting environmental findings during the operation period for the entire SEZ?	According to the EMP, environmental management group/persons (assigned by TSEZMC) need to release the environmental monitoring reports once yearly to interested stakeholders.
Natural Environment	Included a biodiversity management plan in the EMP	Biodiversity management plan will be included as part of the EMP.
Social Environment	Request for training opportunities for local people in new industries since most are very poor and have a low level of education.	SEZ Management Committee will choose business types to operate in the economic zone while prioritizing those that bring in good employment opportunities. There is an arrangement to offer vocational training, too.

7. Development Scenario - Land Use



- Overall SEZ Boundary (2887ha)
- Bonded Zone
- M — Commercial / Administrative
- General Industry
- Logistics
- Residential
- WD — Residential (Workers Dormitory)
- Mixed Use Area
- Green & Open Space
- CP — Customs Checkpoint
- CD — Civil Defense
- P — Polyclinic
- Waterbody - Retention Pond / Lake
- Waterbody - Rivers & Creeks
- Waterbody - Drainage Reserve
- Utility
- Roads
- Exclusion Area
- Class A Industrial Area
- Zone B Industrial Area (266 ha)

8. Possible Constraints in Development Phase

1) Protecting the natural environment

- Loss of mangrove
- Loss of natural habitat for fish and birds
- Possibility of floods

2) Reducing impacts on local people

- Impacts on Livelihood of Farmers and Fishermen
- Impacts on Cultural Assets/ Adjacent Villages/ Universities, Community Facilities in Excluded Areas and surrounding areas, etc.
- Impacts related to HIV/AIDs and communicable disease

9. Operational Scenario

Potential Industrial Sectors
[Demand in Class A]

REPLACE WITH INFO FROM DR. THAN THAN.

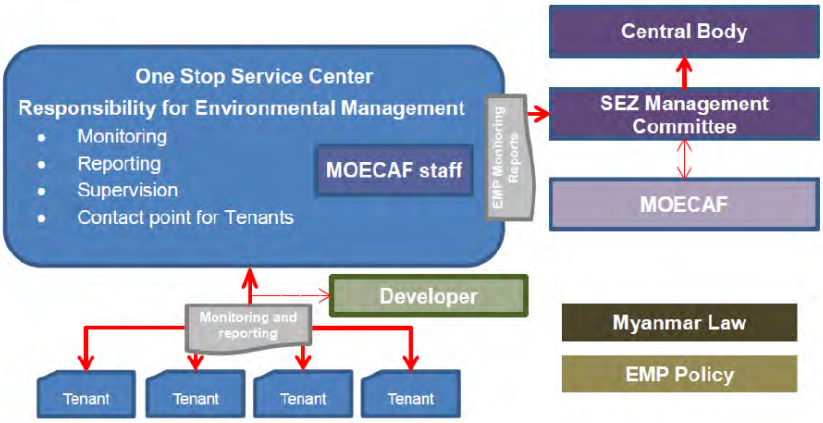
10. Possible Contraints in Operation Phase

Controlling Impacts/Pollutants

- Impact on water resources (streams/rivers)
- Impact on ambient Air, noise & vibration
- Generation of waste (organic and industrial)
- Impacts related to Land Subsidence due to the use of underground water
- Impacts on fauna & flora (pollution in soil and water environment)
- Social Impacts such including safety, landscape, community and so on
- Resettlement work plan prepared separately
- Complaints from the surrounding communities and others with grievance mechanism via GAD
- Response to the local authorities, change in environmental and social laws and regulations

11. Environment Management

One-Stop Service Center will be responsible for Environment Management and manage EIA.



Note: O&M=Operation and Management
Source: SEZ Management Committee

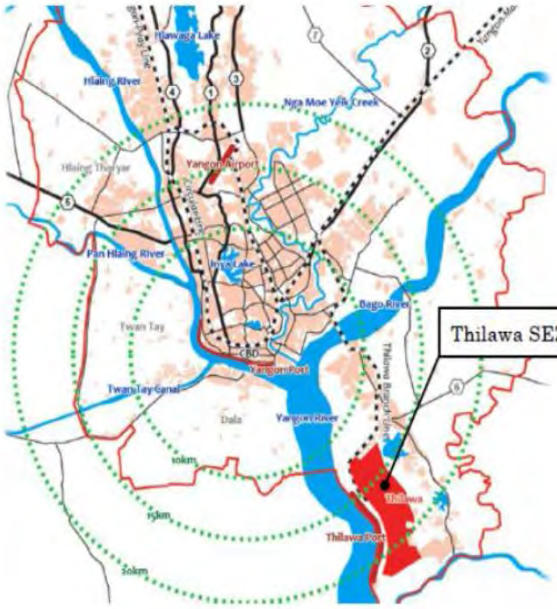
Thank you!

General stakeholder comments can be directed to:
Thilawaygn@gmail.com (SEZ Management Committee)

2. An Burmese Version of Presentation given at the Stakeholder Meeting[1]

[1] Note: Legend in page 12 of this PPT was shown in English but explained in Myanmar language at the stakeholder meeting.

၁) စီမံကိန်းဖော်ပြချက်



စီမံကိန်းရည်ရွယ်ချက်

သီလဝါအထူးစီးပွားရေးဇုန်ဖွံ့ဖြိုးတိုးတက်စေရန်

စီမံကိန်းတည်နေရာ

ရန်ကုန်မြို့၏ အရှေ့တောင်ဘက် ကီလိုမီတာ (၂၀) အကွာအဝေးရှိ သံလျင်နှင့် ကျောက်တန်းမြို့နယ်များအတွင်း

စီမံကိန်းအဆိုပြုသူ

သီလဝါအထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ

၂) မဟာဗျူဟာမြောက်ပတ်ဝန်းကျင်ဆန်းစစ်ခြင်းနည်းလမ်း

စီမံကိန်းနှင့် သက်ဆိုင်သူများကိုသတ်မှတ်ခြင်း

စီမံကိန်းမစတင်မီအခြေအနေ (သတိထားဆောင်ရွက်ရမည့်အကြောင်းကိစ္စများ)

ဥပဒေဆိုင်ရာ မူဘောင်/ ကန့်သတ်ချက်

စီမံကိန်းအတွက် စစ်ဆေးရန် အချက်အလက်ရေးဆွဲခြင်း

ဖွံ့ဖြိုးရေးဆိုင်ရာ အနာဂါတ်မျှော်မှန်းချက်

ဖြစ်ပေါ်လာနိုင်သည့် ထိခိုက်သက်ရောက်မှုများ

ထိခိုက်သက်ရောက်မှုများအတွက် လျော့ချရေး အစီအမံများ

ပတ်ဝန်းကျင်ဆိုင်ရာထိခိုက်မှုဆန်းစစ်လေ့လာခြင်း

၃) စီမံကိန်းမစတင်မီအခြေအနေ (သတိထားဆောင်ရွက်ရမည့်အကြောင်းကိစ္စများ)

◆ <u>သဘာဝ ပတ်ဝန်းကျင်</u>

- သဘာဝ ပတ်ဝန်းကျင် အမျိုးအစား (ဒီရေတော၊ ချောင်း၊ မြောင်း၊ ကန် များ)
- ကာကွယ်ထားသော ရှားပါး တိရစ္ဆာန်များ
- ရန်ကုန်မြစ်၊ မော်ဝန်းမြစ်
- စမ်းချောင်းများ၊ ရေလှောင်တမံများ၊ ရေကန်ငယ်များ

◆ <u>လူမှု ပတ်ဝန်းကျင်</u>

- ငါးလုပ်ငန်းနှင့် စိုက်ပျိုးရေးလုပ်ငန်းများ
- စီမံကိန်းနယ်မြေ၏ အနီးပတ်ဝန်းကျင်ရှိ အရေးပါသော/ သတိထားဆောင်ရွက်ရမည့် ဇရိယာများနှင့်ပိုင်ဆိုင်မှုများ
  - ယဉ်ကျေးမှုဆိုင်ရာ အမွေအနှစ်ပစ္စည်းများ (စေတီ၊ ဟိန္နျဘုရားကျောင်း စသည် ...)
  - တည်ရှိပြီးဖြစ်သော အဆောက်အဦများ (တက္ကသိုလ်များ၊ ရပ်ရွာအခြေပြု အခြား အထောက်အကူပြု ပစ္စည်းများ)
  - အနီးဝန်းကျင်ရှိ ကျေးရွာများ

၄) ဥပဒေဆိုင်ရာ မူဘောင်/ ကန့်သတ်ချက်

[EIA / SIA ဆိုင်ရာ ဥပဒေနှင့် လုပ်ထုံးလုပ်နည်းများ]

- ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၂) နှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေများ (၂၀၁၄)
- ပတ်ဝန်းကျင် ထိခိုက်မှု ဆန်းစစ်ခြင်းလုပ်ငန်း **လုပ်ထုံးလုပ်နည်းများ** (မူကြမ်းအဆင့်)

⇒ မြန်မာနိုင်ငံတွင် ပတ်ဝန်းကျင်ဆိုင်ရာ စံချိန်စံညွှန်း/ လမ်းညွှန်ချက်များ/ လုပ်ထုံးလုပ်နည်းများ တိတိကျကျ သက်မှတ်ထားခြင်း မရှိသေးပါ။

⇒ ပတ်ဝန်းကျင်ဆိုင်ရာ စံချိန်စံညွှန်း များလုပ်ဆောင်ဆဲ ကာလ

[အခြား နည်းဥပဒေနှင့် လုပ်ထုံးလုပ်နည်းများ]

- မြန်မာအထူးစီးပွားရေးဇုန်ဥပဒေ (၂၀၁၄) (ရင်းနှီးမြှုပ်နှံသူများသည် နိုင်ငံတကာ စံသတ်မှတ်ချက်များနှင့်အညီ လိုက်နာဆောင်ထိန်းရမည်။)
- IFC EHS Guidelines ပတ်ဝန်းကျင်ဆိုင်ရာ စံချိန်စံညွှန်းများအား ယာယီသတ်မှတ် ဆောင်ရွက်ထားပါသည်။

၅) ဖွံ့ဖြိုးတိုးတက်မှုဆိုင်ရာအယူအဆ - METI Study -

၁) တန်ဘိုးမြင့် ထုတ်ကုန်ပစ္စည်းများနှင့် မြန်မာနိုင်ငံအမှတ် တံဆိပ်ထုတ်ကုန်ပစ္စည်းများ တိုးမြှင့်ထုတ်လုပ်လာစေရန်၊ ကုန်ထုတ်လုပ်ငန်း၊ ပညာရေး၊ သုတေသနနှင့်ဖွံ့ဖြိုးရေးလုပ်ငန်း များ တိုးတက်လာစေရန်၊

၂) သီလဝါအထူးစီးပွားရေးဇုန်အား လူအများ အလုပ်သွားရောက် လုပ်ကိုင်လိုသည့် နေရာတစ်ခုအဖြစ်သာမက အနာဂါတ်ကာလ တွင် အခြေချနေထိုင်လိုသည့် နေရာတစ်ခုအဖြစ် အကောင် အထည်ဖော်ရန်၊

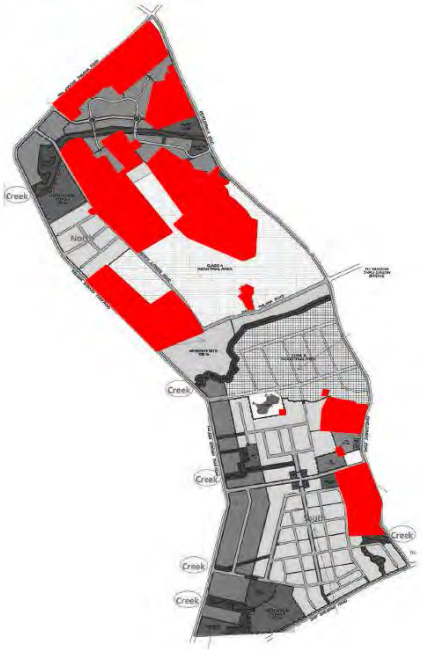
၃) ပတ်ဝန်းကျင်သာမက ဒေသခံများ၊ တည်ရှိပြီး လမ်းများနှင့် မြစ်ချောင်းအင်းအိုင်များအား တတ်နိုင်သမျှ ထိန်းသိမ်းထားနိုင်သည့်ပြင် ကျန်းမာရေးနှင့်ညီညွတ်မှုတာပြီး ပြည့်စုံသည့် မြို့ပြ လူနေမှုဘဝအား တည်ဆောက်ရန်၊

၄) သီလဝါ အထူးစီးပွားရေးဇုန်၏ ကြိုးပမ်း အားထုတ်မှု ဖြစ်သော အခြေခံအဆောက်အအုံ တည်ဆောက်ရာတွင် စွမ်းဆောင်ရည် အမြင့်မားဆုံးရရှိရန်နှင့် ပတ်ဝန်းကျင် ထိခိုက်နိုင်မှု နည်းနိုင်သမျှ နည်းရန် Off-site System (ဥပမာ- စီမံကိန်းတည်နေရာမှ ဝေးကွာသည့် အခြားတစ်နေရာတွင် အညစ်ကြေး/ရေဆိုး စသည်ဖြင့် - တို့အား ပြန်လည်သန့်စင်သည့် စနစ်) အား ဖြည့်ဆည်းပေးရန်၊

၅) ဂေဟစနစ် ထိန်းသိမ်းခြင်း နည်းပညာ (Eco- Smart Technology) များကို အသုံးပြုခြင်းဖြင့် သဘာဝပတ်ဝန်းကျင်နှင့် လူသားများအား ထိခိုက်မှုနည်းစေရန်၊

၆) ဖွံ့ဖြိုးရေးဆိုင်ရာ အနာဂါတ်မျှော်မှန်းချက် - အဓိကအချက် ၂ မူလစီမံချက်

ဇရိယာသတ်မှတ်ချက်

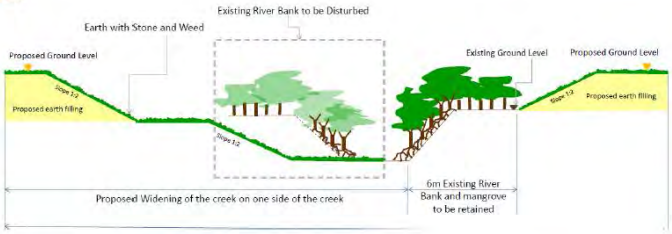


စီမံကိန်းနှင့် မသက်ဆိုင်သော ဇရိယာ

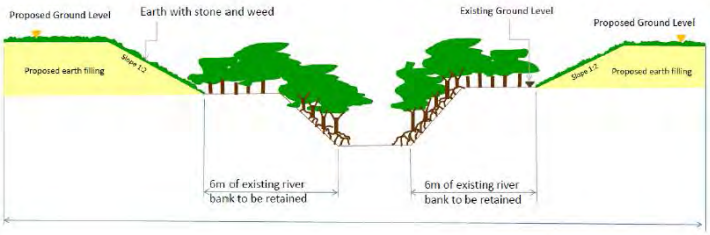
၆) ဖွံ့ဖြိုးရေးဆိုင်ရာ အနာဂါတ်မျှော်မှန်းချက် -အဓိကအချက် (၂): ချောင်းငယ်

တည်ရှိဆဲချောင်း

ဆောင်ရွက်မည့် ချောင်းငယ်အနေအထား (၁)



ဆောင်ရွက်မည့် ချောင်းငယ်အနေအထား (၂)



၆) ဖွံ့ဖြိုးရေးဆိုင်ရာ အနာဂါတ်မျှော်မှန်းချက် - မူလစီမံချက်

အခြားရွေးချယ်နိုင်သည့်နည်းလမ်း (၁)

အခြားရွေးချယ်နိုင်သည့်နည်းလမ်း (၂)

၆) ဖွံ့ဖြိုးရေးဆိုင်ရာ အနာဂါတ်မျှော်မှန်းချက် - အခြားစီမံချက်နည်းလမ်းများ

အဓိကအကြောင်းအရာ	နည်းလမ်း(၁) (မူလစီမံချက်)	နည်းလမ်း(၂) (အဆင့်မြှင့်စီမံချက်)
မြေအသုံးချမှု အစီအစဉ်	ဆောင်ရွက်မည့်ဧရိယာ - ၂,၃၇၆ ဟက်တာ စက်မှုနယ်မြေဧရိယာ - ၁,၅၅၄ ဟက်တာ	ဆောင်ရွက်မည့်ဧရိယာ- ၂,၁၂၀ ဟက်တာ စက်မှုနယ်မြေဧရိယာ - ၁,၁၁၉ ဟက်တာ
သဘာဝပတ်ဝန်းကျင်		
ဂေဟစနစ်	ဒီရေတောတည်ရာ (ချောင်းများ) အနည်းငယ်ထိခိုက်နိုင်ပါသည်။	ဒီရေတောတည်ရာ (ချောင်းများ) ကျန်ရှိမည် ဖြစ်ပါသည်။ စီမံကိန်းဧရိယာ အလယ်ဗဟိုရှိ ဘုန်းကြီးကျောင်းနှင့် ကပ်လျက်တည်ရှိသော ရေကန်မှာလည်း နဂိုမူလအတိုင်း ကျန်ရှိမည် ဖြစ်ပါသည်။
ရေလှောင်ရေဝေစနစ် (Hydrology) (ရေကြီးခြင်း/ ရေလွှမ်းမိုးခြင်း ထိန်းချုပ်ခြင်း)	ရေထိန်းကန်(၃)ခုတူးဖော်၍ အဓိကရေနုတ်မြောင်းများအား ကွန်ကရစ်မြောင်းများ အဖြစ် ပြောင်းလဲတည်ဆောက်သွားမည် ဖြစ်ပါသည်။	ရေထိန်းကန်(၃)ခု တူးဖော်၍ အဓိက ရေနုတ်မြောင်းများအား ရေစီးရေလာပိုမိုကောင်းမွန်စေရန် မြောင်းအကျယ်အား တိုးချဲ့ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ ထိုသို့တိုးချဲ့ဆောင်ရွက်ရာတွင် ဂေဟစနစ် ထိန်းသိမ်းသည့်အနေဖြင့် မူလလမ်းကြောင်းအတိုင်း တည်ဆောက်သွား မည်ဖြစ်ပါသည်။
လူမှုပတ်ဝန်းကျင်		
ပြောင်းရွှေ့နေရာချထားခြင်း	စီမံကိန်းနေရာရှိ မူလနေထိုင်သည့် ဒေသခံများအား ပြန်လည်နေရာချထားပေးရန် လိုအပ်ပါသည်။	
ယဉ်ကျေးမှုအမွေအနှစ်	ယဉ်ကျေးမှုအမွေအနှစ်အား အနည်းငယ်ထိခိုက်နိုင်ပါသည်။	ယဉ်ကျေးမှုအမွေအနှစ်များအား ချန်လှပ်၍ တည်ဆဲဥပဒေ၊ လုပ်ထုံးလုပ်နည်းများနှင့်အညီ ထိန်းသိမ်းဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။

၆) ဖွံ့ဖြိုးရေးဆိုင်ရာ အနာဂါတ်မျှော်မှန်းချက် -တတ်ရောက်သူများ၏ သဘောထားမှတ်ချက်

	သဘောထား	ပြန်လည်ဖြေကြားမှုများ
အထွေထွေ	EIA နှင့် SEA ကွာခြားချက်ကို ဖော်ပြပါ။	EIA ဆိုသည်မှာ စီမံကိန်းများ၏ ဖြစ်ပေါ်လာနိုင်သော အကျိုးဆက် အတွက် စစ်ဆေးခြင်း၊ SEA ဆိုသည်မှာ ဖြစ်ပေါ်လာနိုင်သော ထိခိုက်မှုများကို မဟာဗျူဟာမြောက် ဆန်းစစ်လေ့လာခြင်း ဖြစ်ပါသည်။
	လူအများစု မှီခိုနေရသော ချောင်းငယ် (၆) ခု အပေါ် စိုးရိမ်မှုများရှိပါသည်။	ချောင်းငယ် (၆) ခုလုံးကို ကာကွယ်မှုများ ပြုလုပ်သွားပါမည်။
ရှင်းလင်းချက်	ဒေသခံပြည်သူများအား စစ်ဆေးတွေ့ရှိချက် အစီရင်ခံစာ ကို ရှင်းလင်းပြစေချင်ပါသည်။	နောက်ဆုံးအစီရင်ခံစာကို သီလဝါအထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီဂက်ဆိုက်မှလည်းကောင်း၊ သံလျင်နှင့် ကျောက်တန်းမြို့နယ်များမှ အုပ်ချုပ်ရေးမှူးရုံး သို့ ဖြန့်ဝေပေးသွား ပါမည်။
ညစ်ညမ်းမှုတားဆီးမှုများ	TSEZMC လေနှင့် ရေ ညစ်ညမ်းမှုများကို ဘယ်လို တိုင်းတာပါသလဲ။	စီမံကိန်းပြုလုပ်နေစဉ်အတွင်း ရရှိလာသော အချက်အလက် များနှင့် မူရင်း အချက်အလက်များကို နှိုင်းယှဉ်မှုများ ပြုလုပ်သွားမည်။
	စီမံကိန်းလုပ်ဆောင်နေစဉ်အတွင်း ပတ်ဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှုများအတွက် အစီအမံရှိပါသလား။	EMP အရ၊ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအဖွဲ့များမှ တစ်နှစ်အတွင်း အစီရင်ခံစာများကို စိတ်ဝင်စားသော ပြည်သူများထံသို့ ထုတ်ပြန်ပေးသွားမည်။
သဘာဝပတ်ဝန်းကျင်	EMP တွင် biodiversity management plan ပါဝင်ပါ သလား။	EMP တွင် biodiversity management plan အစိတ်အပိုင်း တစ်ခုအနေဖြင့် ပါဝင်ပါဝင်ပြီမှာမယ်။
လူမှုပတ်ဝန်းကျင်	ဒေသခံပြည်သူများမှာ အသိပညာ နည်းပါးသောကြောင့် စက်ရုံနှင့်ပက်သက်သော သင်တန်းများများ ပြုလုပ်ပေးစေချင်ပါသည်။	SEZ စီမံခန့်ခွဲရေး ကော်မတီမှ အလုပ်အကိုင်အခွင့်အလမ်းအတွက် စီးပွားရေးဇုံအလိုက် ဦးစားပေးရွေးချယ်သွားမည်ဖြစ်ပြီး သင်တန်းများ အတွက်လည်း စီစဉ်ပေးသွားမည် ဖြစ်ပါသည်။

၆) ဖွံ့ဖြိုးရေးဆိုင်ရာ အနာဂါတ်မျှော်မှန်းချက် - မြေအသုံးချမှု

၇) အဓိကကြုံတွေ့နိုင်သည့် ပတ်ဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှုများ

၁) သဘာဝ ပတ်ဝန်းကျင်ကို ကာကွယ်ခြင်း

- ဒီရေတော ပျက်ဆီးဆုံးရှုံးမှု၊
- ငါးနှင့် ငှက်တို့ နေထိုင်ရာနေရာများ ပျောက်ဆုံးမှု၊
- ရေလွှမ်းနိုင်မှု၊

၂) ဒေသခံပြည်သူများအတွက် ထိခိုက်မှုများ လျော့ချခြင်း

- လယ်သမား နှင့် ငါးဖမ်းသမားတို့အပေါ် ထိခိုက်မှုများ၊
- စီမံကိန်း ပတ်လည်ရှိ ဇရိယာအတွင်းရှိ ယဉ်ကျေးမှုအဆောက်အဦးများ၊ အနှီးအနာရှာများ၊ တက္ကသိုလ်များ၊ အများပိုင်အဆောက်အဦးများ၊
- HIV/AIDs နှင့် ပြန့်ပွားနိုင်သော ရောဂါများ၊

၈) အနာဂါတ်တွင်ဖြစ်နိုင်ခြေရှိသော စီးပွားရေးလုပ်ငန်းများ

<u>စက်မှုကဏ္ဍဖွံ့ဖြိုးတိုးတက်နိုင်မှုအလားအလာ</u>

<u>(CLASS A ၏အတွေ့အကြုံအရ)</u>

❑ ကုန်ထုတ်လုပ်ငန်း

အဝတ်အထည်လုပ်ငန်း၊
စားသောက်ကုန်လုပ်ငန်း၊ ပလပ်စတစ်လုပ်ငန်း၊
အစားအစာနှင့်ဆက်စပ်ပစ္စည်းလုပ်ငန်း၊
ဆေးဝါးနှင့်ဆေးဝါးပစ္စည်းလုပ်ငန်း၊ ကားနှင့်
ကားပစ္စည်းလုပ်ငန်း

❑ ဝန်ဆောင်မှုလုပ်ငန်း

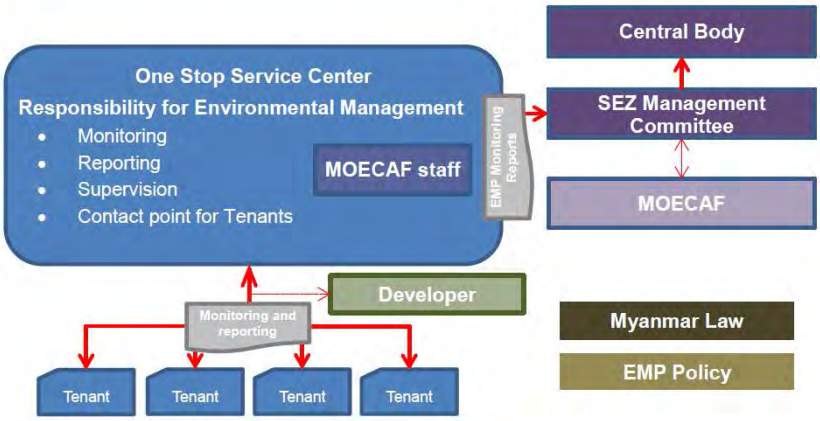
ပို့ဆောင်ရေးနှင့် လမ်းပန်းဆက်သွယ်ရေး
ဆိုင်ရာပစ္စည်းများဖြန့်ဝေခြင်း

၉) အဓိကကြုံတွေ့နိုင်သည့် ပတ်ဝန်းကျင်ထိခိုက်မှုများ

- ရေအရင်းအမြစ်များအပေါ် ထိခိုက်သက်ရောက်မှုများ (မြစ်ချောင်းများ)၊
- ပတ်ဝန်းကျင် လေထုအပေါ် သက်ရောက်မှုများ၊ ဆူညံသံနှင့် တုန်ခါမှုများ၊
- တိုးတက်ဖြစ်ပေါ်လာမည့် စွန့်ပစ်ပစ္စည်း၊
- မြေအောက်ရေ ထုတ်ယူသုံးစွဲမှုကြောင့် မြေလွှာ အောက်သို့ နိမ့်ကျခြင်း များကဲ့သို့သော ထိခိုက်မှုများ၊
- မြေဆီလွှာနှင့် ရေ ညစ်ညမ်းမှုများကြောင့် အပင်နှင့် သားငှက်တိရစ္ဆာန်များ အပေါ် ထိခိုက်မှုများ၊
- ဘေးအန္တရာယ်ကင်းရှင်းခြင်း၊ ဥယျာဉ်ပန်းမာန်နှင့် လူမျိုးစုများ၏အကျိုးစီးပွား အပေါ် ထိခိုက်မှုများ၊
- ပြန်လည်နေရာချမှုများ၊
- ပတ်ဝန်းကျင် လူမှုအဖွဲ့အစည်းများနှင့် အခြားသူများ၏ သဘောထား ကွဲလွဲမှုများ၊
- ဒေသတွင်း တာဝန်ရှိပုဂ္ဂိုလ်များအပေါ် တုန့်ပြန်မှု၊ ပတ်ဝန်းကျင်ဆိုင်ရာနှင့် လူမှုရေးဆိုင်ရာ ဥပဒေများ၊ နည်းဥပဒေများ ပြောင်းလဲလာမှု၊

၁၀) ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှု

OSSC (One Stop Service Center) သည် ပတ်ဝန်းကျင်ဆိုင်ရာထိခိုက်မှုဆိုင်ရာ စီမံခန့်ခွဲမှုများအား ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။



Note: O&M=Operation and Management
Source: SEZ Management Committee

ကျေးဇူးတင်ပါသည်။

ထပ်မံဆွေးနွေးလိုသောအချက်များ၊ အကြံဉာဏ်များနှင့် သုံးသပ်ချက်များအား အောက်ဖော်ပြပါ အီးလ်မေးသို့ (၃၀-၉-၂၀၁၅) ထိနောက်ဆုံးထား၍ပေးပို့နိုင်ပါသည်။

Thilawaygn@gmail.com

(သီလဝါ အထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ)

3. Attendance List

① Morning Session

Government Department

No	Name	Position	Department
1	Daw Win Win Hlaing	Deputy Director	Factory and Labour
2	Dr Than Aug	Secretary	TSEZ MC
3	U Zaw Moe	Deputy Director	MOECAF
4	U Sal Maung	Staff Officer	Drainage and Irrigation
5	Daw Ei Ei Mon	Environmental Expert	TSEZ-MC
6	U Khin Maung Tin	Assistant Administrator	TSEZ, OSSC
7	U Aung Than Zaw	-	Development Supporting
8	U Kyaw Lwin	Hundred Household Head	-
9	U Mya San	Hundred Household Head	-
10	U Ngal	Hundred Household Head	-
11	U Tin Aye	Hundred Household Head	-
12	U Myint Aung	Hundred Household Head	-
13	U Aung Phay Lwin	Deputy Lecturer	-
14	Dr Ngwe Ngwe Lwin	Deputy Rector	Cooperative University (Thanlyin)
15	U Aung Myint	Staff Officer	
16	Dr Khine Moe Aye	Deputy Staff Officer	VET Department
17	U Khin Maung Swe	Deputy Staff Officer	Land Survey Department
18	U Thay Shwe	Staff Officer	Fire Force
19	U Ye Min Htun	District Staff Officer	Fire Force
20	U Ohn Minn Aung	-	YCDC
21	Dr. Thein Htun	Rector	Cooperative University (Thanlyin)
22	Daw Yuzana Hlaing	-	Myanmar Economic Cooperation (Zinc Factory Thanlyin)
23	U Tay Aung	Staff Officer	Agricultural Department Thanlyan
24	Daw Khin Marlar Aung	-	Agri/ Bank
25	Daw Myint Myint Than	Staff Officer	Cooperative
26	Daw Yee Yee Than	Township Officer	Traditional Medicine

27	Daw Khin Ma Ma	Staff Officer	Project Implementation
28	U Khin Maung Than	Staff Officer	Immigration (Thanlyin)
29	U Myo Lwin	E.I	Human Settlement and Housing Development
30	Dr Than Than Thwe	Joint Secretary	TSEZ MC
31	Daw Mya Myat Chal	S.A.E	TSEZ OSSC
32	U Khin Maung Tin	A.D	TSEZ OSSC
33	U Saw Ba Hein	Staff Officer	Forest Department
34	U Bwe Kyone		YCDC PCCD
35	U Htun Htun Thaung		YCDC PCCD

Private Company

No	Name	Position	Company
1	Daw Thwe Thwe Myat Aung	Assistant Manager	Myanmar Japan Thilawa Development(MJTD)
2	Naoko Maruyama		ERM Japan
3	Sadamitsa Sakoguchi		ERM Japan
4	Shinichi Tsunida		Miznbo Bank
5	U Aung Lwin	Interpreter	JICA Study Team
6	U Than Win Aung	MD	Pale Nadi
7	U Khin Lay	Director	Pale Nadi
8	Daw May Than Zin	Manager	Oji
9	Daw Pan Ei Phyu	Assistant Manager	Oji

Local People

No	Name	Address	Position
1	Daw Yin Yin Mar	Alwansweet	Mason worker
2	U Zaw Lwin Htet	Shwe Pyi Thar	Mason worker
3	U Khin Than	Alwansweet	Farmer
4	U Than Zaw	Alwansweet	Contract
5	U Nay Win Aung	Alwansweet	Casual
6	U Aye	Phayar Kone	-
7	U Hla Aye	Phayar Kone	-
8	U Hla Naing Oo	Alwansweet	Carpenter
9	Daw Cho	Alwansweet	Farmer

10	U Thar Cho	Alwansweet	Casual
11	U Kyaw Linn Naing	Alwansweet	Mason worker
12	U Maung Maung Win	Thidar Myaing	Farmer
13	U Maung Htwe	Alwansweet	Driver
14	U Than Htwe	Alwansweet	-
15	U Myint Kyi	Alwansweet	Farmer
16	U Ye Lwin	Alwansweet	Construction
17	Daw Hla Hla Aye	Alwansweet	Casual
18	Daw Aye Hlaing	Alwansweet	Casual
19	U Kan Shwe	Alwansweet	Mason worker
20	U Kyi Aye	Alwansweet	Mason worker
21	U Ko Ko Aung	Alwansweet	Mason worker
22	U Ko Ko Aung	Alwansweet	Mason worker
23	U Zaw Min Hlaing	Thidar Myaing	Farmer
24	U Kyaw Kyaw	Thidar Myaing	Farmer
25	U Zay Yar	Thidar Myaing	Farmer
26	U Hla Myint	Rice Mill	Casual
27	U Aye Kyu	Latt Yat San	Administrator
28	U Kyaw Soe	Latt Yat San	Chairman
29	U Myint Oo	Latt Yat San	Hundred Household Head
30	U Htun Win	Latt Yat San	Hundred Household Head
31	U Thant Zaw	Latt Yat San	Hundred Household Head
32	U Thein Hlaing	Latt Yat San	Hundred Household Head
33	U Nyunt Win	Latt Yat San	Hundred Household Head
34	U Kyaw Thu	Latt Yat San	Hundred Household Head
35	U Aung Htay	Kyaung Kone Sate Gyi	Trade
36	U Thein Aung	Kyaung Kone Sate Gyi	Trade
37	U Myint Naing	Kyaung Kone Sate Gyi	-
38	U Zaw Aye	Kyaung Kone Sate Gyi	-
39	U Kyi Than	Kyaung Kone Sate Gyi	Farmer
40	U Kyaw Zaya	Alwansweet	Farmer
41	Daw Than Than Yee	Alwansweet	Farmer
42	U Tin Htay	Alwansweet	Farmer
43	U Thet Kyaing	Latt Yat San	Hundred Household Head
44	U Htin Linn Kyaw	Latt Yat San	Hundred Household Head

45	Daw Mya Sein	Alwansweet	Dependant
46	Daw Lone Kyal	Alwansweet	Dependant
47	Daw Win	Alwansweet	Dependant
48	U Khin Maung Myint	Alwansweet	Casual
49	U Kyaw Linn	Alwansweet	Casual
50	U Thein Zaw	Alwansweet	Farmer
51	U Win Soe	Alwansweet	Farmer
52	U Kan Win	Alwansweet	Dependant
53	U Ko Ko Latt	Alwansweet	Dependant
54	U Than Win Aung	Alwansweet	Carryer
55	U Bo Htun	Alwansweet	Seller
56	U Tin Nyunt	Alwansweet	Construction
57	U Myint Hlaing	Kyaung Kone Sate Gyi	Administrator
58	U Htain Linn	Alwansweet	Administrator
59	Daw Khin Aye Kyu	Alwansweet	Dependant
60	Daw Hla Moe	Alwansweet	Dependant
61	U Kyi Lwin	Alwansweet	Casual
62	U Thein Aung	Alwansweet	Construction
63	Daw Ohn	Alwansweet	Dependant
64	U Aye Htay	Thidar Myaing	Farmer
65	U Mya Thaung	Thidar Myaing	Farmer
66	U Hla Myo Htun	Alwansweet	Casual
67	U Linn Linn Bo	Kyaung Kone Sate Gyi	Hair Sloon
68	U Win Mg Mg Lwin	Kyaung Kone Sate Gyi	Hair Sloon
69	U Myo Shwe	Alwansweet	-
70	U Kyaw Win	Alwansweet	Casual
71	U Kyaw Than	Alwansweet	Farmer
72	U Aung Ko Ko	Alwansweet	Mason worker
73	U Than Aung	Alwansweet	Farmer
74	U Tin Oo	Rice Mill	Hair Sloon
75	Daw Thin Thin Khine	Alwansweet	Farmer
76	U Aung Linn	Alwansweet	Mason worker
77	U Htun Win	Alwansweet	Carpenter
78	U Zaw Htike Win	Alwansweet	Carpenter
79	U Myint Naing	Thidar Myaing	Carpenter

80	U Thein Zaw	Thidar Myaing	Carpenter
81	U Zaw Win	Thidar Myaing	Carpenter
82	U Thein Naing Oo	Alwansweet	Driver
83	Daw Cho Cho Oo	Alwansweet	Farmer
84	Daw Thwe Thwe Win	Alwansweet	Dependant
85	Daw Aye Aye Aung	Alwansweet	Seller
86	Daw Nwet Nwet Win	Alwansweet	Dependant
87	U Kyaw Win Htun	Alwansweet	Farmer
88	U Aye Zaw	Alwansweet	Farmer
89	U Aung Ko Min	Alwansweet	Casual
90	Daw Kathi Oo	Shwe Pyut Village	Dependant
91	U Tin Oo	Rice Mill	Carpenter
92	Daw April Moe	Alwansweet	Dependant
93	Daw Yee Yee Than	Alwansweet	Dependant
94	U Han Nyein	Alwansweet	Trade
95	U Maung Cho	-	Farmer
96	Daw Thuzar Minn	Shwe Pyut Village	Seller
97	U Zaw Hein Latt	Shwe Pyut Village	Causal
98	U Lay Lwin	Alwansweet	Farmer
99	U Hla Kyi	Alwansweet	Farmer
100	U Maung San	Alwansweet	Farmer
101	U Htay Lwin	Alwansweet	Farmer
102	U Than Htike	Alwansweet	Mason worker
103	U Aung Thu	Alwansweet	Farmer
104	U San Win	Thidar Myaing	Farmer
105	U Myo Zaw Oo	Alwansweet	Seller
106	Daw Kay Thi	Alwansweet	Casual
107	Daw Mi Ngal	Alwansweet	Seller
108	U Kyaw Soe	Alwansweet	Driver
109	U Soe Thein	Alwansweet	Livestock
110	Daw Khin Sint	Alwansweet	Farming
111	U Sein Win	Alwansweet	Carry
112	Daw Than Sint	Alwansweet	Dependant
113	Daw Hla Oo	Alwansweet	Dependant
114	U Zaw Naing Htun	Kyaung Kone Sate Gyi	Company

115	U Thaung Kyi	Kyaung Kone Sate Gyi	Seller
116	U Aye Thein	Kyaung Kone Sate Gyi	Seller
117	U Soe Naing	Kyaung Kone Sate Gyi	-
118	U Myint Shwe	Aye Mya Thidar	Farmer
119	U Kyaw Thu Htwe	Kyaung Kone Sate Gyi	-
120	U Aye Cho	Kyaung Kone Sate Gyi	Chairman
121	Daw Yee Yee Mya	Alwansweet	Dependant
122	U Than Maung	Alwansweet	Farmer
123	U Ba Tin	Alwansweet	Carpenter
124	U Myint Gyi	Alwansweet	-
125	U Maung Aye	Alwansweet	Mason worker/ Carpenter
126	U Win Aung	Alwansweet	Farmer
127	U Ngwe Win	Alwansweet	Farmer
128	U Zaw Oo	Alwansweet	Farmer
129	Daw Yin Shwe	Alwansweet	Cement Factory
130	Daw Ohn Than	Alwansweet	Seller
131	U Than Maung Maung	Alwansweet	Farmer/ Seller
132	U Thant Zin	Alwansweet	Farmer
133	U Han Sein	Alwansweet	Carry
134	Daw San Maw	Alwansweet	Farmer
135	Daw Than Nwet	Alwansweet	Dependant
136	U Thaung Kyi	Alwansweet	Casual
137	U Zaw Min Oo	Alwansweet	Carry
138	U Thein Zaw	Kyauk Kone	Farmer
139	Daw Mee Mee	Alwansweet	Casual
140	Daw Mya Win	Alwansweet	Casual
141	Daw Linn Linn Sein	Alwansweet	Farmer
142	U Thein Yu	Alwansweet	Staff
143	U Thet Naing Myo	Alwansweet	Casual
144	U Maung Zaw	Alwansweet	Carpenter
145	U Thein Linn Aung	Alwansweet	Carpenter
146	U Thein Phay	Alwansweet	Dependant
147	U Soe Maung Maung	Shwe Pyi Thar	Mason worker
148	U Maung Myint	Alwansweet	Seller
149	Daw Thuzar	Shwe Pyut Village	Causal

150	U Moe Kyaw	Alwansweet	Farmer
151	U Aye Lwin	Alwansweet	Carpenter
152	U Thein Aung	Alwansweet	Carpenter
153	U Pan Htike	Alwansweet	Carry

NGO

No	Name	Organization
1	Daw May Zin	Fujita Corporation
2	War War	Fujita Corporation
3	Augustine	ERI
4	Dr Ei Ei Phyoe	Flora Group
5	Daw Hnin Wut Yee	MCRB
6	Daw Hayman Oo	ICJ
7	U Thura Win Htun	MFA
8	U Tun Thura	Flora Group
9	Dr Tint Swe	MSAM
10	Dr Khin Thida Aung	NGO
11	Dr San Kyi	NGO
12	Dr Mac Thi	NGO
13	Dr Tin New	NGO
14	Dr Tin Oo	NGO

Media

No	Name	Position	Media
1	Daw Aye War Hlaing	Staff Officer	MRTV
2	Daw Aye Moe Moe, Aung	Special-1	MRTV
3	U Aung Min Soe	Special-2	MRTV
4	U Thet Ngal	Reporter	Sky Net
5	U Htet Wai Aung	Camera man	Sky Net
6	U Pyae Phyoe Kyaw	Reporter	Union Daily
7	U Zaw Wai	Reporter	Eleven Media
8	Htay Htay	Reporter	Trade Times
9	Daw May Soe	Reporter	Irrawaddy
10	U Pyae Phone Aung	Reporter	MRTV- 4
11	U Zaw Ye Naung	Camera man	MRTV- 4

12	U Arkar	VJ	DVB TV
13	Daw Win Sandar Oo	VJ	Sky Net (NB)
14	Daw Wai Hnin Htut	mntv Reporter	mntv
15	Daw Moe Zaw Htet	Reporter	The Farmer Journal
16	Daw Sulat	Reporter	Myawaddy
17	U Banyar	Reporter	News Watch
18	Daw Su Myat Yadanar	Reporter	MITV
19	U Kyaw Zin Thant	Reporter	Kamayut Media
20	U Soe Ye Aung	Camera man	MITV
21	U Phyoe Wai	-	Eleven Media
22	U Ye Khaung Nyunt	Reporter	-

② Afternoon Session

Government Department

No.	Name	Desigination	Department
1	U Htun Htun Taung	Head	YCDC,PCCD
2	U Than Win Aung	Engineer	YCDC.PCCD
3	U Aye Lwin	Administor	
4	U Myint Lwin	Administor	
5	U Aung Thu	GAD	
6	U Soe Naing	GAD	
7	U Min Zaw	Deputy Township Administrator	
8	U Win Oo	BC	
9	U Myo Lwin	Township Administrator	
10	Dr Zarni Htay	Township Health Officer	
11	U Thin Taung	DTEO	
12	U Than Zaw Win		
13	Dr Than Than Twe		Thilawa SEZ MC
14	Daw Mya Myat Che		TSEZ.OSSC,Industry
15	Daw Pan Ei Phyu		TSEZ.OSSC,Industry
16	U Bwe Kyone		YCDC,PCCD

Private Company

No.	Name	Designation	Company
1	U Than Htun	Surveryor	ShweMyaing Yadanar

2	U Win San Lin	GM	ShweMyaing Yadanar
3	Daw Ei Ei Khaing	Officer	MJTD
4	Ma Nguwa Hlaing	Assistant Officer	MJTD
5	U Myint Ko	Supervisior	Suntac

No.	Name	Address	Occupation
1	Mg Myat	A lwan Sweet	Farmer
2	Thein Linn Aung	A lwan Sweet	Farmer
3	Win Htay	A lwan Sweet	Farmer
4	U Moe Yar Thi	Shwe Pyaut	Farmer
5	U Myint Hlaing	Moe Kyoe Swan	Security
6	Daw San San Win	Moe Kyoe Swan	Seller
7	U Than Lwin	Aye Mya Thidar	Farmer
8	U Ohm Myint	Aye Mya Thidar	Farmer
9	U Myat Aung	Shwe Pyaut	Farmer
10	U Thin Hlaing	ShwePyi Thar Yar	Hundred Household Head
11	U Kan Kaung	Nyaung Wine	Hundred Household Head
12	U Mg Kyin	Shwe Pyaut	Casual
13	U Aung Kyaing	Shwe Pyaut	Agricultural
14	U Win Hlaing		Farmer
15	DawThein Thein Yi	Kyaut Than	Dependance
16	U Myint Thu	Aye Mya Thidar	Administrator
17	Daw Khin Soe Mar	Thidar Myaing	Seller
18	U San Myint	Shwe Pyaut	Farmer
19	U Khin Aung Myint	Shwe Pyaut	Farmer
20	U Aye Lwin	ShwePyi Thar Yar	
21	U Min Zaw	Nyaung Wine	Administrator
22	Aung Soe	Nyaung Wine	Administrator
23	Daw Yim Nu	Moe Kyoe Swan	Seller
24	Daw San Yi	Moe Kyoe Swan	Seller
25	U Min Naung	Moe Kyoe Swan	Mason worker
26	U Nyein Maung	Moe Kyoe Swan	Carry
27	Nay Myo Aung	Moe Kyoe Swan	Staff
28	U Win Khaing	Moe Kyoe Swan	Seller

29	U Swar Lwin	Moe Kyoe Swan	Seller
30	Daw Khin Khin Theim	Moe Kyoe Swan	Seller
31	U Wae Zin Oo	Moe Kyoe Swan	Labour
32	Daw Zarni	Moe Kyoe Swan	Seller
33	Daw NweYim Win	Moe Kyoe Swan	Seller
34	Daw Htay Win	Moe Kyoe Swan	Seller
35	Ko Myo Min Oo	Shwe Pyaut	Garderning
36	Ko Aung Zaw Moe	A lwan Sweet	Construction
37	U Win Maung	Myaing(2) Nyaung Wine	Seller
38	U Kyaw Moe	Thidar Myaing	Farmer
39	Than Zaw Oo	Shwe Pyaut	Agricultural
40	U Myint Swe	ShwePyi Thar Yar	Hundred Household Head
41	U Thin Latt Ko	Shwe Pyaut	Administrator
42	U Than Win	Shwe Pyaut	Hundred Household Head
43	U Thint Swe	Shwe Pyaut	Hundred Household Head
44	Daw Mar Yi Ma	Shwe Pyaut	Seller
45	U Zaw Myo Than	Moe Kyoe Swan	Seller

NGO

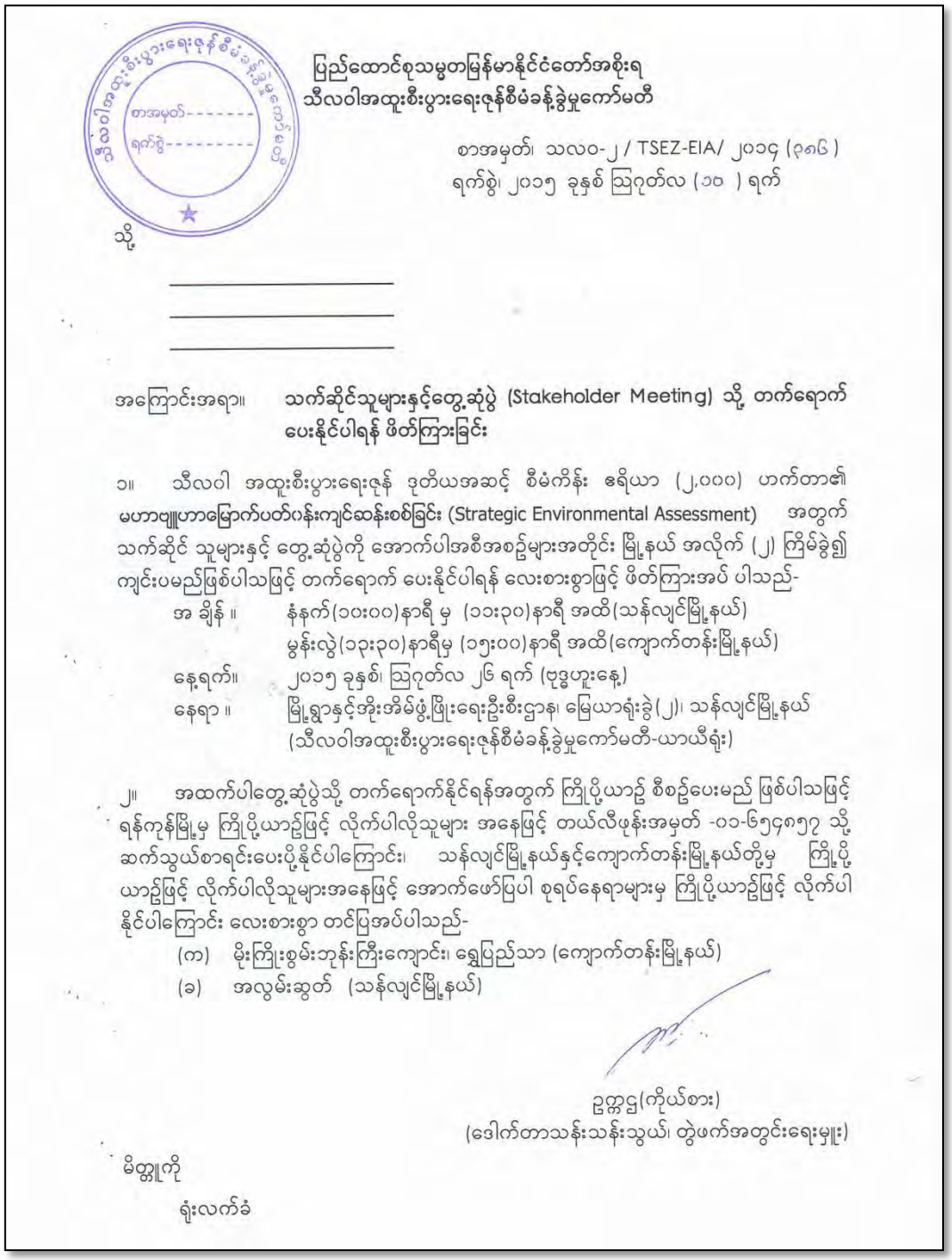
No.	Name	Organization
1	Aung Lwin	JICA Study Team

Media

No.	Name	Designation	Department
1	U Than Win Htun	Chairman	Myanmar Newspaper-Men's Association
2	U Win Soe	Writer	Myanmar Newspaper-Men's Association
3	U Zaw Oo	Writer	Myanmar Newspaper-Men's Association

4. Public Announcement

③ Invitation Letter of TSEZMC (in Myanmar) issued on 10th August, 2015



ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
သီလဝါအထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ

စာအမှတ်၊ သလဝ-၂ / TSEZ-EIA/ ၂၀၁၄ (၃၈၆)
ရက်စွဲ၊ ၂၀၁၅ ခုနှစ် ဩဂုတ်လ (၁၀) ရက်

သို့

အကြောင်းအရာ။ သက်ဆိုင်သူများနှင့်တွေ့ဆုံပွဲ (Stakeholder Meeting) သို့ တက်ရောက်ပေးနိုင်ပါရန် ဖိတ်ကြားခြင်း

၁။ သီလဝါ အထူးစီးပွားရေးဇုန် ဒုတိယအဆင့် စီမံကိန်း ဧရိယာ (၂,၀၀၀) ဟက်တာ၏ မဟာဗျူဟာမြောက်ပတ်ဝန်းကျင်ဆန်းစစ်ခြင်း (Strategic Environmental Assessment) အတွက် သက်ဆိုင် သူများနှင့် တွေ့ဆုံပွဲကို အောက်ပါအစီအစဉ်များအတိုင်း မြို့နယ် အလိုက် (၂) ကြိမ်ခွဲ၍ ကျင်းပမည်ဖြစ်ပါသဖြင့် တက်ရောက် ပေးနိုင်ပါရန် လေးစားစွာဖြင့် ဖိတ်ကြားအပ် ပါသည်-

အ ချိန် ။ နံနက်(၁၀း၀၀)နာရီ မှ (၁၁း၃၀)နာရီ အထိ(သန်လျင်မြို့နယ်)
မွန်းလွဲ(၁၃း၃၀)နာရီမှ (၁၅း၀၀)နာရီ အထိ(ကျောက်တန်းမြို့နယ်)

နေ့ရက်။ ၂၀၁၅ ခုနှစ်၊ ဩဂုတ်လ ၂၆ ရက် (ဗုဒ္ဓဟူးနေ့)

နေရာ ။ မြို့ရွာနှင့်အိုးအိမ်ဖွံ့ဖြိုးရေးဦးစီးဌာန၊ မြေယာရုံးခွဲ(၂)၊ သန်လျင်မြို့နယ် (သီလဝါအထူးစီးပွားရေးဇုန်စီမံခန့်ခွဲမှုကော်မတီ-ယာယီရုံး)

၂။ အထက်ပါတွေ့ဆုံပွဲသို့ တက်ရောက်နိုင်ရန်အတွက် ကြိုပို့ယာဉ် စီစဉ်ပေးမည် ဖြစ်ပါသဖြင့် ရန်ကုန်မြို့မှ ကြိုပို့ယာဉ်ဖြင့် လိုက်ပါလိုသူများ အနေဖြင့် တယ်လီဖုန်းအမှတ် -၀၁-၆၅၄၈၅၇ သို့ ဆက်သွယ်စာရင်းပေးပို့နိုင်ပါကြောင်း၊ သန်လျင်မြို့နယ်နှင့်ကျောက်တန်းမြို့နယ်တို့မှ ကြိုပို့ယာဉ်ဖြင့် လိုက်ပါလိုသူများအနေဖြင့် အောက်ဖော်ပြပါ စုရပ်နေရာများမှ ကြိုပို့ယာဉ်ဖြင့် လိုက်ပါနိုင်ပါကြောင်း လေးစားစွာ တင်ပြအပ်ပါသည်-

(က) မိုးကြိုးစွမ်းဘုန်းကြီးကျောင်း၊ ရွှေပြည်သာ (ကျောက်တန်းမြို့နယ်)
(ခ) အလွမ်းဆွတ် (သန်လျင်မြို့နယ်)

ဥက္ကဋ္ဌ(ကိုယ်စား)
(ဒေါက်တာသန်းသန်းသွယ်၊ တွဲဖက်အတွင်းရေးမှူး)

မိတ္တူကို
ရုံးလက်ခံ

④ **Translation of Invitation Letter of TSEZMC**

GOVERNMENT OF REPUBLIC OF THE UNION OF MYANMAR

THILAWA SPECIAL ECONOMIC ZONE MANAGEMENT COMMITTEE

Reference No: Tha La Wa-2/TSEZ-EIA/2015 (386)

Date: 10th August, 2015

To

Subject: Invitation to attend the stakeholder meeting

The stakeholder meeting for Strategic Environmental Assessment-SEA of Thilawa SEZ Development Project Phase II (2000 ha) will be held as follow and YOU are cordially invited to attend this meeting.

