

Thilawa Special Economic
Zone (Zone B) Development

Environmental Monitoring Report Phase-1 (Construction Phase)



Myanmar Japan Thilawa
Development Limited.

June 2017

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1. Executive Summary

The environmental inspection and compliance monitoring program will be implemented under the direction of Ministry of Natural Resources and Environmental Conservation (MONREC) with oversight by Thilawa SEZ Management Committee.

The monitoring record from March 2017 to May 2017 according to the Environment Monitoring Plan is submitted in conformity with the provision of Chapter 10, 10.1 Table 10.1-2 and 10.2, Table 10.2-2 Content of the EIA Report of Thilawa SEZ Development Project (Zone B).

2. Summary of Monitoring Activities

- a) **Progress made to date on the implementation of the EMP against the submitted implementation schedule;**

We already submit EMP for Pre-Construction Phase Report (March 2017) and Phase-1 Construction Phase Report (No.1, June 2017) is submitted this day attached with Construction Phase implementation schedule.

- b) **Difficulties encountered in implementing of the EMP and recommendations for remedying those difficulties and steps proposed to prevent or avoid similar future difficulties;**

None

- c) **Number and type of non-compliance with the EMP and proposed remedial measures and timelines for completion of remediation;**

None

- d) **Accidents or incidents relating to the occupational and community health and safety, and the environment;**

Neither accidents nor incidents happen during this monitoring period.

- e) **Monitoring data on environmental parameters and conditions as committed in the EMP or otherwise required.**

Please refer to the attached Environmental Monitoring Form.



3. Construction Progress

Thilawa SEZ Zone B Development Project construction activities is submitted enclosed with monthly progress reports from contractor in Appendix A to D.

A. Monthly Progress Report for February, 2017

B. Monthly Progress Report for March, 2017

C. Monthly Progress Report for April, 2017

D. Monthly Progress Report for May, 2017

4. Monitoring Result

Environmental Monitoring plan report for Construction Phase implemented according to the following table, reference on Table 10.2-2, Chapter 10, EIA for Industrial Area of Zone-B.

Monitoring Plan (Construction Phase)

Category	Item	Location	Frequency	Remark
Air Quality	NO ₂ , SO ₂ , CO, TSP, PM ₁₀	Construction site (1point)	Once/ 3month	March 2017, Monitoring Report
Water Quality	Water temperature, pH, SS, DO, BOD, COD, coliform count, oil and grease, chromium	Construction site (6 points) Well in the Monastery (1 point)	Once/ 2 month	February 2017, April 2017 Monitoring Report
Waste	Amount of solid waste Management of solid waste of construction	Construction site	Once/ 3 month	Monthly Progress Reports (February, March, April and May) 2017
Noise and Vibration	Noise and vibration level of construction	Preservation area such as residence around the proposed construction site (2 points) Preservation site such as residence along the route for on-site vehicles (2 points)	Once/ 3 month (peak period)	Noise and Vibration Monitoring Report March 2017
Ground Subsidence	Ground elevation	Representative (1 point)	Every week	Monthly Progress Reports (February, March, April and May) 2017
Hydrology	Consumption of ground water amount			
Risk for infectious disease such as AIDS/HIV	Status of measures of infectious disease	Construction site	Once/month	Monthly Progress Reports (February, March, April and May) 2017
Working conditions (including occupational safety)	Prehension of condition of occupational safety and health Prehension of infectious disease	Construction site	Once/ month	
Accident	Existence of accident	Construction site	As occasion arise	



**Thilawa Special Economic Zone (Zone B)
Development Project –Phase 1**

Environment Monitoring Form

Environment Monitoring Form

The latest results of the below monitoring items shall be submitted to Authorities on once at Pre-Construction Phase and on quarterly basis at Construction Phase, and on bi-annually base at Operation Phase. The items, standards to be applied, measurement points, and frequency for each monitoring parameter are established based on the EIA Report for Thilawa Special Economic Zone Development Project (Industrial Area of Zone B). Should there be any changes to the original plan, such change shall be reviewed and evaluated by environmental expert.

(1) General

1) Phase of the Project

- Please mark the current phase.

☐ Pre-Construction Phase

☒ Construction Phase

☐ Operation Phase

2) Obtainment of Environmental Permits

Name of permits	Expected issuance date	Actual issuance date	Concerned authority	Remarks (Conditions, etc.)





3) Response/Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period	Duration of Report Period	Frequency
Number and contents of formal comments made by the public			Upon receipt of comments/ complaints
Number and contents of responses from Government agencies			

(2) Monitoring Results

1) Ambient Air Quality (March 2017)

NO₂, SO₂, CO, PM_{2.5}, PM₁₀

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standard	Target value to be applied*	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
AQ-1	NO ₂	mg/m ³	0.067	0.055	0.2 mg/m ³ (1 Hour)	0.2 mg/m ³ (1 Hour)	-	One time / 3 months		
	SO ₂	mg/m ³	0.014	0.036	0.02 mg/m ³ (24 Hours)	0.02 mg/m ³ (24 Hours)	-			
	CO	mg/m ³	0.210	0.764	-	10.26 mg/m ³ (24 Hours)	-			
	PM _{2.5}	mg/m ³	0.046	0.141	0.025 mg/m ³ (24 Hours)	0.025 mg/m ³ (24 Hours)	-			
	PM ₁₀	mg/m ³	0.058	0.223	0.05 mg/m ³ (24 Hours)	0.05 mg/m ³ (24 Hours)	-			

*Remarks: Referred to the tentative target value of ambient air quality (EIA Report for industrial area, Table 2.4-1), Reference to the air quality monitoring report (March 2017)

Complaints from Residents

- Are there any complaints from residents regarding air quality in this monitoring period?
If yes, please describe the contents of complains and its countermeasures to fill in below the table.

☐ Yes ☒ No

Contents of Complaints from Residents	Countermeasures

2) (a) Water Quality - February 2017

Measurement Point: Effluent of Wastewater (SW-2, SW-3 and SW-4 are attach as reference point only and they are natural creek water which are combine all the wastewater from the Local industrial water and domestic water from existing living environment)

- Are there any effluents to water body in this monitoring period?

☐ Yes, ☒ No

If yes, please attach "Analysis Record" and fill in the items not to comply with Refereed International Standard

Location	Item	Unit	Measured Value (Max)	Country's Standard ²	Target value to be applied ^{*1}	Freq- uency	Method	Note (Reason of excess of the standard)
SW-3 (reference point)	Temperature	°C	27	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7.4	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS ³	mg/L	2002	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	6.3	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	5.83	50	20		APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	10.8	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform ⁴	MPN/100ml	>160,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	< 3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	0.082	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	



Location	Item	Unit	Measured Value (Max)	Country's Standard ^{*2}	Target value to be applied ^{*1}	Freq- uency	Method	Note (Reason of excess of the standard)
SW-4 (reference point)	Temperature	°C	26	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7.4	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	16	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	6.8	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	4.18	50	20		APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	18.4	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform ^{*4}	MPN/100ml	> 160000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	4.7	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	0.134	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	

^{*1}Remark: Reference to the Water and Wastewater Quality Monitoring Report (February 2017)

^{*2}Remark: Referred to the National Emission Quality Guideline (NEQG) 29th December 2015

^{*3}Remark: For the reference monitoring point of SW-3, the result of SS is excess than the target value due to the two expected reasons; i) delivered from the upstream area such as natural origin and wastewater from local industrial zone outside of Thilawa SEZ and ii) influence by water from the downstream of monitoring point due to flow back by tidal fluctuation.

^{*4}Remark: For the reference monitoring point of SW-3 and SW-4, the result of Total coliform is excess than the target value due to two expected reasons i) natural bacteria existed in discharged creek because there are various kinds of vegetation and creature such as birds, and small animals in and along the discharged creek and ii) wastewater from the local industrial zone outside of Thilawa SEZ.

2) (b) Water Quality - April 2017

Measurement Point: Effluent of Wastewater (SW-2, SW-3 and SW-4 are attach as reference point only and they are natural creek water which are combine all the wastewater from the Local industrial water and domestic water from existing living environment. GW-2 is also as reference point for monitoring of existing tube well located in the Monastery Compound near Zone-B area)

- Are there any effluents to water body in this monitoring period? ☐ Yes, ☒ No

If yes, please attach "Analysis Record" and fill in the items not to comply with Refereed International Standard

Location	Item	Unit	Measured Value (Max)	Country's Standard ²	Target value to be applied ¹	Frequency	Method	Note (Reason of excess of the standard)
SW-2 (reference point)	Temperature	°C	25.2	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS ³	mg/L	156	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	8.57	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	11.6	50	20		APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	19.5	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform ⁴	MPN/100ml	> 160000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	3.67	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	0.006	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
SW-3 (reference point)	Temperature	°C	27.4	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	6.8	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS ³	mg/L	412	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	7.76	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	6.72	50	20		APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	13.2	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	



	Total Coliform ¹	MPN/100ml	35,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	3.33	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	0.032	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
SW-4 (reference point)	Temperature	°C	27.7	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	6.8	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS ²	mg/L	302	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	7.38	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	8	50	20		APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	14.6	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform ¹	MPN/100ml	54,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	< 3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	0.016	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
GW-2 (reference point)	Temperature	°C	25.6	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	6.4	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS	mg/L	10	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	6.93	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	1.47	50	20		APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	< 0.2	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform	MPN/100ml	23	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	< 3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	≤ 0.002	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	

¹Remark: Reference to the Water and Wastewater Quality Monitoring Report (April 2017)

²Remark: Referred to the National Emission Quality Guideline (NEQG) 29th December 2015

³Remark: For the reference monitoring point of SW-2, SW-3 and SW-4, the result of SS is excess than the target value due to the three expected reasons; i) delivered from the

upstream area such as natural origin and wastewater from local industrial zone outside of Thilawa SEZ ii) influence by water from the downstream of monitoring point due to flow back by tidal fluctuation and iii) due to the seasonal effect.

*Remark: For the reference monitoring point of SW-2, SW-3 and SW-4, the result of Total coliform is excess than the target value due to two expected reasons i) natural bacteria existed in discharged creek because there are various kinds of vegetation and creature such as birds, and small animals in and along the discharged creek and ii) wastewater from the local industrial zone outside of Thilawa SEZ.