Time: 10:00 am – 11:30 am (Thanlyin Township)
13:30 pm – 15:00 pm (Kyauktan Township)

Date: August 26, 2015 (Wednesday)

Venue: Temporary Office of Thilawa SEZ Management Committee,
Branch Office of Land Use (2), Human Settlement and Housing Department. Thanlyin Township.

The transportation will be arranged for all attendees and any interested people from Yangon have to contact with Telephone No. 01 654857 for your confirmation to attend this meeting. The assembly area of the transportation for the people from Thanlyin and Kyauktan townships are as follow:

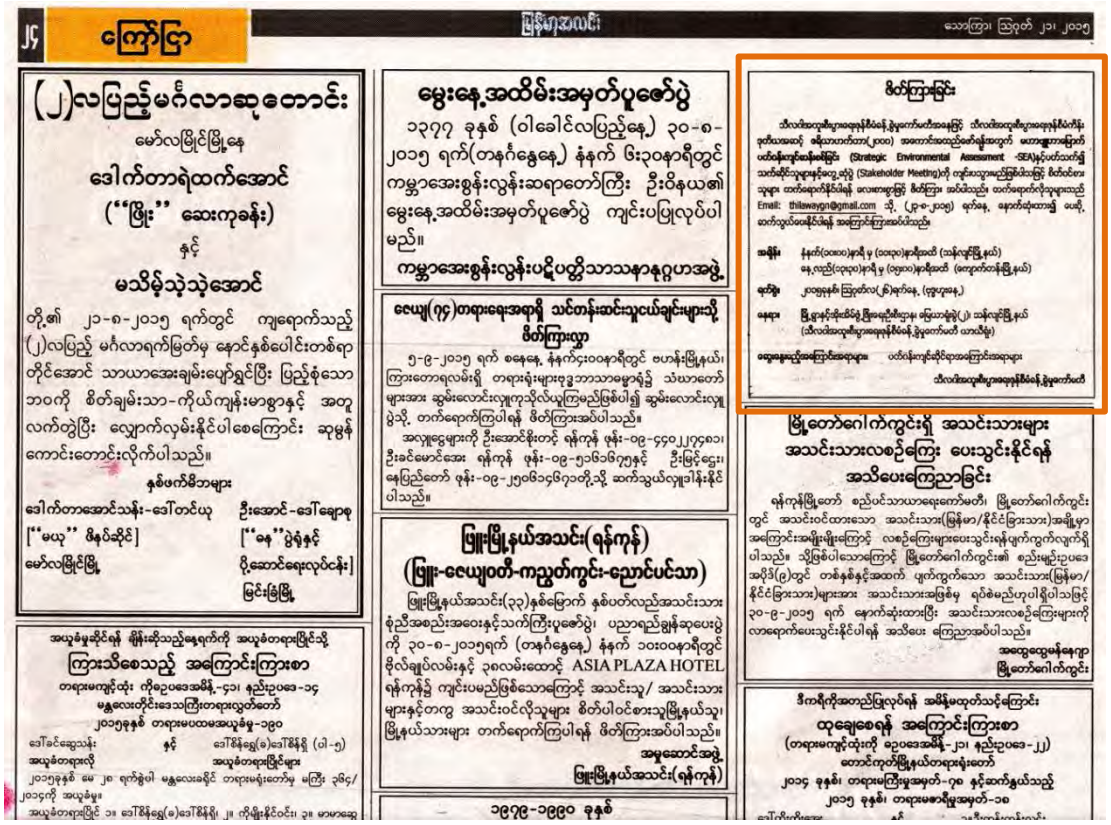
1. Moe Kyo Swam Monastery, Shwe Pyi Thar (Kyauktan township)
2. Ah Lwan Hsut (Thanlyin township)

Sincerely,

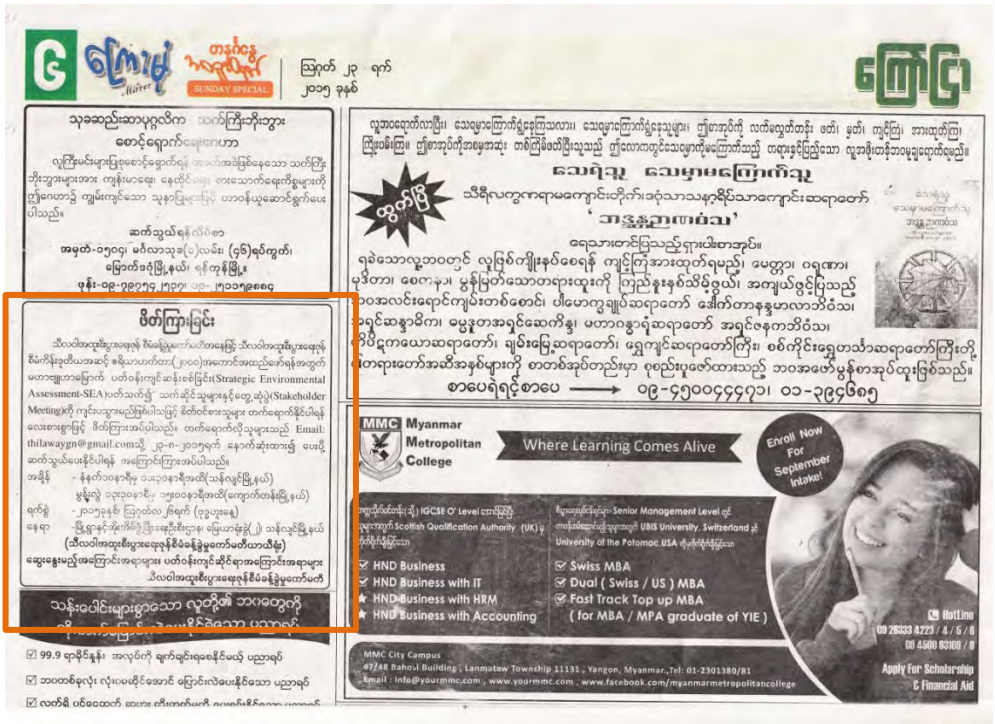
For Chairman

(Dr. Than Than Thwe, Joint Secretary)

⑤ Notification in Myanmar Alin Newspaper on 21st August 2015



⑥ Notification in Mirror (KyeMon) Newspaper on 23rd August 2015



⑦ Translation of Notification

INVITATION

We, Thilawa Special Economic Zone Management Committee, would like to cordially invite you to the Stakeholders' Meeting for the **Strategic Environmental Assessment-SEA** of Thilawa SEZ Phase II Project (2000 Ha). The meeting will be held according to the following plan:

Time: 10:00 am – 11:30 am (Thanlyin Township)

13:30 pm – 15:00 pm (Kyauktan Township)

Date: August 26, 2015 (Wednesday)

Venue: Temporary Office of Thilawa SEZ Management Committee, Branch Office of Land Use (2), Human

Comments and Answers on Strategic Environmental Assessment (SEA)
for Thilawa SEZ Development Project (2,000 ha)

February 2016
Thilawa SEZ Management Committee

No	Reference	Factual points	Comments	Answer by TSEZMC
1	General		I request for the best management by TSEZMC to achieve no negative impacts on environment and people living in special zone area.	Thank you for the information. TSEZMC will manage the SEZ taking into consideration your comment.
2	General		The public don't understand the environmental risks, however they know that those risks must be taken care of for their generation as one of the national tasks.	Thank you for the information. TSEZMC will manage the SEZ taking into consideration your comment.
3	General		For the environmental conservation, all pollutions need to be controlled by the factories in TSEZ.	TSEZMC obliges companies in the SEZ to submit ECPP, and the companies have responsibility of carrying out environmental conservation plan according to the ECPP.
4	General		The SEA states that it will a) provide baseline data; b) identify and analyze anticipated problems; and c) set environmental objectives and standards. We understand that SEAs are also supposed to identify and analyze cumulative impacts of a project. This SEA does not contain this analysis. In addition, we find that the objectives identified by this very SEA have not been met.	This SEA cannot include further analysis/information as the Master Plan-leveled study has not been conducted as of drafting the SEA report. Therefore this SEA merely deals with alternative analysis based on a conceptual land use plan, and does not meet the general level of 'SEA' in terms of its depth of analysis and quantity of information. However, based on your comments, we

			a. The baseline data is very cursory. b. Anticipated problems are neither identified nor analyzed. While the SEA provides an overview of current conditions, it does not indicate how we can expect those conditions to change with the implementation of Phase 2. It would be appropriate at this stage to identify several predictable scenarios and examine the environmental and social impacts such scenarios would have. c. While there is information regarding the various laws, regulations, and guidelines, we did not see any environmental objectives set. In addition, there was mention of standards being applied on a "rolling basis." This opens up the potential for arbitrary changing of applied standards, which could have detrimental environmental and/or social impacts.	will update the baseline data. As for your comment c., the SEA suggests that the appropriate environmental standards should be applied in the EIAs which are to be prepared for each area within the SEZ, and that environmental management plan should be prepared based on the standards.. The SEZ has 5 environmental objectives: Economically Driven, Safe and Secure Livelihoods, Environmentally Friendly, Efficient Infrastructure, and Eco-Smart, as indicated in the SEA.
5	General		There were many issues raised and addressed with varying degrees of success in the Phase 1 area of the Thilawa SEZ, and some are still on-going. There are many lessons from Phase 1 that can be applied to Phase 2, in particular in regard to social impacts, but none of these are mentioned in the SEA.	This SEA cannot include further analysis/information as the Master Plan-leveled study has not been conducted as of drafting the SEA report. Therefore this SEA merely deals with alternative analysis based on a conceptual land use plan, and does not meet the general level of 'SEA' in terms of its depth of analysis and quantity of information. Lessons from Phase 1 regarding social issues shall be dealt with in the
6	General		We find the current quality of the SEA to be insufficient. It fails to address the topics that it itself identifies as the	

			objectives of the study. Further analysis will is needed to identify the types of environmental and social impacts that can be expected. Local people who are supposed to be relocated and who have been carefully monitoring the Phase 1 resettlement process probably have many things to input regarding potential impacts to their livelihoods. More consultations with them could also improve the quality of this SEA.	Resettlement Working Plan Framework for the SEZ and Resettlement Working Plans for each phase.
7	Cover or internal pages		Suggest mention of the SEA authors i.e. E-Guard/ERM	The names of consultants are required in the SEA.
8	Para 1.3, page 1-1	The EIA Rules are not draft – they were adopted August 2014;	This may be intended to be a reference to the draft EIA Procedures (which latest intelligence says the Attorney-General's Office are considering calling Orders)	This has been amended based on your comment.
9	Para 1.3, page 1-2		When and how will the guidelines and standards be determined by the Central Working Committee?	We deleted this sentence as it is not available to obtain such information so far although we have been making inquiries about this matter to the Committee since the SEZ Law was in effective.
10	Para 1.3, page 1-2	Para 1.5 would be expected to include a more up to date account of current tenants and expected employment.	The rationale for conducting an SEA is noted in the document – because the SEZ is 'a regional level programme'. Yet the actual SEA does not consider fully consider the region (see comments in letter above) Similarly page 1-3 the Zone SEZ is touted as a 'leading model city' yet the SEA does not reflect this aspiration (e.g. consideration of energy, water, transport, education and other services)	This SEA is a policy level document that does address regional issues focusing on alternative analysis.

11	Para 2.1		Although the SEA says it will consider 'the socio-environmental aspects of area in and around Thilawa SEZ' it appears to be defining direct impact only as areas within the fence, and not, for example host communities or wide Thanlyin/Kyauktan	This SEA mainly focuses on alternative analysis and not on impact analysis and mitigation measures.
12	Para 2.1/2.2, Part 3 chapeau (p3-1)		There is inconsistent use throughout the report of 'social', 'environmental' and 'socio-environmental'; and the report appears to be put more importance on environmental impacts than social ones. I realise this is partly a confusion arising from definitions in the ECL and EIA procedures, but it would be good for the report to mention both aspects consistently	In the land use planning, both environmental and social aspects are taken into consideration such as avoidance of cultural assets and preservation of lake in the center of the SEZ. Framework for Resettlement Work Plan (RWP) and RWP will examine in detail the social impacts due to resettlement.
13	Page 3-1		EC Rules were adopted Aug 2014 not 2013. Most of the paragraph under Environmental Conservation Rules refers to Article 16 of the ECL and would be better under that heading. It is also unclear why Class A is mentioned, as this is not mentioned in the ECLL Article 16	This has been amended based on your comment.
14	Page 3-1		The Draft EIA Guidelines should be referred to consistently and not called Instructions. The SEZ Law is mentioned as 2013 in the Title and 2014 in the paragraph	This has been amended based on your comment.
15		VFV Law or Rules - It is not clear whether the reference is to the 2012 Law (paragraph refers		This has been amended based on your comment.

		to Law) or the Rules (subtitle).		
16	Page 3-6		Why have WB E&S Safeguards Policies been references but not IFC ones, when the SEZMC and MOECAF are both using IFC standards (see for example the reference on page 4-1)?	The World Bank Guidelines are referenced as the JICA Guidelines refer to it.
17	Para 3.11	EIA Guidelines not Instructions		This has been amended based on your comment.
18	Page 3-8, Table 3-1		This table overall seems weak, particularly the column about implementing best practice. See also comment above about IFC which would be more appropriate for the gap analysis, and as a separate column to the JICA ones	The major gaps are presented here and to be examined for each development project if necessary.
19	Table 4-1, Figure 4.2, Table 4.2		Where were the air quality monitoring points mentioned in the table? There should be a map. Were any outside of the Zone? Why was no water monitoring done outside the Zone?	Please find the air quality monitoring points in Figure 4-1. One of the monitoring points (AQM-3) is outside the SEZ. Water monitoring points are at the border of each stream, which represent the water quality downstream the creeks..
20	Page 4.3		It is good to see a mention of other projects as being contributors to air-shed quality but more detail of which plants are currently in existence or planned, and potential cumulative impacts should be included in this SEA and in the subsequent EIA	The project will go step by step and TSEZMC will manage environmental and social issues as per the SEZ law and other relevant laws and regulations. Cumulative impacts would be addressed by each development project step by step.
21	Page 4-3	Suggest consistent spelling of Bnbwegone Pond and Bant		This has been amended based on your comment.

		Bwaykone Reservoir		
22	Page 4-12 and 4-13		The EIA for Dowa's waste management facility, referenced on p4-13, appears neither to have been the subject to public consultation or disclosure	Stakeholder Meetings were conducted for the project.
23	Page 4-14		Solid waste management for the surrounding communities also needs to be considered.	TSEZMC will coordinate with GADs for various issues which would include waste management.
24	Page 4-23		Given the impacts on the surrounding area and host communities, more information should be gathered on the population various populations close to the Zone.	Information about Population has been included.
25	Page 4-23 = section 4.1.3.(4)		This section concerned baselines so the mention of NGOs willing to work in the area is not relevant. What is the baseline prevalence of HIV/AIDS and other communicable diseases in the area; will this be covered in the EIA?	Information about HIV/AIDS and other communicable diseases has been included.
26	Section 4.1.3		There is no mention in this section of the baseline for other social issues which might be impacted by the Zone and inward migration, such as availability of education and health services, security, inflationary effects. Nor are plans for worker housing mentioned. See MCRB Factsheets on inward Migration, Worker Housing and others in EN/Mya http://www.myanmar-responsiblebusiness.org/fact-sheets/ There is no analysis of the public	Thank you for the information. TSEZMC will manage the SEZ taking into consideration your comment.

			transport baseline	
27	Figure 4-8		It is not clear from this map where the populations living near the Zone are located. Is that the pink colour.	We have provided some descriptions about it.
28	Section 5.1		The 'without project' section is hardly an impartial consideration of other options since the second paragraph of the 'Without Project' case says that the SEZ is the best option; and later that 'the SEZ is therefore the most environmentally and economically sound method for meeting industrial growth in the Yangon region'. However other options could be smaller industrial zones (as elsewhere in Yangon Region	If many smaller industrial zones are randomly located, it would be more difficult to manage and control environmental and social issues in an effective and efficient manner.
29	Page 5-1		This section talks of 'an abundant labour force in Myanmar's most populated area' but there is no analysis anywhere in the document about worker housing or commuting impacts; or transport	This SEA focuses on alternative analysis.
30	Page 5-4	First 2 lines: 'The 2,000 ha Zone that is proposed in this project': as elsewhere in the document, the wording used makes it unclear whether this document is an SEA for the full Zone, or just the 2,000 ha		This SEA is for 2,000ha.
31	Page 6-5		'Impacts on the Poor' (and other aspects in this table) should make clear that host communities are also to be surveyed. See also comments above about consideration of impacts of inward migration. 'Social	This has been amended based on your comment.

			infrastructure' should include education and health	
32	Page 6-6		Children's Rights: It is not clear how Reviewing Myanmar Law Implementation is an effect way to consider impacts on children which could come from education availability, impacts on livelihoods, inward migration, sexual exploitation, increased road traffic, children's increased sensitivity to pollutants etc. The EIA should engage with UNICEF and other experts	This has been amended based on your comment: Review of Myanmar law implementation, data and info by UNICEF and other experts.
33			How are **cumulative impacts** going to be addressed in the EIA (e.g. cumulative impacts of non-SEZ projects in the area such as the Port and industrial projects)?	The whole project will go step by step and TSEZMC will manage environmental and social issues as per the SEZ law and other relevant laws and regulations. Cumulative impacts would be addressed by each development project step by step.
34	Table 7-2	It is not apparent from either documentation from the President's Office or the Thilawa SEZ website that 'SEZ Law exempts individual factories from undertaking an EIA process'. Our understanding is that any project which would need to undertake one outside the Zone needs to undertake one inside. This should be clarified so as to avoid confusion.		TSEZMC decides based on ECPP (Environmental Conservation and Prevention Plan) whether certain factory needs IEE or EIA. In Class A, some factories were required to conduct EIA as a result of the above mentioned process.

			Table 7-3 does not appear to address many of the stakeholder comments in Table 7-2, or even all of those made in the June 2014 meeting.	We combined some comments of the same issues, which might make you think that all the comments are not included. Please check the minutes of the stakeholder meeting.
35	Table 8-1		Shouldn't 'safe and secure livelihoods' be an objective beyond companies and communities in the SEZ, i.e. also 'around'	This is a development objective within the responsibility of TSEZMC established before, which will also contribute to the local communities. TSEZMC will coordinate with GAD for local community.
36	Section 8.3		Is the intention that there should be one EMP for the Zone, or two?	EMP is supposed to be prepared for each project.
37	Section 8.4	Presumably, notwithstanding the wider confusion this paragraph raises (see letter), it is anyway not intended that 'the SEZ managing body should conduct some sort of EIA procedures'		The project will go step by step and TSEZMC will manage environmental and social issues as per the SEZ law and other relevant laws and regulations.
38	Figure 8-1		The chart giving 'Responsibility of Environmental Management' to MJTD is of significant concerns given MJTD's lack of expertise and potential conflict of interest. It is also a matter of concern that there is nothing envisaged for independent or community involvement in monitoring (a point raised repeatedly in Table 7.2). Nor is there any provision in this diagram for	The Figure 8-1: Implementation and Monitoring of Environmental Management Plan has been replaced by a new chart based on the latest situation of the operation.

			transparency and publication of data,	
39	Para 8.5		It would be preferable for an Operational Grievance Mechanism to be established both for the Zone and for individual companies which meets the criteria in the UN Guiding Principles on Business and Human Rights and has been designed by the community in cooperation with the Project Proponent, Developer and Tenant companies. This is not currently in place up for Class A. This issue is being discussed within the Multistakeholder Advisory Group	Grievance Redress mechanism is being prepared by TSEZMC to respond to complaints from local communities. The SEA report has been updated.
40	Other		It would be good to mention about Notice No.4 on Human Rights issued by TSEZMC in August.	This has been added based on your comment.

Appendix D: Baseline Data (Detailed)

Table of Contents

Figures

Tables

1 Description of the Surrounding Environment

This baseline scoping section will set out the baseline socio-environmental conditions, identify possible environmental issues/impacts related to changes in land use and Project implementation, review domestic Myanmar rules and regulations, and review the international guidelines that are applied to this project. In order to gauge the magnitude of impacts, studies were developed as described in the table below.

Table 1 Investigation of Environmental Impact Assessment

Category	Item	Survey Item	Survey Method	Quantity
Pollution Control	Air Quality	Local pollutant indicators: NO_2/NO_x, SO_2, CO, SPM, PM10	Air quality measurement by instrument	6 locations, 2 days/time, 2 times per year (both rainy and dry season)
	Water Quality	Surface water: Temperature*, flow rate*, odor*, color*, electrical conductivity*, pH*, BOD5*, SS*, DO*, total coliform, COD, total nitrogen, total phosphorous, oil and grease, turbidity, arsenic (As), mercury (Hg), lead (Pb), cadmium (Cd), hexavalent chromium (Cr(VI)), copper (Cu), zinc (Zn), nickel (Ni), iron (Fe), cyanide (CN) Underground water: Temperature*, odor*, color*, electrical conductivity*, hardness, pH*, arsenic (As), mercury (Hg), led (Pb), cadmium (Cd), hexavalent chromium (Cr(VI)), copper (Cu), zinc (Zn), nickel (Ni), iron (Fe), cyanide (CN), oil and grease, fluoride, nitrates (NO_3-N, NO_2-N), ammonium nitrogen (NH_4-N), total coliform, water level*	Sampling and measurement by field equipment and laboratory analysis	Surface water: 6 locations, 2 times (both rainy season and dry season). Asterisked items are measured monthly at the 6 locations. Underground water: 3 locations, 2 times (both rainy season and dry season). Asterisked items are measured monthly at the 3 locations.
	Wastewater	Industrial wastewater practices in Myanmar	Interviews with other industrial parks and with relevant authorities	Depends on discharge points of wastewater
	Waste	Amounts of construction waste, amount of operational (industrial/household) waste, location/method for final disposal, capacity for final disposal, responsible authority for waste disposal	Interviews with relevant authorities, reference to construction planning data.	N/A
	Soil Contamination	Mercury (Hg), arsenic (As), lead (Pb), cadmium (Cd), copper (Cu), zinc (Zn), hexavalent chromium (Cr(VI))	Sampling and measurement by laboratory analysis	1 time, 2 locations
	Noise &Vibration	Traffic volume, noise level	Vehicle survey and noise survey	Vehicle survey: 2 intersections and 2 road sections Noise survey: 24 hr continuous monitoring in 6 locations @15-20 seconds/record
	Land Subsidence	Construction water demand	Interviews with relevant authorities Possible water sources in and around the project site.	N/A
	Offensive Odor	Identification of potential sources and receptors in and around the	Examination of possible odor sources and	N/A

Category	Item	Survey Item	Survey Method	Quantity
		site (residences, social infrastructure, etc.)	vectors through the interviews	
	Sediment	Engineering and construction plans for 2,000 ha site.	Literature review	N/A
Natural Environment	Protected Area	Nationally and internationally important areas in terms of flora, fauna, cultural heritage, etc.	Identification of protected areas in and around the site	N/A
	Ecosystem	Water and land ecosystems on the site	Flora/Fauna (mammal, bird, reptile, fish, amphibian, plants/tress) survey, site walk, identification of sensitive habitats in and around site	Flora and Fauna survey conducted once during dry season and once during rainy season
	Hydrology	Surface and underground hydrology	Confirmation of Land Use Plan	N/A
	Topography and Geology	Elevation and geology in and around site	Literature review	N/A
Social Environment	Involuntary Resettlement	Location and number of people in existing households within the 2,000 ha area that are to be moved	No information was available. (Resettlement Work Plan (RWP) is being prepared separately)	N/A
	Impacts on the Poor	Status of the living situation of the poor as well as integration opportunities with the new SEZ	Review of social statistics applicable to the area, reference to RWP-related documentation, interviews with local persons, host communities will be surveyed for consideration of impacts of inward migration	N/A
	Ethnic Minorities and Indigenous Peoples	Status of ethnic minorities and indigenous persons in the site	Review of social statistics applicable to the area, interviews with local persons	N/A
	Living and Livelihood	Status of major livelihoods in the area	Review of social statistics applicable to the area, interviews with local persons	N/A
	Land use and use of local resources	Status of current and future land use including availability and access to resources such as land, roads, aquatic, and water	Examination of land use plans, evaluation of current local resource use through interviews with local persons, reference to the RWP	N/A
	Water availability	The sustainability of and access to water resources	Literature review	N/A
	Existing social infrastructure and services	Identification of social infrastructure including community centers, education, health and religious facilities	Field survey and information available from project resources	N/A
	Uneven distribution of benefits and damages	Socio-economic status of local people and potential changes as a result of the project	Field survey interviews with local persons	N/A
	Conflict of interest in the area	General investigation of potential conflicts of interest in project operation and implementation	N/A	N/A
	Cultural Heritage	Identification of cultural heritage in and around the site	Field survey, interviews with government officials, reference to historical documents	Conducting 1 field survey to verify findings in documentation.
	Landscape	Identification of landscape impacts	Field survey	N/A
	Gender	Identification of impacts on gender equality	Review of gender statistics by industry	N/A

Category	Item	Survey Item	Survey Method	Quantity
	Children's Rights	Identification of child vulnerabilities as a result of this project	Review of Myanmar law implementation, data and info by UNICEF and other experts	N/A
	Infectious Disease such as HIV/AIDS	Identification of prevalence and potential spread of infectious disease as a result of project construction and operation	Review of infectious disease statistics and HIV/AIDs related activities in the area during construction and plans after operations commence.	N/A
	Working conditions (including occupational safety)	Issues surrounding working conditions including non-compliance with international and national conventions and laws and occupational safety	Review of laws and regulations applicable to the project	N/A
	Accidents	Probability of increased accidents on site	Confirmation of engineering plans for pedestrian and motorways	N/A
	Transboundary impacts or Climate Change	Identification of possible sources of GHGs as a result of project implementation		N/A

1.1 General Site Setting

Myanmar is the largest country in Southeast Asia with a total land area of 676,578 km^2. It is bound on the north by the People's Republic of China, on the east by the Lao People's Democratic Republic and the Kingdom of Thailand, and on the west by the People's Republic of Bangladesh and the Republic of India. The southern border is facing the sea. The main river system, the Irrawaddy River, flows from north to south before fanning out into the multi-fingered Irrawaddy Delta in the south of the country eventually emptying into the Andaman Sea and the contiguous Bay of Bengal. East of the Irrawaddy River Basin and across the Pegu range, lies the Sittaung River Basin—distinct but not disconnected from the Irrawaddy River Basin—also flowing from north to south before emptying its contents into the Gulf of Martaban. At the confluence of two tributaries of the system, the Yangon River and the Bago River, lays the Yangon Region and the eponymous city of Yangon, the largest city in Myanmar. Roughly 20km from the city center across the Bago River via either the Dagon Bridge or the Thanlyin Bridge, are situated the townships of Thanlyin and Kyauktan lying respectively north to south along the eastern bank of the Yangon River. This area is also collectively known as Syriam and is host to the Thilawa SEZ.

Myanmar is a country of great diversity in terms of topography, geology, meteorology, agro-ecological zones, cropping patterns, ethnicity, natural resources, and the livelihood patterns of the total population of 55.746 million persons (estimated July 2014) with a moderate population density of about 82 people per km^2. The country can be characterized as a primarily young, rural country. The urban/rural ratio in Myanmar is about 30:70. About 26.4 percent of the population is between 1 and 14 years old (male 7,498,179/female 7,209,588), and 5.2 percent (male 1,277,919/female 1,659,588) is 65 years old and above.

Myanmar is constituted of seven Regions, seven States and the Union territories. States and Regions of Myanmar are divided into districts. These districts consist of townships that include towns, ward and village-tracts. Village-tracts are groups of adjacent villages and the lowest administrative division.

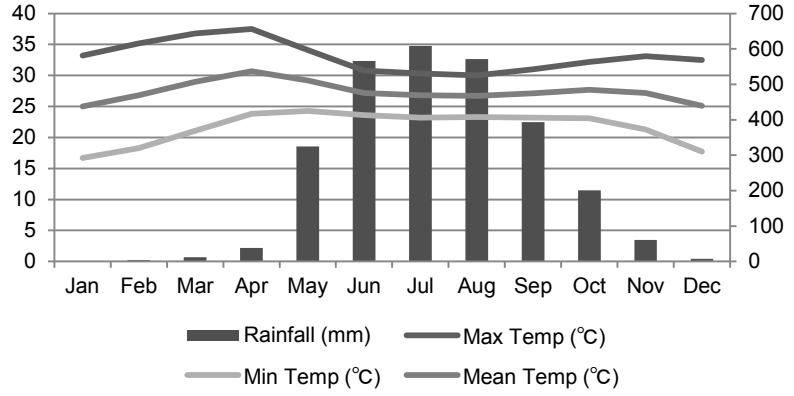
The Syriam area is characteristic of rural lower Myanmar and has been an agricultural hinterland of the economic confluence of Yangon for centuries. The land is flat and dominated by the riverine influence of the Sittaung Delta and the yearly toing and froing of the tropical monsoon climate of the Bay of Bengal. Like other tropical monsoon environments in neighboring countries, the weather is hot and humid during the monsoon months from June to October, but the area also experiences a relatively cold season from November to February and a hot and dry season from March to May. Given the proximity to the marine environment and the concomitant stabilizing effects on the local climate, the terms “hot” season and “cold” season are relative. While there is no weather station directly in the area, the Kabaaye weather station in Yangon City (roughly 15km from the center of the Thilawa site) indicates the following temperature and precipitation data.

Table 2 Meteorology Data from Kabaaye Weather Station in Yangon City (1981-2010)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average/ Total
Max Temp (℃)	33.2	35.2	36.8	37.5	34.1	30.8	30.3	30.0	31.0	32.2	33.1	32.5	33.1
Min Temp (℃)	16.7	18.3	21.1	23.8	24.3	23.6	23.2	23.3	23.2	23.1	21.3	17.7	21.6
Mean Temp (℃)	25.0	26.8	29.0	30.7	29.2	27.2	26.8	26.7	27.1	27.7	27.2	25.1	27.4
Rainfall (mm)	1	4	12	38	325	566	608	571	393	201	61	7	2,787

Source: SEZ Management Committee

Figure 1 Meteorology Data from Kabaaye Weather Station in Yangon City (1981-2010)



Source: SEZ Management Committee

1.2 Pollution Control

In Myanmar there are currently no nationally required ambient environmental regulations.

However, there are currently regulations under debate between MOECAF, Ministry of Industry (MOI), Ministry of Science and Technology (MOST) (and MOST's ESQ subcommittee), etc. As an interim measure before the national environmental regulations are implemented, it is proposed that an EIA for a new project will need to specify an Environmental Management Plan (EMP) with the ambient and emissions standards to be conformed to within the SEZ. If and when the national environmental standards are implemented, these national environmental standards will take precedence and form the new standards for the SEZ environmental regulations. To the extent that the national environmental standards are implemented on a subject-basis (water, effluent, air, etc.), the national environmental standards will replace the corresponding environmental subject on a rolling basis. It is noted that other industrial parks (such as Mingladon Industrial Park) in Yangon has air quality standards established based on those used in the neighboring countries for their environmental management objectives.

In the interim before the national environmental standards are implemented, the Government of Myanmar has decided that the IFC Environmental, Health, and Safety (EHS) Guidelines will apply to the SEZ zone. The IFC EHS Guidelines provide the performance levels and measures that are normally acceptable to IFC, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology. The Government of Myanmar has decided on these measures among others due to the fact that they: have good cost/ performance balance; designed for applicability in developing countries; are project-focused/ easy to implement in an SEZ scenario; provide industry sector guidelines for best practice operations; and are generally accepted by all international financial organizations (NEXI, JBIC, ADB, JICA, World Bank, etc.) for financing projects.

For environmental management coordination it is proposed that environmental standards for the entire 2,000ha area will be set in coordination with the Class A area. However, at a minimum the standards set for the 2,000ha area will conform to the IFC standards proposed by the Central Working Body and/or any Myanmar national environmental standards that are enforced.

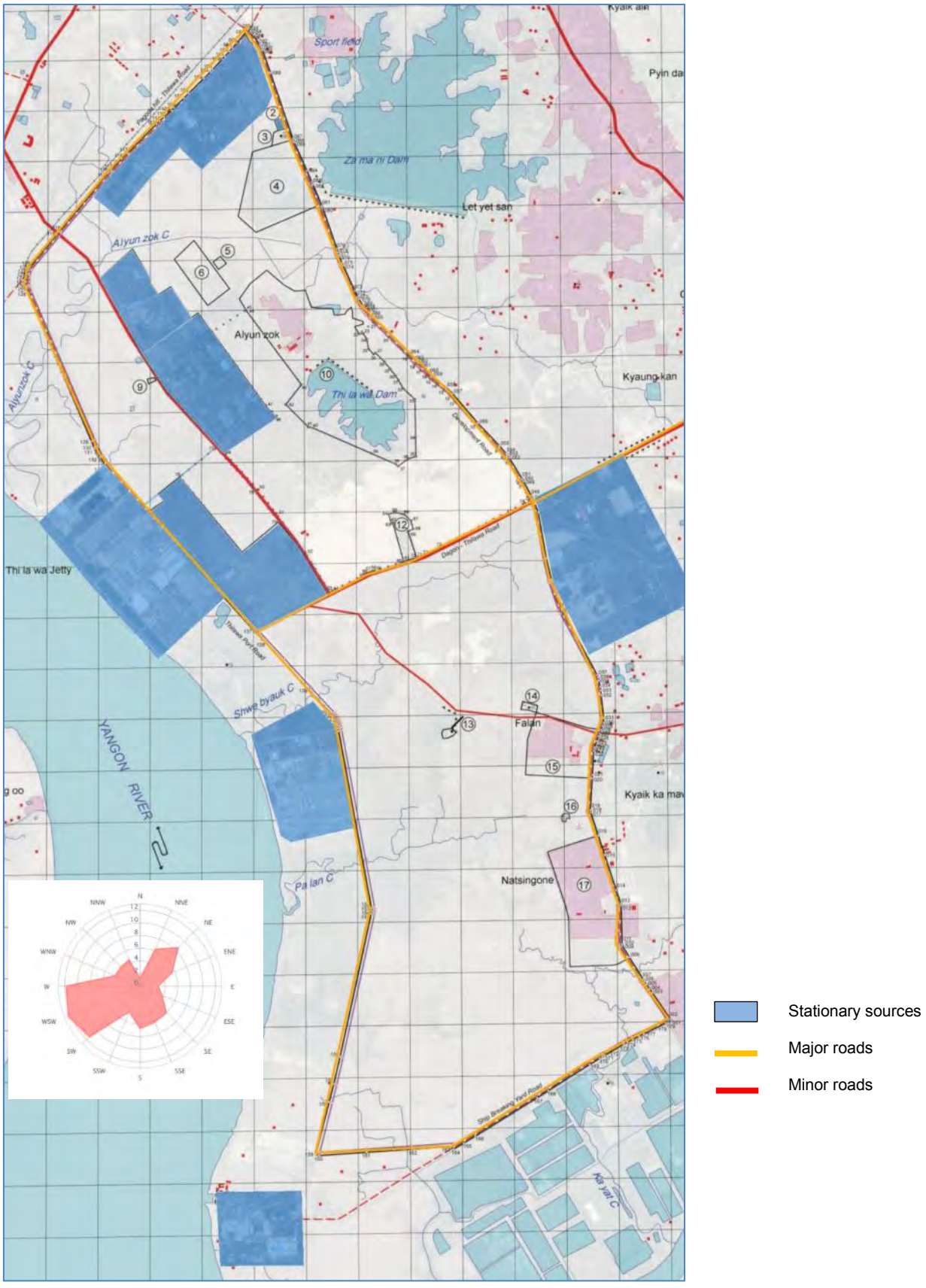
The main pollution sources within an SEZ are point source pollution such as factories and mobile sources such as vehicles, land use change, etc. The SEZ as a whole must manage the pollution of individual factories and the SEZ as an integrated system. Therefore, it was proposed by the Central Working Body to deal with these cumulative impacts in a two-tiered manner implementing zone-wide standards backed up by factory-based ambient and emissions standards. For example, a factory will be required to meet a certain minimum standard for wastewater effluent before discharging that effluent to the SEZ-wide wastewater processing facilities.

The sections following will detail the quantitative targets matching those of the IFC EHS Guidelines as agreed by the Central Working Body for each environmental theme and detail the baseline survey results of the surveys conducted as part of this baseline EIA Framework study.

1.2.1 Air Quality

1） Existing Air Quality

The only existing significant sources of anthropogenic emissions near the site are the factory area in the domestic SEZ on the eastern middle border of the SEZ, the maritime facilities (naval yard, ship breaking, and port facilities) along the western border, and small existing factories within the exclusion zones of the SEZ itself. The educational facilities and surrounding residential areas both in the SEZ and in the greater Kyauktan and Thanlyin areas are not considered a significant source of air emissions. The City of Yangon and its associated air emissions sources are unlikely a large impact in terms air quality within the Thilawa SEZ since the City is both distant at roughly 12km to the north and downwind of the prevailing winds coming West-Southwest from ocean to the South of the SEZ. Existing facilities with potential for significant contribution to air pollution in the SEZ airshed are shown in blue while major road arteries are shown in yellow in the figure below.



Source: SEZ Management Committee

Figure 2 Potentially Significant Baseline Anthropogenic Air Emissions Sources

2） Quantitative Target

The key methods used to manage air quality are to (1) specify concentration limits for pollutants in the ambient air and (2) to specify concentration limits at the point of emission (i.e., in the case of the Thilawa SEZ, mainly in-stack concentration limits at each factory,). Ambient concentrations depend not only on the in-stack concentration, but also on the volume flux of the emission (i.e., the size of the source), the plume rise, the stack height, existing levels of pollution from other sources and the dispersive capacity of the atmosphere. It is the ambient concentrations that are critical for protecting the environment. Emission limits are set to ensure that equipment functions efficiently and that appropriate technology is used, taking account of the environment in which it is operated.

Ambient Air Quality Targets

The air quality guidelines determined for this project by the Central Working Body are to be derived from those recommended by the IFC EHS Guidelines on Air Emissions and Ambient Air Quality. These Guidelines suggests that the prevention of significant impacts should prevent or minimize impacts by ensuring that:

- Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines or other internationally recognized standard such as the United States National Ambient Air Quality Standards (NAAQS);

- Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, it is suggested to set the standards at 25% of the applicable air quality standard to allow additional, future sustainable development in the same airshed.

The suggested ambient air quality standards are set in principle according to ~25% of NAAQS except for particulate parameters and NO2 parameters which are not discounted due to the relatively high baseline levels in the area, as presented in the following table.

Table 3 NAAQS-Derived Interim Ambient Air Quality Standards for Thilawa Airshed

Pollutant	Averaging Time	Level	Form
Carbon Monoxide (CO)	8 hour	3 ppm	Not to be exceeded more than once per year
	1 hour	9 ppm	
Nitrogen Dioxide (NO_2)	Annual	0.053 ppm	Annual mean
	1 hour	0.100 ppm	98th percentile, averaged over 3 years
Particle Pollution (PM10)*	24 hour	150 $\mu g/m^3$	Not be exceeded more than once per year on average over 3 y ears

Pollutant	Averaging Time	Level	Form
Total Suspended particles (TSP) *	24 hour	260 μg/m^3	Not be exceeded more than once per year
Sulfur Dioxide (SO_2)	3 hour	0.13 ppm	Not to be exceeded more than once per year

Note: ppm=parts per million

Source: NAAQS; http://epa.gov/air/criteria.html

Point Source Emissions Targets

Point sources are discrete and stationary sources of emissions releasing pollutants into the atmosphere. They are located principally in manufacturing or production plants. However, within a given factory, there may be several individual emission points that collectively comprise the single point source emission.

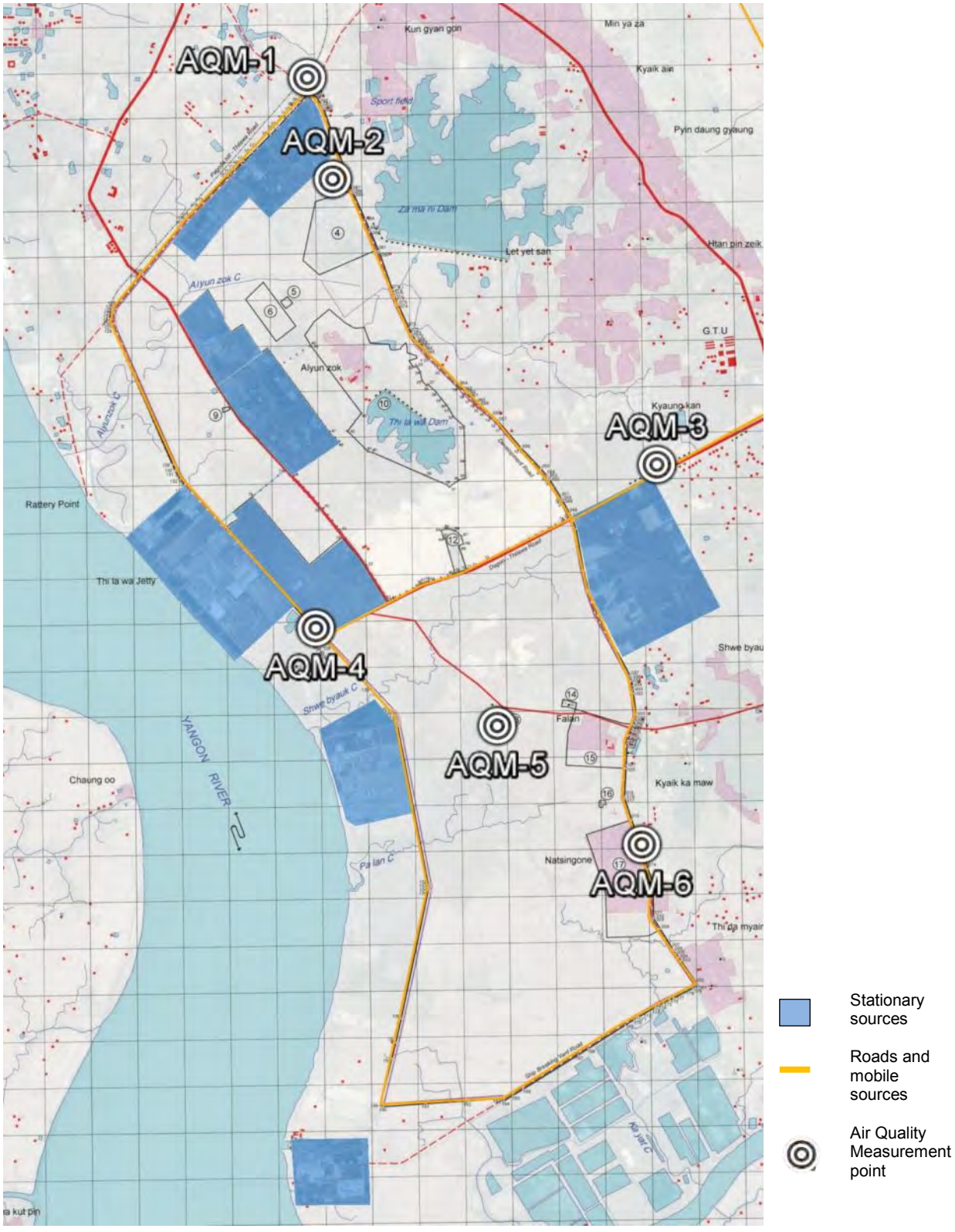
The pollutant types are typically derived from the combustion of fossil fuels and can include nitrogen oxides (NOx), sulfur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM). There may also be some point source emissions associated with industrial activities involving volatile organic compounds (VOCs) and metals. To the extent possible, emissions from such sources should be avoided and controlled according to good international industry practice (GIIP) Industry Sector Guidelines applicable to the relevant industry sector, through the combined application of process modifications and emissions controls.[1]

For point source emissions in the Thilawa SEZ within 800m of the SEZ boundary, whether significant or not, should follow GIIP. Point source emissions in the SEZ but beyond the 800m SEZ boundary should follow GIIP only if the point source emission is a combustion facility (any fuel) with heat output between 3MWth and 50 MWth. For point source emissions that are greater than this, a separate application to the SEZ One Stop Service Center should be made.

3） Survey Results

The survey was conducted in both the dry season and the rainy season. 24 hour data was taken twice on consecutive days at 6 different air quality monitoring (AQM) points. The AQM points were chosen to provide a comprehensive evaluation of the general air quality of the area including existing potentially significant air emissions sources and roads. As air quality is affected by moisture in the air and temperature, days for measurement were chosen according to being hot and dry during the dry season and relatively wet during the rainy season. These points are presented in the figure below.

[1] GIIP guidelines by industry can be found at: www.ifc.org/ehsguidelines



Source: SEZ Management Committee

Figure 3 Air Quality Sampling Points

Aeroqual S500 ENV portable handheld meter is used to measure CO, NO2, SO2 gases at 3hrs interval for 48 hrs at the same designated location of PMs measurement. Non PM10

gas measurements were averaged from samples taken at a 1 min intervals averaged over 1 hour for 8 measurements at each air quality monitoring point. A portable gas monitor was used to measure CO, NO2 and SO2. The sensors employed were of an electrochemical sensor type. PM10 and TSP measurements taken with a Grimm's EDM164 dust monitor (EN12341 US-EPA equivalent) and data was logged once per hour at a 5 minute interval for 24 hours over a 48 hour period.

The data collected is indicated in the table below.

Table 4 Ambient Air Quality Survey Results

		Quantitative Target	Rainy Season Average	Dry Season Average
AQM-1	PM10	24 hr ave < 150 μg/m^3	24.1	71
	TSP	24 hr ave < 260 μg/m^3	35.6	145
	CO	1 hr ave < 9 ppm	0.108	0.094
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.059	0.087
AQM-2	PM10	24 hr ave < 150 μg/m^3	11.5	108
	TSP	24 hr ave < 260 μg/m^3	14.8	308
	CO	1 hr ave < 9 ppm	0.017	0.022
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.045	0.068
AQM-3	PM10	24 hr ave < 150 μg/m^3	16.4	81
	TSP	24 hr ave < 260 μg/m^3	29.8	175
	CO	1 hr ave < 9 ppm	0.015	0.367
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.059	0.059
AQM-4	PM10	24 hr ave < 150 μg/m^3	13.9	108
	TSP	24 hr ave < 260 μg/m^3	21.2	237
	CO	1 hr ave < 9 ppm	0.053	0.114
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.057	0.096
AQM-5	PM10	24 hr ave < 150 μg/m^3	9.3	34
	TSP	24 hr ave < 260 μg/m^3	10.8	61
	CO	1 hr ave < 9 ppm	1.426	0.818
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.051	0.038

		Quantitative Target	Rainy Season Average	Dry Season Average
AQM-6	PM10	24 hr ave < 150 µg/m^3	16.1	54
	TSP	24 hr ave < 260 µg/m^3	24.2	97
	CO	1 hr ave < 9 ppm	0.017	ND
	SO_2	3 hr ave < 0.13 ppm	ND	ND
	NO_2	1 hr ave < 0.10 ppm	0.058	0.330

PM10=Particulate Matter; TSP=Total Suspended Particulates; CO=Carbon Monoxide; SO2=Sulfur Dioxide; NO2=Nitrogen Dioxide; ND=Not Detected at lower detection limit.
Notes: Data taken over the period from 29 May 2014 to 06 June 2014 for the rainy season and March 30-April 4, 2015 for the dry season.

Source: SEZ Management Committee

The results indicate that the air quality survey in the Thilawa area is generally good in the rainy season but worsens during the dry season, particularly for particulate parameters. The Ambient Air Quality survey was conducted once for each season, so even through high concentrations of total suspended particulates (TSP) and of nitrogen dioxide (NO_2) was detected, the high concentrations are likely to be short-term.

1.2.2 Water Quality (Surface and Groundwater)

1） Existing water quality

There are two main bodies of water near to the site. The site is proximate (roughly 700m) to the eastern bank of the Yangon River, which flows from north to south, and the northern bank of the Hmawwun River, which flows from east to west and drains into the Yangon River. There are four streams on the site that flow east to west into the Yangon River and two streams that flow north to south into the Hmawwun River. Roughly 21km downstream of the bank closest to the southwestern tip of the 2,000ha area the Yangon River flows into the Gulf of Martaban and the Indian Ocean.

As for water resources directly in the 2,000ha area there are the six main on-site streams with water almost all year round. However some of these streams are inconsistently dammed by local farmers or else may run at an immeasurable flow rate at low tide during the dry season. These are seasonally connected to permanent bodies of water in the SEZ: the Thilawa Reservoir in the north-central area and the Bant Bway Kone Reservoir in the south-central area. There are two additional permanent bodies of water directly to the east of the site: the Zarmani Reservoir to the northeast and the Bant Bwaykone Reservoir to the east. The two northern-most streams exiting from the western border of the 2,000ha zone are connected with these latter two reservoirs and rainwater catchment area. However, there is a sluice gate preventing direct connection of the reservoirs and the streams. Reportedly, the sluice gate for Zarmani Reservoir is not opened on a regular basis. The two

remaining southern streams exiting the western border as well as the two streams exiting the southern border are fed by rainwater catchment on and off the site. All reservoirs in and around the site are in turn fed by rainwater catchment. In the rainy season the water flowing off site is significant with the two northernmost streams at a depth up to 4m and a width of roughly 10m at some places. In both the dry season and the rainy season the streams experience tidal intrusion with brackish water at high tide. However in the dry season the streams are almost exclusively brackish water at high tide while running dry at low tide. The creek of highest concern is that where wastewater will be disposed of from the Project as well as from the Class A zone. The outlet for wastewater for the project is via Shwe Byauk Creek to the Yangon River, to the west of the wastewater outlet.

Residents in the area rely on hand dug and tube wells in the area for drinking water, although purchased bottled water and trucked water is also consumed in significant quantities.

2） Quantitative Target

Discharges of wastewater or stormwater to surface water should not result in contaminant concentrations of ambient water quality guidelines, when they come into effect in the future. According to IFC EHS Guidelines, discharges to surface water should not result in contaminant concentrations in excess of local ambient quality criteria or other sources of ambient water quality. As noted above, Shwe Byauk Creek and the Yangon River at Shwe Byauk Creek's outlet point is the water body of highest concern since processed wastewater will flow into this creek.

Factors to be taken into account when setting the Project specific performance levels for surface water quality include: (i) receiving water use and assimilative capacity; (ii) other sources of discharges to receiving water; (iii) process wastewater and sanitary waste discharge treatment standards consistent with the applicable guidelines; and (iv) temperature of water prior to discharge.

Receiving water is the Shwe Byauk Creek and then the Yangon River. Shwe Byauk Creek has a minimal assimilative capacity in the dry season when it sometimes runs dry. In both the dry and rainy seasons the creek is heavily influenced by tidal variation. Yangon River has a high assimilative capacity.

Other wastewater outlets into the creek are limited to the Class A wastewater treatment facility and the effluent from the Dowa solid waste treatment facility. Further downstream in the Yangon River, there are a number of wastewater outlet points that mainly come from the Yangon City area. Data is not available on the type, amount, and location of effluent outputs from the Yangon City area, but given the relative location of the project are and the Yangon

City area, any contaminants from effluents are likely to be very well dispersed by the time they flow past the Shwe Byauk Creek outlet point. More localized discharges include from north to south: the Navy area, the various dockyards, the shipbreaking yard, and the aquaculture facilities.

National Recommended Water Quality Criteria of EPA is employed for ambient water quality, and WHO's Guideline for Drinking-water Quality is employed to compare samples collected from groundwater.

Table 5 Ambient Water Quality Criteria for Aquatic Life

Parameter	Unit	Threshold Value (Criteria Maximum Concentration)[2]
Total Coliform	cfu/100mL	-
COD	mg/L	-
Total Nitrogen	µg/L	-
Total Phosphorous	µg/L	-
Turbidity	NTU	-
Arsenic (As)	µg/L	340
Mercury (Hg)	µg/L	1.4
Lead (Pb)	µg/L	65
Cadmium (Cd)	µg/L	2.0
Chromium (Cr) (VI)	µg/L	16
Copper (Cu)	µg/L	2.337
Zinc (Zn)	µg/L	120
Nickel (Ni)	µg/L	470
Iron (Fe)	µg/L	-
Cyanide (CN)	µg/L	22

*EPA does not specify specific targets for items, "-".
Source: National Recommended Water Quality Criteria of EPA

Groundwater in the first aquifers is found at a shallow depth (0.7-5.6m bgl) as measured in 3 different wells in use. Therefore the groundwater vulnerability is considered to be high. The groundwater is also used for drinking purposes and is the main source of household water use for a number of villages in the area and the groundwater sensitivity is also considered to be high.

WHO criteria for drinking water as noted in the Draft National Environmental Quality Standards are provided below. However at the present time it is not considered technically feasible to meet these guidelines in Myanmar. Therefore the table below should be considered as guidance rather than standards for implementation in the present project.

Table 6 WHO Guidelines for Drinking Water Quality

Parameter	Unit	Quantitative Target

[2] The Criteria Maximum Concentration (CMC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect.

Parameter	Unit	Quantitative Target
Total Coliform	**cfu/100mL**	**ND**
Arsenic (As)	**mg/L**	**0.01**
Mercury (Hg)	**mg/L**	**0.006**
Lead (Pb)	**mg/L**	**0.01**
Cadmium (Cd)	**mg/L**	**0.003**
Chromium (Cr)	**mg/L**	**0.05**
Copper (Cu)	**mg/L**	**2**
Zinc (Zn)	**mg/L**	**-**
Nickel (Ni)	**mg/L**	**0.07**
Iron (Fe)	**mg/L**	**-**
Cyanide (CN)	**mg/L**	**-**
Fluoride	**mg/L**	**1.5**
Hardness	**mg/L**	**-**
Nitrates (NO3-N)	**mg/L**	**50**
Nitrites (NO2-N)	**mg/L**	**3**
Ammonium Nitrogen (NH4)	**mg/L**	**-**

*WHO does not specify specific targets for items, "-".
Source: Guidelines for Drinking-water Quality Fourth Edition (WHO)

3) Survey Results

The water quality survey was conducted with a limited parameter set monthly for one year with an additional extended parameter set. Six surface water (SW-1 to SW-6) points and three groundwater (GW-1 to GW-3) were selected as representative samples of surface and groundwater quality in the area.

Source: SEZ Management Committee

Figure 4 Surface and Groundwater Monitoring Points

The results of the monitoring are as below.

Table 7 Surface and Groundwater Sampling Results (Limited Parameter Set)

Parameter	Unit	Sample Date											
		18/12/2013	2014/1/7	2014/1/30	2014/2/18	2014/3/14	2014/4/1	2014/4/25	2014/5/16	2014/6/3	2014/6/24	2014/7/15	2014/8/5
SW-1													
Temp	**°C**	25.3	23.9	24.8	26.2	35.3	31.2	33.4	29.6	31.7	28.4	28.7	27.4
Flow*	**m^3/s**	-	-	-	-	-	-	-	-	-	-	-	-
Level/Depth	**m**	- /0.12	- /0.13	- /0.14	- /0.2	- /0.1	- /0.2	- /0.2	- /0.2	- /0.2	- /1.6	4 /-	3 /-
Odor	**-**	muddy	muddy	muddy	muddy	muddy	muddy	muddy	muddy	muddy	muddy	muddy	muddy
Color	**TCU**	-	45	130	50	20	10	10	10	40	60	100	50
EC	**µs**	1956	142	223	1735	21.67	23.01	20.61	20.61	659	226.1	82.9	51.4
pH	**-**	7	6.9	7.1	7.1	8.66	7.7	7.32	7.32	6.57	6.38	6.39	6.13
BOD	**mg/L**	3.2	1	2.5	2.5	2	2	2.5	2	2	2.5	2	1.5
SS	**mg/L**	540	1068	1035	1912	110	36	36	36	68	382	172	92
DO	**mg/L**	5.2	4	5	4.5	10.36	4.12	4.12	4.12	46.6	3.08	50.5	39.6
SW-2													
Temp	**°C**	23.6	24.2	24.6	26.4	33.3	30.8	33.9	27.1	31.3	28.2	28	27.4
Flow*	**m^3/s**	0.141	0.129	0.102	0.085	0.083	0.089	0.083	0.083	-	-	-	-
Level/Depth**	**m**	-	-	-	-	-	-	-	-	-	-	-	-
Odor	**-**	muddy	muddy	muddy	muddy	muddy	nil	nil	nil	nil	nil	nil	nil
Color	**TCU**	20	80	95	90	25	50	80	80	120	90	160	80
EC	**µs**	1792	411	293	1086	21.47	25.95	22.03	22.03	6.74	325.9	211.1	42.6
pH	**-**	6.8	6.7	7.2	7.1	8.37	7.39	7.98	7.98	7.81	6.73	7.25	6.39
BOD	**mg/L**	0.5	2	2	2	1.5	2	2.5	2	1.5	2	2	1
SS	**mg/L**	526	1052	505	1983	103	95	95	95	388	1320	300	188
DO	**mg/L**	5	4	4.5	4	8.96	4.01	4.01	4.01	3.93	4.23	58	43.2
SW-3													
Temp	**°C**	25.3	24.8	23.8	27.3	34.5	31.8	34.3	29.6	30.2	28.5	27.7	27.1
Flow*	**m^3/s**	-	0.105	0.089	0.068	0.058	0.056	0.051	0.051	-	-	-	-
Level/Depth**	**m**	- /0.12	-	-		-	-	-	-	-	-	-	-
Odor	**-**	muddy	muddy	muddy	muddy	muddy	nil	nil	nil	nil	nil	nil	nil
Color	**TCU**	-	90	75	55	60	40	70	70	80	60	190	60
EC	**µs**	1956	283	765	965	26.52	26.88	20.22	20.22	8.49	1486	495.4	150.2
pH	**-**	7	6.8	7.1	7.1	8.5	7.73	7.76	7.76	7.73	7.08	7.19	6.7
BOD	**mg/L**	3.2	3	2.5	2.1	1.5	1.5	1	1.5	1.5	2.2	1.5	1
SS	**mg/L**	540	584	1403	1739	549	78	78	78	136	136	422	118
DO	**mg/L**	5.2	5	5	4	7.57	4.5	4.5	4.5	3.46	4.68	60.5	52.9
SW-4													
Temp	**°C**	25.9	25.3	26.1	30.2	34.4	31.1	36	29.5	30.4	29.2	28.1	27
Flow*	**m^3/s**	0.078	0.067	0.055	0.055	0.046	0.041	0.042	0.042	-	-	-	-
Level/Depth**	**m**	-	-	-		-	-	-	-	-	-	-	-/2

Parameter	Unit	Sample Date											
		18/12/2013	2014/1/7	2014/1/30	2014/2/18	2014/3/14	2014/4/1	2014/4/25	2014/5/16	2014/6/3	2014/6/24	2014/7/15	2014/8/5
Odor	**-**	muddy	muddy	muddy	muddy	muddy	nil	nil	nil	nil	nil	nil	nil
Color	**TCU**	20	180	35	50	35	70	40	40	140	220	120	90
EC	**µs**	1669	189	297	951	29.74	26.93	22.92	22.92	13.63	5.26	900	291.3
pH	**-**	7.2	7	7.2	7.1	8.67	7.46	8.05	8.05	7.44	7.08	7.33	7.11
BOD	**mg/L**	3.2	3	2.7	2.1	2	2	2	1.5	2	2.5	2	1.5
SS	**mg/L**	615	571	1043	1615	190	128	128	128	385	1930	188	152
DO	**mg/L**	5.2	4	5.2	4	5.57	4.11	4.11	4.11	4.27	62.4	79.3	54.1
SW-5													
Temp	**°C**	25.1	25.7	26.4	31	30.4	31	33	29.5	30.8	29.9	28.2	27.3
Flow*	**m^3/s**	-	-	-	-	-	-	-	-	-	-	-	-
Level/Depth	**m**	- /0.2	- /0.23	- /0.22	- /0.2	- /0.18	- /0.28	- /0.8	-/0.3	-/0.4	-/2.4	-/0.7	-/2
Odor	**-**	foul	foul	muddy	foul	foul	nil	nil	nil	nil	nil	nil	nil
Color	**TCU**	40	110	280	70	25	90	30	30	60	130	40	70
EC	**µs**	1666	252	1344	713	14.92	31.95	33.95	33.95	151.6	4993	1611	300.8
pH	**-**	7.1	6.8	6.8	7.1	7.23	7.23	7.57	7.57	7.58	7.24	7.19	6.94
BOD	**mg/L**	1	3	2	2.5	1.5	2.5	2	1	2	2.5	2.5	1.5
SS	**mg/L**	1253	710	1354	1442	102	147	147	147	160	1460	92	195
DO	**mg/L**	5	4	5	4.5	5.4	4.73	4.73	4.73	4.22	52.8	55.2	43.5
SW-6													
Temp	**°C**	25.5	26.1	25.6	29.7	29.7	29.9	34.2	28.3	30.5	29.1	28.1	28.1
Flow*	**m^3/s**	-	-	-	-	-	-	-	-	-	-	-	-
Level/Depth	**m**	- /0.25	- /0.29	- /0.28	- /0.3	- /0.25	- /1.5	- /1.0	- /1.5	- /0.9	- /2.2	- /1.0	- /1.2
Odor	**-**	foul	foul	foul	foul	foul	fishy	fishy	fishy	fishy	fishy	fishy	fishy
Color	**TCU**	40	50	40	15	10	30	10	10	20	80	70	45
EC	**µs**	1891	262	1523	836	25.85	30.03	35.25	35.25	19.95	1405	568	80.3
pH	**-**	7.2	6.9	6.9	7.1	7.04	7.36	7.95	7.95	7.49	7.1	7.18	6.72
BOD	**mg/L**	2.2	3	2	2.5	2	1.5	2	1	2	2.5	2.5	1.5
SS	**mg/L**	1213	1477	998	1749	45	52	52	52	58	1220	116	98
DO	**mg/L**	5.2	4	4	4.5	4.01	3.8	3.8	3.8	54.6	50.2	50.8	43.5
GW-1													
Temp	**°C**	25.9	25.2	27	28.7	29.6	28.4	29.6	29.1	29.5	28.6	29.1	28.5
Water level	**m**	2.1/2.3	2.5/1.8	2.8/1.5	2.7/1.6	3.6 /0.9	4.3/2.7	4.3/3.1	4.3/3.0	2.5/1.5	1.2/4.3	1.1/4.4	1/4.3
Odor	**-**	rusty	rusty	nil	nil	nil	rusty	rusty	rusty	rusty	rusty	rusty	rusty
Color	**TCU**	5	20	nil	nil	nil	nil	nil	nil	nil	nil	nil	5
EC	**µs**	1478	110	256	974	98	87	79.9	79.9	124.4	95.7	102.3	58.8
pH	**-**	6.8	6.8	4	4	4.73	4.65	4.96	4.96	5.06	4.65	4.53	5.57
GW-2													
Temp	**°C**	26.2	25.9	27	27.2	28.6	28.8	29.9	29.2	28.8	28.8	28.7	28.8
Water level	**m**	3.8/2.5	2.9/2.4	2.7/2.9	3.1/2.4	6.4/2.1	6.4/2.1	6.4/1.4	6.4/1.8	3.2/1.5	1.8/4.7	1.5/4.0	1.1/4.1

Parameter	Unit	Sample Date											
		18/12/2013	2014/1/7	2014/1/30	2014/2/18	2014/3/14	2014/4/1	2014/4/25	2014/5/16	2014/6/3	2014/6/24	2014/7/15	2014/8/5
Odor	**-**	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
Color	**TCU**	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	10
EC	**µs**	1461	101	105	653	54	50.8	68	68	59	67.4	62.7	58.6
pH	**-**	6	6	4.5	6	4.85	5.04	5.29	5.29	5.13	5.07	4.98	5.07
GW-3													
Temp	**°C**	25.8	24.8	27	26.1	29.3	28.4	31	29.3	29.6	29.3	29.2	28.9
Water level	**m**	2.5/3.5	2.3/3.5	3.5/2.8	3.3/3.0	4.2/2.2	4.2/1.6	4.2/1.7	4.2/3.7	0.6/5.6	1.1/5.2	0.7/5.3	0.8/5
Odor	**-**	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
Color	**TCU**	30	25	5	nil	nil	nil	nil	nil	nil	nil	nil	nil
EC	**µs**	1492	90	454	640	124.5	141.3	223.5	223.5	219.1	89.7	68.7	106.6
pH	**-**	6	6.2	5.5	4	4.85	6.37	6.82	6.82	6.05	5.8	5.53	4.6

Note: flow and depth measurements were taken at low tide to identify off-site flow and to minimize the impact of tidal fluctuations on measured values.
*Flow measurements were only able to be taken intermittently due to blockage of rivers by local residents for agricultural activities.
**Depth measurements were nil at low tide.
Source: SEZ Management Committee

Table 8 Surface Water Sampling Dry Season Results (Extended Parameter Set)

Parameter	Unit	Quantitative Target	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6
Total Coliform	**cfu/100mL**	**-**	$3.5x10^3$	$2x10^3$	$1.5x10^3$	$8x10^3$	$2.3x10^3$	$6x10^3$
COD	**mg/L**	**-**	1.84	1.104	ND	2.208	3.680	0.368
Total Nitrogen	**mg/L**	**-**	6.3	3.5	19.6	7.7	21.00	7.70
Total Phosphorous	**mg/L**	**-**	0.004	0.028	0.036	0.044	0.028	0.084
Turbidity	**NTU**	**-**	171	1220	1310	1450	2250	13
Arsenic (As)	**mg/L**	**0.340**	10.9	7.4	9.5	8.2	8.6	7.838
Mercury (Hg)	**mg/L**	**0.0014**	ND	ND	0.003	0.004	0.006	0.007
Lead (Pb)	**mg/L**	**0.065**	0.025	0.017	0.034	0.03	0.12	0.065
Cadmium (Cd)	**mg/L**	**0.002**	ND	ND	ND	ND	ND	ND
Chromium (CrVI)	**mg/L**	**0.016**	1.75	1.67	1.81	1.48	1.45	3.8
Copper (Cu)	**mg/L**	**0.0023**	0.018	0.017	0.017	0.016	0.02	0.022
Zinc (Zn)	**mg/L**	**0.12**	0.01	0.013	0.007	0.015	0.03	0.075
Nickel (Ni)	**mg/L**	**0.47**	0.18	0.17	0.181	0.185	0.283	0.95
Iron (Fe)	**mg/L**	**-**	0.88	2.20	2.60	3.72	4.6	0.58
Cyanide (CN)	**mg/L**	**0.022**	0.002	0.009	0.006	0.005	0.002	0.008

ND=Not Detected
Source: SEZ Management Committee Study

Table 9 Groundwater Sampling Dry Season Results (Extended Parameter Set)

Parameter	Unit	Quantitative Target	GW-1	GW-2	GW-3
Total Coliform	**cfu/100mL**	**ND**	1 x10^2	2 x10^2	5 x10^2
Arsenic (As)	**mg/L**	**0.01**	3.682	ND	6.9
Mercury (Hg)	**mg/L**	**0.006**	0.019	0.033	0.093
Lead (Pb)	**mg/L**	**0.01**	ND	ND	ND
Cadmium (Cd)	**mg/L**	**0.003**	ND	ND	ND
Chromium (Cr)	**mg/L**	**0.05**	1.07	0.998	1.43
Copper (Cu)	**mg/L**	**2**	0.002	0.002	0.002
Zinc (Zn)	**mg/L**	**-**	0.04	0.029	0.003
Nickel (Ni)	**mg/L**	**0.07**	0.093	0.065	0.061
Iron (Fe)	**mg/L**	**-**	0.20	0.22	0.28
Cyanide (CN)	**mg/L**	**-**	0.002	0.005	0.004
Fluoride	**mg/L**	**1.5**	ND	ND	ND
Hardness	**mg/L**	**-**	6	6	20
Nitrates (NO3-N)	**mg/L**	**50**	0.104	0.120	0.98
Nitrites (NO2-N)	**mg/L**	**3**	0.01	ND	ND
Ammonium Nitrogen (NH4)	**mg/L**	**-**	ND	ND	ND

ND=Not Detected
*WHO do not specify specific targets for these items.
Source: SEZ Management Committee Study

Table 10 Surface Water Sampling Rainy Season Results (Extended Parameter Set)

Parameter	Unit	Quantitative Target	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6
Total Coliform	**cfu/100mL**	**-**	0.1x10^3	Numerous	Numerous	Numerous	Numerous	Numerous
COD	**mg/L**	**-**	32	32	32	32	32	32
Total Nitrogen	**mg/L**	**-**	4.2	7.7	8.4	8.4	7.7	5.6
Total Phosphorous	**mg/L**	**-**	0.07	0.1	0.09	0.02	0.08	0.11
Turbidity	**NTU**	**-**	255	630	228	750	725	678
Arsenic (As)	**mg/L**	**0.340**	Nil	Nil	Nil	Nil	Nil	Nil
Mercury (Hg)	**mg/L**	**0.0014**	ND	ND	ND	ND	ND	ND
Lead (Pb)	**mg/L**	**0.065**	ND	ND	ND	ND	ND	ND
Cadmium (Cd)	**mg/L**	**0.002**	ND	ND	ND	ND	ND	ND
Chromium (CrVI)	**mg/L**	**0.016**	ND	ND	ND	ND	ND	ND
Copper (Cu)	**mg/L**	**0.0023**	ND	ND	ND	ND	ND	ND
Zinc (Zn)	**mg/L**	**0.12**	0.001	0.007	ND	ND	0.001	ND
Nickel (Ni)	**mg/L**	**0.47**	ND	ND	ND	ND	ND	ND
Iron (Fe)	**mg/L**	**-**	3.88	6.2	4.22	8.3	6.92	6.25

Parameter	Unit	Quantitative Target	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6
Cyanide (CN)	**mg/L**	**0.022**	0.02	0.03	0.016	0.017	0.031	0.033

ND=Not Detected
Source: SEZ Management Committee Study

Table 11 Groundwater Sampling Rainy Season Results (Extended Parameter Set)

Parameter	Unit	Quantitative Target	GW-1	GW-2	GW-3
Total Coliform	**cfu/100mL**	**ND**	Numerous	Numerous	Numerous
Arsenic (As)	**mg/L**	**0.01**	ND	ND	ND
Mercury (Hg)	**mg/L**	**0.006**	ND	ND	ND
Lead (Pb)	**mg/L**	**0.01**	ND	ND	ND
Cadmium (Cd)	**mg/L**	**0.003**	ND	ND	ND
Chromium (Cr)	**mg/L**	**0.05**	ND	ND	ND
Copper (Cu)	**mg/L**	**2**	ND	ND	ND
Zinc (Zn)	**mg/L**	**-**	0.03	ND	ND
Nickel (Ni)	**mg/L**	**0.07**	ND	ND	ND
Iron (Fe)	**mg/L**	**-**	0.26	0.92	0.79
Cyanide (CN)	**mg/L**	**-**	0	0.007	0.002
Fluoride	**mg/L**	**1.5**	0.5	0.6	0.5
Hardness	**mg/L**	**-**	20	12	16
Nitrates (NO3-N)	**mg/L**	**50**	Nil	Nil	Nil
Nitrites (NO2-N)	**mg/L**	**3**	0.37	0.36	0.77
Ammonium Nitrogen (NH4)	**mg/L**	**-**	Nil	Nil	Nil

ND=Not Detected
*WHO do not specify specific targets for these items.
Source: SEZ Management Committee Study

For dry season results, both surface water and groundwater show similar tendency for analytical results. In six samples (SW-1 to SW-6) corrected from surface water points during dry season, laboratory measurements of Arsenic, Crromium VI, and Copper exceeded the quantitative target, 0.340mg/L, 0.016mg/L, and 0.0023mg/L respectively. Also, Mercury was detected at four samples (SW-3, SW-4, SW-5, and SW-6), and Lead and Nicke was detected at SW-5 and SW-6 respectively. For rainy season results, only Cyanide, which was not detected from samples collected during dry season, was detected from three surface water samples (SW-2, SW-5, and SW-6). Since no operation or pollution sources are present and tendency of detection changes depending on the season, the elevated concentrations from both the surface water and groundwater samples is naturally occuring and has seasonal effect.

1.2.3 Wastewater

1） Quantitative Target

In industrial parks both in Myanmar and in other countries, it is now a common practice to establish a two-step effluent quality checkpoint system whereby wastewater effluent standards are set both at the individual factory level and further on at the SEZ-wide level. The 2,000ha area standards will reflect those employed in the Class A zone while also taking care to adopt national standards as they come into force as a minimum. The table below shows various standards available for consideration. In principle, the 2,000ha area will use the same standards as in the Class A zone.

Table 12 Wastewater Effluent Standards

Parameter	Unit	Class A	Dowa Waste Facility	IFC	China	Vietnam	MEP	MOI	MOM	YCDC
Physical										
Temperature	°C	**35**	40	-	-	40-45	-	40	-	-
Temp. ∆@zone of discharge	°C	-	-	**<3**	-	-	-	-	-	-
Dissolved Solids	mg/L	**2,000**	**2,000**	-	-	-	-	**2,000**	-	-
Suspended Solids	mg/L	**30**	**30**	50	20-800	50-200	50	**30**	-	<500
Coliform Bacteria	MPN/ 100ml	**<400**	-	**<400**	-	5-10,000	**<400**	-	-	-
Color/Odor	Co-Pt	**150**	Not objectionable	-	-	-	-	-	-	-
Chemical										
pH	units	**6.5-8.5**	5-9	6-9	6-9	5-9	6-9	5-9	6-9	6-9
Total Heavy Metals	mg/L	-	-	10.0	-	-	**10.0**	-	-	-
Iron (Fe)	mg/L	-	-	**3.5**	-	1.0-10.0	**3.5**	-	-	-
Zinc (Zn)	mg/L	5.0	5.0	**2.0**	2.0-5.0	1.0-5.0	**2.0**	5.0	-	-
Copper (Cu)	mg/L	1.0	1.0	**0.5**	0.5-2.0	0.2-5.0	**0.5**	1.0	-	-
Silver (Ag)	-	-	-	**0.5**	**0.5**	-	**0.5**	-	-	-
Chromium (Cr)	mg/L	0.5	0.5	**0.1**	0.5	0.05-0.5	**0.1**	0.5	-	-
Cadmium (Cd)	mg/L	**0.03**	**0.03**	0.1	0.1	0.01-0.5	0.1	**0.03**	-	-
Total Mercury (Hg)	mg/L	**0.005**	**0.005**	0.01	0.05	0.005-0.01	0.01	**0.005**	-	-
Barium	mg/L	**1.0**	**1.0**	-	-	-	-	**1.0**	-	-
Nickel (Ni)	mg/L	**0.2**	**0.2**	0.5	1.0	0.2-2.0	0.5	**0.2**	-	-
Phosphate (PO_4-P)	mg/L	-	-	**2.0**	-	-	-	-	-	-
Lead (Pb)	mg/L	0.2	0.2	**0.1**	1.0	0.1-1.0	**0.1**	0.2	-	-
Arsenic (As)	mg/L	0.25	0.25	**0.1**	0.5	0.05-0.5	**0.1**	0.25	**0.1**	-
Selenium (Se)	mg/L	**0.02**	**0.02**	0.1	-	-	0.1	**0.02**	-	-
Cyanide	mg/L	**0.2**	**0.2**	1.0	0.5-1.0	-	1.0	**0.2**	-	-
Sulfide (S)	mg/L	1.0	1.0	1.0	1.0	**0.2-1.0**	1.0	1.0	-	-
Fluoride	-	-	-	20.0	10.0-30.0	**1.0-5.0**	20.0	-	-	-
Chlorine (Cl_2)	mg/L	1.0	1.0	**0.2**	-	-	-	1.0	-	-
Formaldehyde	mg/L	**1.0**	**1.0**	-	-	-	-	**1.0**	-	-
Permanganate	mg/L	-	**60**	-	-	-	-	-	-	-
Oxygen Demand										
Biological (BOD)	mg/L	**20**	20-60	50	20-600	20-100	50	20-60	-	20-60
Chemical (COD)	mg/L	**60 (Cr)** 35 (Mn)	-	250	60-1,000	50-400	250	-	150	<200

Parameter	Unit	Class A	Dowa Waste Facility	IFC	China	Vietnam	MEP	MOI	MOM	YCDC
Free Ammonia (NH3-N)	mg/L	-	-	-	-	**0.1-10.0**	10.0	-	-	-
Total Nitrogen (T-N)	mg/L	**5.0**	-	10.0	-	**-**	-	-	-	-
Other										
Phenols / cresols	mg/L	1.0	1.0	**0.5**	0.5-2.0	0.001-1.0	**0.5**	1.0	-	-
Mineral Oil (hydrocarbons)	mg/L	**5**	**5**	10	20-100	-	10	**5**	15	-
Tar	-	**ND**	**ND**	-	-	-	-	**ND**	-	-
Radioactivity and insecticides	-	**ND**	**ND**	-	**ND**	-	-	**ND**	-	-

Acronyms: ND=non-detected; IFC=International Finance Corporation; MEP=Ministry of Electrical Power; MOI=Ministry of Industry; MOM=Ministry of Mines; YCDC=Yangon City Development Committee
Notes: Bolded items represent the strictest standards for each regulation.
Source: Referenced from consultation with MOECAF ESQ Subcommittee #17 on Air Quality Standards, Water Quality Standards, Drinking Water Standards, and Pesticide Residue Specifications.

2） Survey Results

There are no existing wastewater sources on the site to survey.

1.2.4 Solid Waste

1） Quantitative Target

The project should secure the capacity to dispose of hazardous, non-hazardous, and household wastes in a responsible manner. In concrete terms, waste planning activities should include waste planning, waste prevention, and recycling/reuse in order to reduce the total amount of waste to the extent possible. After such activities are undertaken, waste materials should be treated and disposed of an all measures taken to avoid potential impacts to human health and the environment. Approaches should include:

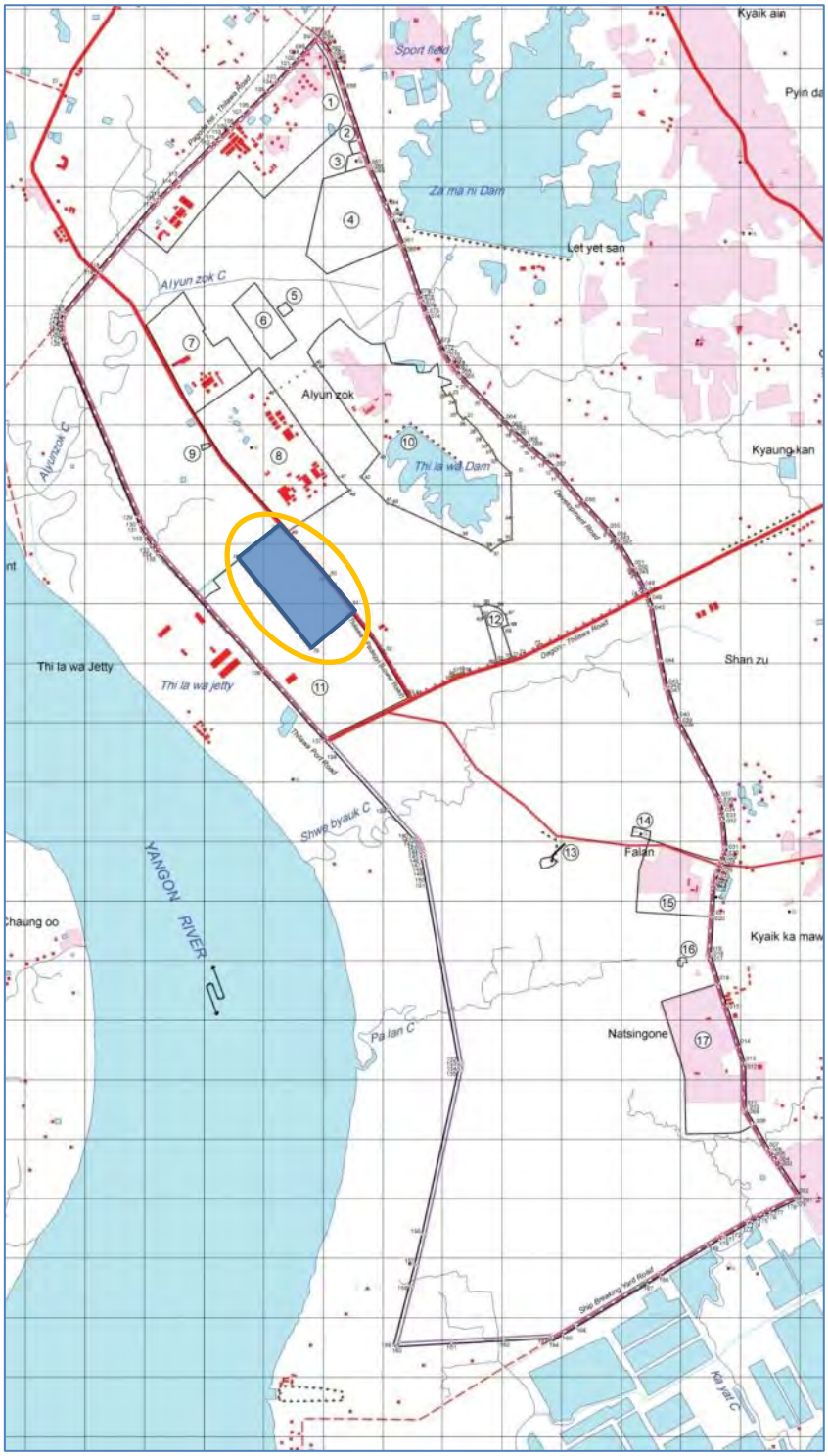
- Provision of on-site or off-site biological, chemical or physical treatment of waste to render it non-hazardous prior to final disposal;
- Treatment or disposal at permitted facilities specifically designed to receive the waste; and
- Provision of relevant documentation to demonstrate that waste is handled properly throughout the waste life cycle from generation to final disposal.

The project will send all generated waste to Dowa Eco-System's solid waste treatment facility in the Class A area. Both non-hazardous and hazardous waste should be stored properly on site until the waste custody is transferred to Dowa's waste transport vehicles. During storage on site,

2） Survey Results

Dowa Eco-System Ltd., a Japan-based company, has received approval for and is

constructing a solid waste treatment facility in the western portion of the Class A area. This facility will receive solid waste from the entire SEZ area as a priority. The location of this facility vis-à-vis the project is outlined in the figure below.



Source: Dowa Eco-System Ltd. (2015). Project on Construction of Solid Waste Management Facilities in Thialwa SEZ Class A Area

Figure 5 Location of Solid Waste Management Facility

According to the EIA report for this facility, the facility will receive industrial non-hazardous, hazardous and recyclable waste. The proposed capacity for the project is as follows:

(i) Recyclables, hazardous and non-hazardous waste disposal (including incineration/landfilling): 10,000-30,000 tons/year (30-80 tons/day)

(ii) Non-hazardous waste incineration: 20 tons/day (<1 ton/hr)

1.2.5 Soil and Sediment

1） Quantitative Target

Like other parameters, there are currently no domestic regulations in Myanmar for soil quality. IFC EHS Guidelines recommend using USEPA Region 3 Risk-Based Concentrations (RBCs)[3] or the Dutch Intervention Values as stipulated in Lijzen et al. 2001[4] in the absence of site-specific national or sub-national regulations. These parameters are a risk-based assessment good for specific land use and contaminant exposure scenarios. However they are practically difficult to implement in Myanmar for general ambient soil quality due to current capacity constraints as laboratories that can measure the full scope of contaminants identified in these two standards. Before national guidelines are established, from a human health standpoint, the WHO Guidelines for the Safe Use of Wastewater, Excreta, and Greywater provide a useful benchmark to evaluate the baseline condition of the soil in the Project area.

Table 13 Selected Quantitative Soil Quality Targets

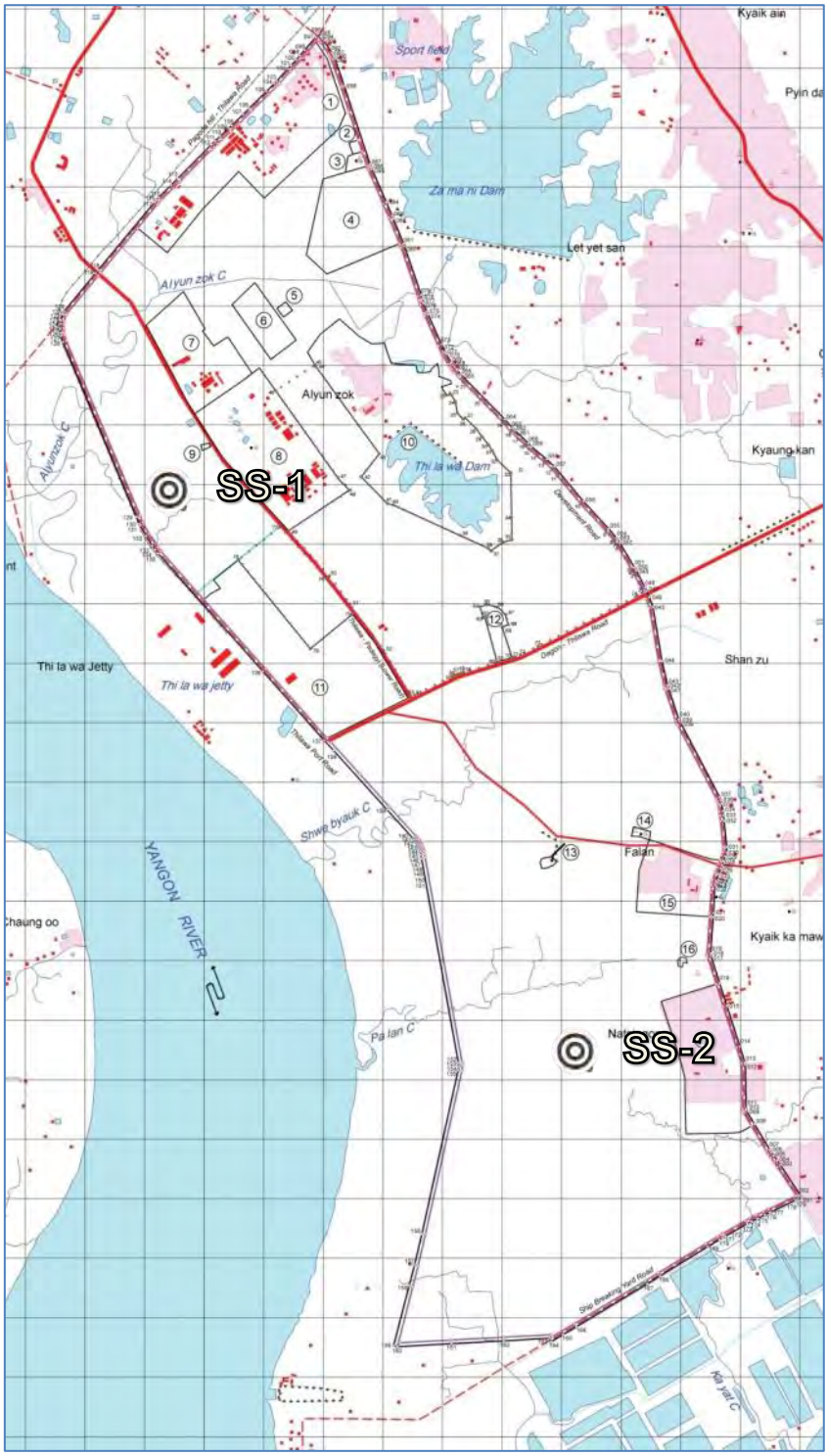
Parameter	Unit	WHO Maximum tolerable soil concentrations of various toxic chemicals based on human health protection
Cadmium	mg/kg	<4.0
Chromium	mg/kg	-
Lead	mg/kg	<84.0
Arsenic	mg/kg	<8.0
Mercury	mg/kg	<7.0
Copper	mg/kg	-
Zinc	mg/kg	-

Source: WHO, Guidelines for the Safe Use of Wastewater, Excreta, and Greywater

2） Survey Results

A soil contamination survey was undertaken at two points as shown in the figure below.

[3] http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
[4] http://www.pbl.nl/sites/default/files/cms/publicaties/711701023.pdf



Source: SEZ Management Committee

Figure 6 Baseline Soil Sampling Points

Table 14 Baseline Soil Contamination

Parameter	Unit	WHO Recommended Maximum Soil Concentrations for Agricultural Purposes	Measured result	
			SS-1	SS-2
Cadmium	mg/kg	<4.0	1.35	1.65
Chromium (total)	mg/kg	-	47.12	63.75
Lead	mg/kg	<84.0	13.97	25.8
Arsenic	mg/kg	<8.0	ND	ND
Mercury	mg/kg	<7.0	ND	ND
Copper	mg/kg	-	7.6	17.12
Zinc	mg/kg	-	28.95	155.85

Source: SEZ Management Committee

The Project area is green-field. Given the past activity of the area, agricultural and residential with some light industry, a limited parameter set was evaluated for naturally occurring metals. When compared to WHO threshold levels, the soil samples taken from each of these sample points did not show any contamination beyond guideline values. However, there were slight elevations in Chromium, Lead, and Cadmium that are possibly a result of natural lateritic soil content.

Regarding sediment, according to the Japanese report written for “The Enhancement of the Efficient Operation of Thilawa Area Port and Logistics Depot Project”, it is reported that concentration of heavy metals (copper and nickel) in the sediment of Yangon River was exceeded a screening level.

1.2.6 Noise and Vibration

1） Quantitative Target

There are no regulations requiring a certain noise threshold currently under Myanmar domestic law. However there are quantitative targets under the Draft National Environmental Quality (Emission) Guidelines as below. According to the Draft Guidelines, Noise impacts should not exceed the levels presented below or result in a maximum increase in background levels of 3dBA at the nearest receptor location off-site.

Table 15 Noise Level Standards

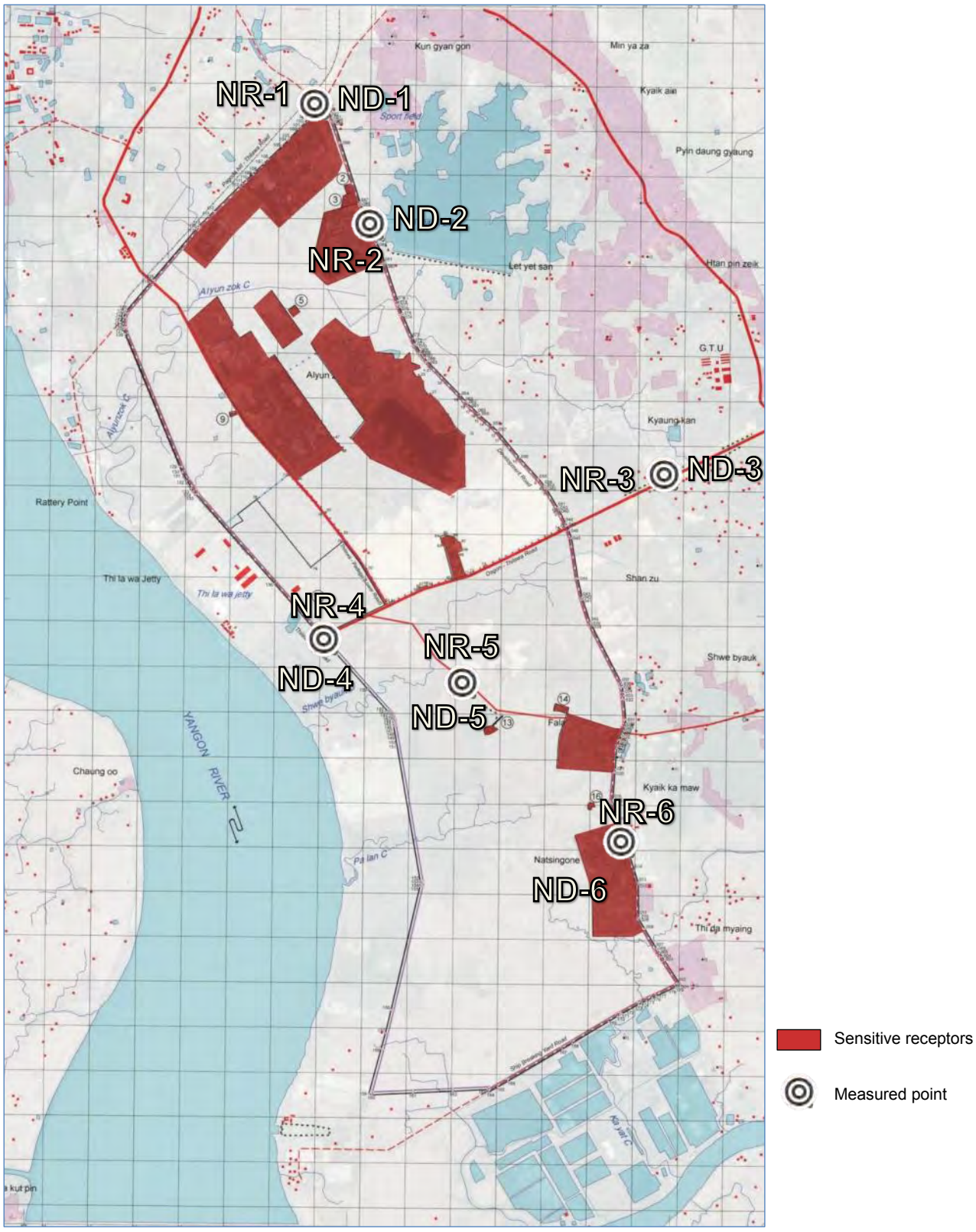
Receptor	One Hour LAeq (dBA)	
	Daytime 07:00-22:00 (10:00-22:00 for public holidays)	**Nighttime 22:00-07:00** (22:00-10:00 for public holidays)
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70

Source: Draft National Environmental Quality (Emission) Guidelines

2） Survey Results

In the case of the Project, residences and educational facilities border the site. Care should

be taken to reduce noise impacts below +3dBA at these sensitive receptors highlighted in red below and at the outside border of the site.



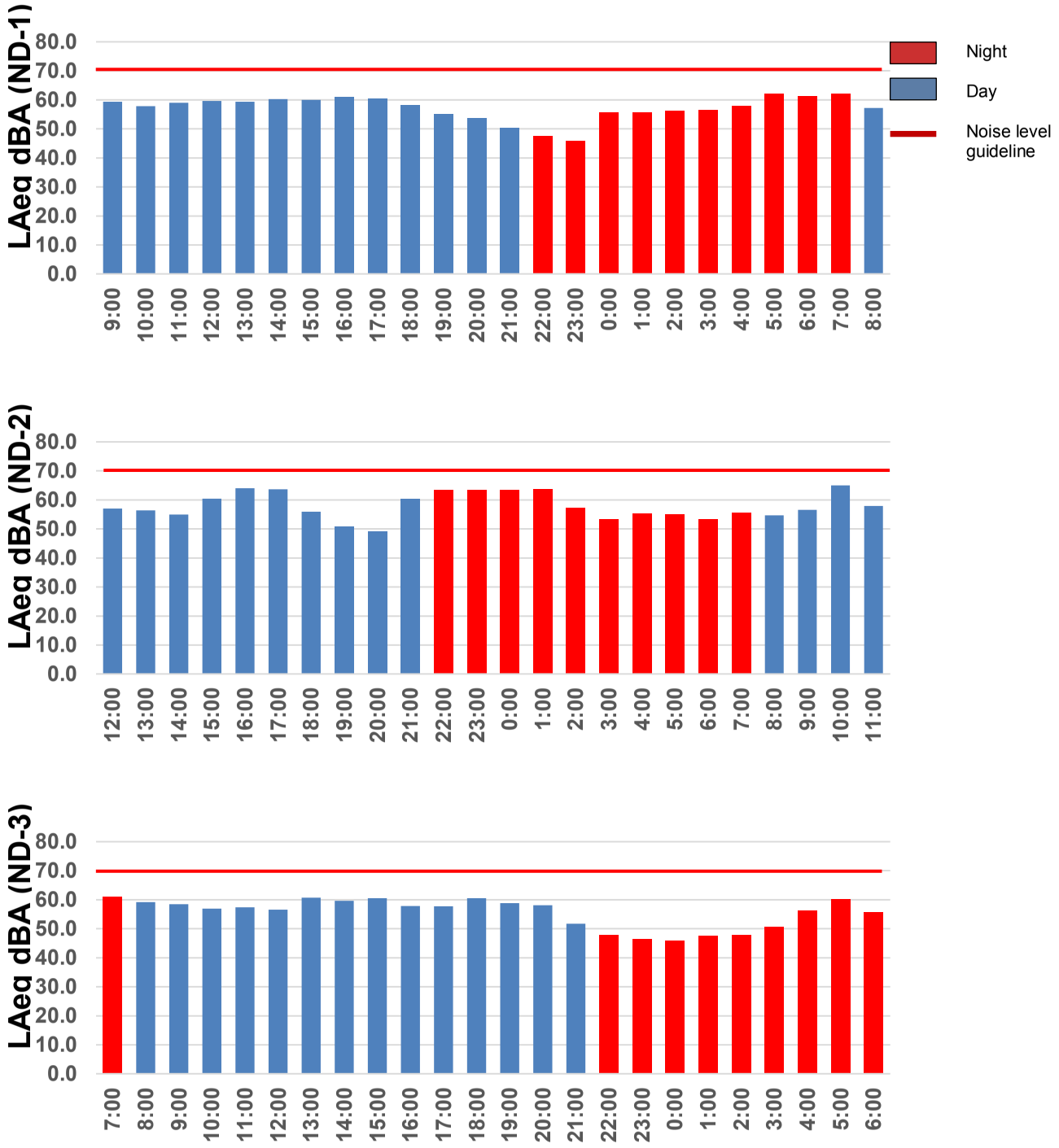
Source: SEZ Management Committee

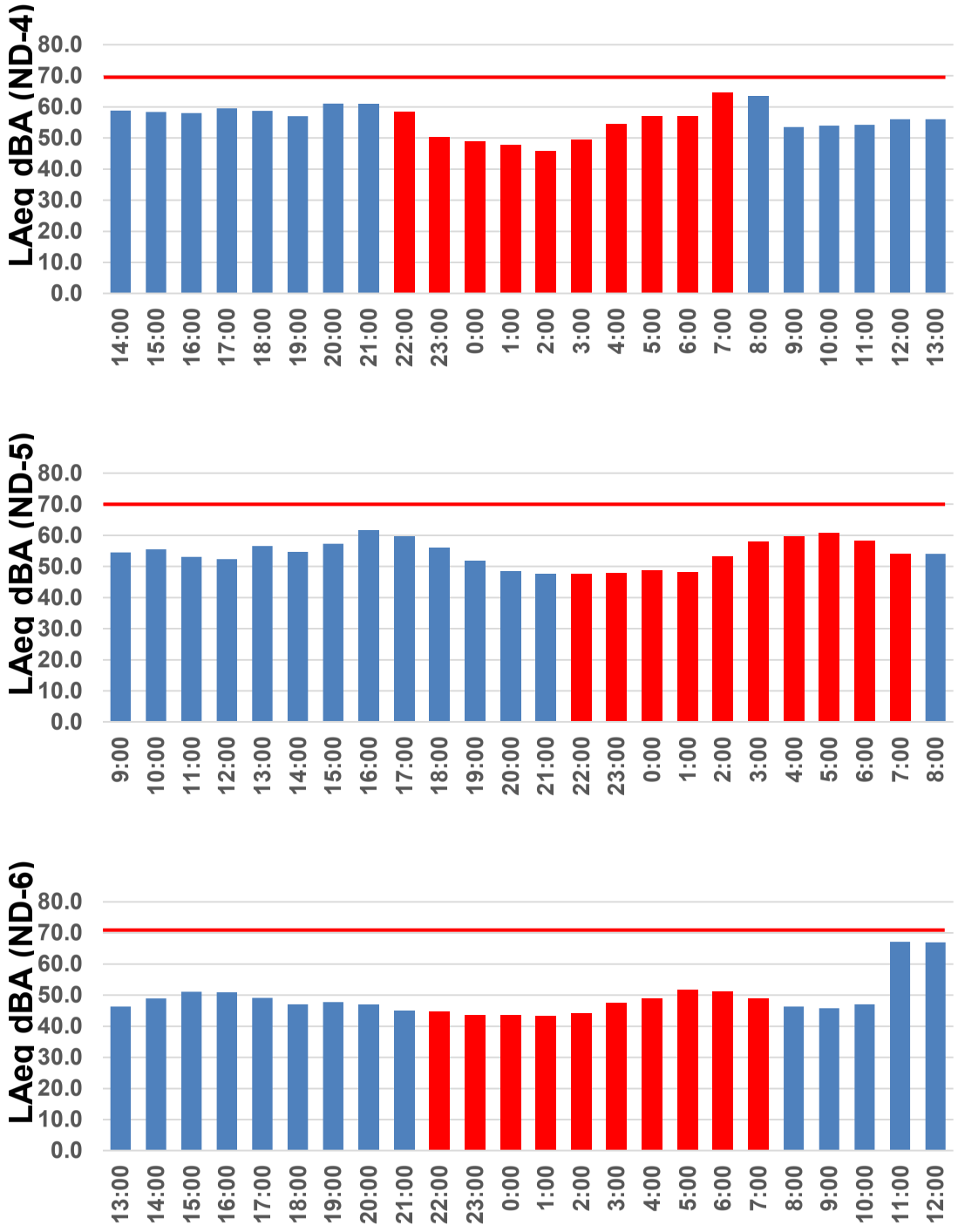
Figure 7 Potentially Sensitive Noise Receptors and Location of Noise Survey

A noise monitoring campaign was undertaken from 20 May 2014 to 6 June 2014 in six different locations identified in the figure below for a period of 24 hours at each location. The

results of this survey are below.