3) Soil Contamination (only operation phase)

Situations environmental report from tenants

- Are there any serious issues regarding soil contamination in this monitoring period? ☐ Yes, ☒ No
If yes please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Issues on Soil Contamination	Countermeasures

4) Noise

Noise Level (March 2017)

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standard	Target value to be applied	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
Residential Area NV-2	Leq (day)	dB(A)	57	63		75	Refer the section 2.4 in EIA main report	One time / 3 months		
	Leq (evening)	dB(A)	51	53		60				
	Leq(night)	dB(A)	43	48		55				
Along the road (NV-1)	Leq (day)	dB(A)	62	70		75				
	Leq(night)	dB(A)	57	63		70				

Remarks: Referred to the tentative target value of ambient air quality (EIA Report for industrial area, Table 2.4-8), Reference to the noise and vibration monitoring report (March 2017)

Complaints from Residents

- Are there any complaints from residents regarding noise in this monitoring period?

☐ Yes, ☒ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures

5) Solid Waste

Measurement Point: Construction Site (Construction Phase), Storage for Sludge (Operation Phase)

- Are there any wastes if sludge in this monitoring period?

☐ Yes, ☒ No

If yes, please report the amount of sludge and fill in the results of solid waste management activities.

Item	Generated from	Unit	Value	Solid Waste Management Activities
Amount of sludge				
Amount of sludge				
Amount of sludge				

6) (a) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
9-March-2017	-	m ³ / week	6,300	m	
16-March-2017	-	m ³ / week	6,300	m	
23-March-2017	-	m ³ / week	6,299	m	
30-March-2017	-	m ³ / week	6,299	m	

Remarks: Reference to Monthly Progress Report (March-2017)

6) (b) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
6-April-2017	-	m ³ / week	6.299	m	
13-April-2017	-	m ³ / week	-	m	
20-April-2017	-	m ³ / week	-	m	
27-April-2017	-	m ³ / week	6.298	m	

Remarks: Reference to Monthly Progress Report (April-2017)

13 April and 20 April not measuring the ground subsidence because of the public holiday.

6) (c) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
4-May-2017	0	m ³ / week	6.299	m	
11-May-2017	10	m ³ / week	6.298	m	
18-May-2017	13	m ³ / week	6.298	m	
25-May-2017	10	m ³ / week	6.299	m	

Remarks: Reference to Monthly Progress Report (May-2017)





7) Offensive Odor (only operation phase)

Complaints from Residents

- Are there any complaints from residents regarding offensive odor in this monitoring period?

☐ Yes, ☒ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures

Situations environmental report from tenants

- Are there any serious issues regarding offensive odor in this monitoring period?

☐ Yes, ☒ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Issues on Soil Contamination	Countermeasures

8) Infectious disease, Working Environment, Accident

Information from contractor (construction phase) or tenants (operation phase)

- Are there any incidents regarding infectious disease, Working Environment, Accident in this monitoring period? ☐ Yes, ☒ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Incidents	Countermeasures

Note: If emergency incidents are occurred, the information shall be reported to the relevant organizations and authorities immediately.

9) Resettlement Works for Project Affected Persons (PAPs) and Common Assets
Information from TSMC

- Please describe the progress and remarkable issues (if any) to fill in below the table.

Resettlement Works		Progress in Narrative	Remarkable Issues
Projected Affected Persons	Land Acquisition and Relocation	Land Acquisition was taken from 15 numbers of Project Affected Households. (7) PAHs from Area 2-1 and (83) PAHs from Area 2-2 (East) will be relocated in Myaing Thar Yar village, Naung Waing Village Tract in Kyauktan Township at the end of May 2017.	
	Income Restoration Program	Established PDNT company to serve Landscaping and maintenance works of TSEZ. PDNT team includes management staff and 23 operation staff, majorities are project affected persons from relocation area of Area 2-2 (East). The service to TSEZ Zone-A is started since May.	
Common Assets	Relocation		

- Are there any grievances submitted, solved and pending regarding resettlement works?
If yes, please describe the contents of grievances to fill in below the table.

☐ Yes, ☒ No

Contents of Grievance	Response/ Countermeasures





10) CSR activities such as Community Support Program

- Are there any CSR activities implemented in this monitoring period?

☒ Yes, ☐ No

If yes, please describe the outline of CSR activities implemented to fill in below the table.

Date	Activities	Description (Location, Participant etc)
9-March-2017	Library, Village road and pipe culvert renovation	Location - Aye Mya Thida village Participant - Village committee and MJTD Remark - started from March 2017 but actual giving ceremony held on June 2017
5-April-2017	Assistance to old people in Myanmar New Year Festival	Location - Thanlyin Region Participant - Thingyan festival committee and MJTD
26-May-2017	Donation of stationeries (1980 students)	Venue - Ceremony held at Moe Kyo Swan Monastery Participant - All students from Aye Mya Thida village, Shwe Pyaut village, Addutaw village, Phayar Kone village, Kyar Kan village, Kyaut Kamot village and project affect households of Zone A

End of Document

**Thilawa Special Economic Zone (Zone B)
Development Project –Phase 1**

Appendix

Water and Waste Water Monitoring Report

February 2017

**WATER QUALITY MONITORING REPORT
FOR DEVELOPMENT OF INDUSTRIAL AREA
IN THILAWA SEZ ZONE B
(PHASE 1 CONSTRUCTION STAGE)**

(Bi-Monthly Monitoring)

**February 2017
Myanmar Koei International Ltd.**



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CHAPTER 1: INTRODUCTION

1.1 General

Thilawa Special Economic Zone (SEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd. (MJTD) has a responsibility to carry out regular monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report and Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area. As for the monitoring of the water quality, total four sampling points are set for water quality survey, named SW-2, SW-3, SW-4 and SW-7 have been monitored in Thilawa SEZ and its surrounding area in timely manner. Among the three locations, SW-7 is main discharging point of Zone B during the construction stage. Location of sampling points for water quality monitoring is shown in Figure 1.1-1.