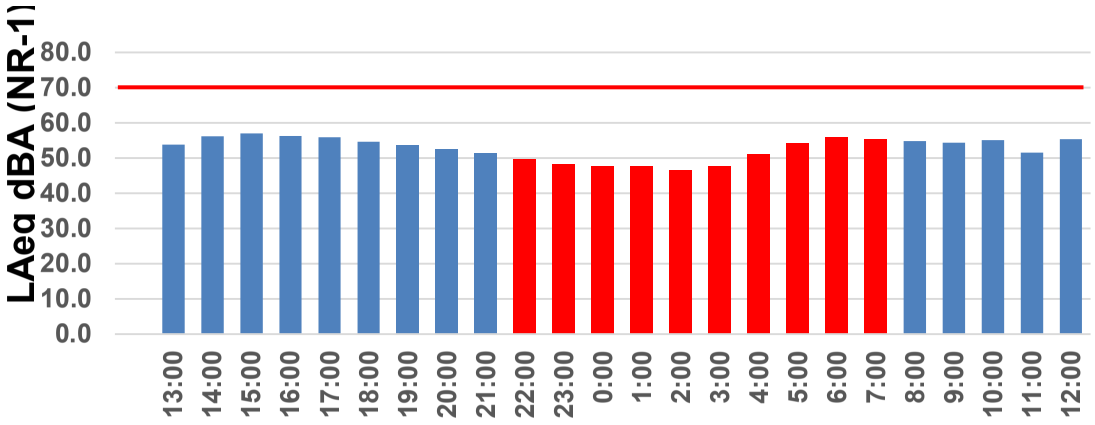
Figure 8 Measured Noise Levels Dry Season (Points ND-1 to ND-6)

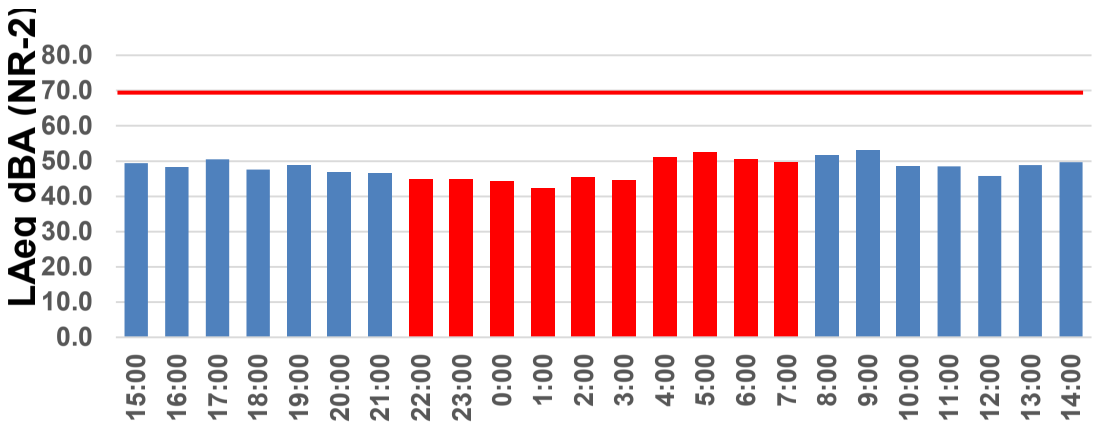


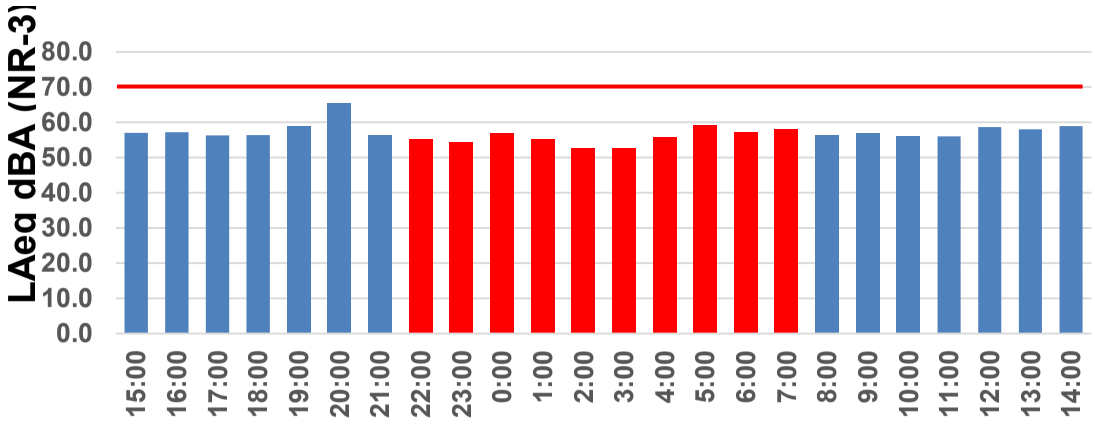


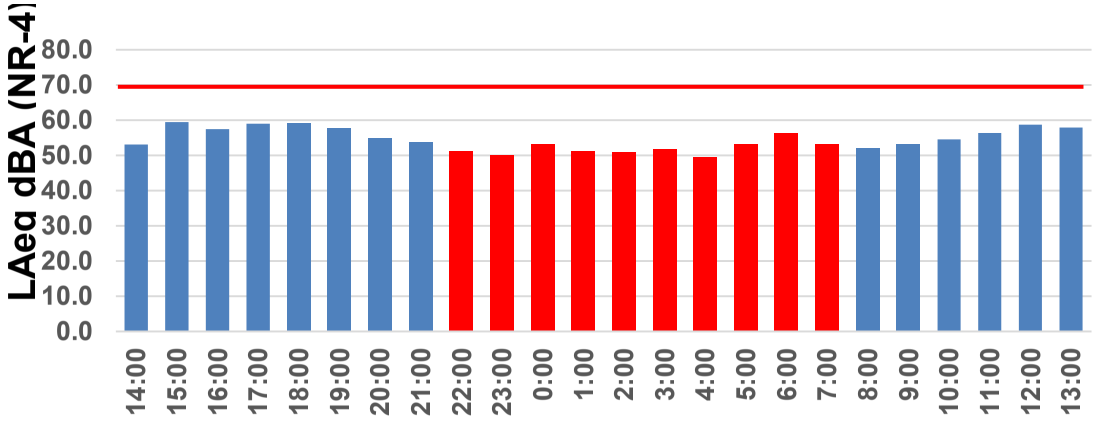
Source: SEZ Management Committee Study

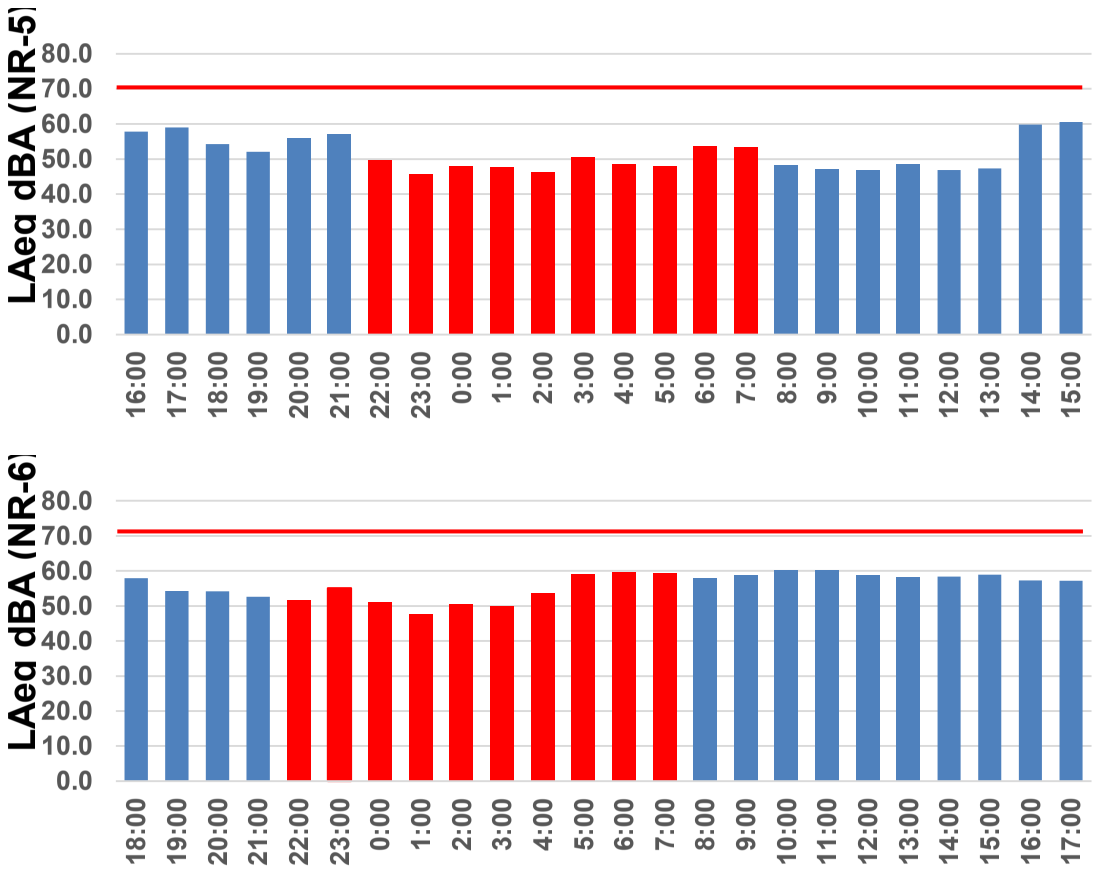
Figure 9 Measured Noise Levels Rainy Season (Points NR-1 to NR-6)


LAeq dBA (NR-1)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00


LAeq dBA (NR-2)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00


LAeq dBA (NR-3)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00


LAeq dBA (NR-4)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00



Source: SEZ Management Committee Study

1.2.7 Traffic

The traffic survey was carried out on two different times, on 20 May 2014 and on 3 April 2015 in 4 locations each time. A map of the traffic survey locations is below.

Source: SEZ Management Committee

Figure 10Traffic Sampling Points

The traffic area surveys were conducted over a 24 hour period at each point identified in the Figure above. The traffic surveys were conducted on 19 August 2014 and 29 April 2015. These periods were chosen for two reasons. The first and principle reason for these date choices was to provide a time period to evaluate change over the course of a half year as

the construction in and around the SEZ was assumed to lead to an increase in traffic. A secondary reason for this timing was to implement the traffic survey during the end of the dry season when preparations for planting and construction traffic around the zone is relatively high. Construction traffic slows due to road conditions and construction conditions during the rainy season. Traffic volume was estimated based on manual counts of vehicles according to vehicle type: motorbike, sedan, light truck, heavy truck, and bus/transporter. Time was categorized into Midnight (00:00~05:59), Morning (06:00~11:59), Afternoon (12:00~17:59), and Evening (18:00~23:59). The results of this survey are as below. The traffic survey data is in the appendix to this report.

1） Survey Point J-1

Survey point J-1 is a 4 way intersection near the Technological University where the Thanlyin-Kyauktan Road on a NW/SE axis intersects Thilawa Road on a SW/NE axis. This road was chosen as it is situated on what will in the future be a major route for cargo into Yangon City over the Dagon Bridge. This route is also proximate to the Technological University which may be impacted by the expected increase in traffic along this route.

The results of the survey at J-1 are as below.

Table 16 Traffic Volume by Modal Type (J-1)

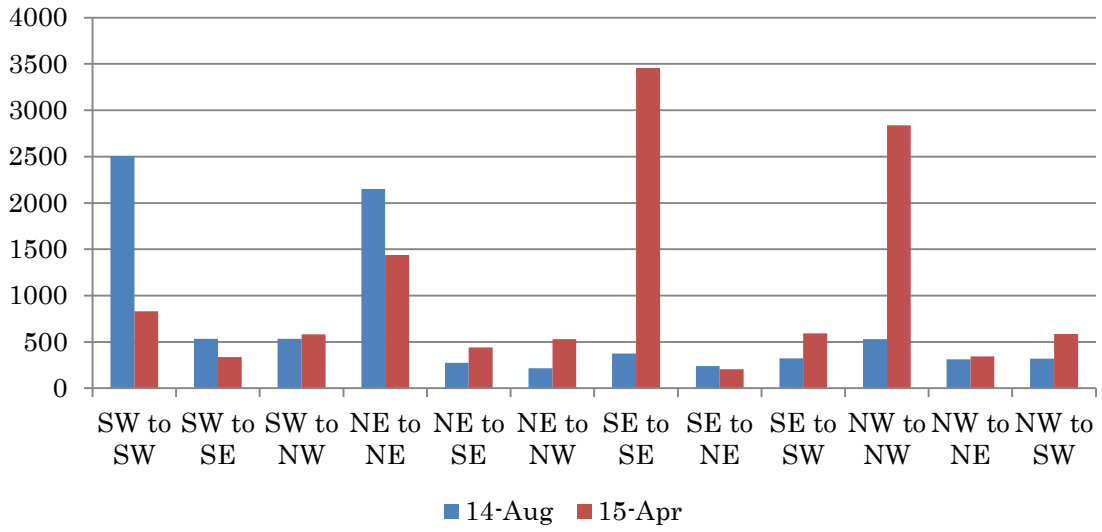
Modal Type	Aug-14				Apr-15			
	Midnight	Morning	Afternoon	Evening	Midnight	Morning	Afternoon	Evening
Motorcycle	125	1339	1419	668	133	1171	1501	832
Sedan	125	701	808	281	152	1162	1720	770
Light Truck	131	421	469	132	100	711	800	541
Heavy Truck	25	121	167	116	7	284	336	95
Bus	126	437	408	294	121	670	723	347
Total	**532**	**3019**	**3271**	**1491**	**513**	**3998**	**5080**	**2585**

Source: SEZ Management Committee Consultants

The survey results suggest that modal type share by time of day remains relatively consistent. However, the 2015 data indicated a slight increase in sedan modal share during the afternoon.

The survey results by total traffic volume by type suggest that Motorcycle traffic has remained relatively constant between the two study points while modal share of sedan and light truck vehicles has increased the most.

Traffic volume by day has increased over the study period in total but the volume of traffic by time of day has remained relatively consistent on a proportional basis with afternoon times experiencing the greatest amount of traffic followed by morning times.



Source: SEZ Management Committee Consultants

Figure 11 Origin and Destination of Traffic (J-1)

The data show an interesting result in that there has been a shift of traffic originating along the Thilawa Road on the NE/SW axis to traffic originating on the Thanlyin-Kyauktan Road on a NW/SE axis. Whereas destination used to be mostly on the NE/SW axis going in and out of Thilawa presumably to the Dagon Bridge access point, there was a marked shift to a higher usage of the Thanlyin-Kyauktan Road. This may be to use the road as an access link between Thanlyin and Kyauktan areas to avoid traffic near the Thilawa area.

2) Survey Point J-2

Survey point J-2 is a 4 way intersection at the eastern edge of the Thilawa SEZ and will presumably be a primary entry/exit point to the industrial areas in the Thilawa SEZ in the future. The road was chosen due to its presumed future role as a high-traffic intersection. This intersection is just north of the Thilawa domestic industrial park and is situated along the Thilawa road on a SW/NE axis and Development Road going to Myanmar Marine University approximately 4km north of the intersection.

The results of the survey at J-2 are as below.

Table 17 Traffic Volume by Modal Type (J-2)

Modal Type	Aug-14				Apr-15			
	Midnight	Morning	Afternoon	Evening	Midnight	Morning	Afternoon	Evening
Motorcycle	55	893	675	335	58	1399	1004	874
Sedan	6	206	250	61	20	282	430	199
Light Truck	9	126	117	38	22	317	307	169
Heavy Truck	57	82	73	23	94	100	152	131
Bus	77	144	228	131	50	531	465	208
Total	**204**	**1451**	**1343**	**588**	**244**	**2629**	**2358**	**1581**

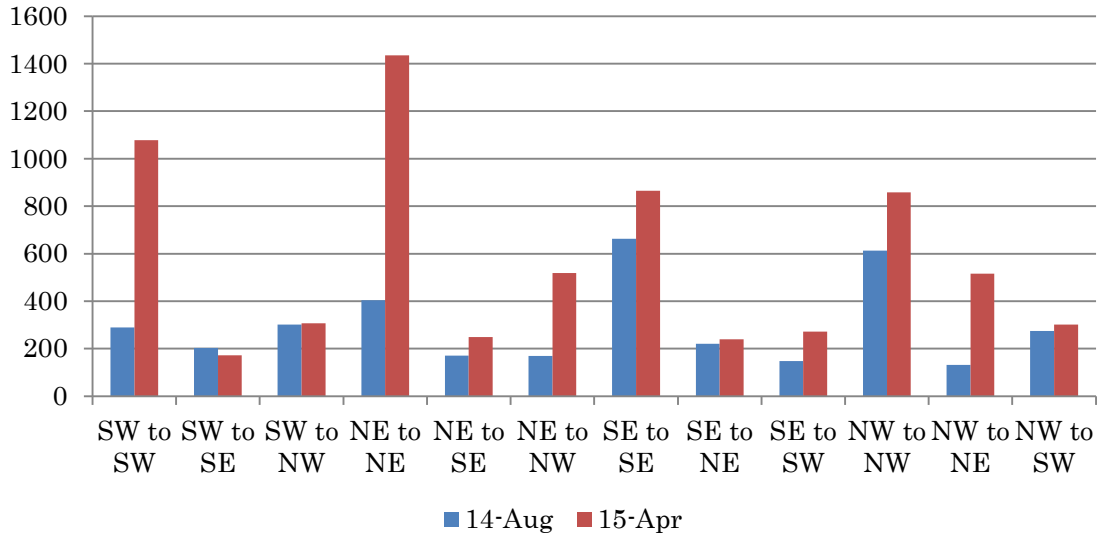
Source: SEZ Management Committee Consultants

The survey results suggest that modal type share by time of day remains relatively

consistent over the period other than a large increase in bus traffic during the morning and afternoon hours.

The survey results by total traffic volume have increased significantly over the period while the modal share has shifted to buses and light trucks. It is assumed that the construction of the Class A area has some impact on this modal shift.

Traffic volume by day has increased over the study period in total but the volume of traffic by time of day has remained relatively consistent on a proportional basis with morning times experiencing the greatest amount of traffic followed by afternoon times.



Source: SEZ Management Committee Consultants

Figure 12Origin and Destination of Traffic (J-2)

The data show that there was fairly even traffic volume distribution by origin in 2014 but that this shifted significantly to traffic volume originating from the NE areas. SW origin traffic also received a particularly large increase over the time period studied. This change is presumably from construction traffic going into the Class A area from the Dagon Bridge route.

3) Survey Point J-3

Survey point J-3 is a 4 way intersection located at the northern corner of the Thilawa SEZ. This location was chosen as it is a primary intersection for traffic entering and exiting the Thanlyin town area and Thanlyin Bridge route and moving to the Thilawa SEZ and surrounding areas south. The intersection is about 1km SW of Kyaik Kyauk Pagoda and about 700m north of the entrance to the Myanmar Marine University. Going SW from the intersection there are residential and light industrial areas existing along the road. The intersection is made up of Pagoda-Hill-Thilawa Road running along a SW/NE axis and

Development Road running on a SE/NW axis.

The results of the survey at J-3 are as below.

Table 18 Traffic Volume by Modal Type (J-3)

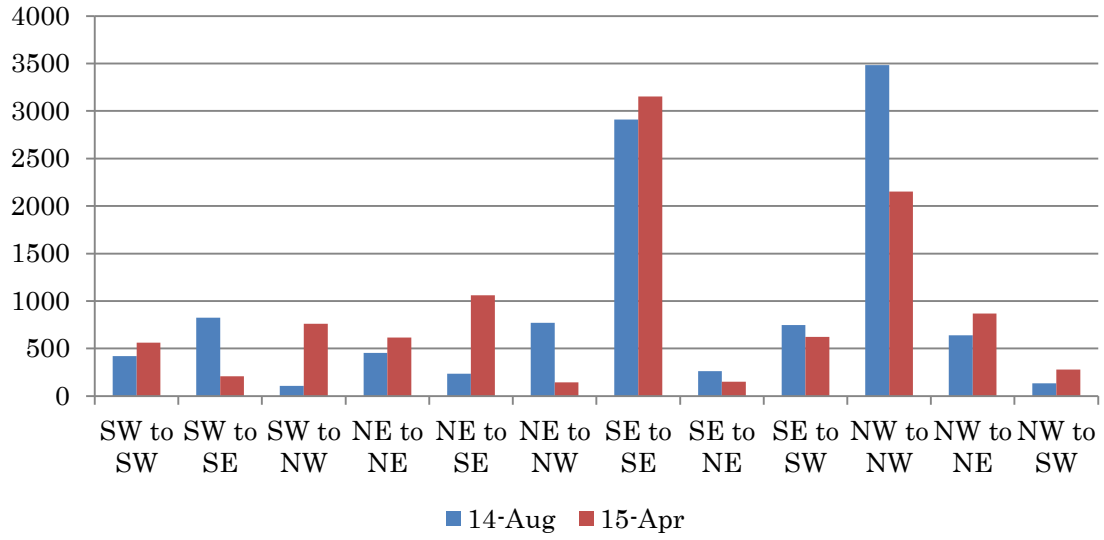
Modal Type	Aug-14				Apr-15			
	Midnight	Morning	Afternoon	Evening	Midnight	Morning	Afternoon	Evening
Motorcycle	193	2742	2627	1440	118	2503	2217	1352
Sedan	23	570	1157	599	64	894	1016	370
Light Truck	14	220	450	212	6	514	556	205
Heavy Truck	12	197	149	101	19	166	156	115
Bus	42	61	68	110	55	38	79	129
Total	**284**	**3790**	**4451**	**2462**	**262**	**4115**	**4024**	**2171**

Source: SEZ Management Committee Consultants

The survey results suggest that modal type share by time of day remains relatively consistent over the period.

Total traffic volume remained relatively consistent over the period. This is consistent with the Class A policy of channeling construction traffic away from Thanlyin Bridge and the populated areas of Thanlyin Town.

Traffic volume by time of day has remained relatively consistent over the time period with a relatively consistent level of traffic volume during the afternoon and morning followed by a drop off in traffic in the evening hours. There is almost no traffic volume in the midnight hours.



Source: SEZ Management Committee Consultants

Figure 13Origin and Destination of Traffic (J-3)

The data show that there is about four times the level of traffic running along the SW/NE Pagoda-Hill-Thilawa Road as compared to the SE/NW Development Road.

4） Survey Point J-4

Survey point J-4 is a 3 way “T” intersection located where the SW/NE axis Dagon-Thilawa Road ends at the SE/NW axis Thilawa Port Road. Proximate to the intersection are a Police Station and the Thilawa Jetty and associated port facilities further to the north. Directly adjacent to the east of the intersection is the Thilawa Power Station facility.

The results of the survey at J-4 are as below.

Table 19 Traffic Volume by Modal Type (J-4)

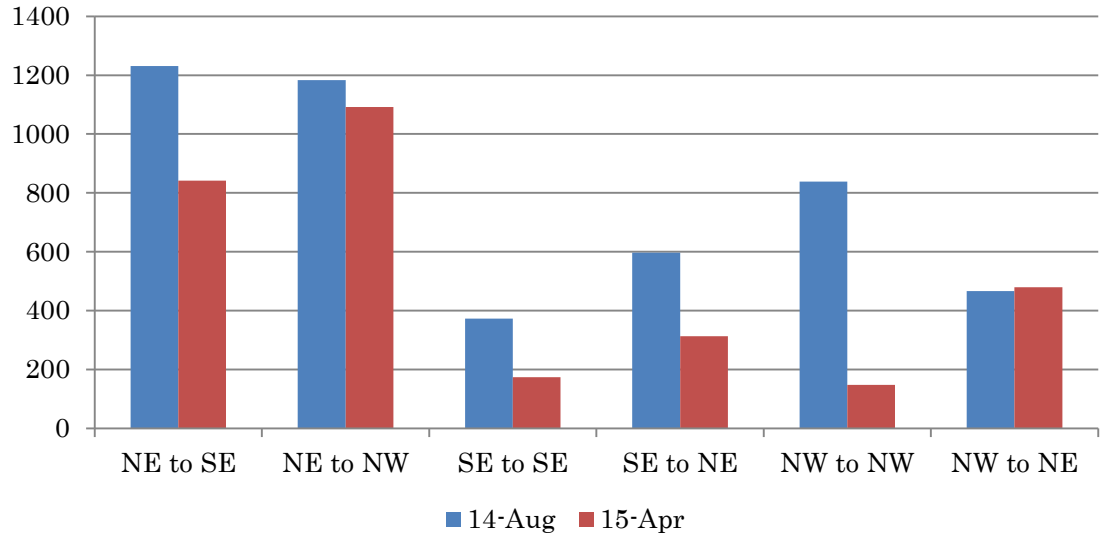
Modal Type	Aug-14				Apr-15			
	Midnight	Morning	Afternoon	Evening	Midnight	Morning	Afternoon	Evening
Motorcycle	33	1799	463	452	96	483	327	231
Sedan	6	564	249	120	20	224	231	89
Light Truck	8	359	122	91	9	177	159	45
Heavy Truck	20	205	36	65	22	307	339	42
Bus	42	375	128	132	86	178	206	125
Total	**109**	**3302**	**998**	**860**	**233**	**1369**	**1262**	**532**

Source: SEZ Management Committee Consultants

The survey results suggest that modal type share by time of day changed significantly over the study period. It is thought that this may be because of increased informal car repair and salvage activity south of the intersection over the study period that effectively blocked the southern route of this intersection after the study began.

Total traffic volume decreased at this intersection during the period significantly although an increase in the number of heavy trucks was observed. It is thought that the decrease in traffic can be attributed to the blockage of the southern route towards the ship breaking yard mentioned in the previous paragraph. The increase in heavy trucks is most likely attributable to the construction activity in the Thilawa SEZ Class A area.

Traffic volume by time of day has decreased significantly in the morning hours and increased slightly in the afternoon hours. Again, the aforementioned reasons of southern route blockage and increase in construction activity are the likely causes of this change.



Source: SEZ Management Committee Consultants

Figure 14Origin and Destination of Traffic (J-4)

There are three routes of ingress/digress from this intersection. The NE route from the Class A area is almost double the traffic volume than the next largest which is from the NW route from around the port and jetty facilities. Again a large decrease in traffic volume was observed over the period.

1.3 Natural Environment

1.3.1 Protected Areas

Currently Myanmar has 39 Protected Areas covering 38,906.49km^2 of land, or 5.75% of Myanmar's land area. Seven of these Protected areas are also ASEAN Heritage Parks and one of the Protected Areas—Moeyungyi Wetland Wildlife Sanctuary—is classified as a Ramsar Site since 2005. There are further proposals for an additional seven Protected Areas that would bring the total number of Protected Areas in Myanmar to 46, or 6.84% of its land area. A map of all Protected Areas in Myanmar is presented in the figure below.

Source: SEZ Management Committee

Figure 15 Map of Myanmar Protected Areas

The nearest Protected Area to the Project is the Hlawga Wildlife Park (#5 in the Figure above) located to the north of Yangon City approximately 45km from the project site by car. Given the distance and proposed transportation routes, the Project is not considered to have an impact on any Protected Area in Myanmar.

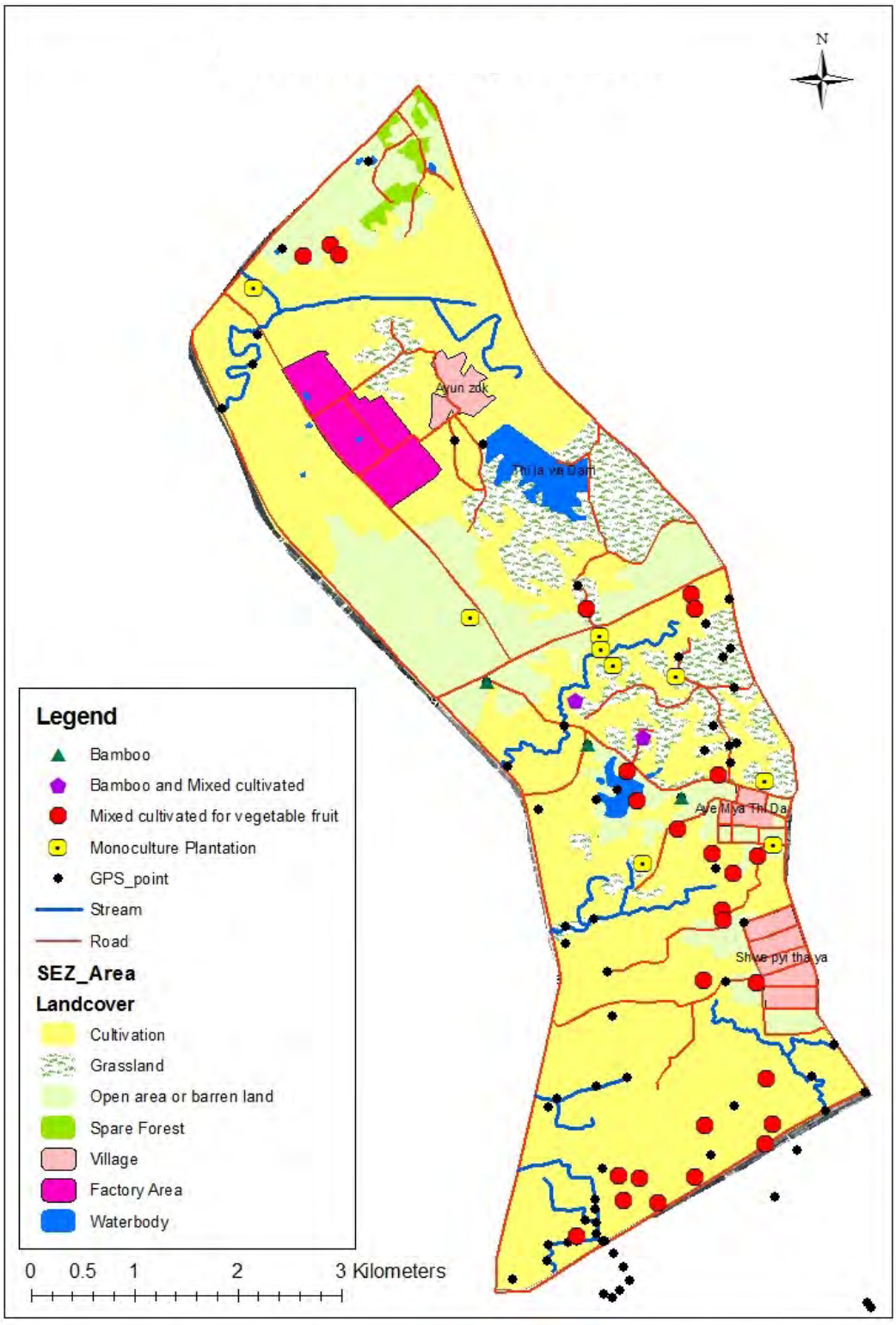
1.3.2 Existing Landcover

The environment in the area is almost entirely converted from the original native forest habitat and heavily converted to human use. It is presently dominated by agricultural use with some mixed industrial use. The table and figure below give an overview of current habitat typology in the area.

Table 20 Existing Habitat Typology

	Land Use Type	Area (km^2)
1	commercial area	0.139
2	cultivated land	12.389
3	education and culture facilities	0.500
4	grass land	5.975
5	industrial area	0.771
6	open space	4.911
7	residential area	1.693
8	swamp area	0.315
9	area under development	1.002
10	water surface	0.752
	Total	**28.447**

Note: The type and data are based on the report of The Project for the Strategic Urban Development Plan of the Greater Yangon modified in association with the satellite image of Thilawa SEZ area.
Source: SEZ Management Committee Consultants



Source: SEZ Management Committee study

Figure 16Landcover Map

1.3.3 Fauna Biodiversity[5]

The apparent fauna on and around the 2,000ha site is of a wide variety. A total of 180 fauna species representing 91 birds (70 species present in cool dry season and 55 species present in rainy season), 31 fishes (16 species present in cool dry season and 27 species present in rainy season), 20 amphibians and reptiles (14 species present in cool dry season and 20 species present in rainy season) and 38 insect species (14 species present in cool dry season and 37 species present in rainy season) were recorded. No endangered species[6] have been identified on site. There was one bird species *Ploceus hypoxanthus* identified on site that is classified as Near Threatened on the IUCN Redlist. There were three fish species, *Labeo nandina*, *Anguilla bicolor,* and *Wallago attu* that are classified as Near Threatened on the IUCN Redlist.

Apart from the IUCN Redlist classification, there are some domestically protected[7] bird species that have been identified within the 2,000ha zone, namely the white-throated babbler (*Turdoides gularis*), which is endemic to Myanmar. Avian wildlife is particularly concentrated in and around water habitats. The mangrove embankments and onsite ponds/lakes provide a habitat for domestically protected birds. Of the 91 unique bird species identified on site, there were 35 bird species were identified in the water and marshland habitat.

Likewise, for aquatic species, the tidal influence on the streams on site and calm waters sheltered by mangrove river embankments may be a relatively important water area in the Yangon River deltaic sub-region that might provide shelter for fish spawning.

A) **Avi-Fauna Species**

A survey was conducted in grassland, marshy, water, and forest habitats in and around the Project area. A total of 91 bird species, representing 70 species, 55 genera, 33 families, and 11 orders were present in the cool dry season and 55 species, 44 genera, 27 families, and 11 orders were present in the rainy season.

According to the habitat types, 32 species were identified in the paddy field, 58 species in trees, Bushes, and grass land, 4 in the water, and 33 species in marshes and wetlands.

[5] A full account of the biodiversity survey results is provided in the appendix.
[6] Status as determined under the International Union for Conservation of Nature's (IUCN) Red List.
[7] Protected under the Forest Department Notification No. 583/94 (http://www.esabii.org/database/others/documents/Myammer_NoticeNo583_94.pdf)

Merops orientalis

Halcyon pileata

Lanius cristatus

Halcyon smyrnensis

Pycnonotus blanfordi

Prinia inornata

Figure 17Sample Avi-Fauna Identified

Table 21 Avi-fauna Identified on Site

	Order / Family	Scientific Name	Common Name	IUCN Redlist Status
I.	**Anseriformes**			
1	Anatidae	1.*Tadorna ferruginea*	Ruddy Shelduck	LC
		2.*Nettapus coromandelianus*	Cotton Pygmy-goose	LC

	Order / Family	Scientific Name	Common Name	IUCN Redlist Status
2	Dendrocygnidae	3.*Dendrocygna javanica*	Lesser Whistling Duck	LC
II	**Podicipediformes**			
3	Podicipedidae	4.*Tachybaptus ruficollis*	Little Grebe	LC
III	**Gruiformes**			
4	Rallidae	5.*Amaurornis phoenicurus*	White-breasted Waterhen	LC
		6.*Porzana fusca*	Ruddy-breasted Crake	LC
		7.*Gallinula chloropus*	Common Moorhen	LC
5	Jacanidae	8.*Metopidius indicus*	Bronze-winged Jacana	LC
IV	**Charadriiformes**			
6	Scolopacidae	9.*Tringa totanus*	Common Redshank	LC
		10.*T. nebularia*	Common Greenshank	LC
		11.*T. ochropus*	Green Sandpiper	LC
		12.*T. stagnatitis*	Marsh Sandpiper	LC
		13.*Actitis hypoleucos*	Common Sandpiper	LC
7	Charadriidae	14.*Charadrius dubius*	Little Ringed Plover	LC
		15.*Himantopus himantopus*	Black-winged Stilt	LC
8	Laridae	16.*Chlidonias leucopterus*	White-winged Tern	LC
V	**Ciconiiformes**			
9	Ardeidae	17. *Egretta garzetta*	Little Egret	LC
		18.*Mesophoyx intermedia*	Intermediate Egret	LC
		19.*Bubulcus coromandus*	Eastern Cattle Egret	LC
		20.*Ardeola* spp:	Pond Heron	LC
		21.*Butorides striatus*	Little Heron	LC
		22.*Ardeoa bacchus*	Chinese pond Heron	LC
		23.*Ardea purpurea*	Purple Heron	LC
		24.*A alba*	Great Egret	LC
		25.*A cinerea*	Grey Heron	LC
		26.*Nycticorax nycticorax*	Black-crowned Night-Heron	LC
		27.*Ixobrychus flavicollis*	Black Bittern	LC
		28.*I. sinensis*	Yellow Bittern	LC
10	Ciconiidae	29.*Anastomus oscitans*	Asian Openbill	LC
VI	**Pelecaniformes**			
11	Phalacrocoracidae	30.*Phalacrocorax niger*	Little Cormorant	LC
VII	**Strigiformes**			
12	Tytonidae	31.*Tyto longimembris*	Eastern Grass-Owl	LC
VIII	**Falconiformes**			
13	Accipitridae	32.*Milvus migrans*	Black Kite	LC
		33.*Elanus caeruleus*	Black-shoulder Kite	LC
		34.*Accipiter badius*	Shikara	LC
14	Falconidae	35.*Falco tinnunculus*	Common Kestrel	LC
IX	**Coraciiformes**			
15	Coraciidae	36.*Coracias benghalensis*	Indian Roller	LC
16	Megalaimidae	37.*Megalaima haemancephala*	Coppersmith Barbet	LC
17	Meropidae	38.*Merops orientalis*	Little Green Bee-eater	LC
		39.*M. philippinus*	Blue-tailed Bee-eater	LC
18	Alcedinidae	40.*Alcedo atthis*	Common Kingfisher	LC
19	Halcyonidae	41.*Halcyon smyrnensis*	White-throated Kingfisher	LC
		42.*H. pileata*	Black-capped Kingfisher	LC
X	**Cuculiformes**			
20	Cuculidae	43.*Cacomantis merulinus*	Plaintive Cuckoo	LC
21	Centropodidae	44.*Centropus sinensis*	Greater Coucal	LC
XI	**Apodiformes**			
22	Apodidae	45.*Cypsiurus balasiensis*	Asian Palm Swift	LC
23	Hemiprocnidae	46.*Hemiprone coronata*	Crested Treeswift	LC
XII	**Piciformes**			
24	Picidae	47.*Iynx torquilla*	Eurasian Wryneck	LC
XIII	**Passeriformes**			
25	Artamidae	48.*Artamus fuscus*	Ashy woodswallow	LC
26	Aegithinidae	49.*Aegithina tiphia*	Common Iora	LC
27	Rhipiduridae	50.*Rhipidura albicollis*	White-throated Fantail	LC
28	Columbidae	51.*Columba livia*	Rock Pigeon	LC
		52.*Streptopelia chinensis*	Spotted Dove	LC
		53.*S. tranquebarica*	Red-collared Dove	LC
29	Laniidae	54.*Lanius cristatus*	Brown Shrike	LC
30	Covidae	55.*Corvus splendens*	House Crow	LC
		56.*C. macrobrynchos*	Large-billed Crow	LC
		57.*Dicrurus macrocercus*	Black Drongo	LC
		58.*Rhipidura albicollis*	White-throated Fantail	LC

	Order / Family	Scientific Name	Common Name	IUCN Redlist Status
31	Muscicapidae	59.*Copsychus saularis*	Oriental Magpie Robin	LC
		60.*Saxicola maura*	Siberian Stonechat	Not evaluated
		61.*S. caprata*	Pied Bushchat	LC
32	Sturnidae	62.*Acridotheres tristis*	Common Myna	LC
		63.*A. fuscus*	Jungle Myna	LC
		64.*A.burmannicus*	Vinous-breasted Myna	LC
		65.*Gracupica contra*	Asian Pied Starling	LC
		66.*Sturnus malabaricus*	Chestnut-tailed starling	LC
33	Alaudidae	67.*Alauda gulaula*	Oriental Skylark	LC
34	Hirundinidae	68.*Riparia paludicola*	Plain Martin	LC
		69.*Hirundo rustica*	Barn Swallow	LC
35	Pycnonotidae	70.*Pycnonotus cafer*	Red-vented Bulbul	LC
		71.*P. jocosus*	Red-whiskered Bulbul	LC
		72.*P.blafordi*	Streak-eared Bulbul	LC
36	Cisticolidae	73.*Cisticola juncidis*	Zitting Cisticola	LC
		74.*Orthotomus sutorius*	Common tailordbird	LC
37	Sylviidae	75.*Prinia inornata*	Plain Prinia	LC
		76.*P.hodgsonii*	Grey-breasted Prinia	LC
		77.*P. flaviventris*	Yellow-bellied Prinia	LC
		78.*Acrocephalus orientalis*	Oriental Reed Warbler	Not evaluated
		79.*Phylloscopus fuscatus*	Dusky Warbler	LC
38	Tamaliidae	80.*Timalia pileata*	Chestnut-capped Babbler	LC
		81.*Turdoides gularis*	White-throated Babbler	LC
		82.*Chrysomma sinense*	Yellow-eyed Babbler	LC
39	Passeridae	83.*Motacilla alba*	White-wagtail	LC
		84.*M. flava*	Yellow Wagtail	LC
		85.*Passer domesticus*	House Sparrow	LC
		86.*P. montanus*	Eurasian Tree Sparrow	LC
40	Ploceidae	87.*Ploceus philippinus*	Baya Weaver	LC
		88.*P.hypoxanthus*	Asian Golden Weaver	NT
		89.*Lonchua punctulata*	Scaly-breasted Munia	LC
		90.*L. atricapilla*	Chestnut Munia	LC
		91.*L. malacca*	Black-headed Munia	LC

Source: SEZ Management Committee study

Table 22 Prevalence of Avi-Fauna in Dry and Rainy Season

No.	Scientific Name	Cool Dry Season	Rainy Season
1	*Tadorna ferruginea*	4	-
2	*Nettapus coromandelianus*	10	4
3	*Dendrocygna javanica*	1010	18
4	*Tachybaptus ruficollis*	2	-
5	*Amaurornis phoenicurus*	3	-
6	*Porzana fusca*	1	-
7	*Gallinula chloropus*	1	-
8	*Metopidius indicus*	1	-
9	*Tringa totanus*	136	-
10	*T. nebularia*	2	-
11	*T. ochropus*	1	-
12	*T. stagnatitis*	3	-
13	*Actitis hypoleucos*	9	-
14	*Charadrius dubius*	5	-
15	*Himantopus himantopus*	5	-
16	*Chlidonias leucopterus*	1	-
17	*Egretta garzetta*	74	30
18	*Mesophoyx intermedia*	-	4
19	*Bubulcus coromandus*	-	17
20	*Ardeola* spp:	52	6
21	*Butorides striatus*	2	2
22	*Ardeoa bacchus*	-	1
23	*Ardea purpurea*	3	4
24	*A alba*	-	13
25	*A cinerea*	4	-
26	*Nycticorax nycticorax*	-	4
27	*Ixobrychus flavicollis*	-	3
28	*I. sinensis*	1	-
29	*Anastomus oscitans*	4	-
30	*Phalacrocorax niger*	1	30

No.	Scientific Name	Cool Dry Season	Rainy Season
31	*Tyto longimembris*	-	1
32	*Milvus migrans*	64	1
33	*Elanus caeruleus*	-	3
34	*Accipiter badius*	1	-
35	*Falco tinnunculus*	2	-
36	*Coracias benghalensis*	2	-
37	*Megalaima haemancephala*	2	-
38	*Merops orientalis*	11	4
39	*M. philippinus*	1	4
40	*Alcedo atthis*	4	-
41	*Halcyon smyrnensis*	4	4
42	*H. pileata*	3	-
43	*Cacomantis merulinus*	1	1
44	*Centropus sinensis*	3	2
45	*Cypsiurus balasiensis*	57	90
46	*Hemiprone coronata*	7	-
47	*Iynx torquilla*	-	1
48	*Artamus fuscus*	-	1
49	*Aegithina tiphia*	-	2
50	*Rhipidura albicollis*	-	2
51	*Columba livia*	-	13
52	*Streptopelia chinensis*	31	36
53	*S. tranquebarica*	1	-
54	*Lanius cristatus*	33	33
55	*Corvus splendens*	49	179
56	*C. macrobrynchos*	7	-
57	*Dicrurus macrocercus*	75	1
58	*Rhipidura albicollis*	5	2
59	*Copsychus saularis*	5	5
60	*Saxicola maura*	8	-
61	*S. caprata*	17	-
62	*Acridotheres tristis*	7	63
63	*A. fuscus*	22	25
64	*A.burmannicus*	-	7
65	*Gracupica contra*	-	2
66	*Sturnus malabaricus*	-	1
67	*Alauda gulaula*	-	1
68	*Riparia paludicola*	6	-
69	*Hirundo rustica*	86	-
70	*Pycnonotus cafer*	7	4
71	*P. jocosus*	3	4
72	*P.blafordi*	-	2
73	*Cisticola juncidis*	-	6
74	*Orthotomus sutorius*	-	5
75	*Prinia inornata*	31	5
76	*P.hodgsonii*	-	-
77	*P. flaviventris*	2	8
78	*Acrocephalus orientalis*	13	2
79	*Phylloscopus fuscatus*	6	-
80	*Timalia pileata*	5	-
81	*Turdoides gularis*	3	3
82	*Chrysomma sinense*	5	3
83	*Motacilla alba*	3	-
84	*M. flava*	1	-
85	*Passer domesticus*	37	13
86	*P. montanus*	20	32
87	*Ploceus philippinus*	85	6
88	*P.hypoxanthus*	7	8
89	*Lonchua punctulata*	-	7
90	*L. atricapilla*	-	5
91	*L. malacca*	6	-
Total number of individuals		**2083**	**733**
Total number of species		**70**	**55**

Source: SEZ Management Committee study

Table 23 Habitat Utilization by Avi-Fauna Species

	Scientific Name	Different study sites				Total
		P	T/B/G	W	M/W	
1	*Tadorna ferruginea*			✓		1
2	*Nettapus coromandelianus*	✓		✓		2
3	*Dendrocygna javanica*			✓	✓	2
4	*Tachybaptus ruficollis*				✓	1
5	*Amaurornis phoenicurus*				✓	1
6	*Porzana fusca*				✓	1
7	*Gallinula chloropus*				✓	1
8	*Metopidius indicus*				✓	1
9	*Tringa totanus*				✓	1
10	*T. nebularia*				✓	1
11	*T. ochropus*				✓	1
12	*T. stagnatitis*				✓	1
13	*Actitis hypoleucos*				✓	1
14	*Charadrius dubius*				✓	1
15	*Himantopus himantopus*				✓	1
16	*Chlidonias leucopterus*		✓			1
17	*Egretta garzetta*	✓	✓		✓	3
18	*Mesophoyx intermedia*	✓			✓	2
19	*Bubulcus coromandus*	✓	✓		✓	3
20	*Ardeola* spp:		✓		✓	2
21	*Butorides striatus*				✓	1
22	*Ardeoa bacchus*	✓			✓	2
23	*Ardea purpurea*	✓	✓		✓	3
24	*A alba*	✓			✓	2
25	*A cinerea*	✓	✓		✓	3
26	*Nycticorax nycticorax*				✓	1
27	*Ixobrychus flavicollis*			✓	✓	2
28	*I. sinensis*		✓		✓	2
29	*Anastomus oscitans*				✓	1
30	*Phalacrocorax niger*	✓	✓		✓	3
31	*Tyto longimembris*		✓			1*
32	*Milvus migrans*					*
33	*Elanus caeruleus*	✓	✓		✓	3
34	*Accipiter badius*	✓	✓		✓	3
35	*Falco tinnunculus*	✓				1
36	*Coracias benghalensis*		✓			1
37	*Megalaima haemancephala*		✓			1
38	*Merops orientalis*		✓			1
39	*M. philippinus*		✓			1
40	*Alcedo atthis*		✓			1
41	*Halcyon smyrnensis*		✓			1**
42	*H. pileata*		✓			1
43	*Cacomantis merulinus*		✓			1
44	*Centropus sinensis*		✓			1
45	*Cypsiurus balasiensis*					*
46	*Hemiprone coronata*					*
47	*Iynx torquilla*		✓			1
48	*Artamus fuscus*		✓			1
49	*Aegithina tiphia*		✓			1
50	*Rhipidura albicollis*		✓			1
51	*Columba livia*	✓	✓			2**
52	*Streptopelia chinensis*	✓	✓			2**
53	*S. tranquebarica*					**
54	*Lanius cristatus*		✓			1**
55	*Corvus splendens*	✓	✓		✓	3**
56	*C. macrobrynchos*		✓			1

	Scientific Name	Different study sites				Total
		P	T/B/G	W	M/W	
57	*Dicrurus macrocercus*	✓	✓		✓	3
58	*Rhipidura albicollis*		✓			1
59	*Copsychus saularis*		✓			1
60	*Saxicola maura*	✓	✓			2
61	*S. caprata*	✓	✓			2
62	*Acridotheres tristis*	✓	✓			2
63	*A. fuscus*	✓	✓			2
64	*A.burmannicus*		✓			1
65	*Gracupica contra*	✓	✓			2
66	*Sturnus malabaricus*	✓				1
67	*Alauda gulaula*	✓				1
68	*Riparia paludicola*					*
69	*Hirundo rustica*					*/ **
70	*Pycnonotus cafer*		✓			1
71	*P. jocosus*		✓			1
72	*P.blafordi*		✓			1
73	*Cisticola juncidis*	✓	✓			2
74	*Orthotomus sutorius*		✓			1
75	*Prinia inornata*	✓	✓			2**
76	*P.hodgsonii*		✓			1
77	*P. flaviventris*	✓	✓			2
78	*Acrocephalus orientalis*		✓			1
79	*Phylloscopus fuscatus*		✓			1
80	*Timalia pileata*		✓			1
81	*Turdoides gularis*		✓			1
82	*Chrysomma sinense*		✓			1
83	*Motacilla alba*				✓	1
84	*M. flava*				✓	1
85	*Passer domesticus*	✓	✓			2*/**
86	*P. montanus*	✓	✓			2*/**
87	*Ploceus philippinus*	✓	✓			2
88	*P.hypoxanthus*	✓	✓			2
89	*Lonchua punctulata*	✓	✓			2
90	*L. atricapilla*	✓	✓			2
91	*L. malacca*		✓			1
Total number of species		**32**	**58**	**4**	**33**	

P= Paddy field; T/B/G = Tree, Bush and Grassland; W= Water; M = March and Wetland
* Aerial ; ** Cable
Source: SEZ Management Committee study

B) **Fish species**

A survey was conducted along the banks of the creeks inland as well as around the fishing villages on the Yangon River and Hwammun River. Fish fauna were collected from local fishermen fishing in particular streams, creeks, and dam.

A total of 8 orders, 24 families representing 31 fish species in project area were recorded, in which 16 were present during the cool dry season and 27 species were present during the rainy season. Habitat typology included 7 species in brackish water, 13 freshwater species, 11 marine species, 1 catadromous species, and 2 brackish/marine species.

Rainy season is the breeding time for the fish species, brackish and marine fishes usually migrate to the fresh water habitats, especially after the first rain. Water temperature changes stimulate the fish to breed in the cooler water. The temperature must be cool, hence, the

frequency and duration of rainy times, and enough rain fall set the time for breeding season and breeding sites. In Myanmar paddy fields can also be an important breeding ground for fish.

Johnius coitor

Johnius belangerii

Puntius chola

Harpadon nehereus

Anabas testudineus

Figure 18Fish Fauna Identified on Site

Table 24 Fish Species Collected and Identified

No.	Order/Family	Scientific Name	Common Name	Local Name	IUCN Redlist Status
I	**Perciformes**				
1	Sciaenidae	1.*Jonhius belangerii*	Belangeri croaker	Nga poke thin	Not evaluated
		2.*Jonhius coitor*	Coitor croaker	Kyuk nga poke thin	LC
2	Channidae	3.*Channa striatus*	Snake head	Nga yant	LC
		4.*Channa punctatus*	Spotted Snake head	Nga pa naw	Not evaluated
3	Gobidae	5.*Grobius nunus*	Gobi	Ka tha poe	Not

No.	Order/Family	Scientific Name	Common Name	Local Name	IUCN Redlist Status
					evaluated
		6.*Glossogobius giuris*	Gobby	Nga pyat hmwe ni	LC
4	Nandidae	7.*Nandus marnoratus*	Cuvier	Nga wet ma	Not evaluated
5	Cichlidae	8.*Oreochromisniloticus*	Mouth breeder	Tod Tilapia	Not evaluated
6	Terapontidae	9.*Terapon jarbua*	Tiger perch	Nga kyar	LC
II	**Cypriniformes**				
7	Bagridae	10.*Mystus gulio*	Long whiskered	Nga zin yaing	LC
8	Cyprinidae	11.*Labeo nandina*	Carplet	Nga ohon thon	NT
		12.*L. rohita*	Rohu	Nga myit chin	LC
		13.*Puntius chola*	Barbus	Nga khone ma	LC
9	Clariidae	14.*Clarias batracus*	Cat fish	Nga khu	LC
III	**Anguilliformes**				
10	Angullidae	15.*Monopterus albus*	Mud eel	Nga shint	KC
		16.*Anguilla bicolor*	Mud eel	Nga lin ban	NT
11	Muraenesocidae	17.*Congresox talabon*	Conger eel	Thin baw pauk	Not evaluated
12	Mugilidae	18.*Mugil corsula*	Mullet	Ka be luu	LC
IV	**Polynemiformes**				
13	Polynemidae	19.*Polynemus paradiseus*	Threadfiah	Nga pone narr	Not evaluated
14	Anabantidae	20.*Anabas testunidieus*	Clibing perch	Nga pyay ma	Data deficient
15	Centropomidae	21.*Lates calcarifer*	Sea perch	Ka katid	Not evaluated
16	Siluridae	22.*Wallago attu*	Fresh water shark	Nga but	NT
17	Belonidae	23.*Belone cancilia*	Gar fish	Nga phaung yoe	LC
18	Exocoetidae	24.*Exocoetus poecilopterus*	Flying fish	Nga pyan	Not evaluated
19	Clupeidae	25.*Tenualosa ilisha*	Hilsa shed	Nga tha lauk	LC
V	**Scopeliformes**				
20	Synodidae	27.*Harpadon nehereus*	Bombay ducks	Nga hnut	Not evaluated
VI	**Cypriniformes**				
21	Arridae	28.*Arius burmanicus*	Sea catfish	Nga yaung	LC
VII	**Tetraodontiformes**				
22	Tetrodontidae	29.*Tetrodon oblangus*	Globe fish	Nga pu tinn	LC
VIII	**Cypriniformes**				
23	Chacidae	30.*Opiathognathus nigronarginathus*	Jaw fish	Nga kyuk phar	Not evaluated

Source: SEZ Management Committee study

Table 25 Fish Species Collected in Dry and Rainy Season

No.	Scientific Name	Cool Dry Season	Raining Season	Habitat
1	*Jonhius belangerii*	✓	-	MF
2	*Jonhius coitor*	✓	✓	MF
3	*Pangasius pangasius* or *Pangasius myanmar*	-	✓	MF
4	*Channa striatus*	✓	✓	FF
5	*Channa punctatus*	✓	✓	FF
6	*Grobius nunus*	-	✓	BF
7	*Glossogobius giuris*	✓	-	MF
8	*Nandus marnoratus*	✓	✓	MF
9	*Oreochromisniloticus*	✓	✓	FF
10	*Terapon jarbua*	✓	-	FF
11	*Mystus gulio*	✓	✓	BF/FF
12	*Labeo nandina*	-	✓	FF
13	*Labeo rohita*	-	✓	FF
14	*Puntius chola*	✓	✓	FF
15	*Clarias batracus*	✓	✓	FF
16	*Monopterus albus*	-	✓	BF
17	*Anguilla bicolor*	✓	✓	BF
18	*Congresox talabon*	✓	-	BF
19	*Mugil corsula*	✓	✓	MF/BF

No.	Scientific Name	Cool Dry Season	Raining Season	Habitat
20	*Polynemus paradiseus*	✓	✓	MF
21	*Anabas testunidieus*	-	✓	FF
22	*Lates calcarifer*	✓	✓	FF
23	*Wallago attu*	-	✓	FF
24	*Belone cancilia*	-	✓	BF
25	*Exocoetus poecilopterus*	-	✓	FF
26	*Tenualosa ilisha*	-	✓	BF/MF
27	*Harpadon nehereus*	-	✓	MF
28	*Arius burmanicus*	-	✓	MF
29	*Tetrodon oblangus*	-	✓	MF
30	*Opiathognathus nigronarginathus*	-	✓	MF
Total number of species		**16**	**26**	

MF=Marine Fish, FF= Fresh water Fish, BF= Brakish water Fish
Source: SEZ Management Committee study

C) **Reptile and Amphibian species**

A total of 19 species comprising 9 families and 3 orders of amphibian and reptiles were observed in the Project Area surveyed during dry cool and rainy season. In the cool dry season, there are 13 species under 11 genera and 8 families. In the rainy season, there are 19 species under 16 genera and 9 families. No species above the IUCN classification of Least Concern were identified. All species recorded are small and are adapted to habitation in microhabitats; their feeding types are mostly insect eaters.