Figure 1.1- 1 Location of Sampling Points of Water Quality Monitoring



CHAPTER 2: WATER QUALITY MONITORING

2.1 Monitoring Items

Sampling points and parameters for water quality survey are determined to cover the environmental monitoring plan of the EIA report.

Water quality sampling was carried out at four locations. Monitoring items and sampling points are summarized in Table 2.1-1.

Table 2.1-1 Monitoring Items for Water Quality

No.	Parameters	SW-2	SW-3	SW-4	SW-7	Remarks
1	pH	○	○	○	○	On-site measurement
2	Water temperature	○	○	○	○	On-site measurement
3	DO	○	○	○	○	On-site measurement
4	BOD (5)	○	○	○	○	Laboratory analysis
5	COD (Cr)	○	○	○	○	Laboratory analysis
6	Suspended solids	○	○	○	○	Laboratory analysis
7	Total coliform	○	○	○	○	Laboratory analysis
8	Oil and grease	○	○	○	○	Laboratory analysis
9	Chromium	○	○	○	○	Laboratory analysis

Source: Myanmar Koei International Ltd.

2.2 Description of Sampling Points

The outline of sampling points is mentioned in Table 2.2-1. The photos of conducting field survey at each sampling points are mentioned in Appendix-1.

Table 2.2-1 Outline of Sampling Points

No.	Station	Detailed Information
1	SW-2	Coordinate- N-16° 40' 20.70", E- 96° 17' 18.10"
		Location - Upstream of Shwe Pyauk Creek
		Survey Item - Surface water sampling
2	SW-3	Coordinate- N-16° 40' 05.5", E- 96° 16' 41.6"
		Location - Upstream of Shwe Pyauk Creek, after mixing point of Thilawa SEZ Zone A and Zone B.
		Survey Item - Surface water sampling
3	SW-4	Coordinate- N-16° 39' 54.6", E- 96° 16' 26.4"
		Location - Downstream of Shwe Pyauk Creek
		Survey Item - Surface water sampling
4	SW-7	Coordinate- N-16° 40' 20.70", E- 96° 17' 18.10"
		Location - Discharge drain of Zone B construction site before connect to Shwe Pyauk Creek
		Survey Item - Discharge water sampling

Source: Myanmar Koei International Ltd.



SW-2 (Reference Point)

SW-2 is mixing point of discharge water from Zone B construction site and local industrial zone, upstream of Shwe Pyauk creek. There is no water in this monitoring period. This sampling point is almost same location as SW-7 and it is at the Shwe Pyauk creek.

SW-3 (Reference Point)

SW-3 was collected at the Shwe Pyauk creek, after mixing point of Zone A and Zone B, which is flowing from east to west and then entering into the Yangon river. The distance is about 1.2 km downstream of SW-2. This sampling point is located at south of Zone A area and Dagon-Thilawa road. The surrounding area are Zone A in the north, Zone B in the south, local industrial zone in the east and paddy field in the south and west respectively.

SW-4 (Reference Point)

SW-4 was collected at the downstream of Shwe Pyauk creek, after mixing of discharged water from local industrial zone, construction site of Zone B and Zone A, which is flowing from east to west and then entering into the Yangon river. The distance is about 500 m downstream of SW-3. This sampling point is located at north of Zone A area and Dagon-Thilawa road. The surrounding area are Zone A in the north, Zone B in the south, local industrial zone in the east and paddy field in the south and west respectively.

SW-7 (Discharging Point)

SW-7 is main discharging point of Zone B during construction stage. Since there was no water usage in Zone B construction area at monitoring period, there was no discharge water. However, in rainy season, all rainwater might be discharged from construction site of Zone B to SW-7 is expected. This sampling point is located at the northeast of Zone B area and at the south of Dagon-Thilawa road. The surrounding area are Zone A in the northwest, local industrial zone in the east and paddy field in the west respectively.

2.3 Monitoring Method

All water samples were collected with cleaned sampling bottle and analyzed by the following standard method as shown in Table 2.3-1. All samples were kept in iced boxes keeping at 2-4° C and were transported to the laboratory. Among the parameters; water temperature, pH and DO, were measured by the on-site instrument "Horiba, U-52".

Table 2.3-1 Analytic Method for Water Quality

No.	Parameter	Method
1	Temperature	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
2	pH	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
3	Suspended solids (SS)	APHA 2540D (Dry at 103-105°C Method)
4	Dissolved oxygen (DO)	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
5	BOD (5)	APHA 5210 B (5 days BOD Test)
6	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)
7	Total coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)
8	Oil and grease	APHA 5520B (Partition-Gravimetric Method)
9	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)

Source: Myanmar Koei International Ltd.



2.4 Monitoring Period

Water quality monitoring were conducted on 13th February 2017 and sampling time is shown in Table 2.4-1 to avoid tidal effect. The tide record for Yangon river, Myanmar on 13th February 2017 is shown in Figure 2.4-1.

Table 2.4-1 Sampling Time of Each Station

No.	Station	Sampling Time
1	SW-2	13/02/2017 10:42
2	SW-3	13/02/2017 10:30
3	SW-4	13/02/2017 09:47
4	SW-7	13/02/2017 10:42

Source: Myanmar Koei International Ltd.

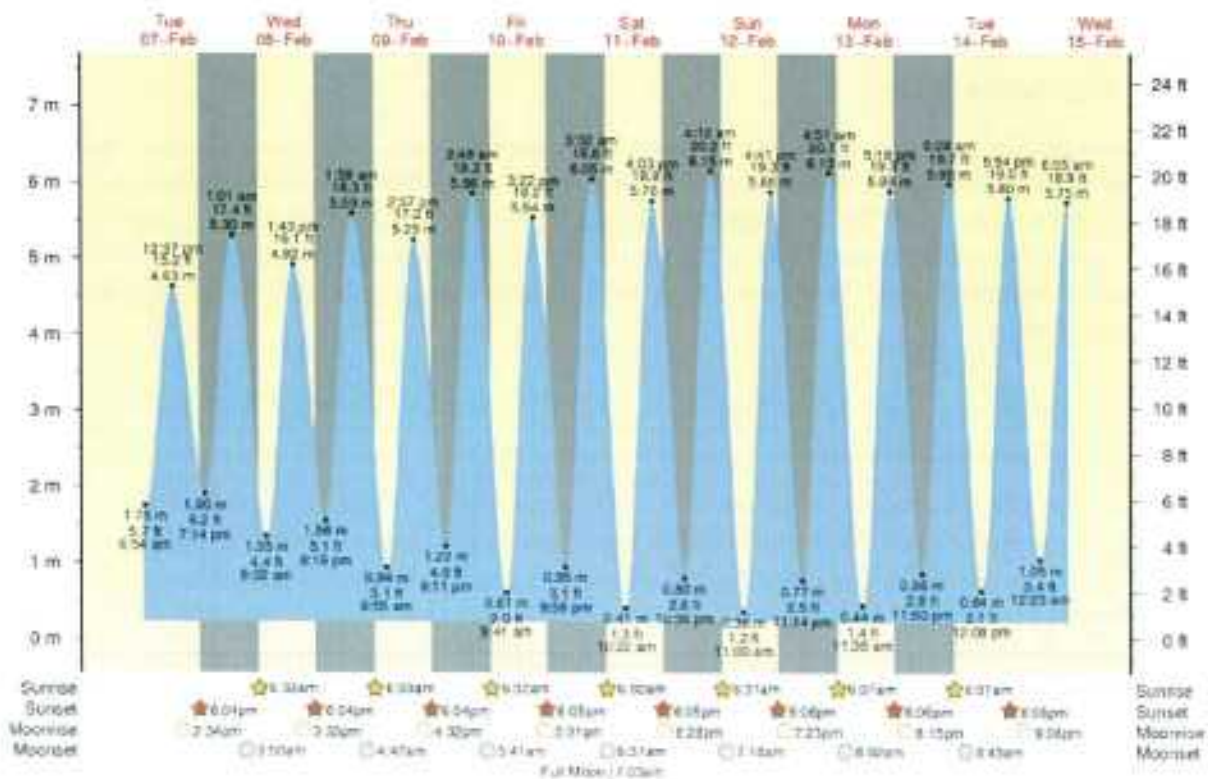


Figure 2.4-1 Tide Record for Yangon River, Myanmar



2.5 Monitoring Results

Since there was no water usage in Zone B construction area at this monitoring period, there was no discharge water at SW-7. During the construction stage of Zone B in rainy season, all rainwater runoff from the project area would be collected by temporary drain and discharged to SW-2 through SW-7. Results of water quality monitoring are summarized in Table 2.5-1. Analytical results of the laboratory are described in Appendix-2. The results were compared with the target value of effluent water quality discharging to water body stipulated in the EIA report.

2.5.1 Results of Discharging point and Discharged Creek

As described in section 2.5, since there was no discharged water from Zone B construction site, there is no negative impact on water quality due to construction activities of Zone B.

As the comparison with the target value and reference point, the results of SS and total coliform were exceeded than the target value. As for the result of SS, results at the surface water monitoring point (SW-3) exceeded the target value due to two expected reasons; i) delivered from upstream area such as natural origin and wastewater from local industrial zone outside of Thilawa SEZ and ii) influence by water from the downstream of monitoring point due to flow back by tidal fluctuation.

As for the result of total coliform of surface water, results at the surface water monitoring points (SW-3, SW-4) exceeded the target value due to two expected reasons; i) natural bacteria existed in discharged creek because there are various kinds of vegetation and creature such as birds, and small animals in and along the discharged creek and ii) wastewater from the local industrial zone outside of Thilawa SEZ.