Bronchocela cristatella

Calotes htunwini

Calotes mystaceus

Gekko gecko

Mabuya mulifasciata

Hemidactylus sp.

Amphiesma stolta

Rana macrodactyla

Kaoula pulchara

Polypedates leucomystax

Rana limnocharis

Figure 19Selected Reptiles and Amphibians Identified on Site

Table 26 Amphibian and Reptile Species Identified in Dry and Rainy Seasons

No.	Scientific Name	Scientific Name		Habitat Type	Total No.	IUCN Redlist Status
		Cool dry season	Rainy season			
1	*Calotes versicolar*	✓	✓	Tree	3	Not evaluated
2	*Calotes mystaceous*	✓	✓	Tree	3	Not evaluated

3	*Bronchocela cristatella*	-	✓	Bush	1	Not evaluated
4	*Calotes htunwini*	-	✓	Tree	2	Not evaluated
5	*Hemidactylus frenatus*	✓	✓	Building Wall	2	LC
6	*Gekko gecko*	-	✓	Building	3	Not evaluated
7	*Mabuya multifasciatus*	✓	✓	Roadside	3	Not evaluated
8	*Ptyas mucosus*	✓	✓	Pond	1	Not evaluated
9	*Xenochropis piscata*	✓	✓	Creek	1	Not evaluated
10	*Enhydris enhydris*	✓	✓	Pond	1	LC
11	*Homalopsis buccata*	-	✓	-	2	LC
12	*Amphiasma stolata*	✓	✓	Bush	1	LC
13	*Naja kaouthia*	✓	✓	-	1	LC
14	*Bufo melanostictus*	✓	✓	Near the pond	3	LC
15	*Rana tigerina*	✓	✓	Grass	1	LC
16	*Rana limnocharis*	✓	✓	Bush	2	LC
17	*Rana macrodactylus*	-	✓	Tree	4	Not evaluated
18	*Polypidates lucomystax*	-	✓	Grass	2	LC
19	*Kaoula pulchara*	✓	✓	Near the pond	3	LC
Total numbers of species		**13**	**19**		**39**	

Source: SEZ Management Committee study

D) **Insect species**

Insect species in terms of pure species number and population size, insects are by far the largest category and are a fundamental to most ecosystems. A total of 37 species in 11 families were observed, including 3 orders of butterflies, dragonflies and damselflies, beetles were observed from Thilawa Project Area during dry cool and rainy season. In the dry cool season, there are 14 species under 11 genera, and 5 families. In the rainy season, there are 37 species under 28 genera and 10 families. Recorded diversity is low as it is converted agricultural land without habitat diversity.

Captosilia pyranthe pyranthe

Arhopala aeeta de

Junonia altites

Junonia almana almana

Neurothemis tullia tullia

Brachythemis contaminata

Diplacodes nebulosa

Diplacodes trivialis

Orthetrum sabina.

Sympetrum fonscolombei

Pantala flavescens

Ceriagrion nigroflavum

Figure 20 Selected Insect Species Identified on Site

Table 27 Insect Species Identified

Order	Family	Scientific Name	IUCN Redlist Status
I. Lepidoptera	1. Pieridae	1. *Captopsilia pyranthe pyranthe*	Not evaluated
		2. *Eurema blanda silhetana*	Not evaluated
	2. Danaidae	3. *Danaus limniace limniace*	Not evaluated
		4. *Danaus melanippus hegesippus*	Not evaluated
	3. Nymphalidae	5. *Pseudergolis wedah wedah*	Not evaluated
		6. *Jononia hierta*	LC
		7. *J. almana almana*	LC
		8. *J. atlites*	Not evaluated
		9. *Cupha erymanthis lotis*	Not evaluated
		10. *Hypolimnas anomala anomala*	Not evaluated
	4. Lycaenidae	11. *Arhopala aeeta de*	Not evaluated
II. Odonata	5. Libellulidae	12. *Orthetrum sabina*	LC

Order	Family	Scientific Name	IUCN Redlist Status
		13. *Neurothemis intermedia atalanta*	LC
		14. *Neurothemis tullia tullia*	LC
		15. *Neurothemis inquirendae*	-
		16. *Rhodothemis rufa*	LC
		17. *Brachythemis contaminata*	LC
		18. *Diplacodes nebulosa*	LC
		19. *Diplacodes trivialis*	LC
		20. *Sympetrum fonscolombei*	LC
		21. *Pantala flavescens*	LC
		22. *Trithemis kirbyi kirbyi*	LC
	6. Coenagriidae	23. *Ceriagrion fallax*	LC
		24. *Ceriagrion nigroflavum*	Data deficient
		25. *Coenagrion* sp.	-
		26. *Ischnura senegalensis*	LC
		27. *Crocothemis servilia*	LC
III. Coleoptera	7. Coccinelidae	28. *Coccinella transversalis*	Not evaluated
	8. Chrysomelidae	30. *Aulacophora foveicollis*	Not evaluated
		31. *Aulacophora lewisii*	Not evaluated
		32. *Aspidomorpha miliaris*	Not evaluated
		33. *Sagra* sp.	-
		34. *Lilioceris* sp.	-
		35. *Cassida circumdata*	Not evaluated
		36. *Taiwania citcumdata*	Not evaluated
	9. Canthridae	37. *Cantharis* sp.	-
	10. Buprestidae	38. *Sternocera aequisignata*	Not evaluated

Source: SEZ Management Committee study

Table 28 Insect Species Identified in Dry and Rainy Seasons

No.	Scientific Name	Cool dry season	Rainy Season
1	*Captopsilia pyranthe pyranthe*	✓	✓
2	*Eurema blanda silhetana*	-	✓
3	*Danaus limniace limniace*	-	✓
4	*Danaus melanippus hegesippus*	-	✓
5	*Pseudergolis wedah wedah*	-	✓
6	*Jononia hierta*	-	✓
7	*J. almana almana*	✓	✓
8	*J. atlites*	✓	✓
9	*Cupha erymanthis lotis*	-	✓
10	*Hypolimnas anomala anomala*	-	✓
11	*Arhopala aeeta de*	✓	-
12	*Orthetrum sabina*	✓	✓
13	*Neurothemis intermedia atalanta*	-	✓
14	*Neurothemis tullia tullia*	✓	✓
15	*Neurothemis inquirendae*	-	✓
16	*Rhodothemis rufa*	-	✓
17	*Brachythemis contaminata*	✓	✓
18	*Diplacodes nebulosa*	✓	✓
19	*Diplacodes trivialis*	✓	✓
20	*Sympetrum fonscolombei*	✓	✓
21	*Pantala flavescens*	✓	✓
22	*Trithemis kirbyi kirbyi*	-	✓
23	*Ceriagrion fallax*	✓	✓
24	*Ceriagrion nigroflavum*	✓	✓
25	*Coenagrion* sp.	-	✓
26	*Ischnura senegalensis*	✓	✓
27	*Crocothemis servilia*	-	✓
28	*Coccinella transversalis*	-	✓
29	*Coccinella transversalis*	-	✓
30	*Aulacophora foveicollis*	-	✓
31	*Aulacophora lewisii*	-	✓
32	*Aspidomorpha miliaris*	-	✓
33	*Sagra* sp.	-	✓
34	*Lilioceris* sp.	-	✓

No.	Scientific Name	Cool dry season	Rainy Season
35	*Cassida circumdata*	-	✓
36	*Taiwania citcumdata*	-	✓
37	*Cantharis* sp.	-	✓
38	*Sternocera aequisignata*	-	✓
Total number of species		**14**	**37**

Source: SEZ Management Committee study

1.3.4 Flora Biodiversity

A) Methodology

The floristic data and ecological data collection was conducted in both the cool dry season and the rainy season in the Thilawa SEZ Area . As the environment is continuous across the borders of the Project area, areas both inside and outside of the Project area zone were surveyed. Outside the project zone is referred to as indirect area while the inside of the project zone area is referred to as the direct area. Global Positioning System (GPS) was used to navigate and mark the coordinates of the sample plots.

In order to obtain data to predict tree species composition in the forest and vegetation types, 30x30 meter quadrants were set up and tree species in the plot were identified and population of each species were also counted. Permanent sample plots were made for easy accessibility in both sample seasons. The species identification was carried out by using a key to flowering plants families and appropriate literature while being confirmed by matching with herbarium specimens of Department of Botany, University of Yangon.

To get representative checklists of the mangrove species, plant collection was also carried out by random transect lines along creek and the river bank in the patches of mangrove wherever possible. Specimen collection was made within 10 and 20 meter on either sides of the transect lines. Mangrove vegetation was surveyed at direct impact zones and indirect impact zones according to the method of Whittaker plots (Stohlgren et. al. 1995), for assessing types of vegetation.

A profile pro-forma is used in the sections below to sketch a cross section of the vegetation along the bio-hotspot mangrove area of the construction sites but site's representative plot may be common one and types of species composition in each and every site are same. From the edge of the lowest tide water to the place where maximum reach of the mangrove species. Transect lines were conducted along the area. Sketching profile enables the structure and stem distribution to be visualized, and different canopy level.

In every sites, GPS locations were recorded and 100m transect lines were made along the stream in direct and indirect zones, according to the maximum reach of mangrove vegetation. Each and every plant was recorded; stamped and all stem of multi-stemmed trees were also measured. Heights of the plants were estimated by measuring the height of

human who standing under sample tree.

Mangroves were found in limited areas such as the bank of the creeks and near river only. So the creeks were surveyed by boat at high tide and low tide times and measured the plants on their bank. The profiles of the creeks were sketched 30m crossing including wide of the creeks and until maximum reach of the mangrove and its associate growing. Photographs were taken on each transect and for each species composition.

1) Population of Individual Species (per hectare)

The population of species will show not only the composition of species but also the richness of the species in the study area. According to R.He'dl, M Sva'tek, M. Dancak, Rodzay A.W., M. Salleh A.B., Kamariah A.S.(2009), population of individual species (per hectare) is determined by following formula.

$$Pop\ of\ individual\ species\ = \frac{Total\ Individual\ species}{Total\ Plots\ Area\ (m^2)} \times 10{,}000m^2$$

2) Relative Density of Tree species

The density of a species refers to the numerical representation of its individual and the availability of space in a unit area. The density index shows not only the richness of the taxa but also the relative distribution of the individuals. According to Curtis (1959), the density index is determined by the following formula.

$$Relative\ density\ of\ tree\ species\ = \frac{No\ of\ individual\ species}{Total\ no.of\ all\ individual\ species} \times 100$$

3) Relative frequency of Tree species

The relative frequency of a species refers to the percentage occurrence of its individuals and shows the frequency of different species growing in the study area. The species which fall in high frequency class can be considered as the most common species in the study area. According to Curtis (1959), the relative frequency is determined by the following formula.

$$Relative\ frequency\ of\ tree\ species\ = \frac{Sample\ plots\ with\ Species}{Total\ no.of\ all\ species} \times 100$$

According to Raunkiaer's Law of frequency (1934), each species was grouped into one of five frequency class (FC) quintiles with 1-20% being the rarest and 80-100% being the most dominant. This frequency class also indicates the homogeneity or heterogeneity of the floristic distribution in the study area.

4） Population of tree species by girth at breast height (GBH) class interval

Tree species in GBH class interval is calculated, where:

$$Population\ of\ GBH\ class\ interval\ = \frac{No\ of\ specimens\ at\ GBH\ class\ interval}{Total\ no.of\ all\ specimens} \times 100$$

A low GBH class interval indicates a degraded and secondary forest height. A high GBH class interval indicates primary forest.

5） Tree species in Height class interval

Tree species in Height class interval is calculated, where:

$$Population\ of\ height\ class\ interval\ = \frac{No\ of\ specimens\ at\ height\ interval}{Total\ no.of\ all\ specimens} \times 100$$

Low height class interval indicates a degraded and secondary forest and high height class interval indicates a primary forest.

B) Overview of Flora

The flora in the project area belongs to Asia tropical coastal tidal region. According to WWF Eco-regions (Figure 1-42 below), the study area is situated in the Myanmar coastal mangroves and Myanmar coastal rain forest. Mangrove species grow only in the brackish or salty water and are sensitive to the changes of ecosystem. Since at least colonial times, forest lands in the Project area have been converted to agriculture land and other development activities. The mangroves lining the banks of the rivers and creeks are subject to severe degradation because there is no clear-cut land-use system in the past and mangrove resources have most likely been used in an informal way over the past. Mangroves today are found only in small patches along the creek and river banks.

Today, dominant mangrove species are *Sonneratia caseolaris (L.) Engl., Avicennia spp., Sonneratia apetala Buch.-Ham.,* and *Excoecaria agallocha L.*, which are Irrawaddy Mangroves according to WWF. These species are growing wild in patches along the bank of Yangon River and the creeks which drain into it. Only 9 mangrove species (7 species in direct impact zone and 9 species in indirect impact zone) and 27 mangrove associate species are extant in summer with 4 additional mangroves associate species extant in the rainy season are growing in patches along the bank of creeks and Yangon River.

There were two IUCN Redlist endangered or near threatened species found in the area, *Dalbergia cultrate* Grah. and *Dipterocarpus alatus* Roxb. They do not occur naturally here

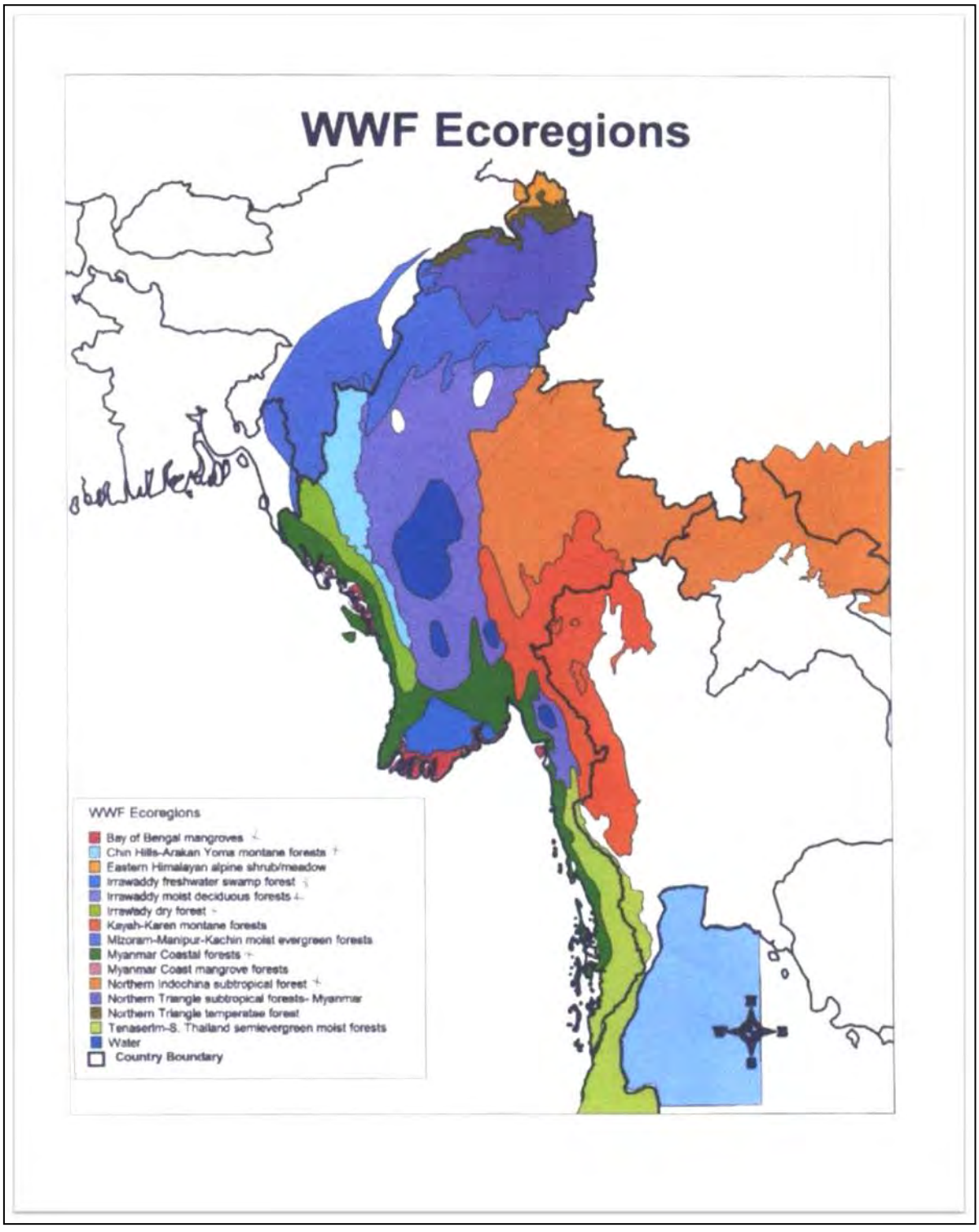
and are both cultivated *ex situ* at monasteries or village homesteads. The location of the *Dipterocarpus alatus* Roxb. specimen may be within the project area itself nearby Phalan village. Steps should be taken to avoid the destruction of this specimen.

Table 29 Endangered or Near Threatened Flora Species

	Scientific Name	Family Name	Vernacular Name	IUCN criteria	Place	Location
1	*Dalbergia cultrata* Grah.*	Fabaceae	Yin-daik	NT	Moekyoswum Monastery	N16° 40' 24.8" E96° 16' 30.9"
2	*Dipterocarpus alatus* Roxb.	Dipterocarpaceae	Kanyin-phyu	EN A1 cd +2cd, B1 +2c	Phalan old village near Thidarmyaing	N16° 38' 20.2" E96° 17' 26.7"

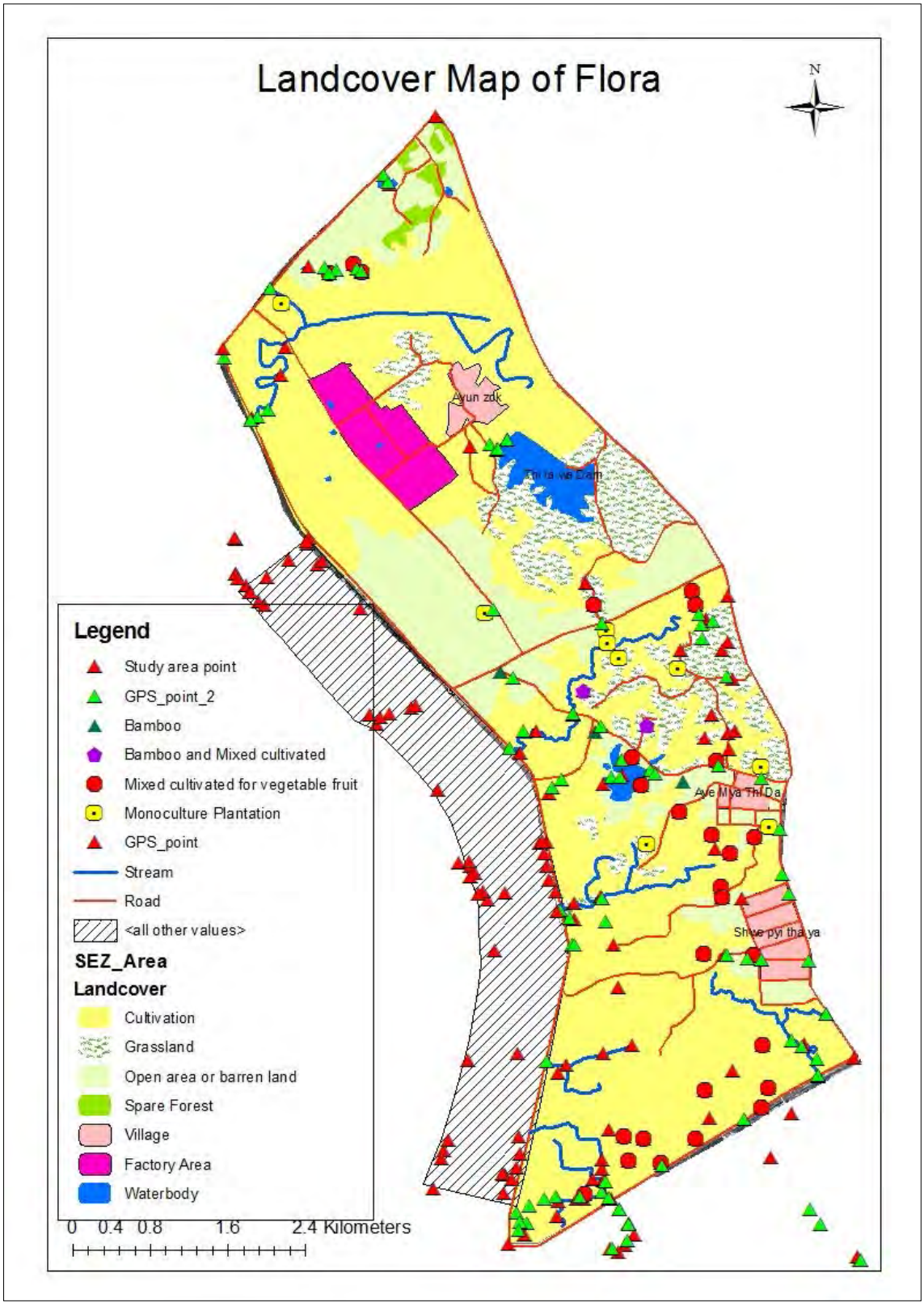
**Dalbergia cultrata* Grah. is listed in the World List of Threatened Trees as Endangered (A1cd).

Source: SEZ Management Committee study



Source: World Wildlife Fund

Figure 21WWF Ecoregions of Myanmar



Source: SEZ Management Committee study

Figure 22Area of Study and Landcover

As indicated in the landcover map (Figure 1-22) above, almost all of the terrestrial

ecosystem in the Project area is covered by agriculture lands. There are also monoculture plantations of *Acacia auriculiformis* A.Cunn., and some bamboo patches as well as a mixed plantation of fruit trees like *Anacardium occidentale* L., found in large patches in the studied area. Ornamental flower cultivation in private orchards is also common in the Project area.

C) Terrestrial Ecosystem

1) Tree Species in Direct Impact Zone





Note: bottom two photos are *Dipterocarpus alatus Roxb.*, (Endangered Species)

Figure 23Mixed Cultivated for Vegetable Fruit (Direct Zone)

The total number of tree species in 24 representative sample plots is 71 species belonging to 64 genera. The dominant tree species is the cultivated species *Acacia auriculiformis A.Cunn.*, (Ma-lay-sia-padauk) followed by *Microcos tomentosa J.E.Smith.,* (Mya-ya), *Anacardium occidentale L.*, (Thi-ho) and *Lannea coromandelica* (Houtt.) Merrr., (Na-be).

Table 30 Tree Species Population (Direct Zone)

	Scientific Name	No. of individual	Total no. of individual/ha	Total no. of population/ha (%)
1	*Acacia auriculiformis* A.Cunn.	*11,369*	*449.13*	*70.90*
2	*Acacia concinna* DC.	*1*	*0.04*	*0.01*
3	*Albizia lebbek* (L.) Benth.	*3*	*0.12*	*0.02*
4	*Anacardium occidentale* L.	*551*	*21.77*	*3.44*
5	*Antidesma* sp.	*21*	*0.83*	*0.13*
6	*Archidendron jiringa* (Jack) Nielsen	*1*	*0.04*	*0.01*
7	*Artocarpus heterophyllus* Lam.	*29*	*1.15*	*0.18*
8	*Azadirachta indica* A.Juss.	*8*	*0.32*	*0.05*
9	*Barringtonia acutangula* Kurz.	*1*	*0.04*	*0.01*
10	*Borassus flabellifer* L.	*12*	*0.47*	*0.07*
11	*Carallia brachiata* (Lour.) Merr	*63*	*2.49*	*0.39*
12	*Careya arborea* Roxb.	*13*	*0.51*	*0.08*
13	*Carica papaya* L.	*3*	*0.12*	*0.02*
14	*Casuarina equisetifolia* Forst.	*4*	*0.16*	*0.02*
15	*Ceiba pentandra* Gaertn.	*33*	*1.30*	*0.21*
16	*Chaetocarpus castanocarpus* Thwaites	*13*	*0.51*	*0.08*
17	*Citharexylum suberratum* Sw.	*1*	*0.04*	*0.01*
18	*Citrus aurantiifolia* (Christm.) Sw.	*2*	*0.08*	*0.01*
19	*Citrus medica* L.	*3*	*0.12*	*0.02*
20	*Cocos nucifera* L.	*18*	*0.71*	*0.11*
21	*Couroupita guianensis*	*1*	*0.04*	*0.01*
22	*Crateva adansonii* DC.	*7*	*0.28*	*0.04*
23	*Delonix regia* (Bojer ex Hook) Rafin.	*4*	*0.16*	*0.02*
24	*Dendrocalamus calostachyus* (Kurz) Kurz	*1*	*0.04*	*0.01*
25	*Dendrocalamus longispathus* (Kurz)Kurz	*44*	*1.74*	*0.27*
26	*Diospyros* sp.	*5*	*0.20*	*0.03*
27	*Dipterocarpus alatus*	*1*	*0.04*	*0.01*
28	*Erythrina crista-galli*	*10*	*0.40*	*0.06*
29	*Eucalyptus ovata* Labill.	*56*	*2.21*	*0.35*
30	*Ficus altissima* Blume	*3*	*0.12*	*0.02*
31	*Ficus hispida* L.	*1*	*0.04*	*0.01*
32	*Ficus lacor* Buch.-Ham.	*1*	*0.04*	*0.01*
33	*Ficus religiosa* L.	*12*	*0.47*	*0.07*
34	*Fluggea leucopyrus* Willd	*1*	*0.04*	*0.01*
35	*Garcinia heterandra* Wall.	*20*	*0.79*	*0.12*
36	*Getonia floribunda* Roxb.	*1*	*0.04*	*0.01*
37	*Gigantochloa nigrociliata* (Buse) Kurz	*48*	*1.90*	*0.30*
38	*Heterophragma adenophyllum* (Willd.) Seem. ex Benth.& Hook.	*100*	*3.95*	*0.62*
39	*Lagerstroemia speciosa* (L.) Pers.	*18*	*0.71*	*0.11*
40	*Lannea coromandelica* (Houtt.) Merrr.	*537*	*21.21*	*3.35*
41	*Mangifera indica* L.	*240*	*9.48*	*1.50*
42	*Markhamia stipulata* (Wall.) Seem.ex K.Schum.	*20*	*0.79*	*0.12*
43	*Microcos tomentosa* J.E.Smith	*1,361*	*53.77*	*8.49*
44	*Mimusops elengi* L.	*2*	*0.08*	*0.01*
45	*Moringa pterygosperma* Gaertn.	*23*	*0.91*	*0.14*
46	*Oroxylum indicum* (L.) Kurz.	*8*	*0.32*	*0.05*
47	*Oxytenanthera albociliata* Munro	*35*	*1.38*	*0.22*
48	*Phyllanthus emblica* L.	*1*	*0.04*	*0.01*
49	*Pithecellobium dulce* (Roxb.) Benth.	*94*	*3.71*	*0.59*
50	*Plumeria obtusa*	*1*	*0.04*	*0.01*

	Scientific Name	No. of individual	Total no. of individual/ha	Total no. of population/ha (%)
51	*Polyalthia longifolia* (Lam.)Benth. & Hook.f.	*1*	*0.04*	*0.01*
52	*Psidium guajava* L.	*34*	*1.34*	*0.21*
53	*Pterocarpus macrocarpus* Kurz	*5*	*0.20*	*0.03*
54	*Pterospermum semisagittatum* Buch.-Ham.	*4*	*0.16*	*0.02*
55	*Randia erythroclada* Kurz.	*500*	*19.75*	*3.12*
56	*Samanea saman* (Jacq.) Merr.	*31*	*1.22*	*0.19*
57	*Sandoricum koetjape* (Burm.f.) Merr.	*1*	*0.04*	*0.01*
58	*Schleichera oleosa* (Lour.) Oken	*5*	*0.20*	*0.03*
59	*Senna siamea* (Lam.) Irwin & Barneby	*1*	*0.04*	*0.01*
60	*Sesbania grandiflora* (L.) Poir.	*19*	*0.75*	*0.12*
61	*Simarouba glauca* DC.	*25*	*0.99*	*0.16*
62	*Spondias pinnata* (L.)Kurz.	*4*	*0.16*	*0.02*
63	*Streblus asper* Lour.	*22*	*0.87*	*0.14*
64	*Syzygium grande* (Wight) Walp	*495*	*19.56*	*3.09*
65	*Tamarindus indica* L.	*9*	*0.36*	*0.06*
66	*Tectona grandis* L. f.	*2*	*0.08*	*0.01*
67	*Terminalia bellirica* (Gaertn) Roxb.	*15*	*0.59*	*0.09*
68	*Terminalia catappa* L.	*3*	*0.12*	*0.02*
69	*Thyrsostachys siamensis* (Kurz ex Munro) Gamble	*9*	*0.36*	*0.06*
70	*Uvaria cordata* Schum. & Thonn.	*20*	*0.79*	*0.12*
71	*Zizyphus jujuba* Lam.	*26*	*1.03*	*0.16*
	Total	**16,036**	**633.50**	**100.00**

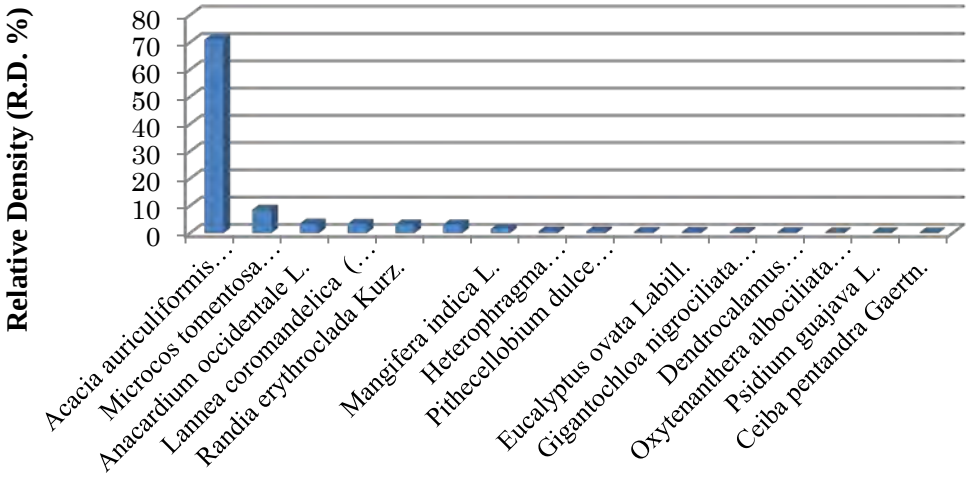
Source: SEZ Management Committee study

Among the sample plots species density per hectare varied and the highest density was observed *Acacia auriculiformis A.Cunn.*, followed by *Microcos tomentosa J.E.Smith.*,. This shows that these two species are abundant in this area.

Table 31 Tree Density (Direct Zone)

	Scientific Name	Density (D)	Relative Density (R.D. %)
1	*Acacia auriculiformis* A.Cunn.	473.71	70.90
2	*Microcos tomentosa* J.E.Smith	56.71	8.49
3	*Anacardium occidentale* L.	22.96	3.44
4	*Lannea coromandelica* (Houtt.) Merrr.	22.38	3.35
5	*Randia erythroclada* Kurz.	20.83	3.12
6	*Syzygium grande* (Wight) Walp	20.63	3.09
7	*Mangifera indica* L.	10.00	1.50
8	*Heterophragma adenophyllum* (Willd.)Seem. ex Benth.& Hook.	4.17	0.62
9	*Pithecellobium dulce* (Roxb.) Benth.	3.92	0.59
10	*Carallia brachiata* (Lour.) Merr	2.63	0.39
11	*Eucalyptus ovata* Labill.	2.33	0.35
12	*Gigantochloa nigrociliata* (Buse) Kurz	2.00	0.30
13	*Dendrocalamus longispathus* (Kurz)Kurz	1.83	0.27
14	*Oxytenanthera albociliata* Munro	1.46	0.22
15	*Psidium guajava* L.	1.42	0.21
16	*Ceiba pentandra* Gaertn.	1.38	0.21
17	*Samanea saman* (Jacq.) Merr.	1.29	0.19
18	*Artocarpus heterophyllus* Lam.	1.21	0.18
19	*Zizyphus jujuba* Lam.	1.08	0.16
20	*Simarouba glauca* DC.	1.04	0.16
21	*Moringa pterygosperma* Gaertn.	0.96	0.14
22	*Streblus asper* Lour.	0.92	0.14
23	*Antidesma* sp.	0.88	0.13
24	*Garcinia heterandra* Wall.	0.83	0.12
25	*Markhamia stipulata* (Wall.) Seem.ex K.Schum.	0.83	0.12
26	*Uvaria cordata* Schum. & Thonn.	0.83	0.12
27	*Sesbania grandiflora* (L.) Poir.	0.79	0.12
28	*Cocos nucifera* L.	0.75	0.11
29	*Lagerstroemia speciosa* (L.) Pers.	0.75	0.11
30	*Terminalia bellirica* (Gaertn) Roxb.	0.63	0.09

	Scientific Name	Density (D)	Relative Density (R.D. %)
31	*Careya arborea* Roxb.	0.54	0.08
32	*Chaetocarpus castanocarpus* Thwaites	0.54	0.08
33	*Borassus flabellifer* L.	0.50	0.07
34	*Ficus religiosa* L.	0.50	0.07
35	*Erythrina crista-galli*	0.42	0.06
36	*Tamarindus indica* L.	0.38	0.06
37	*Thyrsostachys siamensis* (Kurz ex Munro) Gamble	0.38	0.06
38	*Azadirachta indica* A.Juss.	0.33	0.05
39	*Oroxylum indicum* (L.) Kurz.	0.33	0.05
40	*Crateva adansonii* DC.	0.29	0.04
41	*Diospyros* sp.	0.21	0.03
42	*Pterocarpus macrocarpus* Kurz	0.21	0.03
43	*Schleichera oleosa* (Lour.) Oken	0.21	0.03
44	*Casuarina equisetifolia* Forst.	0.17	0.02
45	*Delonix regia* (Bojer ex Hook) Rafin.	0.17	0.02
46	*Pterospermum semisagittatum* Buch.-Ham.	0.17	0.02
47	*Spondias pinnata* (L.)Kurz.	0.17	0.02
48	*Albizia lebbek* (L.) Benth.	0.13	0.02
49	*Carica papaya* L.	0.13	0.02
50	*Citrus medica* L.	0.13	0.02
51	*Ficus altissima* Blume	0.13	0.02
52	*Terminalia catappa* L.	0.13	0.02
53	*Citrus aurantiifolia* (Christm.) Sw.	0.08	0.01
54	*Mimusops elengi* L.	0.08	0.01
55	*Tectona grandis* L. f.	0.08	0.01
56	*Acacia concinna* DC.	0.04	0.01
57	*Archidendron jiringa* (Jack) Nielsen	0.04	0.01
58	*Barringtonia acutangula* Kurz.	0.04	0.01
59	*Citharexylum suberratum* Sw.	0.04	0.01
60	*Couroupita guianensis*	0.04	0.01
61	*Dendrocalamus calostachyus* (Kurz) Kurz	0.04	0.01
62	*Dipterocarpus alatus*	0.04	0.01
63	*Ficus hispida* L.	0.04	0.01
64	*Ficus lacor* Buch.-Ham.	0.04	0.01
65	*Fluggea leucopyrus* Willd	0.04	0.01
66	*Getonia floribunda* Roxb.	0.04	0.01
67	*Phyllanthus emblica* L.	0.04	0.01
68	*Plumeria obtusa*	0.04	0.01
69	*Polyalthia longifolia* (Lam.)Benth. & Hook.f.	0.04	0.01
70	*Sandoricum koetjape* (Burm.f.) Merr.	0.04	0.01
71	*Senna siamea* (Lam.) Irwin & Barneby	0.04	0.01



Source: SEZ Management Committee study

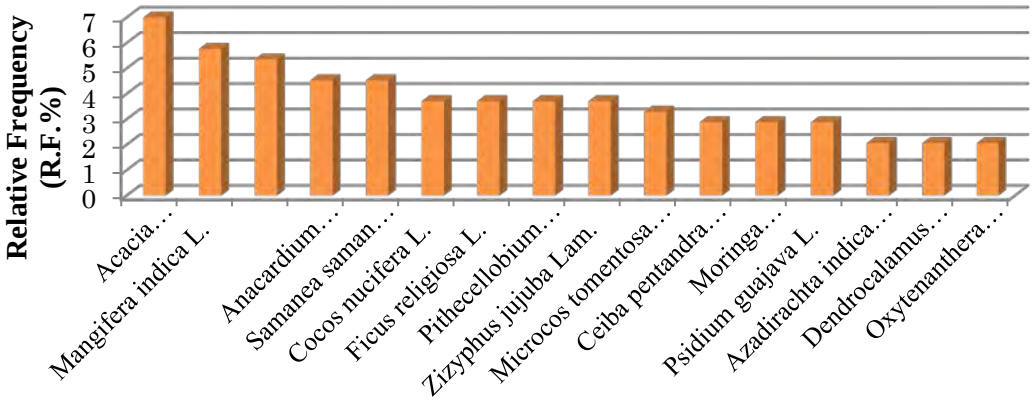
Relative frequency is the frequency of one species compared to the total frequency of all the species. According the results, the cultivated *Acacia auriculiformis* A.Cunn., *(7%), Mangifera*

indica L.*, (6%), Syzygium grande (Wight)* Walp.*, (5.3%), Anacardium occidentale L.,* and *Samanea saman (*Jacq.) Merr.*,* had high equally relative frequency value (4.53%) followed by *Cocos nucifera* L.*, Ficus religiosa* L.*, Pithecellobium dulce* (Roxb.) *Benth.,* and *Zizyphus jujuba* Lam.*,* had equally (4%) respectively. Therefore these species occur everywhere in the study area.

Table 32 Tree Frequency (Direct Zone)

	Scientific Name	Frequency (F)	Relative Frequency (R.F. %)
1	*Acacia auriculiformis* A.Cunn.	0.71	7.00
2	*Mangifera indica* L.	0.58	5.76
3	*Syzygium grande* (Wight) Walp	0.54	5.35
4	*Anacardium occidentale* L.	0.46	4.53
5	*Samanea saman* (Jacq.) Merr.	0.46	4.53
6	*Cocos nucifera* L.	0.38	3.70
7	*Ficus religiosa* L.	0.38	3.70
8	*Pithecellobium dulce* (Roxb.) Benth.	0.38	3.70
9	*Zizyphus jujuba* Lam.	0.38	3.70
10	*Microcos tomentosa* J.E.Smith	0.33	3.29
11	*Ceiba pentandra* Gaertn.	0.29	2.88
12	*Moringa pterygosperma* Gaertn.	0.29	2.88
13	*Psidium guajava* L.	0.29	2.88
14	*Azadirachta indica* A.Juss.	0.21	2.06
15	*Dendrocalamus longispathus* (Kurz)Kurz	0.21	2.06
16	*Oxytenanthera albociliata* Munro	0.21	2.06
17	*Tamarindus indica* L.	0.21	2.06
18	*Artocarpus heterophyllus* Lam.	0.17	1.65
19	*Borassus flabellifer* L.	0.17	1.65
20	*Lannea coromandelica* (Houtt.) Merrr.	0.17	1.65
21	*Pterocarpus macrocarpus* Kurz	0.17	1.65
22	*Sesbania grandiflora* (L.) Poir.	0.17	1.65
23	*Albizia lebbek* (L.) Benth.	0.13	1.23
24	*Careya arborea* Roxb.	0.13	1.23
25	*Gigantochloa nigrociliata* (Buse) Kurz	0.13	1.23
26	*Lagerstroemia speciosa* (L.) Pers.	0.13	1.23
27	*Oroxylum indicum* (L.) Kurz.	0.13	1.23
28	*Spondias pinnata* (L.)Kurz.	0.13	1.23
29	*Streblus asper* Lour.	0.13	1.23
30	*Antidesma* sp.	0.08	0.82
31	*Carallia brachiata* (Lour.) Merr	0.08	0.82
32	*Citrus aurantiifolia* (Christm.) Sw.	0.08	0.82
33	*Crateva adansonii* DC.	0.08	0.82
34	*Delonix regia* (Bojer ex Hook) Rafin.	0.08	0.82
35	*Eucalyptus ovata* Labill.	0.08	0.82
36	*Ficus altissima* Blume	0.08	0.82
37	*Mimusops elengi* L.	0.08	0.82
38	*Thyrsostachys siamensis* (Kurz ex Munro) Gamble	0.08	0.82
39	*Acacia concinna* DC.	0.04	0.41
40	*Archidendron jiringa* (Jack) Nielsen	0.04	0.41
41	*Barringtonia acutangula* Kurz.	0.04	0.41
42	*Carica papaya* L.	0.04	0.41
43	*Casuarina equisetifolia* Forst.	0.04	0.41
44	*Chaetocarpus castanocarpus* Thwaites	0.04	0.41
45	*Citharexylum suberratum* Sw.	0.04	0.41
46	*Citrus medica* L.	0.04	0.41
47	*Couroupita guianensis*	0.04	0.41
48	*Dendrocalamus calostachyus* (Kurz) Kurz	0.04	0.41
49	*Diospyros* sp.	0.04	0.41
50	*Dipterocarpus alatus*	0.04	0.41
51	*Erythrina crista-galli*	0.04	0.41
52	*Ficus hispida* L.	0.04	0.41
53	*Ficus lacor* Buch.-Ham.	0.04	0.41

	Scientific Name	Frequency (F)	Relative Frequency (R.F. %)
54	*Fluggea leucopyrus* Willd	0.04	0.41
55	*Garcinia heterandra* Wall.	0.04	0.41
56	*Getonia floribunda* Roxb.	0.04	0.41
57	*Heterophragma adenophyllum* (Willd.)Seem. ex Benth.& Hook.	0.04	0.41
58	*Markhamia stipulata* (Wall.) Seem.ex K.Schum.	0.04	0.41
59	*Phyllanthus emblica* L.	0.04	0.41
60	*Plumeria obtusa*	0.04	0.41
61	*Polyalthia longifolia* (Lam.)Benth. & Hook.f.	0.04	0.41
62	*Pterospermum semisagittatum* Buch.-Ham.	0.04	0.41
63	*Randia erythroclada* Kurz.	0.04	0.41
64	*Sandoricum koetjape* (Burm.f.) Merr.	0.04	0.41
65	*Schleichera oleosa* (Lour.) Oken	0.04	0.41
66	*Senna siamea* (Lam.) Irwin & Barneby	0.04	0.41
67	*Simarouba glauca* DC.	0.04	0.41
68	*Tectona grandis* L. f.	0.04	0.41
69	*Terminalia bellirica* (Gaertn) Roxb.	0.04	0.41
70	*Terminalia catappa* L.	0.04	0.41
71	*Uvaria cordata* Schum. & Thonn.	0.04	0.41



Source: SEZ Management Committee study

In order to clarify the homogeneity and heterogeneity of the floristic distribution in the area, the species distribution by frequency class was examined. According to the outcome of the frequency classes, only one species are in a higher frequency class and the rest of the identified species are in a low to intermediate frequency class. This shows that this area is floristically high degree of heterogeneity while dominated by *Acacia auriculiformis* A.Cunn., as mentioned above.

Table 33 Tree Species Distribution by Frequency Class (Direct Zone)

Frequency class	No. of species
1-20 %	54
20-40%	12
40-60%	4
60-80%	1
80-100%	0

2） Tree Species in Indirect Impact Zone

Note: Bottom 2 photos are *Dalbergia cultrata* Grah. (Endangered species)

Figure 24Mixed Cultivated for Vegetable Fruit (Indirect Zone)

The total number of tree species in 3 representative sample plots is 52 species belonging to 34 genera. The dominant tree species is the cultivate species *Acacia auriculiformis A.Cunn., (Malay-sia-padauk) followed by Anacardium occidentale L., (Thi-ho)* and *Microcos tomentosa J.E.Smith.*, *(Mya-ya)*.

Table 34 Tree Species Population (Indirect Zone)

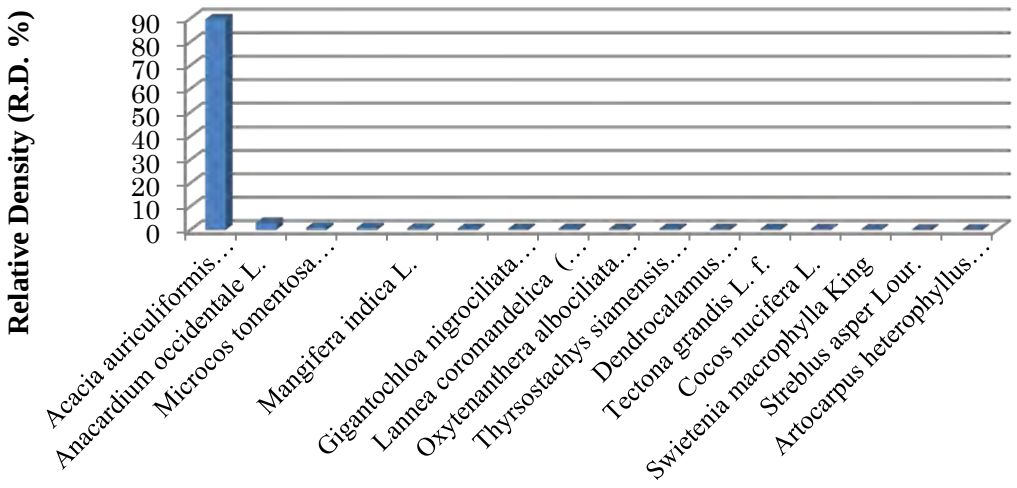
	Scientific Name	No. of individual	Total no. of individual/ha	Total no. of population/ha (%)
1	*Anacardium occidentale* L.	350	31.25	3.04
2	*Acacia auriculiformis* A.Cunn.	10,310	920.54	89.61
3	*Annona squamosa* L.	4	0.36	0.03
4	*Artocarpus heterophyllus* Lam.	10	0.89	0.09
5	*Baccaurea sapida* Muell. Arg.	3	0.27	0.03
6	*Bambusa wamin* E.G. Camus	1	0.09	0.01
7	*Bouea burmanica* Griff.	3	0.27	0.03
8	*Caesalpinia sappan* L.	2	0.18	0.02
9	*Carallia brachiata* (Lour.) Merr	50	4.46	0.43
10	*Careya arborea* Roxb.	10	0.89	0.09
11	*Casacabla thevetia*	1	0.09	0.01
12	*Ceiba pentandra* Gaertn.	9	0.80	0.08
13	*Cephalostachyum pergracile* Munro	2	0.18	0.02
14	*Cocos nucifera* L.	35	3.13	0.30
15	*Cordia myxa* L.	5	0.45	0.04
16	*Couroupita guianensis*	1	0.09	0.01
17	*Dalbergia cultrata* Grah.	5	0.45	0.04
18	*Delonix regia* (Bojer ex Hook) Rafin.	5	0.45	0.04
19	*Dendrocalamus brandisii* (Munro) Kurz	3	0.27	0.03
20	*Dendrocalamus longispathus* (Kurz) Kurz	40	3.57	0.35
21	*Diospyros variegata* Kurz	4	0.36	0.03
22	*Ficus altissima* Blume	1	0.09	0.01
23	*Ficus hispida* L.	5	0.45	0.04
24	*Ficus religiosa* L.	6	0.54	0.05
25	*Garcinia cowa* Roxb.	10	0.89	0.09
26	*Gigantochloa nigrociliata* (Buse) Kurz	50	4.46	0.43
27	*Hevea brasiliensis* (Willd. ex A. Juss.) Muell. Arg.	2	0.18	0.02
28	*Lannea coromandelica* (Houtt.) Merrr.	50	4.46	0.43
29	*Mangifera indica* L.	69	6.16	0.60
30	*Mesua ferrea* L.	4	0.36	0.03
31	*Microcos tomentosa* J.E.Smith	102	9.11	0.89
32	*Millettia atropurpurea* Dunn.	1	0.09	0.01
33	*Mimusops elengi* L.	6	0.54	0.05
34	*Moringa pterygosperma* Gaertn.	5	0.45	0.04
35	*Oxytenanthera albociliata* Munro	50	4.46	0.43
36	*Phyllanthus emblica* L.	1	0.09	0.01
37	*Pithecellobium dulce* (Roxb.) Benth.	4	0.36	0.03
38	*Psidium guajava* L.	3	0.27	0.03
39	*Pterocarpus macrocarpus* Kurz	5	0.45	0.04
40	*Samanea saman* (Jacq.) Merr.	9	0.80	0.08
41	*Sandoricum koetjape* (Burm.f.) Merr.	2	0.18	0.02
42	*Senna siamea* (Lam.) Irwin & Barneby	5	0.45	0.04
43	*Tectona grandis* L. f.	40	3.57	0.35
44	*Streblus asper* Lour.	11	0.98	0.10
45	*Swietenia macrophylla* King	30	2.68	0.26
46	*Syzygium grande* (Wight) Walp	101	9.02	0.88
47	*Tamarindus indica* L.	10	0.89	0.09
48	*Terminalia catappa* L.	6	0.54	0.05
49	*Terminalia chebula* Retz.	1	0.09	0.01
50	*Thyrsostachys siamensis* (Kurz ex Munro) Gamble	50	4.46	0.43
51	*Xylia xylocarpa* (Roxb.) Taub.	10	0.89	0.09
52	*Zizyphus jujuba* Lam.	3	0.27	0.03
	Total	**11,505**	**1,027.23**	**100.00**

Source: SEZ Management Committee study

Among the sample plots species density per hectare varied and the highest density was observed *Acacia auriculiformis A.Cunn.*, followed by *Anacardium occidentale L.*,. This indicates that these two species are abundant in this area.

Table 35 Tree Species Relative Density (Indirect Zone)

	Scientific Name	Density (D)	Relative Density (R.D. %)
1	*Acacia auriculiformis* A.Cunn.	3,436.67	89.61
2	*Anacardium occidentale* L.	116.67	3.04
3	*Microcos tomentosa* J.E.Smith	34.00	0.89
4	*Syzygium grande* (Wight) Walp	33.67	0.88
5	*Mangifera indica* L.	23.00	0.60
6	*Carallia brachiata* (Lour.) Merr	16.67	0.43
7	*Gigantochloa nigrociliata* (Buse) Kurz	16.67	0.43
8	*Lannea coromandelica* (Houtt.) Merrr.	16.67	0.43
9	*Oxytenanthera albociliata* Munro	16.67	0.43
10	*Thyrsostachys siamensis* (Kurz ex Munro) Gamble	16.67	0.43
11	*Dendrocalamus longispathus* (Kurz) Kurz	13.33	0.35
12	*Tectona grandis* L. f.	13.33	0.35
13	*Cocos nucifera* L.	11.67	0.30
14	*Swietenia macrophylla* King	10.00	0.26
15	*Streblus asper* Lour.	3.67	0.10
16	*Artocarpus heterophyllus* Lam.	3.33	0.09
17	*Careya arborea* Roxb.	3.33	0.09
18	*Garcinia cowa* Roxb.	3.33	0.09
19	*Tamarindus indica* L.	3.33	0.09
20	*Xylia xylocarpa* (Roxb.) Taub.	3.33	0.09
21	*Ceiba pentandra* Gaertn.	3.00	0.08
22	*Samanea saman* (Jacq.) Merr.	3.00	0.08
23	*Ficus religiosa* L.	2.00	0.05
24	*Mimusops elengi* L.	2.00	0.05
25	*Terminalia catappa* L.	2.00	0.05
26	*Cordia myxa* L.	1.67	0.04
27	*Dalbergia cultrata* Grah.	1.67	0.04
28	*Delonix regia* (Bojer ex Hook) Rafin.	1.67	0.04
29	*Ficus hispida* L.	1.67	0.04
30	*Moringa pterygosperma* Gaertn.	1.67	0.04
31	*Pterocarpus macrocarpus* Kurz	1.67	0.04
32	*Senna siamea* (Lam.) Irwin & Barneby	1.67	0.04
33	*Annona squamosa* L.	1.33	0.03
34	*Diospyros variegata* Kurz	1.33	0.03
35	*Mesua ferrea* L.	1.33	0.03
36	*Pithecellobium dulce* (Roxb.) Benth.	1.33	0.03
37	*Baccaurea sapida* Muell. Arg.	1.00	0.03
38	*Bouea burmanica* Griff.	1.00	0.03
39	*Dendrocalamus brandisii* (Munro) Kurz	1.00	0.03
40	*Psidium guajava* L.	1.00	0.03
41	*Zizyphus jujuba* Lam.	1.00	0.03
42	*Caesalpinia sappan* L.	0.67	0.02
43	*Cephalostachyum pergracile* Munro	0.67	0.02
44	*Hevea brasiliensis* (Willd. ex A. Juss.) Muell. Arg.	0.67	0.02
45	*Sandoricum koetjape* (Burm.f.) Merr.	0.67	0.02
46	*Bambusa wamin* E.G. Camus	0.33	0.01
47	*Casacabla thevetia*	0.33	0.01
48	*Couroupita guianensis*	0.33	0.01
49	*Ficus altissima* Blume	0.33	0.01
50	*Millettia atropurpurea* Dunn.	0.33	0.01
51	*Phyllanthus emblica* L.	0.33	0.01
52	*Terminalia chebula* Retz.	0.33	0.01



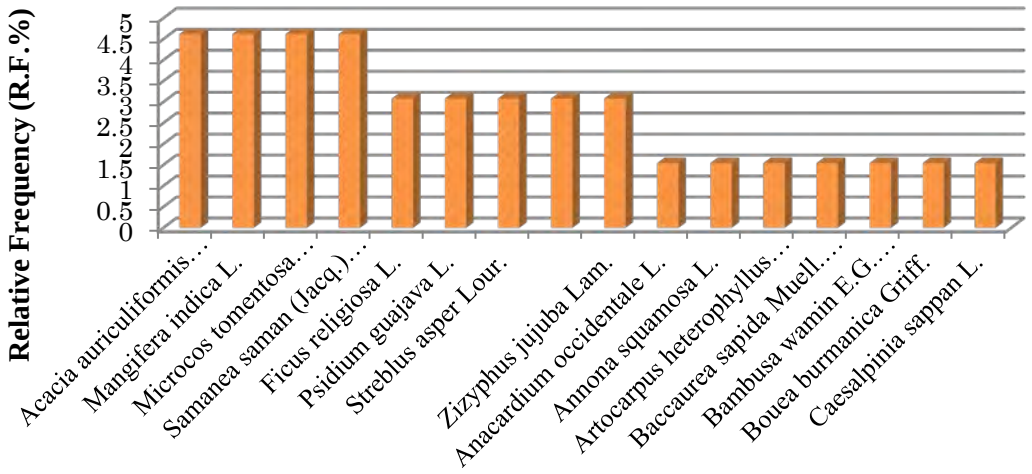
Source: SEZ Management Committee study

Relative frequency is the frequency of one species compared to the total frequency of all the species. According to the results, A*cacia auriculiformis* A.Cunn*., Mangifera indica L., Microcos tomentosa* J.E.Smith., and *Samanea saman* (Jacq.) Merr., had high equally relative frequency value (4.62 %) followed by *Ficus religiosa* L*., Psidium guajava* L*., Streblus asper Lour., Syzygium grande* (Wight) Walp*.,* and *Zizyphus jujuba* Lam., had equally value (3.08%) respectively. These species occur very often in the study area.