Table 2.5-1 Results of Water Quality Monitoring at Discharge Point and Discharged Creek

No.	Parameters	Unit	SW-2 (Reference Point)	SW-3 (Reference Point)	SW-4 (Reference Point)	SW-7 (Discharge Point)	Target ⁽¹⁾ Value
1	Temperature	°C	-	27	26	-	40
2	pH	-	-	7.4	7.4	-	6.0-9.0
3	Suspended solid (SS)	mg/L	-	2,002	16	-	30
4	Dissolved oxygen (DO)	mg/L	-	6.3	5.8	-	-
5	BOD (5)	mg/L	-	5.83	4.18	-	20.00
6	COD (Cr)	mg/L	-	10.8	18.4	-	70.0
7	Total coliform	MPN/ 100ml	-	> 160,000	> 160,000	-	400
8	Oil and grease	mg/L	-	< 3.1	4.7	-	10.0
9	Chromium	mg/L	-	0.082	0.134	-	0.500

Note: Target value is applied to the tentative target value of effluent water quality after centralized STP in the EIA Report for Thilawa SEZ Development Project (Zone B).

Source: Myanmar Koei International Ltd.



CHAPTER 3: CONCLUSION AND RECOMMENDATIONS

As described in Chapter 2, since there was no discharged water from Zone B construction site, there is no negative impact on water quality due to construction activities of Zone B.

As for result of SS and total coliform at reference point were exceeded the target value at SW-3 and SW-4 in this monitoring period. However, there was no wastewater discharge from Zone B construction site, therefore it does not contribute to monitoring results at reference point.

For SW-3 and SW-4, there are some possible reasons for exceeding the target values due to delivered from upstream area such as natural origin and wastewater from the local industrial zone outside of Thilawa SEZ, and delivered from surrounding area by tidal effect. However, it cannot reach to the conclusion of what is the reason to be exceeded the target values, the continuous monitoring and seasonal data and yearly trend analysis will be necessary.

End of the Document



APPENDIX-1 FIELD SURVEY PHOTOS



FOR DISCHARGING POINTS OF THILAWA SEZ ZONE B



No discharge water at SW-7 and SW-2



Surface water sampling and onsite measurement at SW-3



Surface water sampling and onsite measurement at SW-4



APPENDIX-2 LABORATORY RESULTS



FOR DISCHARGING POINTS

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.

Lot No. 11, Thilawa SEZ Zone B, Yangon Region, the Union of Myanmar
Tel: 09-7389031, 98-796435108

Report No. : GEM-LAB-201702127

Revision No. : 1

Report Date : 27 February, 2017

Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa:
Project Name : -
Sample Description :
Sample Name : MKI-SW-3-0213 Sampling Date : 13 February, 2017
Sample No. : W-1702080 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 13 February, 2017

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	2002.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	5.83	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	10.8	0.7
4	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	3.6	0.0
5	Total Phosphorus	APHA 4500-P E (Ascorbic Acid Method)	mg/l	< 0.05	0.05
6	Color	APHA 2120C (Spectrophotometric Method)	TCU	13.20	0.00
7	Odor	APHA 2150 B (Threshold Odor Test)	TON	2	-
8	Oil and Grease	APHA 5520B (Petroleum Gravimetric Method)	mg/l	< 3.1	3.1
9	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	> 160000	1.8
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.062	0.002

Remark : LOQ - Limit of Quantitation

APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition



Analysed By :

[Signature]

Mr. Aye Lwin
Assistant supervisor

Approved By :

[Signature]

Tomoya Suzuki
Director



GOLDEN DOWA ECU-SYSTEM MYANMAR CO., LTD
Lot No. 62, Thilawa SEZ Zone B, Thilawa Region, the Union of Myanmar
Tel: 01-2546051 ~ 09-7849311, 09-

Report No. : GEM-LAB-201702130
Revision No. : 1
Report Date : 27 February, 2017
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /26, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : -
Sample Description :

Sample Name : MKI-SW-4-0213 Sampling Date : 13 February, 2017
Sample No. : W-1702083 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 13 February, 2017

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	16.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	4.18	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	19.4	0.7
4	Total Nitrogen	HACH Method 10073 (TNT Persulfate Digestion Method)	mg/l	3.6	0.0
5	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.089	0.05
6	Color	APHA 2120C (Spectrophotometric Method)	TCU	14.26	0.00
7	Odor	APHA 2150 B (Threshold Odor Test)	TON	1	-
8	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	4.73	3.1
9	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	> 160000	1.8
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.134	0.002

Remark : LOQ - Limit of Quantitation

APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

Analysed By :

Ni Ni Aye Lwin

Assistant supervisor

Approved By :

Tomoya Suzuki

Director



**Thilawa Special Economic Zone (Zone B)
Development Project –Phase 1**

Appendix

Water and Waste Water Monitoring Report

April 2017

**WATER QUALITY MONITORING REPORT
FOR DEVELOPMENT OF INDUSTRIAL AREA
IN THILAWA SEZ ZONE B
(PHASE 1 CONSTRUCTION STAGE)**

(Bi-Monthly Monitoring)

April 2017

Myanmar Koei International Ltd.



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CHAPTER 1: INTRODUCTION

1.1 General

Thilawa Special Economic Zone (SEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd. (MJTD) has a responsibility to carry out regular monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report and Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area. As for the monitoring of the water quality, total five sampling points are set for water quality survey, named SW-2, SW-3, SW-4, SW-7 and GW-2 have been monitored in Thilawa SEZ and its surrounding area in timely manner. Among the five locations, SW-7 is main discharging point of Zone B during the construction stage. Moreover, GW-2 is monitored as a reference of existing tube well which located in the monastery compound of Phalan village. Location of sampling points for water quality monitoring is shown in Figure 1.1-1.



Figure 1.1- 1 Location of Sampling Points of Water Quality Monitoring



CHAPTER 2: WATER QUALITY MONITORING

2.1 Monitoring Items

Sampling points and parameters for water quality monitoring are determined to cover the environmental monitoring plan of the EIA report.

Water quality sampling was carried out at five locations. Among the five locations, water flow measurement was carried out at one location (SW-4) where can be measured by current meter. Monitoring items and sampling points are summarized in Table 2.1-1.

Table 2.1-1 Monitoring Items for Water Quality

No.	Parameters	SW-2	SW-3	SW-4	SW-7	GW-2	Remarks
1	pH	○	○	○	○	○	On-site measurement
2	Water temperature	○	○	○	○	○	On-site measurement
3	DO	○	○	○	○	○	On-site measurement
4	BOD (5)	○	○	○	○	○	Laboratory analysis
5	COD (Cr)	○	○	○	○	○	Laboratory analysis
6	Suspended solids	○	○	○	○	○	Laboratory analysis
7	Total coliform	○	○	○	○	○	Laboratory analysis
8	Oil and grease	○	○	○	○	○	Laboratory analysis
9	Chromium	○	○	○	○	○	Laboratory analysis
10	Flow Rate	-	-	○	-	-	On-site measurement

Source: Myanmar Koei International Ltd.

2.2 Description of Sampling Points

The outline of sampling points is mentioned in Table 2.2-1. The photos of conducting field survey at each sampling points are mentioned in Appendix-1.

Table 2.2-1 Outline of Sampling Points

No.	Station	Detailed Information
1	SW-2	Coordinate- N-16° 40' 20.70", E- 96° 17' 18.10"
		Location - Upstream of Shwe Pyauk Creek
		Survey Item - Surface water sampling.
2	SW-3	Coordinate- N-16° 40' 5.50", E- 96° 16' 41.60"
		Location - Upstream of Shwe Pyauk Creek, after mixing point of Thilawa SEZ Zone A and Zone B.
		Survey Item - Surface water sampling.
3	SW-4	Coordinate- N-16° 39' 41.00", E- 96° 16' 26.50"
		Location - Downstream of Shwe Pyauk Creek
		Survey Item - Surface water sampling.
4	SW-7	Coordinate- N-16° 40' 20.70", E- 96° 17' 18.10"
		Location - Discharge drain of Zone B construction site before connect to Shwe Pyauk Creek
		Survey Item - Discharge water sampling.
5	GW-2	Coordinate- N- 16° 39' 25.30", E- 96° 17' 15.60"E
		Location - In the monastery compound of Phalan village
		Survey Item - Ground water sampling.

Source: Myanmar Koei International Ltd.



SW-2 (Reference Point)

SW-2 is mixing point of discharge water from Zone B construction site and local industrial zone, upstream of Shwe Pyauk creek. This sampling point is almost same location as SW-7 and it is at the Shwe Pyauk creek.

SW-3 (Reference Point)

SW-3 was collected at the Shwe Pyauk creek, after mixing point of Zone A and Zone B, which is flowing from east to west and then entering into the Yangon river. The distance is about 1.2 km downstream of SW-2. This sampling point is located at south of Zone A area and Dagon-Thilawa road. The surrounding area are Zone A in the north, Zone B in the south, local industrial zone in the east and paddy field in the south and west respectively.

SW-4 (Reference Point)

SW-4 was collected at the downstream of Shwe Pyauk creek, after mixing of discharged water from local industrial zone, construction site of Zone B and Zone A, which is flowing from east to west and then entering into the Yangon river. The distance is about 500 m downstream of SW-3. This sampling point is located at north of Zone A area and Dagon-Thilawa road. The surrounding area are Zone A in the north, Zone B in the south, local industrial zone in the east and paddy field in the south and west respectively.

SW-7 (Discharging Point)

SW-7 is main discharging point of Zone B during construction stage. There is no water in this monitoring period. However, in rainy season, all rainwater might be discharged from construction site of Zone B to SW-7 is expected. This sampling point is located at the northeast of Zone B area and at the south of Dagon-Thilawa road. The surrounding area are Zone A in the northwest, local industrial zone in the east and paddy field in the west respectively.

GW-2 (Reference of Existing Tube Well)

GW-2 was collected from tube well as ground water sample. It is located in the monastery compound of Phalan village. The surrounding area are Thilawa SEZ Zone A in north, Phalan village in the south and fields in west and local industrial zone in northeast, and construction of Thilawa SEZ Zone B in east and northeast respectively.



2.3 Monitoring Method

All water samples were collected with cleaned sampling bottle and analyzed by the following standard method as shown in Table 2.3-1. All samples were kept in iced boxes keeping at 2-4° C and were transported to the laboratory. Among the parameters; water temperature, pH and DO, were measured by the on-site instrument "Horiba, U-52" and water flow rate was also conducted by using the on-site instrument "Tamaya Digital Current Meter".

Table 2.3-1 Analytic Method for Water Quality

No.	Parameter	Method
1	Temperature	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
2	pH	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
3	Dissolved oxygen (DO)	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
4	BOD (5)	APHA 5210 B (5 days BOD Test)
5	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)
6	Suspended solids (SS)	APHA 2540D (Dry at 103-105°C Method)
7	Total coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)
8	Oil and grease	APHA 5520B (Partition-Gravimetric Method)
9	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)
10	Flow Rate	Detection of Electromagnetic Elements (Real-time measurement by UC-200V Digital Current Meters)

Source: Myanmar Koei International Ltd.