Table 36 Tree Species Relative Frequency (Indirect Zone)

	Scientific Name	Frequency (F)	Relative Frequency (R.F.%)
1	*Acacia auriculiformis* A.Cunn.	1.00	4.62
2	*Mangifera indica* L.	1.00	4.62
3	*Microcos tomentosa* J.E.Smith	1.00	4.62
4	*Samanea saman* (Jacq.) Merr.	1.00	4.62
5	*Ficus religiosa* L.	0.67	3.08
6	*Psidium guajava* L.	0.67	3.08
7	*Streblus asper* Lour.	0.67	3.08
8	*Syzygium grande* (Wight) Walp	0.67	3.08
9	*Zizyphus jujuba* Lam.	0.67	3.08
10	*Anacardium occidentale* L.	0.33	1.54
11	*Annona squamosa* L.	0.33	1.54
12	*Artocarpus heterophyllus* Lam.	0.33	1.54
13	*Baccaurea sapida* Muell. Arg.	0.33	1.54
14	*Bambusa wamin* E.G. Camus	0.33	1.54
15	*Bouea burmanica* Griff.	0.33	1.54
16	*Caesalpinia sappan* L.	0.33	1.54
17	*Carallia brachiata* (Lour.) Merr	0.33	1.54
18	*Careya arborea* Roxb.	0.33	1.54
19	*Casacabla thevetia*	0.33	1.54
20	*Ceiba pentandra* Gaertn.	0.33	1.54
21	*Cephalostachyum pergracile* Munro	0.33	1.54
22	*Cocos nucifera* L.	0.33	1.54
23	*Cordia myxa* L.	0.33	1.54
24	*Couroupita guianensis*	0.33	1.54
25	*Dalbergia cultrata* Grah.	0.33	1.54
26	*Delonix regia* (Bojer ex Hook) Rafin.	0.33	1.54
27	*Dendrocalamus brandisii* (Munro) Kurz	0.33	1.54
28	*Dendrocalamus longispathus* (Kurz) Kurz	0.33	1.54
29	*Diospyros variegata* Kurz	0.33	1.54
30	*Ficus altissima* Blume	0.33	1.54
31	*Ficus hispida* L.	0.33	1.54

32	*Garcinia cowa* Roxb.	0.33	1.54
33	*Gigantochloa nigrociliata* (Buse) Kurz	0.33	1.54
34	*Hevea brasiliensis* (Willd. ex A. Juss.) Muell. Arg.	0.33	1.54
35	*Lannea coromandelica* (Houtt.) Merrr.	0.33	1.54
36	*Mesua ferrea* L.	0.33	1.54
37	*Millettia atropurpurea* Dunn.	0.33	1.54
38	*Mimusops elengi* L.	0.33	1.54
39	*Moringa pterygosperma* Gaertn.	0.33	1.54
40	*Oxytenanthera albociliata* Munro	0.33	1.54
41	*Phyllanthus emblica* L.	0.33	1.54
42	*Pithecellobium dulce* (Roxb.) Benth.	0.33	1.54
43	*Pterocarpus macrocarpus* Kurz	0.33	1.54
44	*Sandoricum koetjape* (Burm.f.) Merr.	0.33	1.54
45	*Senna siamea* (Lam.) Irwin & Barneby	0.33	1.54
46	*Tectona grandis* L. f.	0.33	1.54
47	*Swietenia macrophylla* King	0.33	1.54
48	*Tamarindus indica* L.	0.33	1.54
49	*Terminalia catappa* L.	0.33	1.54
50	*Terminalia chebula* Retz.	0.33	1.54
51	*Thyrsostachys siamensis* (Kurz ex Munro) Gamble	0.33	1.54
52	*Xylia xylocarpa* (Roxb.) Taub.	0.33	1.54



Source: SEZ Management Committee study

In order to clarify the homogeneity and heterogeneity of the floristic distribution in the area, the species distribution by frequency class was examined. According to the outcome of the frequency classes, only 4 species are in high frequency class and 48 of the species are in an intermediate frequency class. The area could be considered floristically heterogeneous.

Table 37 Tree Species Frequency Class (Indirect Zone)

Frequency class	No. of species
1-20 %	0
20-40%	43
40-60%	0
60-80%	5
80-100%	4

Source: SEZ Management Committee study

D) Bamboo Ecosystems in Project Area

Table 38 Bamboo Species (Indirect and Direct Zone)

	Common Name	Scientific Name	Family Name
1	Hti-yoe-wa	*Thyrsostachys siamensis* (Kurz ex Munro) Gamble	Poaceae

2	Kya-khat-wa	*Bambusa bambos* (L.) Voss	Poaceae
3	Tin-wa/Khae-tan-kyi-tauk-wa	*Cephalostachyum pergracile* Munro	Poaceae
4	Wa-bo	*Dendrocalamus brandisii* (Munro) Kurz	Poaceae
5	Wa-gauk	*Oxytenanthera albociliata* Munro	Poaceae
6	Wa-min	*Bambusa wamin* E.G. Camus	Poaceae
7	Wa-net	*Dendrocalamus longispathus* (Kurz)Kurz	Poaceae
8	Wa-ya	*Gigantochloa nigrociliata* (Buse) Kurz	Poaceae

Source: SEZ Management Committee study

Figure 25 Bamboo Patches in Direct Impact Zone

The bamboo species collected in 6 representative sample plots are 7 species belonging to 6 genera. The dominant bamboo species are *Oxytenanthera albociliata* Munro., (Wa-gauk), *Gigantochloa nigrociliata* (Buse) Kurz., (Wa-ya) and *Dendrocalamus longispathus* (Kurz) Kurz., (Wa-net).

Table 39 Bamboo Patch Population (Direct Zone)

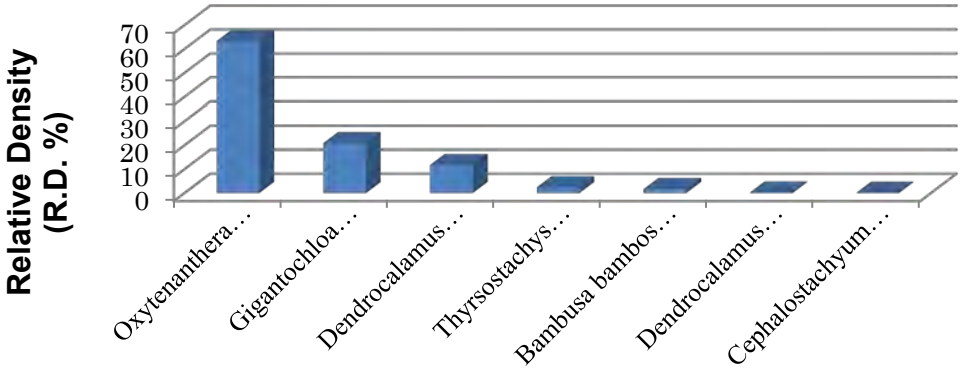
	Scientific Name	No. of individual	Total no. of individual/ha	Total no. of population/ha (%)
1	*Bambusa bambos* (L.) Voss	23	2.71	1.59
2	*Cephalostachyum pergracile* Munro	1	0.12	0.07
3	*Dendrocalamus brandisii* (Munro) Kurz	3	0.35	0.21
4	*Dendrocalamus longispathus* (Kurz) Kurz	169	19.88	11.70
5	*Gigantochloa nigrociliata* (Buse) Kurz	301	35.41	20.83
6	*Oxytenanthera albociliata* Munro	914	107.53	63.25
7	*Thyrsostachys siamensis* (Kurz ex Munro) Gamble	34	4.00	2.35
	Total	**1,445**	**170.00**	**100.00**

Source: SEZ Management Committee study

Table 40 Bamboo Patch Relative Density (Direct Zone)

	Scientific Name	Density (D)	Relative Density (R.D. %)
1	*Oxytenanthera albociliata* Munro	114.25	63.25
2	*Gigantochloa nigrociliata* (Buse) Kurz	37.63	20.83
3	*Dendrocalamus longispathus* (Kurz) Kurz	21.13	11.70
4	*Thyrsostachys siamensis* (Kurz ex Munro) Gamble	4.25	2.35
5	*Bambusa bambos* (L.) Voss	2.88	1.59

	Scientific Name	Density (D)	Relative Density (R.D. %)
6	*Dendrocalamus brandisii* (Munro) Kurz	0.38	0.21
7	*Cephalostachyum pergracile* Munro	0.13	0.07



Source: SEZ Management Committee study

In order to clarify the homogeneity and heterogeneity of the floristic distribution in the area, the species distribution by frequency class was examined. There are only 5 species of bamboo in the project area with 3 species in medium-high to high frequency and the rest in lower frequency classes. The area could be considered floristically heterogeneous within this particular trophic zone.

Table 41 Bamboo Patch Species Frequency (Direct Zone)

	Scientific Name	Frequency (F)	Relative Frequency (R.F.%)
1	*Gigantochloa nigrociliata* (Buse) Kurz	0.88	26.92
2	*Oxytenanthera albociliata* Munro	0.75	23.08
3	*Dendrocalamus longispathus* (Kurz) Kurz	0.63	19.23
4	*Dendrocalamus brandisii* (Munro) Kurz	0.38	11.54
5	*Thyrsostachys siamensis* (Kurz ex Munro) Gamble	0.38	11.54
6	*Bambusa bambos* (L.) Voss	0.13	3.85
7	*Cephalostachyum pergracile* Munro	0.13	3.85

Source: SEZ Management Committee study

Table 42 Bamboo Species Frequency Class (Direct Zone)

Frequency class	No. of species
1-20 %	2
20-40%	2
40-60%	0
60-80%	2
80-100%	1

Source: SEZ Management Committee study

E) Cultivated Plantation Ecosystems

1） Direct Impact Zone

Figure 26Monoculture Plantation (Direct Zone)

The total number of tree species in this area collected in 9 representative sample plots is 2 species belonging to 2 genera. The dominant monoculture species are *Acacia auriculiformis.*, (Malay-sia-padauk).

Table 43 Monoculture Tree Species Population (Direct Zone)

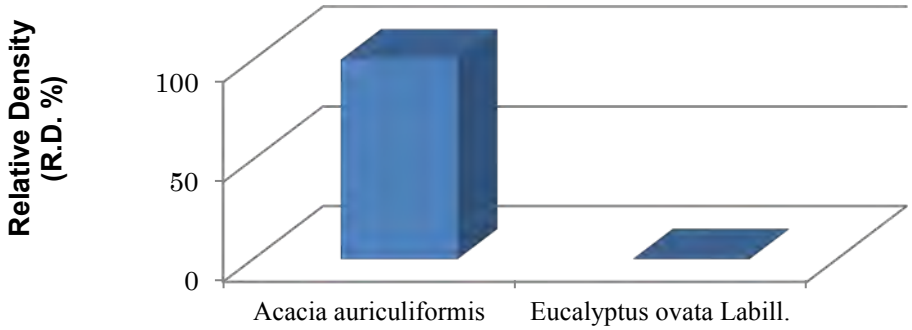
	Scientific Name	No. of individual	Total no. of individual/ha	Total no. of population/ha (%)
1	*Acacia auriculiformis*	111,664	6,344.55	99.99
2	*Eucalyptus ovata* Labill.	15	0.85	0.01
	Total	**111,679**	**6,345.40**	**100.00**

Source: SEZ Management Committee study

Among the sample plots species density per hectare varied and the highest density was observed *Acacia auriculiformis* followed by *Eucalyptus ovata* Labill. This shows that these one species are abundant in this area.

Table 44 Monoculture Tree Species Relative Density (Direct Zone)

	Scientific Name	Density (D)	Relative Density (R.D. %)
1	*Acacia auriculiformis*	12,407.11	99.99
2	*Eucalyptus ovata* Labill.	1.67	0.01



Source: SEZ Management Committee study

Relative frequency is the frequency of one species compared to the total frequency of all the species. According to the results, *Acacia auriculiformis* is high relative frequency value (90%) followed by *Eucalyptus ovata* Labill., (10%) respectively. Therefore these species occur extremely often and are more or less completely homogenous.

Table 45 Monoculture Tree Species Relative Frequency (Direct Zone)

	Scientific Name	Frequency (F)	Relative Frequency (R.F.%)
1	*Acacia auriculiformis*	1	90
2	*Eucalyptus ovata* Labill.	0.11	10

Source: SEZ Management Committee study

2） Indirect Impact Zone

Figure 27Monoculture Plantation

The total number of tree species in this area collected in 2 representative sample plots is 1 species belonging to 1 genus. The tree species is *Acacia auriculiformis* (Malay-sia-padauk).

Table 46 Tree Species Population

	Scientific Name	No. of individual	Total no. of individual/ha	Total no. of population/ha (%)
1	*Acacia auriculiformis*	450	482.57	100
	Total	**450**	**482.57**	**100**

Source: SEZ Management Committee study

3） Cultivated Ornamental and Vegetable Species Identified

In addition to the tree species identified above, the following species were also identified in the mostly cultivated terrestrial ecosystem.

Table 47 Cultivated Ornamental and Vegetable Species (Perennial)

	Common Name	Scientific Name	Family Name
1	A-da-lut	*Canna edulis* Ker Gawl.	Cannaceae
2	Amyauk-san	*Couroupita guianensis*	Lecythidaceae

	Common Name	Scientific Name	Family Name
3	Aw-za	*Annona squamosa* L.	Annonaceae
4	Dan-tha-lun	*Moringa pterygosperma* Gaertn.	Moringaceae
5	Eu-ca-lit	*Eucalyptus ovata* Labill.	Myrtaceae
6	Gan-gaw	*Mesua ferrea* L.	Hypericaceae
7	Hpi-gyan-nget-pyaw	*Musa malaccensis* Ridl.	Musaceae
8	Htika-yone	*Neptunia javanica* Miq.	Mimosaceae
9	Ka-mon-chin	*Acacia concinna* (Willd.) DC.	Mimosaceae
10	Kha-yan-chin	*Lycopersicon esculentum* Mill.	Solanaceae
11	Kyan	*Saccharum officinarum* L.	Poaceae
12	Kyet-paung	*Hevea brasiliensis* (Willd. ex A. Juss.) Muell. Arg.	Euphorbiaceae
13	Kyun	*Tectona grandis* L. f.	Verbenaceae
14	Ma-haw-ga-ni	*Swietenia macrophylla* King	Meliaceae
15	Ma-la-ka	*Psidium guajava* L.	Myrtaceae
16	Ma-lay-sha-padauk	*Acacia auriculiformis* A.Cunn.	Mimosaceae
17	Ma-yan	*Bouea burmanica* Griff.	Anacardiaceae
18	Na-yoke-kaung	*Piper longum* L.	Piperaceae
19	Nget-pyaw	*Musa* sp. (1)	Musaceae
20	Nga-yoke	*Capsicum frutescens*	Solanaceae
21	Nget-pyaw-chin	*Musa* sp. (2)	Musaceae
22	Nwe-pe	*Lablab purpureus*	Fabaceae
23	Ohn	*Cocos nucifera* L.	Arecaceae
24	Pauk-pan-phyu	*Sesbania grandiflora* (L.) Poir.	Fabaceae
25	Pein-gyi	*Alocasia macrorrhizos* (L.) G. Don	Araceae
26	Pein-ne	*Artocarpus heterophyllus* Lam.	Moraceae
27	Pe-zaung-ya	*Dolichos tetragonolobus* L.	Fabaceae
28	Phan-kha	*Terminalia chebula* Retz.	Combretaceae
29	Pinle-ga-bwe	*Casuarina equisetifolia* Forst.	Casuarinaceae
30	Pin-sein	*Ocimum sanctum* L.	Lamiaceae
31	Pyin-ka-do	*Xylia xylocarpa* (Roxb.) Taub.	Mimosaceae
32	Se-hna-ya-thi	*Casacabla thevetia*	Apocynaceae
33	Sein-pan-gyi	*Delonix regia* (Bojer ex Hook) Rafin.	Caesalpiniaceae
34	Shauk	*Citrus medica* L.	Rutaceae
35	Shwe-nget-pyaw	*Musa sapientum* var. *rubra* Firminger	Musaceae
36	Si-tha-bye	*Simarouba glauca* DC.	Simaroubaceae
37	Ta-ma	*Azadirachta indica* A.Juss.	Meliaceae
38	Taung-tha-le	*Garcinia cowa* Roxb.	Hypericaceae
39	Tayok-saga-aphyu	*Plumeria obtusa* L.	Apocynaceae
40	Tha-na-kha-pan	*Aglaia odorata* Lour.	Meliaceae
41	Than-pa-ya	*Citrus aurantiifolia* (Christm.) Sw.	Rutaceae
42	Tha-yet	*Mangifera indica* L.	Anacardiaceae
43	Thi-ho	*Anacardium occidentale* L.	Anacardiaceae
44	Thin-baw	*Carica papaya* L.	Caricaceae
45	Wet-ma-lut	*Musa sinensis* Sw.	Musaceae
46	Yakhaing-nget-pyaw	*Musa sapientum* var. *arakanensis* Ripl.	Musaceae
47	Ye-hmwe-pan	*Angelonia cornigera* Hook.	Scrophulariaceae
48	Ye-ta-ma	*Polyalthia longifolia* (Lam.)Benth. & Hook.f.	Annonaceae
49	Ye-yo	*Morinda angustifolia* Roxb.	Rubiaceae
50	Zi-za-wa	*Gardenia lucida* Roxb.	Rubiaceae

Source: SEZ Management Committee study

Table 48 Cultivated Ornamental and Vegetable Species (Annual)

	Common Name	Scientific Name	Family Name
1	Gan-da-mar	*Chrysanthemum roxburghii* Desf.	Asteraceae
2	Bu-pin	*Lagenaria siceraria* (Molina) Standl.	Cucurbitaceae
3	Chin-paung-ni	*Hibiscus sabdariffa* L.	Malvaceae
4	Chin-paung-phyu	*Hibiscus surratensis* L.	Malvaceae
5	Kha-yan	*Solanum melongena* L.	Solanaceae
6	Kon-ka-zun	*Ipomoea sagittata* Poir.	Convolvulaceae
7	Kun	*Piper betel* L.	Piperaceae
8	May-myo	*Callistephus chinensis*	Asteraceae
9	Mon-la	*Raphanus sativus* L.	Brassicaceae
10	Taing-taung-pe	*Vigna peduncularis*(Kunth)Fawc.& Rendle	Fabaceae
11	Yon-padi	*Hibiscus esculentus* L.	Malvaceae

Source: SEZ Management Committee study

F) Aquatic Ecosystems in Project Area

The aquatic ecosystem of studied area includes brackish water ecosystem (Mangrove ecosystem) and fresh water ecosystem. The brackish water ecosystem comprises Kayet Creek (Both direct and indirect), Gwe Creek (Both direct and indirect), Baybauk Creek (Both direct and indirect), Phalan Creek (Both direct and indirect), and Shwebyauk Creek (Both direct and indirect impact zone). The fresh water ecosystem includes Thilawa Reservoir and the lake near Phalan Kanoo Monastery.

1） Mangrove Ecosystem (Direct Zone)

The following species were identified in and around the Project area.

Table 49 Mangrove Species (Direct Zone)

	Common Name	Scientific Name	Family Name
1	Da-ni	*Nypa fruticans* Wurmb	Arecaceae
2	Ka-na-zo	*Heritiera littoralis* Dryand.	Sterculiaceae
3	Kat-ma-lar	*Sonneratia apetala* Buch.-Ham	Sonneratiaceae
4	La-mu	*Sonneratia caseolaris* (L.)Engl.	Sonneratiaceae
5	Ma-da-ma	*Ceriops decandra* (Griff.)Ding Hou	Rhizophoraceae
6	Tha-mae	*Avicennia officinalis* L.	Avicenniaceae
7	Tha-met-ywet-leik	*Avicennia marina* (Forsk)Vierh.	Avicenniaceae
8	Tha-yaw	*Excoecaria agallocha* L.	Euphorbiaceae
9	Ye-kha-ya	*Aegiceras coniculatum* (L.)Blanco	Myrsinaceae

Source: SEZ Management Committee study

Table 50 Mangrove Associated Species (Direct Zone)

	Common Name	Scientific Name	Family Name	Perennial	Annual (Rainy Season)
1	A-lo-lay	*Caesalpinia crista* L.	Caesalpiniaceae	✓	✓
2	Ana-nya-kokko	*Albizia lebbek* (L.) Benth.	Mimosaceae	✓	✓
3	Byaik	*Dalbergia spinosa* Roxb.	Fabaceae	✓	✓
4	Kha-mon	*Hoya burmanica* Rolfe	Asclepiadaceae	✓	✓
5	Kha-ru	*Pluchea indica* (L.)Less.	Asteraceae	✓	✓
6	Kha-ya	*Acanthus ilicifolius* L.	Acanthaceae	✓	✓
7	Khwe-lae-ya	*Canavalia cathartica*	Fabaceae	✓	✓
8	Khwe-la-ya	*Mucuna pruriens*	Fabaceae	✓	✓
9	Mi-chaung-pan	*Derris trifoliata* Lour.	Fabaceae	✓	✓
10	Myauk-kyein	*Flagellaria indica* L.	Flagellariaceae	✓	✓
11	Nget-kyi-taung	*Acrostichum speciosum*	Pteridaceae	✓	✓
12	Not known	*Pontederia* sp.	Pontederiaceae	✓	✓
13	Not known	*Melanthera biflora* (L.) Wild	Asteraceae	✓	✓
14	Not known	*Fimbristylis ferruginea* Vahl	Cyperaceae	✓	✓
15	Not known	*Derris scandens*	Fabaceae	✓	✓
16	Nyan	*Sesbania paludosa* Roxb.	Fabaceae	✓	✓
17	Shwe-nwee	*Cassytha filiformis* L.	Lauraceae	✓	✓
18	Sit	*Albizia procera* (Roxb.) Benth.	Mimosaceae	✓	✓
19	Taung-ka-thit	*Erythrina crista-galli*	Fabaceae	✓	✓
20	Taw-kyaung-pan	*Clerodendrum inerme* Gaertn.	Verbenaceae	✓	✓
21	Taw-kyet-thon	*Ipomoea violacea* L.	Convolvulaceae	✓	✓
22	Taw-sa-byit	*Cayratia trifolia* (L.) Domin	Vitaceae	✓	✓
23	Tha-baw	*Pandanus foetidus* Roxb.	Pandanaceae	✓	✓
24	Tha-khut	*Dolichandrone spathacea* (L. f.) K. Schum.	Bignoniaceae	✓	✓
25	Tha-nat	*Cordia myxa* L.	Boraginaceae	✓	✓
26	Thin-paung	*Phoenix paludosa* Roxb.	Arecaceae	✓	✓
27	Thon-dauk-myat	*Cyperus exaltatus* Retz	Cyperaceae	-	✓
28	Ka-thit	*Erythrina* sp.	Fabaceae	-	✓

29	Ko-yan-gyi	*Crinum asiaticum* L.	Amaryllidaceae	-	✓
30	Myauk-u	*Dioscorea sativa* L.	Dioscoreaceae	-	✓
31	Not known	*Crinum* sp.	Amaryllidaceae	-	✓

Source: SEZ Management Committee study

Source: SEZ Management Committee study

Figure 28 Typical Mangrove Area (Direct Zone)

Total numbers of species collected in the studied area are altogether 36 mangrove and mangrove associated species. However, only four mangrove species belonging to 3 genera and other three species are growing in large patches to be collected in 7 representative plots. The dominant mangrove species in this area are *Sonneratia caseolaris* (L.) Engl., (La-mu) followed by *Avicennia officinalis* L., (Tha-mae), and *Sonneratia apetala* Buch.-Ham., (Kant-ma-lar), *Excoecaria agallocha* L., (Tha-yaw). The other two species are growing sparsely along the creeks. These species are *Nypa fruticans* and *Avicennia marina*.

Table 51 Mangrove Species Population (Direct Zone)

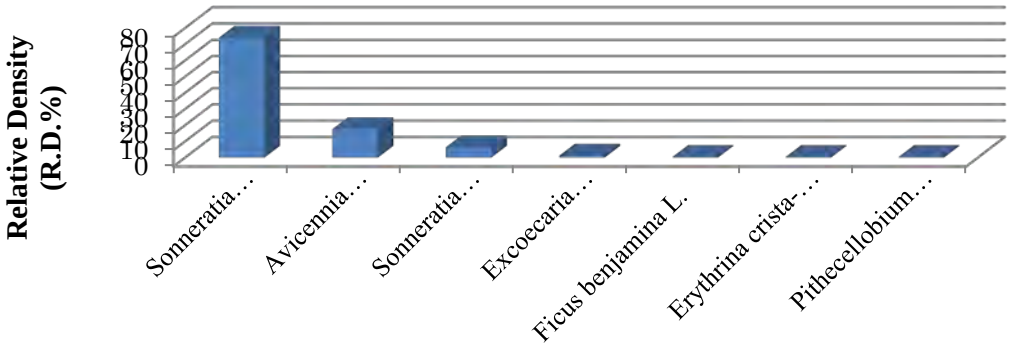
	Scientific Name	No. of individual	Total no. of individual/ha	Total no. of population/ha(%)
1	*Ficus benjamina* L.	1	0.91	0.35
2	*Avicennia officinalis* L.	50	45.45	17.54
3	*Excoecaria agallocha* L.	3	2.73	1.05
4	*Sonneratia apetala* Buch.-Ham	18	16.36	6.32
5	*Sonneratia caseolaris* (L.)Engl.	211	191.82	74.04
6	*Erythrina crista-galli*	1	0.91	0.35
7	*Pithecellobium dulce* (Roxb.) Benth.	1	0.91	0.35
	Total	**285**	**259.09**	**100.00**

Source: SEZ Management Committee study

Among the sample plots species density per hectare varied and the highest density was observed *Sonneratia caseolaris* (L.)Engl., followed by *Avicennia officinalis* L., and *Sonneratia apetala* Buch.-Ham. This shows that these three species are abundant in this area.

Table 52 Relative Density of Mangrove Species (Direct Zone)

	Scientific Name	Density (D)	Relative Density (R.D. %)
1	*Sonneratia caseolaris* (L.)Engl.	30.14	74.04
2	*Avicennia officinalis* L.	7.14	17.54
3	*Sonneratia apetala* Buch.-Ham	2.57	6.32
4	*Excoecaria agallocha* L.	0.43	1.05
5	*Ficus benjamina* L.	0.14	0.35
6	*Erythrina crista-galli*	0.14	0.35
7	*Pithecellobium dulce* (Roxb.) Benth.	0.14	0.35



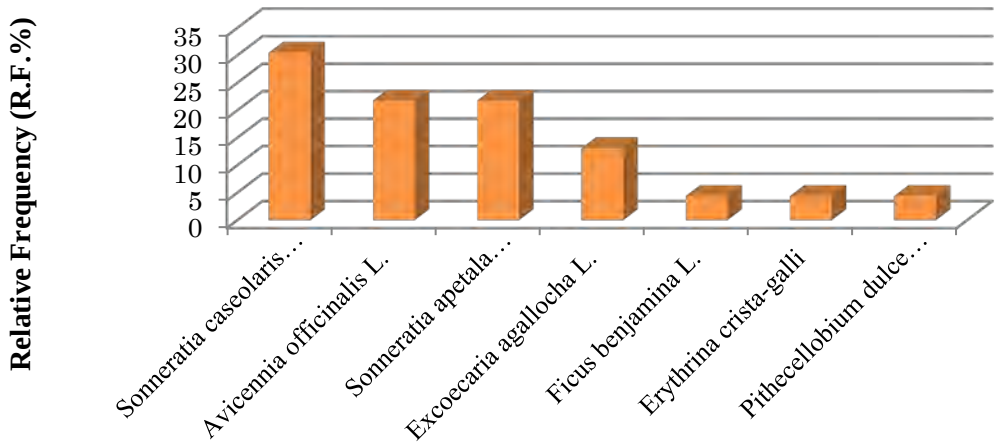
Source: SEZ Management Committee study

Relative frequency is the frequency of one species compared to the total frequency of all the species. *Sonneratia caseolaris* (L.) Engl., is high relative frequency value (30.44%) followed by *Avicennia officinalis* L., and *Sonneratia apetala* Buch.-Ham., (21.74%) are equal *Excoecaria agallocha* L., (13.04%) respectively. Therefore these species occur often in the study area.

Table 53 Relative Frequency of Mangrove Species (Direct Zone)

	Scientific Name	Frequency (F)	Relative Frequency (R.F. %)
1	*Sonneratia caseolaris* (L.)Engl.	1.00	30.43
2	*Avicennia officinalis* L.	0.71	21.74
3	*Sonneratia apetala* Buch.-Ham	0.71	21.74
4	*Excoecaria agallocha* L.	0.43	13.04
5	*Ficus benjamina* L.	0.14	4.35

6	*Erythrina crista-galli*	0.14	4.35
7	*Pithecellobium dulce* (Roxb.) Benth.	0.14	4.35



Source: SEZ Management Committee study

In order to clarify the homogeneity and heterogeneity of the floristic distribution in the area, the species distribution by frequency class was examined. According to the outcome of the frequency classes, only 1 species is in the highest frequency class and 3 species are in the low frequency class. This shows that this area has a low to medium degree of heterogeneity.

Table 54 Species distribution by frequency class (Direct Zone)

Frequency class	No. of species
1-20 %	3
20-40%	0
40-60%	1
60-80%	2
80 - 100 %	1

Source: SEZ Management Committee study

The distribution of GBH interval class reveals the dominant of small stem individuals in the area. 48.65% of the mangroves sampled are less than 40cm GBH. Large stem individuals with GBH more than 80cm are only 8.10%. The majority of the trees are less than 60cm in diameter, which indicates that the mangrove habitats are marginal and in a degraded state.

Table 55 Mangrove species in GBH class interval (Direct Zone)

GBH Class	Total number of individual	% of total population
<40cm	126	48.65
41-60cm	82	31.66
61-80cm	31	11.97
81-100cm	15	5.79
>101cm	6	2.32
Total	**259**	**100.00**

Source: SEZ Management Committee study

The distribution of height class shows that 184 individuals are less than 10 meters, comprising 71% and of the total population only 1.5% of the individuals sampled were above 15m in height. Again, this indicates a marginal mangrove ecosystem.

Table 56 Mangrove species in Height class interval (Direct Zone)

Height Class	Total number of individual	% of total population
<10m	184	71.04247
11-15m	72	27.79923
16-20m	4	1.544402
21-25m	0	0
>26m	0	0
Total	**259**	**100.00**

Source: SEZ Management Committee study

2） Mangrove Ecosystem (Indirect Zone)

Source: SEZ Management Committee study

Total numbers of species collected in the indirect zone mangrove ecosystem study area are

36 mangrove and mangrove associated species. However, only 4 mangrove species belonging to 3 genera and other 5 species are growing in large patches to be collected in 5 representative plots. The dominant mangrove species in this area are *Sonneratia caseolaris* (L.)Engl., (La-mu) and *Avicennia officinalis* L., (Tha-mae) followed by *Excoecaria agallocha* L., (Tha-yaw) and *Sonneratia apetala* Buch.-Ham., (Kant-ma-lar). The other two species are growing sparsely along the creeks. These species are *Nypa fruticans* and *Avicennia marina*.

Table 57 Mangrove Species Population (Indirect Zone)

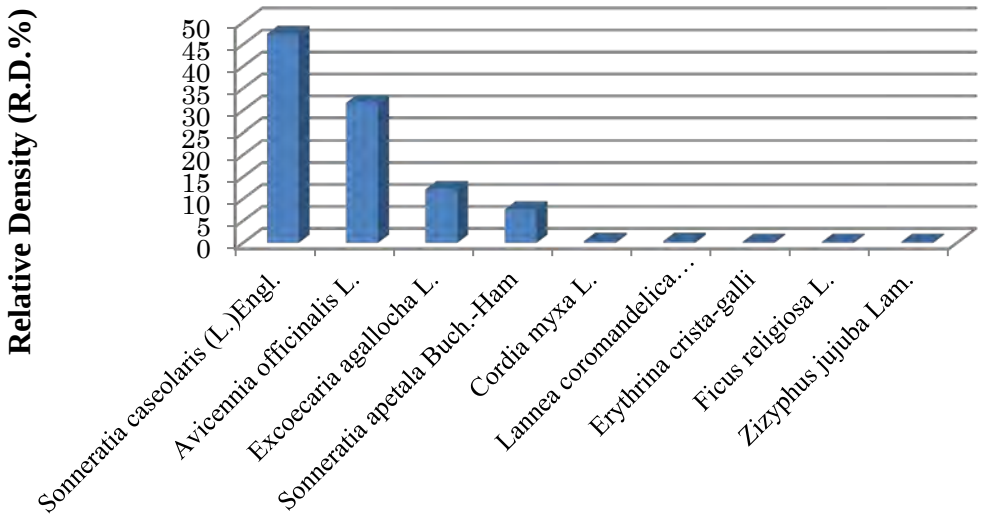
	Scientific Name	No. of individual	Total no. of individuals/ha	Total no. of population/ha (%)
1	*Avicennia officinalis* L.	180	90.45	31.69
2	*Cordia myxa* L.	2	1.01	0.35
3	*Erythrina crista-galli*	1	0.50	0.18
4	*Excoecaria agallocha* L.	69	34.67	12.15
5	*Ficus religiosa* L.	1	0.50	0.18
6	*Lannea coromandelica* (Houtt.)Merr.	2	1.01	0.35
7	*Sonneratia apetala* Buch.-Ham	43	21.61	7.57
8	*Sonneratia caseolaris* (L.)Engl.	269	135.18	47.36
9	*Zizyphus jujuba* Lam.	1	0.50	0.18
	Total	**568**	**285.43**	**100.00**

Source: SEZ Management Committee study

Among the sample plots species density per hectare varied and the highest density was observed *Avicennia officinalis* L., and *Sonneratia caseolaris* (L.) Engl., followed by *Excoecaria agallocha* L., and *Sonneratia apetala* Buch.-Ham. These four species are abundant in this area.

Table 58 Relative Density of Mangrove Species (Indirect Zone)

	Scientific Name	Density (D)	Relative Density (R.D. %)
1	*Sonneratia caseolaris* (L.)Engl.	26.9	47.36
2	*Avicennia officinalis* L.	18.0	31.69
3	*Excoecaria agallocha* L.	6.9	12.15
4	*Sonneratia apetala* Buch.-Ham	4.3	7.57
5	*Cordia myxa* L.	0.2	0.35
6	*Lannea coromandelica* (Houtt.)Merr.	0.2	0.35
7	*Erythrina crista-galli*	0.1	0.18
8	*Ficus religiosa* L.	0.1	0.18
9	*Zizyphus jujuba* Lam.	0.1	0.18

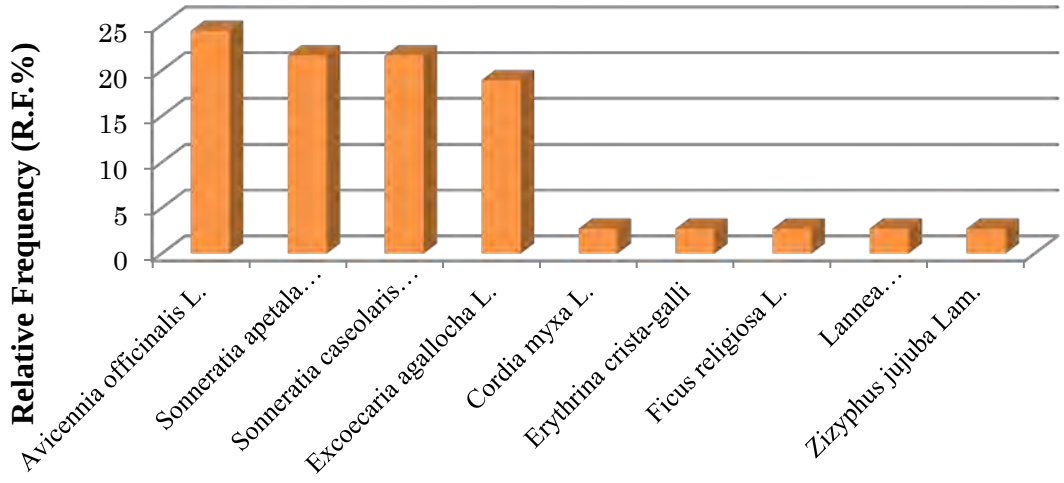


Source: SEZ Management Committee study

Relative frequency is the frequency of one species compared to the total frequency of all the species. According to the results, *Avicennia officinalis* L., is (24.32%) high and *Sonneratia apetala* Buch.-Ham., and *Sonneratia caseolaris* (L.) Engl., are relative frequency value (21.62%) followed is *Excoecaria agallocha* L., is (19%) and respectively. These species are common in the study area.

Table 59 Relative Frequency of Mangrove Species (Indirect Zone)

	Scientific Name	Frequency (F)	Relative Frequency (R.F. %)
1	*Avicennia officinalis* L.	0.9	24.32
2	*Sonneratia apetala* Buch.-Ham	0.8	21.62
3	*Sonneratia caseolaris* (L.)Engl.	0.8	21.62
4	*Excoecaria agallocha* L.	0.7	18.92
5	*Cordia myxa* L.	0.1	2.70
6	*Erythrina crista-galli*	0.1	2.70
7	*Ficus religiosa* L.	0.1	2.70
8	*Lannea coromandelica* (Houtt.)Merr.	0.1	2.70
9	*Zizyphus jujuba* Lam.	0.1	2.70



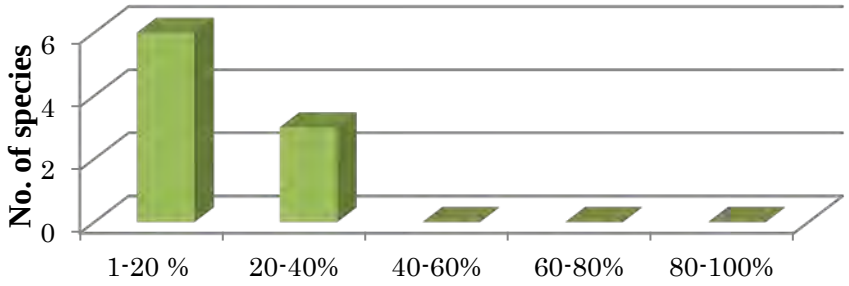
Source: SEZ Management Committee study

In order to clarify the homogeneity and heterogeneity of the floristic distribution in the area, the species distribution by frequency class was examined. According to the outcome of the frequency classes, only two species are in high frequency class and 9% of the species are in low frequency class. This shows that this area is floristically high degree of heterogeneity without a high degree of dominance of any one species.

Table 60 Species distribution by frequency class (Indirect Zone)

Frequency class	No. of species
1-20 %	6
20-40%	3
40-60%	0
60-80%	0
80-100%	0

Source: SEZ Management Committee study



Source: SEZ Management Committee study

The distribution of GBH interval class reveals the dominance of small stem individuals in the area. 69.89% of the mangrove species are less than 40cm GBH. Large stem individuals with GBH more than 80cm are about 5.99%. Majority of the trees are less than 40cm in diameter, which indicates that the forests are marginal and degraded.

Table 61 Mangrove species in GBH class interval (Indirect Zone)

DBH Class	Total number of individual	% of total population
<40cm	199	69.89
41-60cm	47	16.55
61-80cm	22	7.57
81-100cm	14	4.93
>101cm	3	1.06
	285	**100.00**

Source: SEZ Management Committee study

The distribution of height class shows that 257 individuals are less than 10 meters, comprising 90.32% and of the total population and 28 individuals are more than 15 meters, comprising 9.68% of the total population. The low height class of the studied area indicates a degraded mangrove ecosystem in the indirect zone.

Table 62 Mangrove species in Height class interval (Indirect Zone)

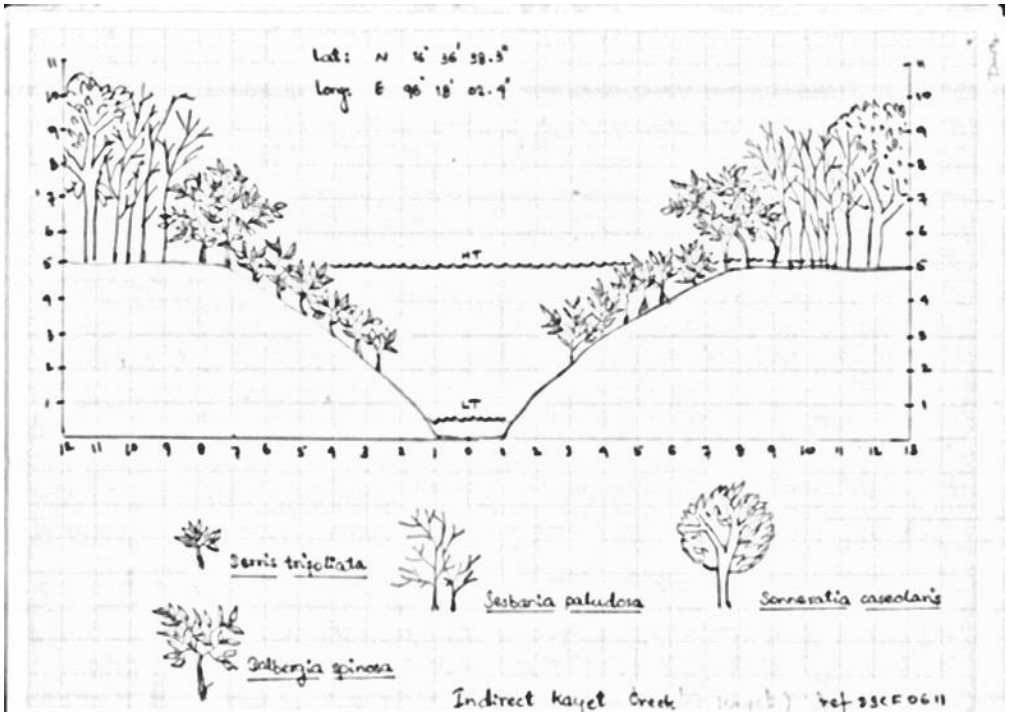
Height Class	Total number of individual	% of total population
<10m	258	90.32
11-15m	28	9.68
16-20m	0	0
21-25m	0	0

>26m	0	0
Total	**285**	**100**

Source: SEZ Management Committee study

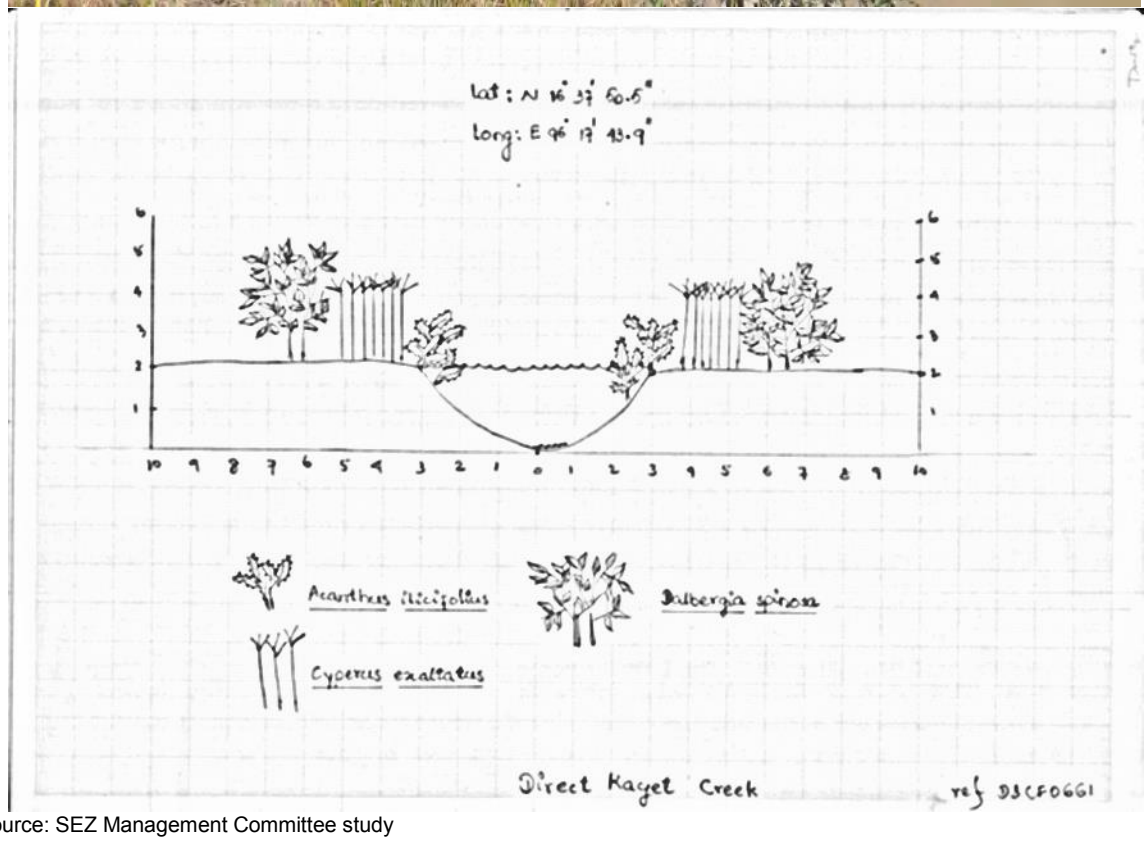
3） Mangrove Ecosystem Profiles in Creeks with Mangroves

Below are described the vegetation profiles of the five main mangrove areas in the Project area.



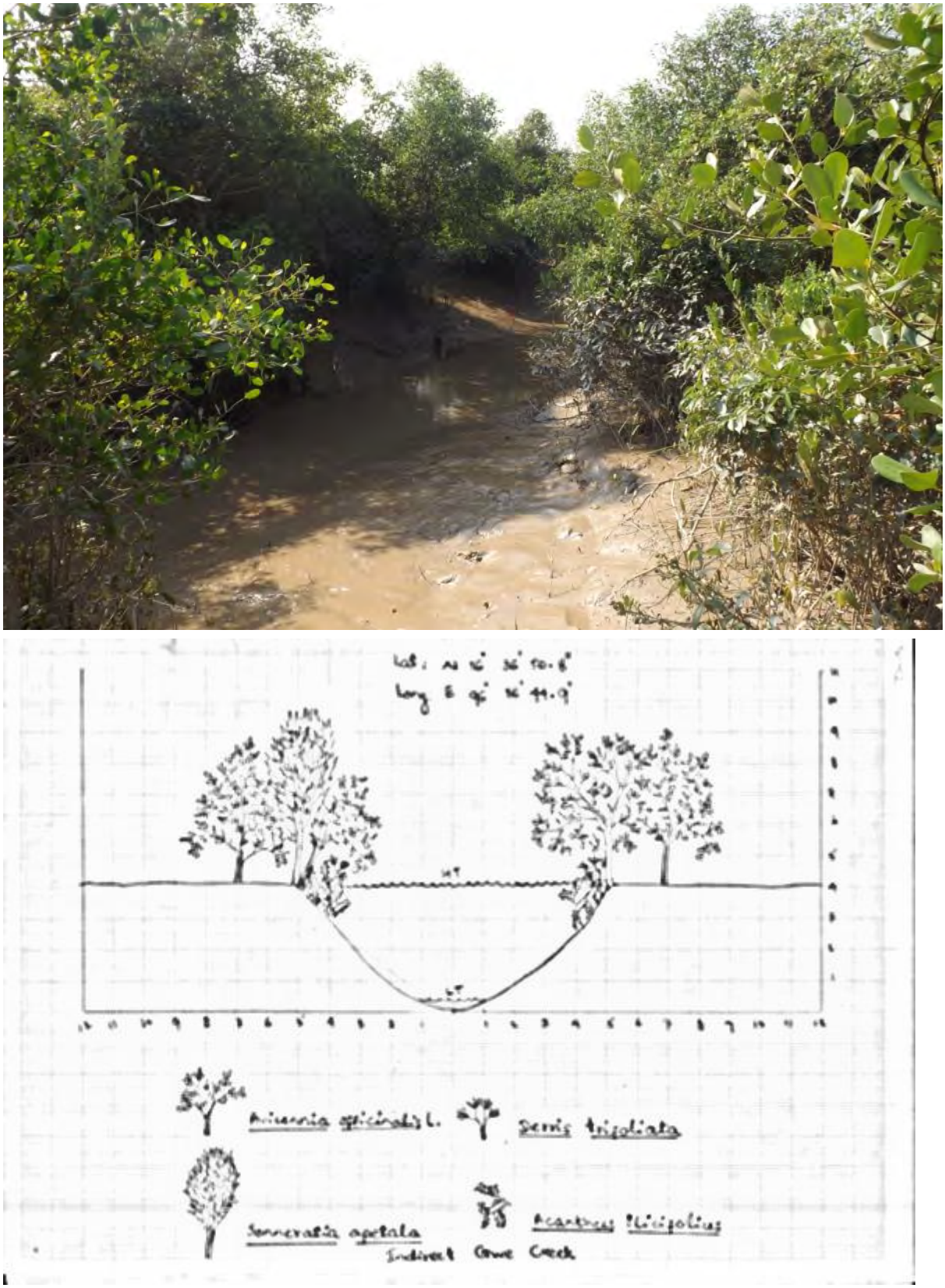
Source: SEZ Management Committee study

Figure 29Indirect Kayet Creek Mangrove Profile



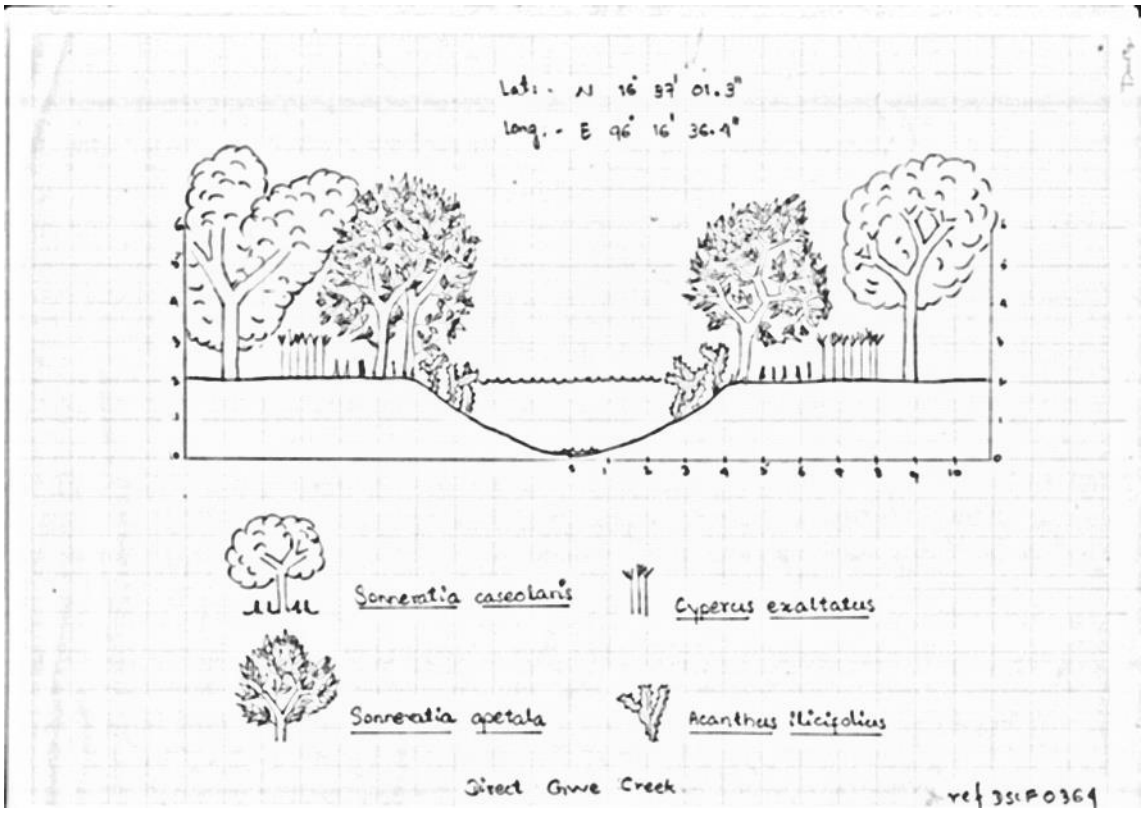
Source: SEZ Management Committee study

Figure 30Direct Kayet Creek Mangrove Profile



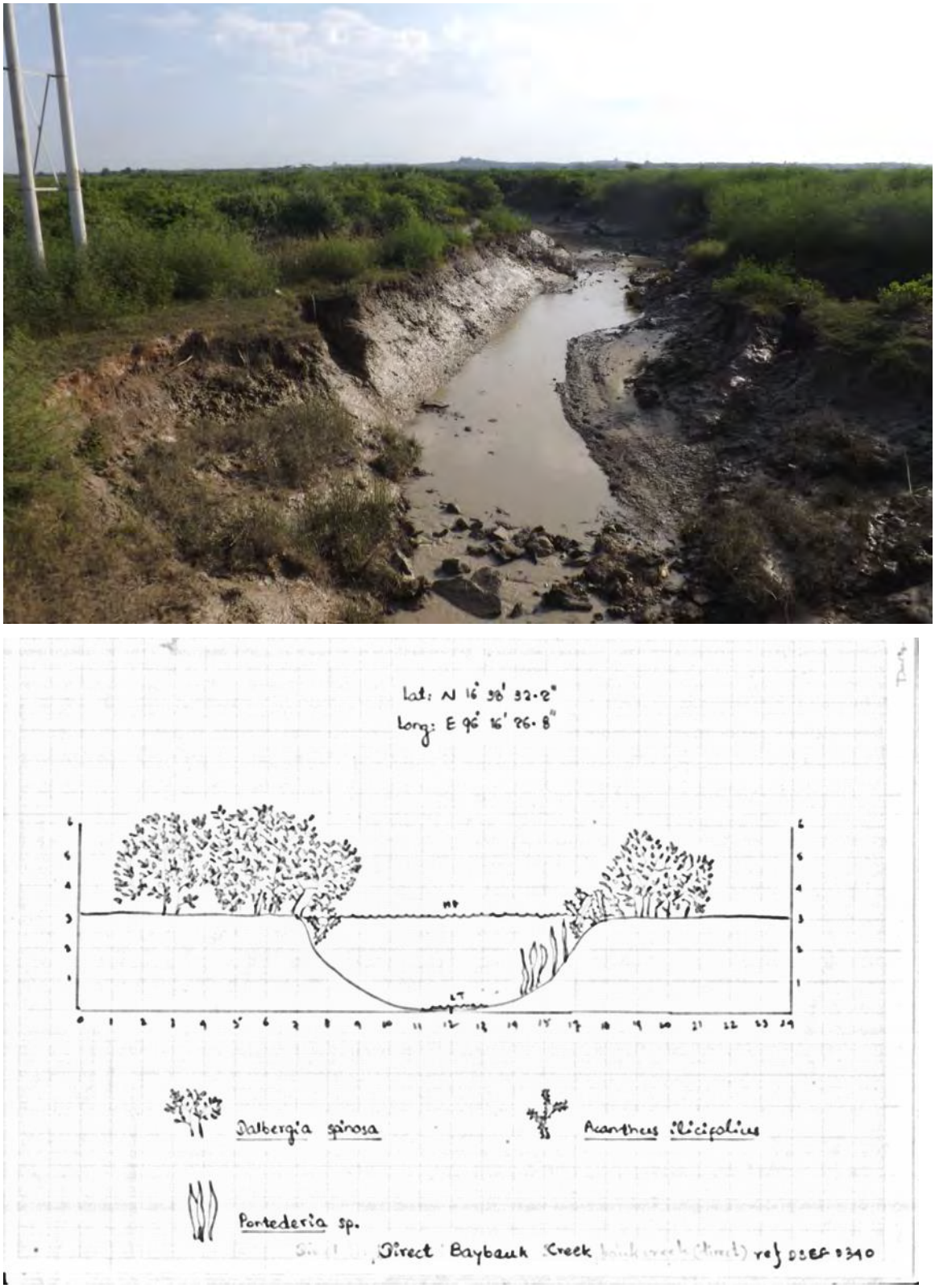
Source: SEZ Management Committee study

Figure 31 Indirect Gwe Creek Mangrove Profile



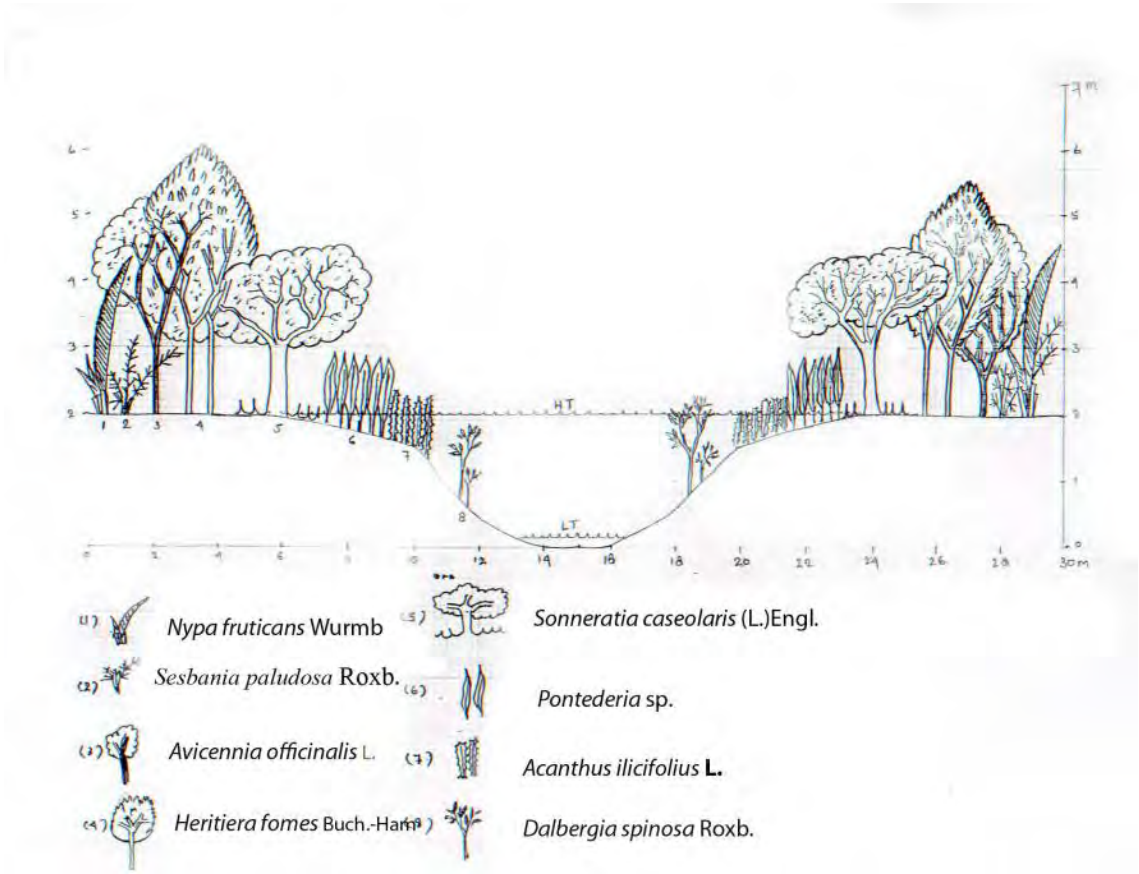
Source: SEZ Management Committee study

Figure 32Direct Gwe Creek Mangrove Profile



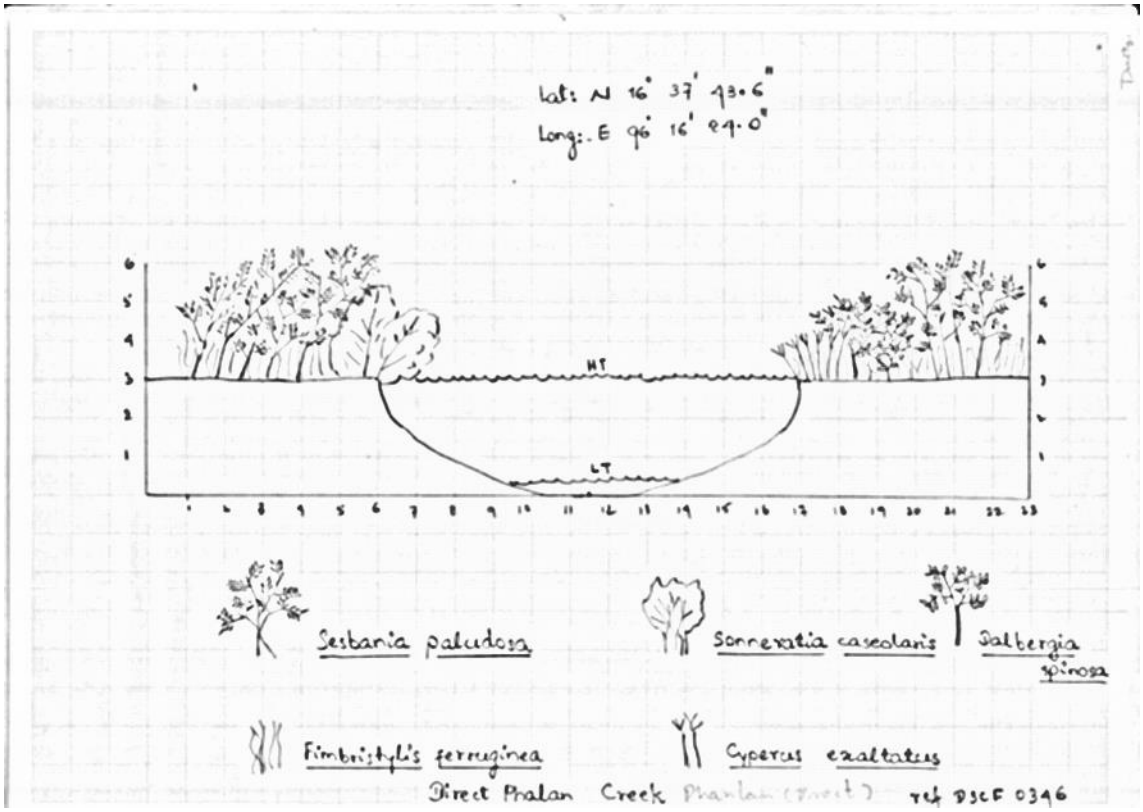
Source: SEZ Management Committee study

Figure 33Direct Baybauk Creek Mangrove Profile



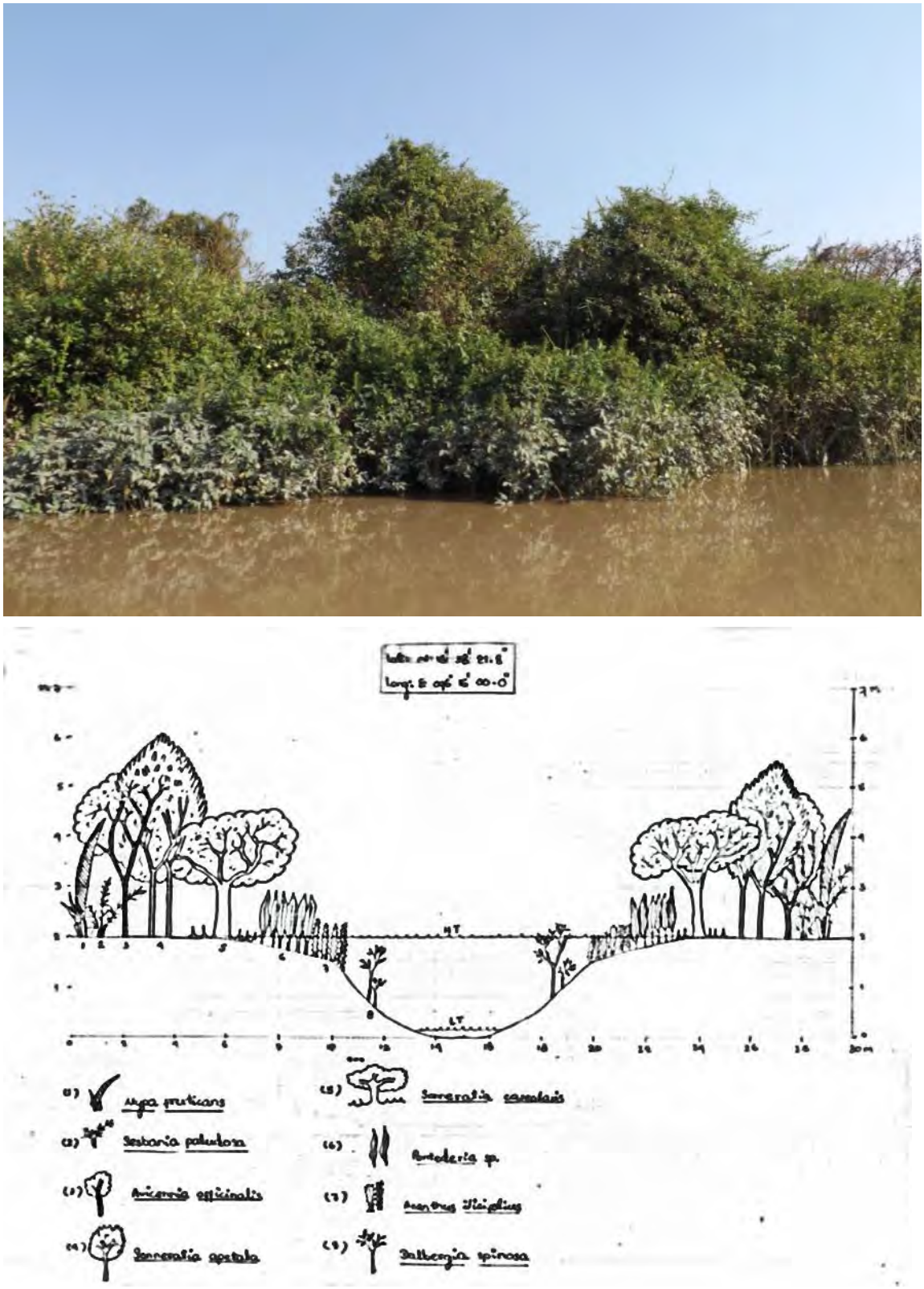
Source: SEZ Management Committee study

Figure 34Indirect Baybauk Creek Mangrove Profile



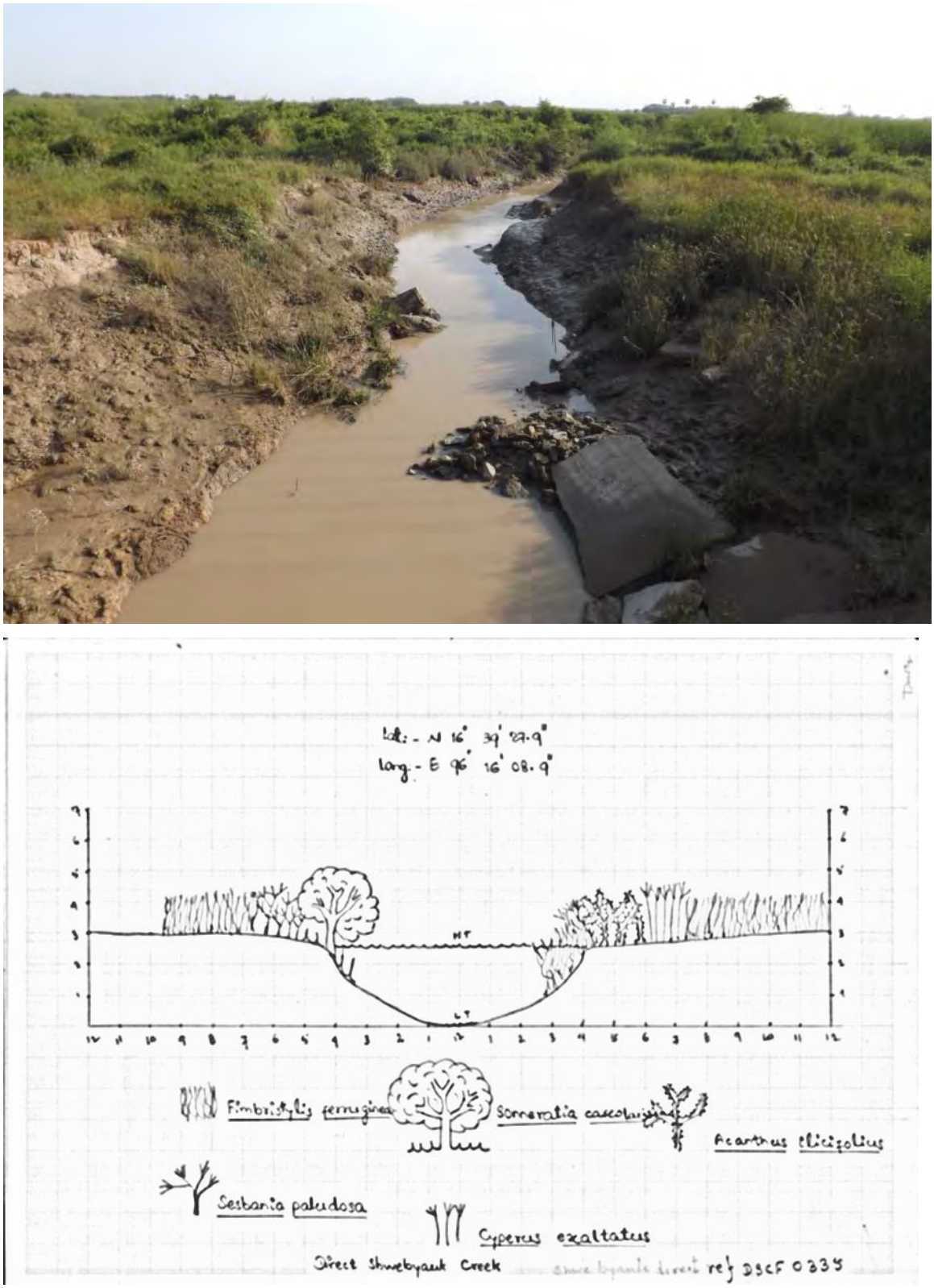
Source: SEZ Management Committee study

Figure 35Direct Phalan Creek Mangrove Profile



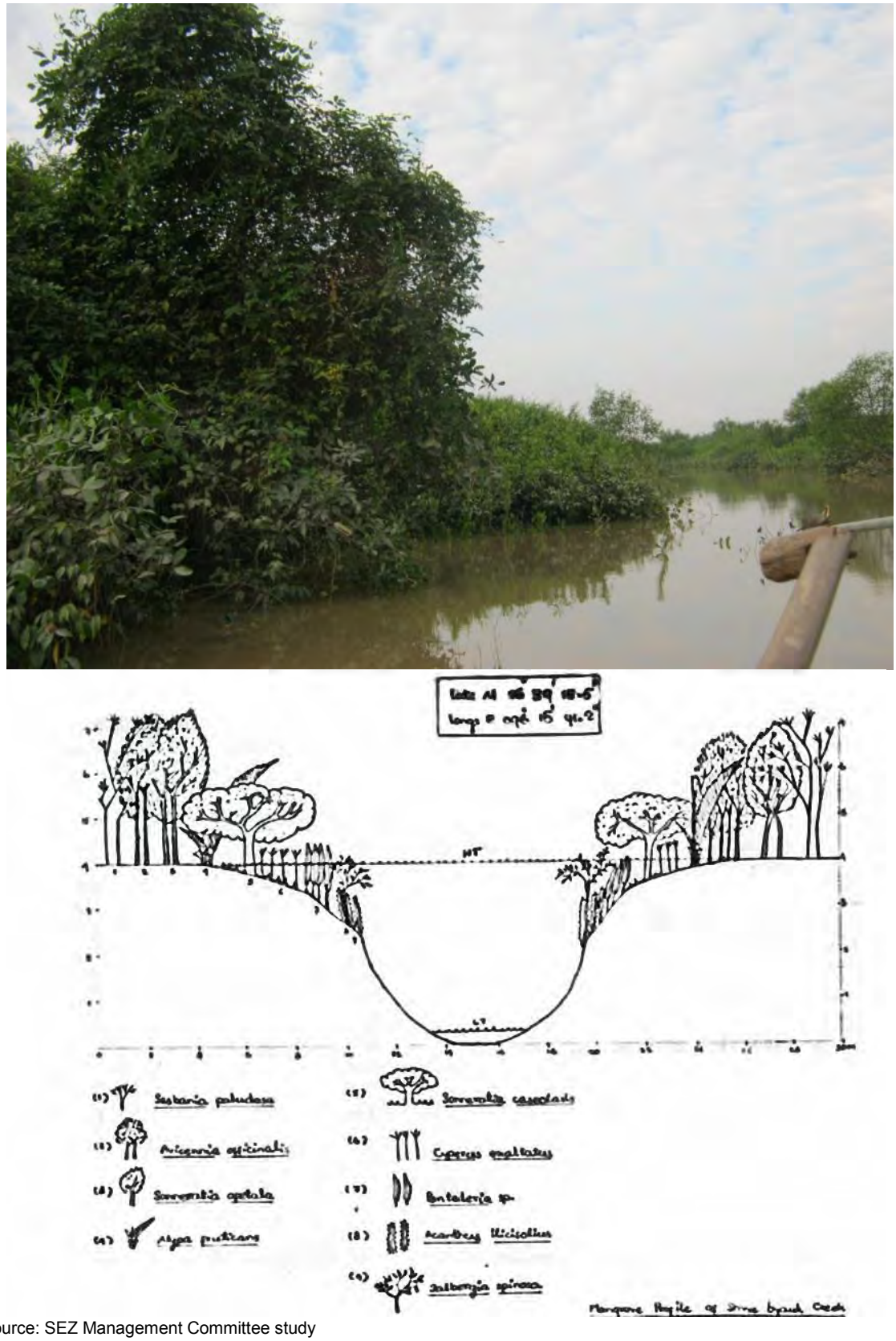
Source: SEZ Management Committee study

Figure 36Indirect Phalan Creek Mangrove Profile



Source: SEZ Management Committee study

Figure 37Direct Shwebyauk Creek Mangrove Profile



Source: SEZ Management Committee study

Figure 38Indirect Shwebyauk Creek Mangrove Profile

4） Fresh Water Ecosystem

The freshwater ecosystem includes the Thilawa Reservoir as well as the freshwater pond near Phalankanoo Monastery.

Source: SEZ Management Committee study

Figure 39Freshwater Ecosystem in Project Area

Table 63 Freshwater Flora Species in Summer Season

	Common Name	Scientific Name	Family Name
1	Bae-da	*Eichhornia crassipes* (Mart.) Solms	Pontederiaceae
2	Bu-baung-pin	*Utricularia* sp.	Lentibulariaceae
3	Bu-baung-pin	*Utricularia uliginosa* Vahl	Lentibulariaceae
4	Bu-baung-pin	*Utricularia aurea* Lour.	Lentibulariaceae
5	Dal grass	*Hymenachne amplexicaulis* (Rudge) Nees	Poaceae
6	Duck weed	*Lemna minor* L.	Lemnaceae
7	Hmo-nato	*Marsilea quardrifoliata* Linn.	Marsileaceae
8	Htika-yone	*Neptunia oleracea* Lour.	Mimosaceae
9	Ka-dauk-set	*Monochoria vaginalis* (Presl) Kunth	Pontederiaceae
10	Ka-na-phaw	*Enhydra fluctuans* Lour.	Asteraceae
11	Kyar-lin-pan	*Nymphoides hydrophylla* Lour.	Menyanthaceae
12	Kyar-ni	*Nymphaea pubescens* Willd.	Nymphaeaceae
13	Kyar-phyu	*Nymphaea tetragona* Georgi	Nymphaeaceae
14	Kyar-pya	*Nymphaea nouchali* Byrn. f.	Nymphaeaceae
15	Le-pa-du	*Sphenoclea zeylanica* Gaertn.	Sphenocleaceae
16	Not known	*Schoenoplectus maritimus* (L.) K. Lye	Cyperaceae
17	Not known	*Azolla pinnata*	Salviniaceae
18	Not known	*Ceratopteris thalictroides*	Pteridaceae
19	Not known	*Gratiola sexdentata*	Scrophulariaceae
20	Not known	*Eriocaulon parkeri*	Eriocaulaceae
21	Not known	*Eriocaulon luzulaefolium* Mart	Eriocaulaceae
22	Not known	*Pontederia* sp.	Pontederiaceae
23	Padon-ma-kya	*Nelumbo nucifera* Gaertn.	Nelumbonaceae
24	Peik-swel	*Typha angustifolia* Chaub.& Bory	Typhaceae

	Common Name	Scientific Name	Family Name
25	Algae	*Spirogyra* sp.	Zygnemataceae
26	Thon-dauk-myat	*Cyperus exaltatus* Retz	Cyperaceae
27	Ye-ka-nyut	*Ludwigia adscendens* (L.) H. Hara	Onagraceae
28	Ye-ka-zun	*Ipomoea aquatica* Forssk.	Convolvulaceae

Source: SEZ Management Committee study

Table 64 Additional Emergent Species in Rainy Season

	Common Name	Scientific Name	Family Name
1	Le-pa-dauk	*Monochoria hastaefolia* Presl	Pontederiaceae
2	Myet	*Eleocharis acicularis*(L.)Roem.& Schult.	Cyperaceae
3	Narrowleaved Pondweeds	*Potamogeton* sp.	Potamogetonaceae
4	Not known	*Calamagrostis canadensis* (Michx.) Beauv.	Poaceae
5	Not known	*Cyperus iria* L.	Cyperaceae
6	Not known	*Cyperus odoratus* L.	Cyperaceae
7	Not known	*Echinochloa muricata*	Poaceae
8	Not known	*Eleocharis* sp.	Cyperaceae
9	Not known	*Eriocaulon willdenovianum*	Eriocaulaceae
10	Not known	*Kyllinga brevifolia* Rottb.	Cyperaceae
11	Pyaung-sa-myet	*Paspalum conjugatum* P.J.Bergius	Poaceae
12	Sin-monnyin-myet	*Fimbristylis dichotoma* (L.)Vahl.	Cyperaceae
13	Tet-pya	*Limnocharis emarginata* H & B.	Butomaceae
14	Ye-hmoke-beda	*Ottelia alismoides* (L.) Pers.	Hydrocharitaceae
15	Ye-za-let	*Pistia stratiotes*	Araceae

Source: SEZ Management Committee study

Table 65 Aquatic Ecosystem Plant Typology Prevalence by Season

	Type of plants	Perennial Species	Additional Annual Species in Rainy Season	Total
1	Algae (A)	1	-	1
2	Aquatic Fern (Aq F)	5	-	5
3	Aquatic Grass (Aq G)	1	3	4
4	Aquatic Herb(Aq H)	22	7	29
5	Bamboo (B)	8	-	8
6	Climber /Creeper(Cl/Cr)	31	3	34
7	Grass (G)	8	-	8
8	Herbs (H)	39	14	53
9	Parasitic Fern (P F)	1	-	1
10	Parasitic Shrub(P S)	1	-	1
11	Shrub (S)	60	6	66
12	Small Tree (ST)	46	1	47
13	Tree (T)	45	-	45
14	Mushroom (M)	-	1	1
	Total species	**268**	**35**	**303**

Source: SEZ Management Committee study

G) Flora Value in Project Area

1） Economic and Livelihood Value

The following table describes the value and usages of flora in the project area.

Table 66 Interview with Local Gardeners and Farmers

Place	Plants used	Use of plant	Location	Value of Flora	Opinions of interviewees
Phalan old village	Hti-yoe, Wa-net, Wa-gauk & Wa-ya	Household construction	N 16° 39' 34.9" E 96° 16' 33.6"	1 plant=1,500kyats	Tree plantations can serve as useful buffers between new developments and living areas.
	Wa-bo,Wa-ya, Wa-net, Malay-sia-padauk & Thi-ho	Household construction, Firewood & family use	N16° 39' 48.9" E 96° 16' 30.1"	1 plant=1,500kyats 1 plant=3,500kyats (7 years)	Tree plantations can serve as useful buffers between new developments

Place	Plants used	Use of plant	Location	Value of Flora	Opinions of interviewees
					and living areas.
	Thi-ho	Family use	N16° 39' 26.4" E 96° 16' 46.1"	Unknown	None
	Wa-net, Wa-gauk , Wa-ya & Thi-ho,	Household construction & family use	N16° 39' 37.2" E 96° 16' 51.3"	1 plant=3,500kyats (7 years)	Tree plantations can serve as useful buffers between new developments and living areas.
	Malay-sia-padauk	Firewood	N16° 40' 02.4" E 96° 17' 02.2"	1 plant=3,500kyats (7 years)	Tree plantations can serve as useful buffers between new developments and living areas.
	Malay-sia-padauk	Firewood	N16° 39' 40.8" E 96° 17' 12.9"	1 plant=3,500kyats (7 years)	Tree plantations can serve as useful buffers between new developments and living areas.
	Thi-ho	Commercial use	N16° 39' 08.3" E 96° 17' 01.8"	1 year=300,000kyats	none
	Malay-sia-padauk	Firewood	N16° 38' 57.3" E 96° 16' 51.1"	1 plant=3,500kyats	Tree plantations can serve as useful buffers between new developments and living areas.
	Malay-sia-padauk	Firewood	N16° 39' 25.2" E 96° 17' 14.5"	1 plant=3,500kyats	Tree plantations can serve as useful buffers between new developments and living areas.
	Malay-sia-padauk	Firewood	N16° 39' 23.4" E 96° 17' 29.4"	1 plant=3,500kyats	Tree plantations can serve as useful buffers between new developments and living areas.
	Bu, May-myo Taing-daung-pe	Commercial use	N16° 39' 52.5" E 96° 17' 19.7"	1 fruit=500kyats 1 plant=80-90kyats 10 fruits=100kyats	none
Thidar myaing village	Wa-ya, Wa-net & Malay-sia-padauk	Household construction & Firewood	N16° 37' 35.8" E 96° 17' 31.6"	1 plant=1,500kyats 1 plant=3,500kyats	Tree plantations can serve as useful buffers between new developments and living areas.
Phalan old village	Wa-net, Wa-gauk , Wa-ya , Thi-ho & Malay-sia-padauk	Household construction, family use & Firewood	N16° 38' 59.7" E 96° 17' 27.1"	1 plant=1,500kyats 1 plant=3,500kyats (7 years)	Tree plantations can serve as useful buffers between new developments and living areas.
Shwepyi thayar old village	Hti-yoe, Wa-net, Wa-ya & Thi-ho	Household construction & family use	N16° 38' 42.9" E 96° 17' 15.8"	1 plant=1,500kyats	Tree plantations can serve as useful buffers between new developments and living areas.
	Gan-da-mar, Kha-yan Chin-paung-ni Mon-la Kon-ka-zun	Commercial use	N16° 38' 39.1" E 96° 17' 22.6"	1 plant=130kyats 1 viss=500-1,000kyats 10 plants=50kyats 5 plants=200kyats 10 plants=70kyats	none
Letyetsan old village	Wa-net, Wa-gauk , Wa-ya , Thi-ho & Malay-sia-padauk	Household construction, family use & Firewood	N16° 40' 21.9" E 96° 17' 06.1"	1 plant=1,500kyats 1 plant=3.500kyats (7 years)	Tree plantations can serve as useful buffers between new developments and living areas.
Thilawa old village	Malaysia-padauk	Firewood	N 16° 40' 08.6 " E 96° 16' 37.6"	1 plant=3,500kyats (7 years)	Tree plantations can serve as useful buffers between new developments and living areas.

Place	Plants used	Use of plant	Location	Value of Flora	Opinions of interviewees
Alwumsut old village	Malaysia-padauk	Firewood	N 16° 42' 08.4" E 96° 15' 15.7"	1 plant=3,500kyats (7 years)	Tree plantations can serve as useful buffers between new developments and living areas.
	Malaysia-padauk	Firewood	N 16° 41' 58.0" E 96° 14' 49.3"	1 plant=3,500kyats (7 years)	Tree plantations can serve as useful buffers between new developments and living areas.

Source: SEZ Management Committee study

2） Ecosystem Service Value

The following table provides an estimate of the total CO_2 sequestration in the Project area as a result of monoculture plantations. The total estimated sequestration on site is calculated by total planted acres multiplied by the estimated sequestration in kg/acre, resulting in an estimate of 508,847.6kg or ~508 tons of CO_2.

Table 67 Carbon Sequestration of Monocultural Plantation

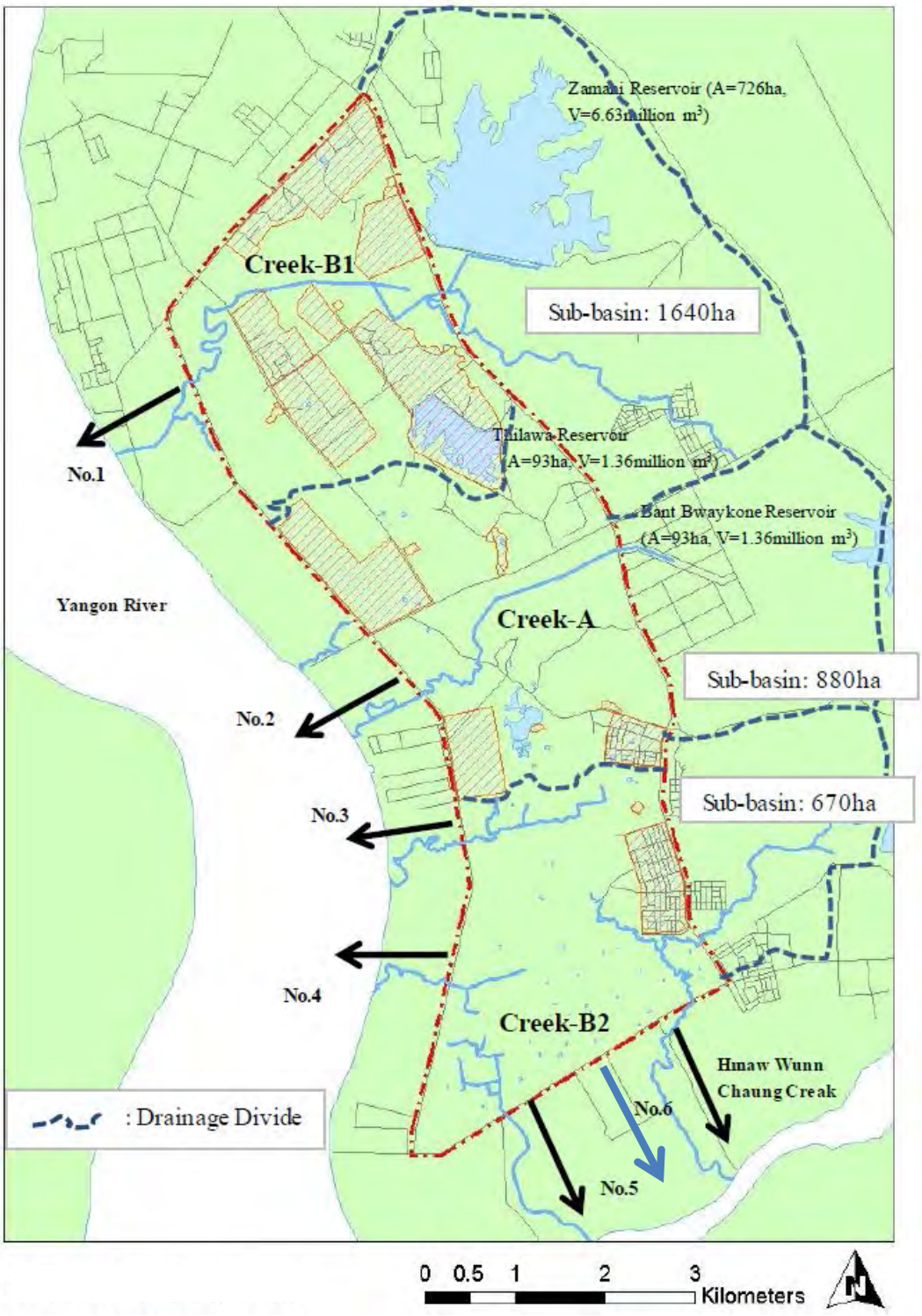
Scientific Name	CO2 sequestration in individual tree	CO_2 Sequestration rate (kg)	No. of tree/acre	Total planted acre	Total CO_2 Sequestration (kg/acre)	Total CO_2 Sequestration (kg)
(9 years old) *Acacia auriculiformis*	0.756	0.084	251.8	20.0	5,036.9	100,737.2
(9 years old) *Acacia auriculiformis*	0.756	0.084	251.8	10.0	2,518.4	25,184.3
(8 years old) *Acacia auriculiformis*	0.474	0.059	177.8	5.0	888.8	4,443.9
(7 years old) *Acacia auriculiformis*	0.704	0.101	301.7	0.4	119.3	47.2
(7 years old) *Acacia auriculiformis*	0.704	0.101	301.7	0.4	119.3	47.2
(7 years old) *Acacia auriculiformis*	0.856	0.122	366.8	5.0	1,834.1	9,170.4
(4 years old) *Acacia auriculiformis*	0.311	0.078	232.9	3.0	698.8	2,096.3
(4 years old) *Acacia auriculiformis*	0.175	0.044	131.0	0.6	80.9	50.0
(4 years old) *Acacia auriculiformis*	0.205	0.051	153.8	0.4	60.8	24.0
Total	**4.939**	**0.723**	**2,169.4**	**44.8**	**11,357.2**	**508,847.6**

Source: SEZ Management Committee study

1.3.5 Hydrology

The two main dynamic water bodies around the SEZ into which water drains are the Yangon River and the Hmawwun River. The main river around the Thilawa SEZ area is the Yangon River, a large tidal river flowing from north to south to the west of the Thilawa SEZ. The much smaller Hmawwun River flows from east to west to the south of the Thilawa SEZ and empties into the Yangon River. The main reservoirs include the Zarmani Dam, just offsite to the north, the Thilawa Dam in the central northern portion of the site adjoining the Class A zone, and the Bant Bway Kone Dam in the central southern portion of the site. The Thilawa SEZ area in its natural state is very low-lying and floods during the rainy season to the point that most non-paved roads are inaccessible by vehicle. Therefore, there are a multitude of rivulets and streams on the site. These flow out into the six main creeks exiting the site: two

exiting southerly into the Hmawwun River and four exiting westerly to the Yangon River. A map of the basins within the area is shown below.



Source: JICA (2013) *Preparatory Study on Thilawa Special Economic Zone (SEZ) Infrastructure Development in the Republic of the Union of Myanmar*

Figure 40 Drainage Catchments of the Project Area Zone

1.3.6 Topography and Geology

The topography of the Project area consists of mostly flat alluvial plan in the western areas

around Kyauktan Township dominated by paddy fields. This alluvial plain area is generally less than 6.6m above sea level. In the rainy season this area floods and is planted with paddy.

The topography changes to the north and west towards Thanlyin area, gradually changing into rolling hills. The highest areas of the Project area lie along the western section of the area along the Thanlyin-Kyauktan Highway and western part of Nyaungwine Village Tract and Shwebyauk Village. The maximum elevation in the Project area is 17m above sea level near the border of Thanlyin and Kyauktan Townships along the road between the Ahle Village of Thanlyin and the Thilawa Village of Kyauktan.

A topographical map of the area is presented in the figure to the right.

Source: SEZ Management Committee

Figure 41 Topographical Map of the Project Area

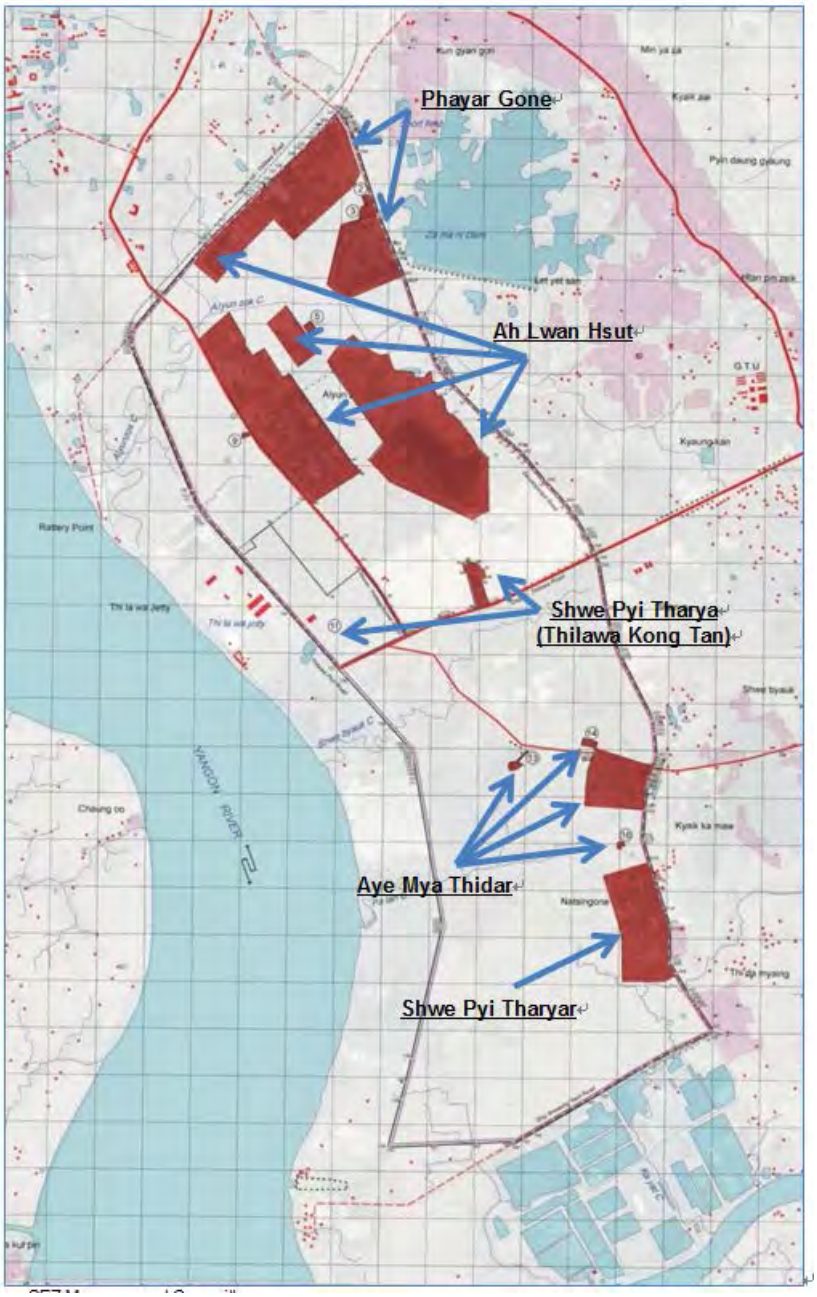
1.4 Social Environment

The Project area is located approximately 20km south of by road or 8km directly. Yangon is the principal commercial and cultural city of Myanmar. Yangon is also the largest city with an estimated 4.259 million people, followed by Mandalay with about 1.009 million people and Naypyidaw (the capital of the country) with 992,000 at the end of 2009. The average national adult literacy is 92.7 percent with a higher percentage among the male population than in the females. The maternal mortality indicators have been gradually improving in recent years. The infant mortality rate (IMR) in 2013 was 47.74 per 1,000 live births.

Thilawa SEZ overlaps both the Thanlyin and Kyauktan Townships south of Yangon with the northern half of the Project in Thanlyin and the southern half in Kyauktan. Thanlyin as a

whole has an area of 143.982mi^2 (372.912km^2) with a population of 210,838 people in 2015. Kyauktan as a whole has an area of 325.76mi^2 (843.715km^2) with a population of 170,844 people in 2015. In the Thilawa SEZ itself, there seems to be a number of households in the 2,000ha area of the SEZ with the highest population density in the northern area of the SEZ zone.[8] Villages in and immediately around the SEZ are labeled in the map below.

[8] JICA (2013b). *Resettlement Work Plan (RWP) for Development of Phase 1 Area Thilawa Special Economic Zone (SEZ)*



Source: SEZ Management Committee

Figure 42Villages In and Around the Thilawa SEZ

Detailed data from the General Administrative Departments of Thanlyin and Kyauktan follow below.

Table 68 Total Population of Thanlyin Township (2015)

Village Tract / Quarter	Village Unit	Houses	Households	Under 18 years			Over 18 years			Total		
				Male	Female	Total	Male	Female	Total	Male	Female	Total
Quarters												
East New Town	-	327	327	126	117	*243*	487	529	*1,016*	613	646	*1,259*
Middle New Town	-	192	192	27	11	*38*	360	456	*816*	387	467	*854*
West New Town	-	100	100	41	26	*67*	172	195	*367*	213	221	*434*
East Old Town	-	2,145	2,185	2,343	1,332	*3,675*	3,230	3,741	*6,971*	463	5,073	*5,536*
Middle Old Town	-	796	98	527	543	*1,070*	1,354	1,594	*2,948*	1,881	2,128	*4,009*
West Old Town	-	720	720	520	483	*1,003*	1,032	1,147	*2,179*	1,552	1,630	*3,182*
South Myo Ma	-	1,151	1,151	340	328	*668*	115	2,213	*2,328*	2,055	2,541	*4,596*
North Myo Ma	-	241	241	129	111	*240*	462	559	*1,021*	591	670	*1,261*
Yae Nan	-	608	608	237	223	*460*	980	106	*1,086*	1,217	1,290	*2,507*
Dar Gar	-	1,004	1,004	552	551	*1,103*	1,591	196	*1,787*	1,243	2,348	*3,591*
Aung Mingalar	-	439	439	107	103	*210*	685	889	*1,574*	792	992	*1,784*
Thaut Taw Kwin	-	1,087	1,087	598	380	*978*	159	214	*373*	2,195	2,527	*4,722*
Oak Pho Su	-	1,039	1,039	563	701	*1,264*	1,736	191	*1,927*	2,299	2,618	*4,917*
A Mhu Htan	-	1,958	2,002	1,251	1,379	*2,630*	3,154	3,561	*6,715*	4,405	4,940	*9,345*
Htan Pin Kone	-	661	661	312	342	*654*	1,261	1,452	*2,713*	1,573	1,794	*3,367*
Pago Su	-	1,044	1,044	361	524	*885*	1,754	2,070	*3,824*	2,115	2,594	*4,709*
Aung Chan Thar	-	1,532	1,550	527	884	*1,411*	3,375	3,924	*7,299*	3,902	4,808	*8,710*
	Total of 17 Quarters	***15,044***	***14,448***	***8,561***	***8,038***	***16,599***	***21,907***	***23,037***	***44,944***	***27,496***	***37,287***	***64,783***
Village Tracts												
Win Kanei	-	277	286	150	196	*346*	413	450	*863*	563	646	*1,209*
East Pharku	-	1,015	1,030	576	508	*1,084*	1,517	1,566	*3,083*	2,093	2,110	*4,203*
West Pharku	-	498	498	300	306	*606*	705	791	*1,496*	1,005	1,097	*2,102*
Bot Tha Pyay Kan	-	1,003	1,003	654	692	*1,346*	1,428	1,523	*2,951*	2,082	2,215	*4,297*
Kayin Sate	-	787	802	570	556	*1,126*	1,236	1,288	*2,524*	1,806	1,844	*3,650*
Tha Pyay Kone	-	682	683	289	357	*646*	929	964	*1,893*	1,218	1,321	*2,539*
Ah Lwan Sut	-	1,169	1,179	793	728	*1,521*	1,698	1,979	*3,677*	2,491	2,707	*5,198*
Kyaung Kone Sate Gyi	-	1,059	1,090	912	1,045	*1,957*	6,413	2,204	*8,617*	7,323	3,249	*10,572*
Tha Htay Kwin	-	519	519	380	401	*781*	784	883	*1,667*	1,164	1,284	*2,448*
Sit Pin Kwin	-	563	563	283	298	*581*	842	834	*1,676*	1,125	1,132	*2,257*
Bayat	-	353	353	197	274	*471*	485	518	*1,003*	682	792	*1,474*
Ngar Pyay Ma	-	418	418	266	282	*548*	636	653	*1,289*	902	935	*1,837*
Nga/ Pa	-	466	473	395	389	*784*	752	746	*1,498*	1,147	1,153	*2,300*
Thana Pin	-	162	162	116	133	*249*	227	232	*459*	343	365	*708*
Nyaung Thone Pin	-	1,379	1,446	923	1,094	*2,017*	2,909	3,371	*6,280*	3,832	4,465	*8,297*
Yone Tha Pyay Kan	Yone Thapyay Kan	568	568	357	349	*706*	827	853	*1,680*	1,184	1,202	*2,386*
	Lat Pan	96	95	130	80	*210*	178	254	*432*	308	334	*642*
	Total	*664*	*663*	*487*	*429*	*916*	*1,005*	*1,107*	*2,112*	*1,492*	*1,536*	*3,028*
Daezart	Daezart	350	350	165	148	*313*	320	344	*664*	485	492	*977*
	Kankyisu	152	152	34	19	*53*	59	78	*137*	93	97	*190*
	KanHla-Kalartan	110	110	77	67	*144*	159	156	*315*	236	223	*459*
	Uyinkone	183	183	89	74	*163*	241	274	*515*	330	348	*678*

Village Tract / Quarter	Village Unit	Houses	Households	Under 18 years			Over 18 years			Total		
				Male	Female	Total	Male	Female	Total	Male	Female	Total
	Total	*795*	*795*	*365*	*308*	*673*	*779*	*852*	*1,631*	*1,144*	*1,160*	*2,304*
Mingalon	Mingalon	465	465	330	326	*656*	881	933	*1,814*	1,211	1,259	*2,470*
	Pauktaw	192	192	123	135	*258*	150	150	*300*	273	285	*558*
	Nyaungwine	178	178	123	135	*258*	150	150	*300*	273	285	*558*
	Total	*835*	*835*	*576*	*596*	*1,172*	*1,181*	*1,233*	*2,414*	*1,757*	*1,829*	*3,586*
Bagantaung	Bagantaung	514	514	164	170	*334*	616	671	*1,287*	780	841	*1,621*
	Ywarthit	283	283	169	254	*423*	234	169	*403*	403	423	*826*
	Total	*797*	*797*	*333*	*424*	*757*	*850*	*840*	*1,690*	*1,183*	*1,264*	*2,447*
Bogyoke	Bogyoke	1,531	1,537	1,561	1,102	*2,663*	2,039	2,539	*4,578*	3,600	3,641	*7,241*
	Ywarthit	1,302	1,307	806	1,135	*1,941*	2,363	2,597	*4,960*	3,169	3,732	*6,901*
	Tharyarkone	717	721	786	702	*1,488*	707	802	*1,509*	1,493	1,504	*2,997*
	Total	*3,550*	*3,565*	*3,153*	*2,939*	*6,092*	*5,109*	*5,938*	*11,047*	*8,262*	*8,877*	*17,139*
Laharyet	Laharyet	431	341	165	189	*354*	422	485	*907*	587	674	*1,261*
	Tharyarkone	201	167	132	95	*227*	215	247	*462*	347	342	*689*
	Total	*632*	*508*	*297*	*284*	*581*	*637*	*732*	*1,369*	*934*	*1,016*	*1,950*
Kadatphyar	Kadatphyar	252	150	87	83	*170*	245	242	*487*	332	325	*657*
	Pyitawthar	125	70	51	50	*101*	31	83	*114*	82	133	*215*
	Sikone	315	153	109	103	*212*	207	225	*432*	316	328	*644*
	Total	*692*	*373*	*247*	*236*	*483*	*483*	*550*	*1,033*	*730*	*786*	*1,516*
Nyaunglaypin	Nyaunglaypin	347	347	109	234	*343*	460	466	*926*	569	700	*1,269*
	Kantharmyint	100	100	192	61	*253*	135	189	*324*	327	250	*577*
	Total	*447*	*447*	*301*	*295*	*596*	*595*	*655*	*1,250*	*896*	*950*	*1,846*
Kalarwae	Kalarwae	496	486	322	353	*675*	695	667	*1,362*	1,017	1,020	*2,037*
	Htawthwin	135	130	67	98	*165*	231	262	*493*	298	360	*658*
	Total	*631*	*616*	*389*	*451*	*840*	*926*	*929*	*1,855*	*1,315*	*1,380*	*2,695*
Letyetsan	Letyetsan	605	592	491	598	*1,089*	1,270	1,342	*2,612*	1,761	1,940	*3,701*
	Pyinhtaungkyaung	425	428	417	385	*802*	601	542	*1,143*	1,018	927	*1,945*
	Htanpinseik	681	681	545	504	*1,049*	1,039	951	*1,990*	1,584	1,455	*3,039*
	KyeikInn	238	238	251	203	*454*	360	308	*668*	611	511	*1,122*
	Kyaungkankwin	301	301	370	233	*603*	370	333	*703*	740	566	*1,306*
	Alaeywar	598	598	416	364	*780*	927	778	*1,705*	1,343	1,142	*2,485*
	Myayaryoe	1,392	1,392	603	577	*1,180*	1,720	2,216	*3,936*	2,323	2,793	*5,116*
	Htarmalon	1,397	1,397	713	740	*1,453*	1,948	1,696	*3,644*	2,661	1,586	*4,247*
	Total	*5,637*	*5,627*	*3,806*	*3,604*	*7,410*	*8,235*	*8,166*	*16,401*	*12,041*	*10,920*	*22,961*
Saylonekyi	-	258	259	198	147	*345*	367	415	*782*	565	562	*1,127*
Chaungsauk	-	246	242	147	137	*284*	410	540	*950*	557	677	*1,234*
Phayarkone	Phayarkone	1,472	2,281	1,704	867	*2,571*	2,988	4,437	*7,425*	4,692	5,304	*9,996*
	Kyeik Inn	374	309	198	93	*291*	822	814	*1,636*	1,020	907	*1,927*
	Kwinchankone	1,371	1,270	265	272	*537*	1,833	1,919	*3,752*	2,098	2,191	*4,289*
	Kyaukyaetwin	1,064	1,064	290	310	*600*	1,519	1,565	*3,084*	1,809	1,875	*3,684*
	Natsinkone	288	213	128	48	*176*	694	657	*1,351*	822	705	*1,527*
	Thaephyuchaung	780	680	185	54	*239*	1,226	1,236	*2,462*	1,411	1,290	*2,701*
	Kanyinpin	1,062	1,093	457	363	*820*	979	1,056	*2,035*	1,436	1,419	*2,855*
	Letyetsan	634	558	171	117	*288*	510	1,226	*1,736*	681	1,343	*2,024*

Village Tract / Quarter	Village Unit	Houses	Households	Under 18 years			Over 18 years			Total		
				Male	Female	Total	Male	Female	Total	Male	Female	Total
	Batonesan	386	436	176	202	*378*	699	1,051	*1,750*	875	1,253	*2,128*
	Total	*7,431*	*7,904*	*3,574*	*2,326*	*5,900*	*11,270*	*13,961*	*25,231*	*14,844*	*16,287*	*31,131*
	Total of 28 Village Tracts	***32,965***	***33,136***	***20,677***	***19,435***	***40,112***	***52,821***	***53,920***	***106,741***	***73,496***	***72,559***	***146,055***
	Total Township Population	**48,009**	**47,584**	**29,238**	**27,473**	**56,711**	**74,728**	**76,957**	**151,685**	**100,992**	**109,846**	**210,838**

Source: General Administrative Department, Thanlyin

Table 69 Total Population of Kyauktan Township (2015)

Village Tract / Quarter	Village Unit	Houses	Households	Under 18 years			Over 18 years			Total		
				Male	Female	Total	Male	Female	Total	Male	Female	Total
Quarter												
Eastern Quarter	-	564	642	371	339	710	988	1,021	2,009	1,359	1,360	2,719
Middle Quarter	-	152	256	75	84	159	549	577	1,126	624	661	1,285
Western Quarter	-	720	1,088	587	615	1,202	1,396	1,657	3,053	1,983	2,272	4,255
Ywe Kone Quarter	-	1,797	1,930	969	937	1,906	2,837	3,306	6,143	3,806	4,243	8,049
Sin Kan Quarter	-	1,234	1,366	633	631	1,264	1,951	2,305	4,256	2,584	2,936	5,520
San Chane Mhe Quarter	-	1,265	1,388	685	665	1,350	1,888	2,264	4,152	2,573	2,929	5,502
Thida Myaing Quarter	-	469	563	259	315	574	707	805	1,512	966	1,120	2,086
Aye Mya Thida Quarter	-	279	314	179	176	355	385	430	815	564	606	1,170
Shwe Pyi Thar Quarter	-	698	716	540	480	1,020	1,010	1,012	2,022	1,550	1,492	3,042
No (1) Quarter	-	497	540	282	225	507	731	835	1,566	1,013	1,060	2,073
No (2) Quarter	-	600	744	335	276	611	1,053	1,276	2,329	1,388	1,552	2,940
No (3) Quarter	-	468	513	236	210	446	706	760	1,466	942	970	1,912
No (4) Quarter	-	606	856	426	428	854	1,055	803	1,858	1,481	1,231	2,712
	Total of 13 Quarters	***9,349***	***10,916***	***5,577***	***5,381***	***10,958***	***15,256***	***17,051***	***32,307***	***20,833***	***22,432***	***43,265***
Village Tracts												
Nyaung Wine Village Tract	Nyaung Wine	307	334	203	188	391	427	467	894	630	655	1,285
	Myaing Thar Yar	1,230	1,311	778	790	1,568	1,623	1,798	3,421	2,401	2,588	4,989
	Shansu	267	282	231	187	418	303	327	630	534	514	1,048
	Total	*1,804*	*1,927*	*1,212*	*1,165*	*2,377*	*2,353*	*2,592*	*4,945*	*3,565*	*3,757*	*7,322*
Kyar Kan Village Tract	Kyar Kan	499	508	309	283	592	610	656	1,266	919	939	1,858
Yay Kyaw Village Tract	Yay Kyaw	178	188	84	79	163	218	227	445	302	306	608
	Chaung Sauk	527	568	310	296	606	740	808	1,548	1,050	1,104	2,154
	Total	*705*	*756*	*394*	*375*	*769*	*958*	*1,035*	*1,993*	*1,352*	*1,410*	*2,762*
Shwe Pyauk Village Tract	Shwe Pyauk	310	315	172	163	335	365	410	775	537	573	1,110
	A Dwut Taw	514	516	248	274	522	606	660	1,266	854	934	1,788
	Kyaik Ka Mawt	95	99	52	45	97	125	139	264	177	184	361
	Kyar Kan Date	32	35	15	22	37	42	53	95	57	25	132
	Say Bo Wa	290	291	169	150	319	486	516	1,002	655	666	1,321
	Thein Kone	-	-	-	-	-	-	-	-	-	-	-
	Total	*1,241*	*1,256*	*656*	*654*	*1,310*	*1,624*	*1,778*	*3,402*	*2,280*	*2,382*	*4,712*
Bawga Lut Village Tract	Bawga Lut	294	330	145	127	272	529	512	1,041	674	639	1,313
	Kha Mal	116	128	118	98	216	142	146	288	260	244	504
	Total	*410*	*458*	*263*	*225*	*488*	*671*	*658*	*1,329*	*934*	*883*	*1,817*

Village Tract / Quarter	Village Unit	Houses	Households	Under 18 years			Over 18 years			Total		
				Male	Female	Total	Male	Female	Total	Male	Female	Total
Par Da Gyi Village Tract	Par Da Gyi	431	410	93	96	189	497	486	983	590	582	1,172
	Say Bo Wa	76	78	59	85	144	150	203	353	209	288	497
	Zin Byun Kone	46	59	48	61	107	360	431	791	408	492	900
	Total	*553*	*547*	*200*	*242*	*440*	*1,007*	*1,120*	*2,127*	*1,207*	*1,362*	*2,569*
Chaung wa Village Tract	Chaung Wa	550	608	327	315	642	814	805	1,619	1,141	1,120	2,261
Thanapin Chin Village Tract	Thanapin Chin	102	105	71	79	150	208	198	406	279	277	556
	A Ngu	211	234	124	132	256	341	387	728	465	519	984
	Mway Pway Kone	52	45	34	40	74	71	74	145	105	114	219
	Total	*365*	*384*	*229*	*251*	*480*	*620*	*659*	*1,279*	*849*	*910*	*1,759*
Mee Pya Village Tract	Mee Pya	1,102	1,290	706	723	1,429	1,401	1,311	2,712	2,107	2,034	4,141
	Ka Lout Swae	305	374	432	517	949	883	878	1,761	1,315	1,395	2,710
	Total	*1,407*	*1,664*	*1,138*	*1,240*	*2,378*	*2,284*	*2,189*	*4,473*	*3,422*	*3,429*	*6,851*
Zwe Bar Kone Tan Village Tract	Zwe Bar Kone Tan	623	646	373	386	759	893	956	1,849	1,266	1,342	2,608
Kwa Nee Village Tract	Kwa Nee	620	636	335	300	632	964	1,060	2,024	1,291	130	2,661
Ywa Thit Gyi Village Tract	Ywa Thit Gyi	350	362	267	279	546	560	554	1,114	827	833	1,660
Kyan Pin Village Tract	Kyan Pin	426	432	279	261	540	639	674	1,313	918	935	1,853
Thaung gyi Village Tract	Thaung Gyi	192	210	75	102	177	292	312	604	367	414	781
U Yin Village Tract	U Yin	445	462	228	247	475	630	670	1,300	858	917	1,775
Wae Gyi Village Tract	Wae Gyi	237	313	191	262	453	419	450	869	610	712	1,322
	Kwin Pout	130	201	70	69	139	370	310	680	440	379	819
	Nyaung wie Lay	83	159	139	70	209	275	295	570	414	365	779
	Total	*450*	*673*	*400*	*401*	*801*	*1,064*	*1,055*	*2,119*	*1,464*	*1,456*	*2,920*
Pan Taw Village Tract	Pan Taw	681	722	386	384	770	989	1,052	2,041	1,375	1,436	2,811
	Kyun Ka Lay	345	390	207	210	417	438	495	933	645	705	1,350
	Total	*1,026*	*1,112*	*593*	*594*	*1,187*	*1,427*	*1,547*	*2,974*	*2,020*	*2,141*	*4,161*
Kyone Kan Village Tract	Kyone Kan	425	581	267	275	542	780	808	1,588	1,047	1,083	2,130
Kan Pyaung Village Tract	Kan Pyaung	600	636	475	367	842	937	966	1,903	1,412	1,333	2,745
	Pyin makan	50	151	107	108	215	198	225	423	306	332	638
	Total	*650*	*787*	*582*	*475*	*1,057*	*1,135*	*1,191*	*2,326*	*1,718*	*1,665*	*3,383*
Pi Lakhat Village Tract	Pi Lakhat	101	135	39	38	77	95	243	338	134	281	415
	Kalar Pi lakhat	83	139	89	104	193	60	136	196	149	240	389
	Taman Gyi	68	99	115	150	265	79	118	197	194	268	462
	Total	*252*	*373*	*243*	*292*	*535*	*234*	*497*	*731*	*477*	*789*	*1,266*
Ywar Thit Kalay Village Tract	Ywar Thit Kalay	420	430	330	345	675	390	430	820	720	775	1,495
	Sandi	175	180	68	120	188	312	326	638	380	446	826
	Kyar Kan	168	176	20	51	71	372	340	712	392	391	783
	Total	*763*	*786*	*418*	*516*	*934*	*1,074*	*1,096*	*2,170*	*1,492*	*1,612*	*3,104*
Kayin Chaung Village Tract	Kayin Chaung	288	289	204	206	410	572	476	1,048	776	62	1,458
Kamar Kalote Village Tract	Kamar Kalote	513	526	532	398	930	871	1,103	194	1,403	1,501	2,904
	Kamar Kalote(N)	499	501	189	317	502	816	670	1,486	1,001	987	1,988
	Kamar Lane	258	250	51	107	158	66	154	220	117	261	378
	Paung	1,203	1,310	768	822	1,590	1,753	1,927	3,680	2,521	2,749	5,270
	Total	*2,473*	*2,587*	*1,540*	*1,644*	*3,180*	*3,506*	*3,854*	*5,580*	*5,042*	*5,498*	*10,540*
Kalar Tan Village Tract	Kalar Tan	406	420	301	300	601	429	409	838	730	709	1,439

Village Tract / Quarter	Village Unit	Houses	Households	Under 18 years			Over 18 years			Total		
				Male	Female	Total	Male	Female	Total	Male	Female	Total
	Shwe Pyi Thit	136	146	86	137	223	290	202	492	376	339	715
	Than Tae	101	111	52	27	79	208	193	401	260	220	480
	Taw Ka Lote	106	125	258	95	353	296	388	684	554	483	1,037
	Total	*749*	*802*	*697*	*559*	*1,256*	*1,223*	*1,192*	*2,415*	*1,920*	*1,751*	*3,671*
A Se Village Tract	A Se	432	669	381	361	742	959	1,030	1,989	1,340	1,391	2,731
Mingalon Village Tract	Minga Lon	959	1,101	408	357	765	1,503	1,673	3,176	1,911	2,030	3,941
	Aye Chan Thar	121	351	445	366	811	701	682	1,383	1,146	1,048	2,194
	Total	*1,080*	*1,452*	*853*	*723*	*1,576*	*2,204*	*2,355*	*4,559*	*3,057*	*3,078*	*6,135*
Kanaung Village Tract	Kanaung(East)	304	320	275	182	457	556	638	1,194	831	820	1,651
	Bon Lon	121	280	21	120	141	290	237	527	311	357	668
	Kanaung(west)	289	317	267	173	440	453	468	921	720	641	1,361
	Total	*714*	*917*	*563*	*475*	*1,038*	*1,299*	*1,343*	*2,642*	*1,862*	*1,818*	*3,680*
Mya Kaing Village Tract	Mya kaing	752	792	341	384	725	1,099	1,200	2,299	1,440	1,584	3,024
	Kyone Chike	145	147	123	94	317	200	177	377	423	271	694
	Total	*897*	*939*	*464*	*478*	*1,042*	*1,299*	*1,377*	*2,676*	*1,863*	*1,855*	*3,718*
Zwekana Village Tract	Zwekana	452	482	311	316	627	710	683	1,393	1,021	999	2,020
Boeba Villager Tract	Boeba	300	300	185	205	390	497	527	1,024	682	732	1,414
	Mote Soe Sape	63	84	99	121	220	41	46	87	140	167	307
	Total	*363*	*384*	*284*	*326*	*610*	*538*	*573*	*1,111*	*822*	*899*	*1,721*
Naywechaung Village Tract	Naywechaung	399	487	313	281	594	672	709	1,381	985	990	1,975
Sitta Pin Village Tract	Sitta Pin	55	123	42	44	86	209	180	389	251	224	475
Sittan Village Tract	Sittan	923	1,074	573	563	1,136	1,302	1,380	2,682	1,875	1,943	3,818
Tamankyi Kone Village Tract	Tamankyi Kone	715	729	378	437	815	911	861	1,772	1,289	1,298	2,587
Tumyaung Village Tract	Tumyaung	260	306	125	103	228	391	380	771	516	483	999
Tapa Village Tract	Tapa	525	530	220	211	431	510	590	1,100	730	801	1,531
	Ziphyu Pin	140	151	87	54	141	284	294	578	371	348	719
	Total	*665*	*681*	*307*	*265*	*572*	*794*	*884*	*1,678*	*1,101*	*1,149*	*2,250*
Win Kyi Village Tract	Win Kyi	300	382	272	274	546	604	628	1,232	876	902	1,778
Kadadpana Village Tract	Kadadpana	323	448	236	136	372	773	774	1,547	1,009	910	1,919
Mayanbay Village Tract	Mayanbay	179	210	91	96	187	309	332	641	400	428	828
	Ah Wa Kauk	210	262	104	106	210	321	352	673	425	458	883
	Thu Kha Aung	63	73	39	39	78	86	86	172	125	125	250
	Aungdaphay	167	264	143	112	255	326	326	652	469	438	907
	Total	*619*	*809*	*377*	*353*	*730*	*1,042*	*1,096*	*2,138*	*1,419*	*1,449*	*2,868*
Sinmakaw Village	Sinmakaw	160	381	247	261	508	552	545	1,097	799	806	1,605
Aungchanthar Village	Aungchanthar	400	427	238	203	441	531	538	1,069	769	741	1,510
Shanchaung Village	Shanchaung	689	695	369	371	740	873	866	1,739	1,242	1,237	2,479
Potetalote Village	Potetalote	998	1,054	789	782	1,571	1,370	1,493	2,863	2,159	2,275	4,434
Panchaung Village	Panchaung	263	269	144	130	274	311	390	701	455	520	975
	Total of 54 Village Tracts	***28,425***	***32,036***	***18,806***	***18,485***	***37,382***	***43,988***	***46,202***	***88,410***	***62,883***	***62,786***	***127,579***
	Total Township Population	***37,774***	***42,952***	***24,383***	***23,866***	***48,340***	***59,244***	***63,253***	***120,717***	***83,716***	***85,218***	***170,844***

Source: General Administrative Department, Kyauktan

1.4.1 Historical Context

The area in question is Thilawa, reportedly established first as a village in the early 1700s. Thilawa is a part of the greater Thanlyin (also called Syriam) and Kyauktan townships that in turn need to be considered in the regional context. The majority of the immediate region's historical area is a rough circle ranging from present day Bago to Yangon and down to the Gulf of Martaban on either side of the Yangon River.

There is considerable doubt as to the history of the region before the 16th century. It is probably likely that various Buddhist settlers with links to areas in the present day India were present in the area since before the Common Era. These settlers are associated with the ancient Pada Kingdom, where there are at present day laterite remains around the Pardagyi Pagoda. However, there is very little known about this Kingdom. Local legends first begin in 514 AD with the foundation of the Mon-speaking Hanthawaddy Kingdom in Pegu, which lasted as a collection of Buddhist and Hindu states until 1050 AD when governors were appointed from the Bamar Pagan empire. The last of these governors rebelled against the Pagan rule successfully in 1287 AD after collapse of the Bagan to the Mongols resulting in the re-establishment of Pegu as a state in its own right as the first Peguan empire. Under this rule, the first Peguan Empire consolidated Mon rule over a wide area including the Hanthawaddy Kingdom and Martaban and Bassein, two other nearby kingdoms. This empire was overthrown in 1540 AD with the succession of the Toungoo Dynasty (the second Peguan Empire). During the Toungoo Dynasty, Syriam became an increasingly important center for commerce.

As a historical anecdote in the context of the Syriam, the short-lived fortress of Portuguese adventurer/mercenary Filipe de Brito e Nicote ("Nga Zinga") is well remembered in modern times. Along with Rakhine forces under the King of Arakan Min Razagri, de Brito was given Syriam by the King as recompense for his loyalty as a mercenary and in 1603 and became de facto ruler of the Syriam town around present-day Thanlyin where he attempted to establish a base for further Portuguese influence in Lower Myanmar. In 1613 he was defeated by forces from Pegu and executed.

By 1740, the Toungoo Dynasty had (re-)conquered all of Pegu and its kingdoms. By this time, Syriam was the main trading city due to silted up ports at Pegu. The Burmese armies successfully defeated the Toungoo dynasty in 1740 taking control of Syriam. During this period, French and British interests interloped in a number of administrative divisions and in 1824 the First Anglo-Burmese War began. During the first war the British made a first foray into Syriam before it was retaken by Burmese troops and the British retired from the area. Subsequently during the Second Anglo-Burmese War in 1853 the area came under the rule of the British East India Company after the province of Pegu was formally annexed to the

British.[9] The British ruled as administrators until Burmese independence on 4th January 1948.

During British rule, Syriam was an important port town that was characterized by industrial land on the east side of the Syriam ridge and rice fields on the west side of the Syriam ridge. The most prominent industrial activity at the time was the large oil works. The Burma Oil Company, Indo-Burma Company, and Rangoon Oil Company all had refineries in the area with the Rangoon Oil Company locating theirs in Thilawa (formerly known as Konthilawa). At the time, Thilawa village also was engaged in the construction of river steamers and river flats.

1.4.2 Ethnic Minorities and Indigenous Peoples

The ethnic make-up of the population is overwhelmingly Bamar (95%+) with Kayin, Rakhine, Indian and other smaller ethnicities also represented.

There are 17 wards and 28 village tracts in Thanlyin Township. Within this boundary, 93.34 percent is Burmese, 0.56 percent is Rakhine and 0.74 percent is Karen. In the population, 198,157 persons are Burmese, 1,573 persons are Kayin and 1,183 persons are Rakhine. Other races include Mon, Chin, Shan, Kachin and Kayah. Foreigners living in Thanlyin Township are Chinese, Indians, Bangladeshi and Pakistani. Among the population, 93.33 percent are Buddhist. Buddhist population is 198,157 persons and others include Christian, Hindu and Islam.

Kyauktan Township is a Township in Yangon (South) District of Yangon Region, Myanmar. Kyauktan Township is subdivided into 2 Towns include Kyauktan Town and Tadar Town. Kyauktan Township is also subdivided into 45 Village Tracts and there are 41 wards and 44 village tracts in Kyauktan township. The races live in Kyauktan township are mostly Bamar (157,073), Rakhine (90) and Kayin (224). Foreigners living in the township are Chinese, and Indians. Among the population, Buddhists are the main religion with 96.86 percent of total population. Other religions practiced include Christian, Hindu and Islam. The details of these demographics are shown in the following tables.

Table 70 Registered Ethnicities in Thanlyin and Kyauktan Townships (2014)

Township	Thanlyin		Kyauktan	
	Person	%	Person	%
Indigenous				
Kachin	52	0.02	3	0.001
Kayar	2	0.01	2	0.001
Kayin	1574	0.74	224	0.138

[9] The annexation of Myanmar by the British occurred in three wars on a piecemeal basis ending in the final annexation of the entire country in 1885.

Chin	224	0.11	12	0.007
Bamar	198,157	93.34	157,073	96.86
Mon	415	0.20	8	0.004
Rakhaine	1183	0.56	90	0.055
Shan	133	0.06	3	0.001
Foreigner				
Chinese	371	0.17	391	0.24
Indian	7,090	3.34	4345	2.67
Bangladesh	425	0.20	-	-
Pakistan	64	0.03	-	-
Others	2,615	1.23	-	-
Total	**212,304**	**100**	**162,521**	**100**

Source: Southern Yangon District Administrative Office, Thanlyin

Table 71 Religions of Thanlyin and Kyauktan Townships (2014)

Township	Religious (Persons)					Total
	Buddhist	Christian	Hindu	Islam	Others	
Thanlyin	198,157	1,851	7,579	2,102	2,615	212,304
Kyauktan	157,073	1,220	3,486	372	-	162,151

Source: Southern Yangon District Administrative Office, Thanlyin

1.4.3 Living and Livelihoods

There is small-scale fishing activity around the mangrove-lined streams exiting the SEZ from the western border and emptying into the Yangon River. These communities include fishermen dependent on fisheries activities and aquatic products for income and food security. It is considered likely that these small streams might provide a spawning ground for larger fish in the greater Yangon River system. There is also artisanal fish aquaculture and fishing occurring sporadically throughout the zone in seasonal ponds that are damned up during the rainy season.

Data from the Thanlyin and Kyauktan General Administrative Department characterizes the living and livelihoods in the overall Thanlyin Township (including parts of the SEZ).

Table 72 Agricultural Production in Thanlyin and Kyauktan Townships

Reported Livestock (head)							
Township	**Year**	**Buffalo**	**Cow**	**Pig**	**Chicken**	**Duck**	**Goat/Sheep**
Thanlyin	2013-2014	757	14,188	5,563	12,098	8,447	26,662
	2014-2015	995	14,420	5,855	280,860	18,850	2,400
Kyauktan	2013-2014	1,947	17,199	7,040	163,385	40,283	2,828
	2014-2015	2,248	12,345	5,730	186,943	28,786	2,885
Reported Meat Production (kg)							
Township	**Year**	**Buffalo**	**Beef**	**Pork**	**Chicken**	**Duck**	**Goat/Sheep**
Thanlyin	2013-2014	0	735,766	3,046,796	7,616,827	1,255,263	76,887
	2014-2015	0	797,559	3,321,125	8,355,869	1,371,645	83,456
Kyauktan	2013-2014	511	1,017	4,265	7,815	1,844	147
	2014-2015	513	1,114	4,669	8,581	2,020	161
Reported Poultry Egg Production (number)							
Township	**Year**	**Chicken Eggs**			**Duck Eggs**		
Thanlyin	2013-2014	37,821,400			7,001,500		

	2014-2015	41,646,300	7,618,100
Kyauktan	2013-2014	33,873	13,384
	2014-2015	37,394	14,662

Reported Dairy Production

Township	Year	Dairy Cows (head)	Dairy Products (kg)
Thanlyin	2013-2014	452	530,467
	2014-2015	593	695,945
Kyauktan	2013-2014	30	245
	2014-2015	173	5,322

Fish and Prawn Aquaculture

Township	Year	Fish			Prawn		
		Ponds	Acres	Production (kg)	Ponds	Acres	Production (kg)
Thanlyin	2013-2014	No aquaculture in Thanlyin					
	2014-2015						
Kyauktan	2013-2014	6	13	10,685	54	6,964	299,597
	2014-2015	6	13	1,141	61	10,935	702,106

Note: data includes statistics gathered by the GAD of Thanlyin and Kyauktan for the entirety of these two townships, including the project area.
Source: General Administrative Department, Thanlyin and Kyauktan

Table 73 Reported Industrial and Commercial Employment in Thanlyin and Kyauktan Townships

	Category	Township	Name	Type	Government/ Private	Employees
1	Factory	Thanlyin	Paper Parceling	Paper	Government	125
2	Factory	Thanlyin	(No-1) Petroleum	Petrol	Government	1,177
3	Factory	Thanlyin	Tin Factory	Metal	Government	142
4	Factory	Thanlyin	(No-10) Wood Mill	Teak/ wood	Government	134
5	Factory	Thanlyin	Glass Factory	Glass	Private	436
6	Factory	Thanlyin	Flat Zinc Factory	Zinc	Private	116
7	Factory	Thanlyin	Miba Gone Yae Garment	Clothes	Private	929
8	Factory	Thanlyin	Shwe Sagar Garment	Clothes	Private	1,235
9	Factory	Thanlyin	Sin Phyu Taw Garment	Clothes	Private	595
10	Factory	Thanlyin	Green Garment Garment	Clothes	Private	520
11	Factory	Kyauktan	Ship Breaking Factory	Iron	Government	50
12	Factory	Kyauktan	Food Factory	Crab	Private	180
13	Factory	Kyauktan	Clothing Factory	Clothes	Private	180
14	Factory	Kyauktan	Liquor Factory	Alcohol	Private	10
15	Factory	Kyauktan	Purified Drinking Water Factory (2)	Water	Private	30
16	Workshop	Thanlyin	War War Win Garment	Clothes	Private	11
17	Workshop	Thanlyin	Ever Smile Garment	Clothes	Private	20
18	Workshop	Thanlyin	Daw Nu Nu Khine Garment	Clothes	Private	15
19	Workshop	Thanlyin	Myittar Mon Garment	Clothes	Private	59
20	Workshop	Thanlyin	Linn Garment	Clothes	Private	26
21	Workshop	Thanlyin	Yadanar Drinking Water	Drinking Water	Private	10
22	Workshop	Thanlyin	Galorie Drinking Water	Drinking Water	Private	26
23	Workshop	Thanlyin	Shwe Thanlin Drinking Water	Drinking Water	Private	12
24	Workshop	Thanlyin	Duwon Drinking Water	Drinking Water	Private	10
25	Workshop	Thanlyin	Super Cool Drinking Water	Drinking Water	Private	19
26	Workshop	Thanlyin	Moe Thee Drinking Water	Drinking Water	Private	10
27	Workshop	Thanlyin	One Plus Drinking Water	Drinking Water	Private	7
28	Workshop	Thanlyin	Mr. Pure Drinking Water	Drinking Water	Private	12
29	Workshop	Thanlyin	Ever Drinking Water	Drinking Water	Private	30
30	Workshop	Thanlyin	Mirami Drinking Water	Drinking Water	Private	28

	Category	Township	Name	Type	Government/ Private	Employees
31	Workshop	Thanlyin	Yaza Drinking Water	Drinking Water	Private	11
32	Workshop	Thanlyin	Pai Hay Drinking Water	Drinking Water	Private	10
33	Workshop	Thanlyin	YMG Iron Door	Iron Grille	Private	37
34	Workshop	Thanlyin	Sky Star Bindery	Book	Private	41
35	Workshop	Thanlyin	KKL Cashewnut	Cashewnut	Private	45
36	Workshop	Thanlyin	Ko Nyi Nyi Cashewnut	Cashewnut	Private	70
37	Workshop	Thanlyin	Daw May Nan Khine Rattan	Rattan	Private	33
38	Workshop	Thanlyin	Myanmar Mosflies Mosquito Coil	Mosquito Coil	Private	20
39	Workshop	Thanlyin	Feel Hair Gel	Cosmetic	Private	87
40	Workshop	Thanlyin	U Ngwe Soe Car Engine Work	Workshop	Private	3
41	Workshop	Thanlyin	OK Footwear Business	Foot Wear	Private	10
42	Workshop	Thanlyin	Venus Foot Wear Business	Foot Wear	Private	27
43	Workshop	Thanlyin	Cobra Ointment	Medicine	Private	15
44	Workshop	Kyauktan	Aung Thukha Rice Mill	15 ton+ Rice mill	Private	30
45	Workshop	Kyauktan	Golden Dragon Rice mill	15 ton+ Rice mill	Private	35
46	Workshop	Kyauktan	Htapin Shwe Htee	15 ton+ Rice mill	Private	30
47	Workshop	Kyauktan	Htapin Shwe Htee	15 ton+ Rice mill	Private	30
48	Workshop	Kyauktan	Halar Rice Mill (94)	Under 15 Ton	Private	282
49	Small shop	Thanlyin	Garment x 27	-	Private	2,795
50	Small shop	Thanlyin	Powder Factory x 6	-	Private	10
51	Small shop	Thanlyin	Lathe x 6	-	Private	15
52	Small shop	Kyauktan	Snap Business x 2	-	Private	23
53	Small shop	Kyauktan	Motephat Noodles x 9	-	Private	30
54	Small shop	Kyauktan	Grilling Business x 18	-	Private	18
55	Small shop	Kyauktan	Iron Door Business x 8	-	Private	20
56	Small shop	Kyauktan	Iron Bending Business x 1	-	Private	5
57	Small shop	Kyauktan	Twin Khone x 24	-	Private	86
58	Small shop	Kyauktan	Car Workshop x 6	-	Private	10
59	Small shop	Kyauktan	Car Body Business x 4	-	Private	16
60	Small shop	Kyauktan	Car Brushing Business x 1	-	Private	2
61	Small shop	Kyauktan	Blacksmith x 20	-	Private	36

Note: data includes statistics gathered by the GAD of Thanlyin and Kyauktan for the entirety of these two townships, including the project area.

Source: General Administrative Department, Thanlyin and Kyauktan

1.4.4 Water Availability and Usage

The Township Development Committees of Kyauktan and Thanlyin have responsibility for providing water in their respective areas. At present, water sources for Thilawa area are underground water and surface water which is stored by three water storage reservoirs: Zarmani, Thilawa, and Bant Bwaykone in Thanlyin and Kyauktan Townships. The water rights for underground water belong to the Ministry of Development Affairs (MDA) and the rights to surface water belong to the Ministry of Agriculture and Irrigation (MOAI). Therefore, Zarmani and Bant Bwaykone reservoirs are controlled by MOAI. However, the Thilawa Reservoir is managed by MOI and Ministry of Construction (MOC).

Reportedly, the Zarmani Reservoir is used only for irrigation purposes. Thilawa Reservoir is utilized for industrial and irrigation water. The water supply from the Thilawa Reservoir is purified at 2 purification plants and sent to the various industries and facilities around the Thilawa SEZ area. There are not any industrial water supply issues presented and a water shortage has occurred only once in the past 16 years.

In addition to these surface water sources, there are also a number of groundwater wells found on site.

1.4.5 Education

Educational resources in Thanlyin and Kyauktan are divided into Higher Education (university), Basic Education High School (BEHS), Basic Education Middle School (BEMS), Basic Education Primary School (BEPS), Kindergarten, and Monastery School. The table below depicts the extent of educational infrastructure in the two surrounding townships.

Table 74 Educational Infrastructure (Secondary) in Thanlyin and Kyauktan

Township	Name of University / College / Science School	Location	Area (acre)	Number of Teachers	Quantity of Students	Ratio of Students to Teachers
Higher Education						
Thanlyin	Yangon Eastern University	Phayar Kone Village	158.1	509	9,375	18.42
Thanlyin	Navy University	Phayar Kone Village	110.0	113	1,868	16.53
Thanlyin	Technology University	Lat Yat San Village	310.1	342	7,294	21.33
Thanlyin	Economic University	Nyaung Thone Pin Village	208.2	93	1,350	14.52
Kyauktan	-	-	-	-	-	-
		Total	*786.4*	*1,057*	*19,887*	*17.7 (ave)*
Basic Education High School						
Thanlyin	BEHS (1)	Oak Pho Su	7.4	67	2,091	31.21
Thanlyin	BEHS (2)	Eastern New Town	5.4	75	2,628	35.04
Thanlyin	BEHS (3)	Htan Pin kone	7.9	44	1,266	28.77
Thanlyin	BEHS (4)	Pago Su	4.9	59	1,856	31.46
Thanlyin	BEHS Kyauk Yae Twin	Phayar Kone	1.3	58	2,413	41.60
Thanlyin	BEHS Phar Ku	East Phar Ku	6.1	24	841	35.04
Thanlyin	BEHS Thapyay Kone	Thapyay Kone	2.9	24	628	26.17
Kyauktan	BEHS (1)	Sanchain Mi Quarter	3.6	44	1,248	28.36
Kyauktan	BEHS (2)	Sinkan Quarter	1.2	48	2,087	43.48
Kyauktan	BEHS Tatar	Tatar Sub-township	3.4	37	982	26.54
Kyauktan	BEHS Mingalon	Mingalon Village	9.7	32	800	25.00
Kyauktan	BEHS Kamarkalote	Kamarkalote Village	7.2	20	623	31.15
Kyauktan	BEHS Khanaung	Khanaung Village	4.8	20	498	24.90
Kyauktan	BEHS Sittan	Sittan Village	5.0	26	572	22.00
		Total	*70.9*	*578*	*18,533*	*30.77 (ave)*
Basic Education Middle School						
Thanlyin	Sub BEHS (Old Town)	Middle Quarter of Old Town	0.9	37	1,414	38.22
Thanlyin	Sub BEHS (Yone Thapyay Kan)	Yone Thapyay Kan Village)	4.3	21	585	27.86

Township	Name of University / College / Science School	Location	Area (acre)	Number of Teachers	Quantity of Students	Ratio of Students to Teachers
Thanlyin	Sub BEHS Gamar	Kyaung Kone Sate Gyi Village Tract	5.5	35	1,290	36.86
Thanlyin	Sub BEHS Chaung Sout	Chaung Sout Village	5.7	22	534	24.27
Thanlyin	Sub BEHS Kyaung Kone Sate Gyi	Kyaung Kone Sate Gyi Village	2.2	27	998	36.96
Thanlyin	Sub BEHS Pyin Htaung School	Lat Yat San Village	2.4	55	2,175	39.55
Thanlyin	BEMS Laharyat	Laharyat Village	0.7	11	209	19.00
Thanlyin	BEMS Kon Chan Kone	Phayar Kone Village	1.1	23	950	41.30
Thanlyin	Sub BEMS Bot Thapyay Kan (1)	Bot Thapyay kan	1.3	12	477	39.75
Thanlyin	Sub BEMS Kayin Sate	Kayin Sate	2.3	13	493	37.92
Thanlyin	Sub BEMS Sit Pin Kwin	Sit Pin Kwin Village	1.1	11	443	40.27
Thanlyin	Sub BEMS Kalar Wae	Kalar Wae	0.5	12	514	42.83
Thanlyin	Sub BEMS Myayar Yoe	Lat Yat San Village	2.4	20	1,056	52.80
Thanlyin	Sub BEMS Htaw Wat	Aung Chan Thar Quarter	2.7	21	860	40.95
Thanlyin	Sub BEMS General New Village	General New Village	0.6	18	596	33.11
Thanlyin	Sub BEMS Nyaung Thone Pin	Amhu Htan Quarter	0.5	25	936	37.44
Kyauktan	BEMS Myoma	Middle Quarter	1.0	17	567	33.35
Kyauktan	BEHS(Sub) Myaingtharyar	Nyaung Wine Village	3.5	27	859	31.81
Kyauktan	BEMS Police Force(7)	Shwe Pyauk Village	7.0	16	459	28.69
Kyauktan	BEMS Pantaw	Pantaw Village	3.0	19	515	27.11
Kyauktan	BEHS (Sub) Kyonekan	Kyonekan Village	5.0	20	330	16.50
Kyauktan	BEMS Ywarthit Gyi	Ywarthit Gyi Village	3.1	22	349	15.86
Kyauktan	BEHS (Sub) Meepya	Meepya Village	2.0	25	702	28.08
Kyauktan	BEMS Kalartan	Kalartan Village	0.1	18	366	20.33
Kyauktan	BEMS Sinmakaw	Sinmakaw Village	0.8	14	180	12.86
Kyauktan	BEHS (Sub) Potetalote	Potetelote Village	4.0	18	590	32.78
Kyauktan	BEMS Asae	Asae	0.1	12	344	28.67
		Total	*63.7*	*571*	*18,791*	*32.04 (ave)*

Note: data includes statistics gathered by the GAD of Thanlyin and Kyauktan for the entirety of these two townships, including the project area.

Source: General Administrative Department, Thanlyin and Kyauktan

Table 75 Educational Infrastructure (Primary) in Thanlyin and Kyauktan

	Number	Quantity of Teachers	Quantity of Students	Ratio of Students to Teachers
Basic Education Primary School				
Thanlyin	56	422	12,083	28.63
Kyauktan	109	678	13,873	20.46
Total	*165*	*27,056*	*27,105*	*24.55 (ave)*
Kindergarten				
Thanlyin	Thanlyin Kindergarten	2	30	15.00
Kyauktan	None			

Note: data includes statistics gathered by the GAD of Thanlyin and Kyauktan for the entirety of these two townships, including the project area.

Source: General Administrative Department, Thanlyin and Kyauktan

Table 76 Educational Infrastructure (Monastic) in Thanlyin and Kyauktan

		Quantity of Teachers	Quantity of Students	Ratio of Students to Teachers
Monastery School				
Thanlyin	Pone Pyan	21	765	36.43
Thanlyin	Su Taung Pyae	45	1,509	33.53
Thanlyin	Thadama Zawtikaryone	19	677	35.63
Thanlyin	Thartana Mandai	5	29	5.80
Thanlyin	Damikar Yarma	9	224	24.89
Thanlyin	Su Htoo Pan	9	262	29.11
Thanlyin	Tharyar Kone	10	290	29.00
Thanlyin	Kharmar Yarma	21	774	36.86
Thanlyin	Wana Warthi Aye Yait San	5	146	29.20
Thanlyin	Wiyati Taw Ya	6	209	34.83
Thanlyin	Kaythaya Wadi	13	367	28.23
Thanlyin	Thamidawdaya Tayzathit	N/A	8,220	-
Thanlyin	Damadipa	12	228	19.00
Thanlyin	Thilawa	6	146	24.33
Kyauktan	Mee Pya Monastery	3	39	13.00
Kyauktan	Kamarkalote Monastery	7	109	15.57
Kyauktan	Myaingtharyar Monastery	24	888	37.00
Kyauktan	Tatar (1) Quarter Monastery	5	82	16.40
Kyauktan	Sinkan Quarter Monastery	5	132	26.40
Kyauktan	Shwe Kone Quarter Monastery	5	109	21.80
	Total	*230*	*15,205*	*26.16 (ave)*

Note: data includes statistics gathered by the GAD of Thanlyin and Kyauktan for the entirety of these two townships, including the project area.

Source: General Administrative Department, Thanlyin and Kyauktan

1.4.6 Cultural Heritage

In and around the Thanlyin and Kyauktan townships, there are 126 pagodas, 177 Buddhist temples, 5 churches, 10 mosques, 31 Hindu temples, and 2 Chinese Temples. The most important of these are the Kyaik Khauk Pagoda, the Yay Le Pagoda in the Hmawwun River south of the SEZ, and the Pardagyi Pagoda a few kilometers to the east of the SEZ.

There is no known significant cultural heritage existing within the non-excluded areas of the SEZ site itself. There are however numerous pagodas, temples, monasteries, churches, mosques, and Hindu temples in the greater area. The most significant cultural heritage assets near the Thilawa SEZ include the Kyaik Khauk Pagoda, believed by local people to be around 2,000 years old (but probably much younger), and the associated remnants of the ancient Mon kingdom of Pada located around the Pardagyi Pagoda several kilometers to the east of the SEZ.

The Pada Kingdom was a so-called ‘laterite’ kingdom in that the principal building materials used were laterite from the Syriam ridge, which is the last spike of the Pegu mountain range

running down to the Hmawwun River. The Ministry of Culture confirmed that laterite in the region is mostly situated 15m+ above sea level and the ground at lower elevations to the west is generally silty and is inappropriate for the type of construction conducted by these 'laterite' kingdoms. Therefore, since the SEZ lays predominantly below 15m above sea level, it is unlikely that any archaeological remnants of the Pada Gyi Kingdom exist directly in the 2,000ha SEZ area. While there were none identified, it is possible that some archaeological remnants of the Pada Gyi Kingdom might be located proximate to the route leaving the Thilawa SEZ and going to Dagon Bridge.

Cultural heritage identified is labeled on the map below. Cultural heritage that is identified in the zone is already excluded by the aforementioned government notice and will not be altered. A full list of the heritage identified corresponding with the numbers on the map is located in the appendix to this report.

Note: Please see appendix for full list of numbered items, location, pictures, and notes.
It was identified that five buildings (No 15, 16, 45, 46, and 49) were not cultural heritage and photos were not included in the full list.
Source: SEZ Management Committee Study

Figure 43 Cultural Heritage Identified on and around the Thilawa SEZ

1.4.7 Landscape

There is no virgin habitat left in the Project area, which has been completely converted to agriculture, residential, commercial, or industrial use. The landscape is similar to that in the surrounding region with agricultural lands dominating. As mentioned in other sections, the land does provide services including crop growing, livestock rearing, artisanal aquaculture in

dammed ponds, biomass fuel, and cultural resources nearby.

According to the Gazetteers[10] left by the British, even as far back as 1914, the land to the west of the Syriam ridge that constitutes the project area was not very fertile land and even back then was used largely for industrial purposes with the presence of several oil refineries, brick factories, ports, and river steamer building industries although it is likely that there was always interspersed agricultural activity that is still seen today.

Typical Mangrove-Lined Creek

Typical Rice Paddy

Phalankanoo Monastery near Bant Bway Kone Reservoir (excluded area)

View over Bant Bway Kone Reservoir (excluded area)

[10] Furnivall and Morrison (1914). *Burma Gazetteer, Syriam District Volume A.*

Project Area from Kyaik Kyauk Pagoda

View over field to factories

View over field (northern area)

Zarmani Dam

Factory and field

View over fields towards the port

Source: SEZ Management Committee Study

Figure 44Representative Landscape in Project Area

1.4.8 Health

The disease prevalence as reported by the respective GADs of Thanlyin and Kyauktan is as follows.

Table 77 Disease Prevalence in Thanlyin and Kyauktan

Township	Disease Type											
	Malaria		Diarrhoea		Tuberculosis		Dysentery		Hepatitus		HIV / AIDS	
	Afflicted	Deaths	Afflicted	Deaths	Afflicted	Deaths	Afflicted	Deaths	Afflicted	Deaths	Afflicted	Deaths
Thanlyin	11	-	1013	2	259	-	239	-	4	-	60 (2015) 63 (2014)	4 (2015) 2 (2014)
Kyauktan	5	-	728	-	258	-	471	-	14	-	10 (2015) 33 (2014)	0 (2015) 4 (2014)

Source: General Administrative Department, Thanlyin and Kyauktan

Table 78 Availability of Health Care

	Township	Name of Hospital / Health Facility	Type	Comment
1	Thanlyin	Thanlyin Hospital	Government hospital	200 beds
2	Thanlyin	Township Hospital	Government hospital	16 beds
3	Thanlyin	Chan Myae Myitta Hospital	Government hospital	20 beds
4	Thanlyin	Swan	Private clinic	General admission
5	Thanlyin	Aung (24) Hours	Private clinic	General admission
6	Thanlyin	Win	Private clinic	General admission
7	Thanlyin	Hlaing	Private clinic	General admission
8	Thanlyin	Myat Thukha	Private clinic	General admission
9	Thanlyin	Win Myittar	Private clinic	General admission
10	Thanlyin	Linn	Private clinic	General admission
11	Thanlyin	Kyaw	Private clinic	General admission
12	Thanlyin	That Thar Aung	Private clinic	General admission
13	Thanlyin	Aung Chann Myae	Private clinic	General admission
14	Thanlyin	San Mya Thidar	Private clinic	General admission
15	Thanlyin	Myitta Yait	Private clinic	General admission
16	Thanlyin	Kan Kaw Shwe Yee	Private clinic	General admission
17	Thanlyin	Moe	Private clinic	General admission
18	Thanlyin	Aung Thapyay	Private clinic	General admission
19	Thanlyin	Moe Thet	Private clinic	General admission
20	Thanlyin	Shwe Thet Lone	Private clinic	General admission
21	Thanlyin	Htet	Private clinic	General admission
22	Thanlyin	Myittar	Private clinic	General admission
23	Thanlyin	Taw Win	Private clinic	General admission
24	Thanlyin	Myitta Mon	Private clinic	General admission
25	Thanlyin	Aung	Private clinic	General admission
26	Thanlyin	Health Clinic	Private clinic	General admission
27	Thanlyin	Shwe	Private clinic	General admission
28	Thanlyin	Linn	Private clinic	General admission
29	Thanlyin	Nway Moe Saung	Private clinic	General admission
30	Thanlyin	Kyaw	Private clinic	General admission
31	Thanlyin	Parami	Private clinic	General admission
32	Thanlyin	Lamin	Private clinic	General admission
33	Thanlyin	Maristoke	Private clinic	General admission
34	Thanlyin	Free clinic	Private clinic	General admission
35	Thanlyin	Thitsar clinic	Private clinic	General admission
36	Thanlyin	Satku Yarzar	Private clinic	General admission
37	Thanlyin	Yuzana	Private clinic	General admission
38	Thanlyin	Family Care Fcc	Private clinic	General admission
39	Thanlyin	Linn Lat	Private clinic	General admission
40	Thanlyin	Aye Chan (24)	Private clinic	General admission
41	Thanlyin	Hlaing Myitta	Private clinic	General admission
42	Thanlyin	Lwin	Private clinic	General admission
43	Thanlyin	Laesar	Private clinic	General admission
44	Thanlyin	Han Thazin	Private clinic	General admission
45	Thanlyin	May	Private clinic	General admission
46	Thanlyin	Myat Thiri	Private clinic	General admission
47	Thanlyin	Depoler	Private clinic	General admission
48	Thanlyin	Diamond	Private clinic	General admission

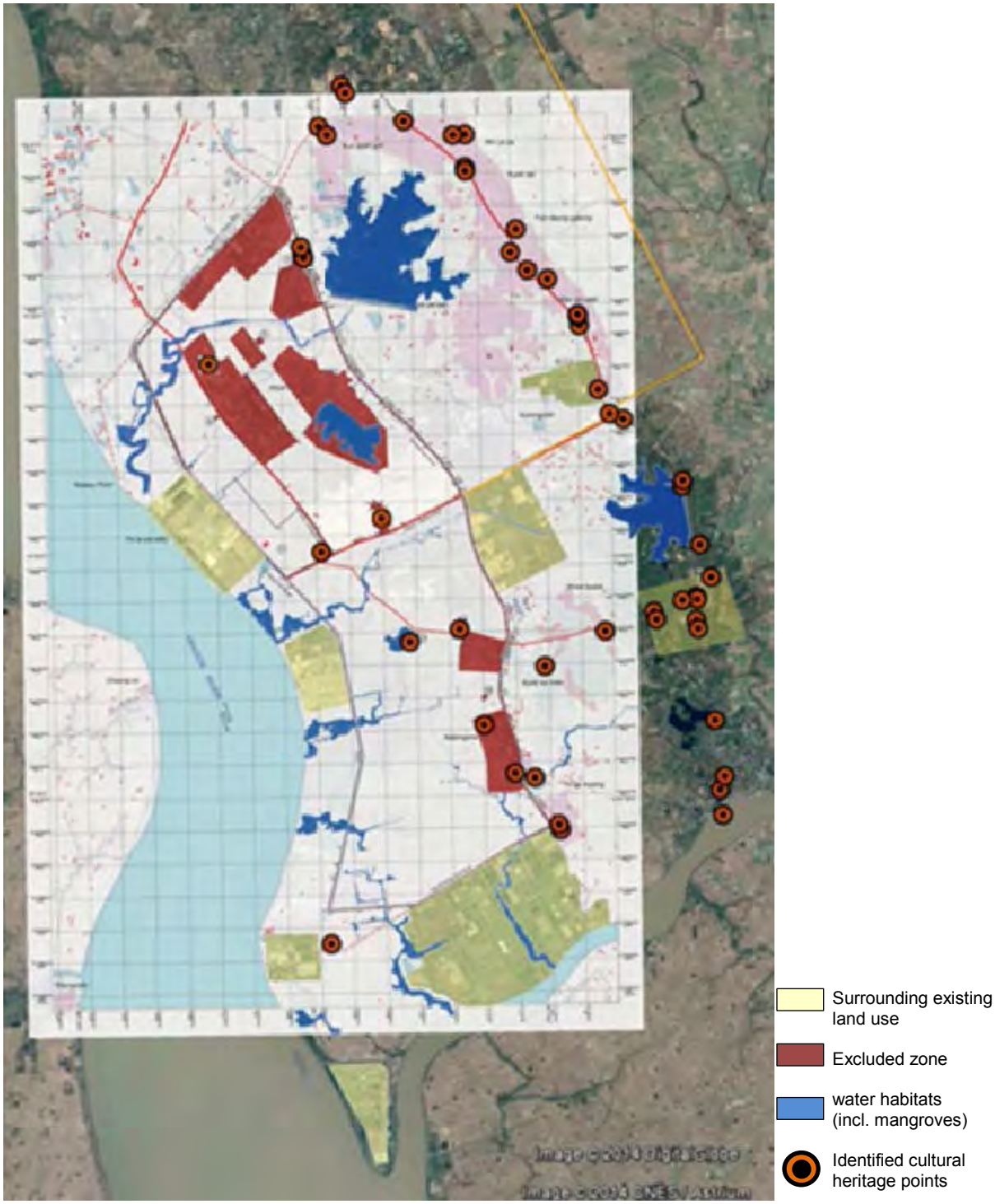
49	Thanlyin	Lat Yat San	Rural health center	-
50	Thanlyin	Phayar Kone	Rural health center	-
51	Thanlyin	Kalar Wae	Rural health center	-
52	Thanlyin	Thapyay Kan	Rural health center	-
53	Thanlyin	Day Zat	Rural health center	-
54	Kyauktan	Kyauk Tan Hospital	Government hospital	25 beds
55	Kyauktan	Tatar Sub-township Hospital	Government hospital	16 beds
56	Kyauktan	Meepya Village Tract	Government hospital	16 beds
57	Kyauktan	Leprosy Clinic	Government clinic	Treatment of Leprosy
58	Kyauktan	Malaria Clinic	Government clinic	Treatment of Malaria
59	Kyauktan	Tuberculosis Clinic	Government clinic	Treatment of Tuberculosis
60	Kyauktan	Doctor Aung Clinic	Private clinic	General admission
61	Kyauktan	Doctor Kyi Htoo Clinic	Private clinic	General admission
62	Kyauktan	Athawka Clinic	Private clinic	General admission
63	Kyauktan	Doctor Tin Maung Thein Clinic	Private clinic	General admission
64	Kyauktan	Woman Affairs Association	Rural health center	-
65	Kyauktan	Tatar Sub-Township	Rural health center	-
66	Kyauktan	Meepya	Rural health center	-
67	Kyauktan	Mingalon	Rural health center	-
68	Kyauktan	Kyonekan	Rural health center	-
69	Kyauktan	Kamarkalote	Rural health center	-
70	Kyauktan	Potetalote	Rural health center	-
71	Kyauktan	Myaingtharyar	Rural health center	-
72	Kyauktan	Khanaung	Rural health center	-
73	Kyauktan	Shan Chaung	Rural health center	-

Source: General Administrative Department, Thanlyin and Kyauktan

According to the International HIV/AIDS Alliance there are a number of sexually transmitted disease (STD) and Human immunodeficiency virus / acquired immunodeficiency syndrome (HIV/AIDs) clinics/programs run by government organizations and NGOs that would be willing to establish activities during construction and project implementation to deal with the influx of workers to the area.

1.5 Environmental Sensitivity

The following figure provides a summary of the potential socio-environmental sensitivities as described in the sections above.



Note: Map boundaries are not necessarily accurate.

Source: SEZ Management Committee Consultants using Google Earth imagery

Figure 45Environmentally Sensitive Areas