2.4 Monitoring Period

Water quality and water flow rate monitoring were conducted on 26th April 2017 and sampling time is shown in Table 2.4-1 to avoid tidal effect. The tide record for Yangon river, Myanmar on 26th April 2017 is shown in Table 2.4-2.

Table 2.4-1 Sampling Time of Each Station

No.	Station	Sampling Time
1	SW-2	26/4/2017 9:47
2	SW-3	26/4/2017 10:24
3	SW-4	26/4/2017 11:00
4	SW-7	26/4/2017 9:47
5	GW-2	26/4/2017 11:53

Source: Myanmar Koei International Ltd.

Table 2.4-2 Tide Record for Yangon River, Myanmar

Date	Time	Height	Tide Conditions
26/4/2017	04:11	5.79 m	High Tide
	11:54	0.37 m	Low Tide
	16:24	6.09 m	High Tide

Source: Myanmar Port Authority, Tide Table for the Yangon River and Elephant Point, 2017.

Note: Myanmar Port Authority, Tide Table which is official and more reliable compare to previous report's Tide Table source (<http://www.tide-forecast.com>)



2.5 Monitoring Results

There was no discharge water at SW-7 in this monitoring period. Results of water quality monitoring at discharge point and discharged creek is summarized in Table 2.5-1. Analytical results of the laboratory are described in Appendix-2. The results were compared with the target value of effluent water quality discharging to water body stipulated in the EIA report.

2.5.1 Results of Discharging Point and Discharged Creek

As described in section 2.5, since there was no discharged water from Zone B construction site, there was no negative impact on water quality due to construction activities of Zone B.

As the comparison with the target value and reference point, the results of SS and total coliform were exceeded than the target value. As for the result of SS, results at the surface water monitoring point (SW-2, SW-3 and SW-4) exceeded the target value due to three expected reasons; i) delivered from upstream area such as natural origin and wastewater from local industrial zone outside of Thilawa SEZ, and ii) influence by water from the downstream of monitoring point due to flow back by tidal fluctuation, iii) due to the seasonal effect¹

As for the result of total coliform of surface water, results at the other surface water monitoring points (SW-2, SW-3 and SW-4) exceeded the target value due to two expected reasons; i) natural bacteria existed in discharged creek because there are various kinds of vegetation and creature such as birds, and small animals in and along the discharged creek. and ii) wastewater from the local industrial zone outside of Thilawa SEZ.

Table 2.5-1 Results of Water Quality Monitoring at Discharge Point and Discharged Creek

No.	Parameters	Unit	SW-2 (Reference Point)	SW-3 (Reference Point)	SW-4 (Reference Point)	SW-7 (Discharge Point)	Target Value
1	Temperature	°C	25.2	27.4	27.7	-	40.0
2	pH	-	7.0	6.8	6.8	-	6.0-9.0
3	Suspended solid (SS)	mg/L	156	412	302	-	30
4	Dissolved oxygen (DO)	mg/L	8.57	7.76	7.38	-	-
5	BOD (5)	mg/L	11.60	6.72	8.00	-	20.00
6	COD (Cr)	mg/L	19.5	13.2	14.6	-	70.0
7	Total coliform	MPN/ 100ml	>160,000	35,000	54,000	-	400
8	Oil and grease	mg/L	3.67	3.33	< 3.1	-	10.0
9	Chromium	mg/L	0.006	0.032	0.016	-	0.500
10	Flow Rate	m ³ /s	-	-	0.174	-	-

Source: Myanmar Koei International Ltd.

¹ Based on the monitoring results from Sep.2016 to Apr. 2107, it has been confirmed there is a seasonal trend as SS level to be high in dry season. In the dry season, it is inferred that the concentration of the SS will be increased due to water reducing.



2.5.2 Result of Reference Tube Well

Result of water quality monitoring at reference monitoring point is shown in Table 2.5-2. All parameters of result are below the target value.

Table 2.5-2 Results of Water Quality Monitoring at Reference Tube Well

No.	Parameters	Unit	GW-2 (Reference Point)	Target Value
1	Temperature	°C	25.6	40.0
2	pH	-	6.4	6.0-9.0
3	Suspended solid (SS)	mg/L	10.00	30
4	Dissolved oxygen (DO)	mg/L	6.93	-
5	BOD (5)	mg/L	1.47	20.00
6	COD (Cr)	mg/L	< 0.2	70.0
7	Total coliform	MPN/ 100ml	23	400
8	Oil and grease	mg/L	< 3.1	10.0
9	Chromium	mg/L	≤0.002	0.500
10	Flow Rate	m ³ /s	-	-

Source: Myanmar Koei International Ltd.



CHAPTER 3: CONCLUSION AND RECOMMENDATIONS

As described in Chapter 2, since there was no discharged water from Zone B construction site, there is no negative impact on water quality due to construction activities of Zone B.

As for result of SS and total coliform at reference point were exceeded the target value at SW-2, SW-3 and SW-4 in this period for construction stage of Thilawa SEZ Zone B. However, there was no wastewater discharge from Zone B construction site, therefore it does not contribute to monitoring results at reference point.

For SW-2, SW-3 and SW-4, there are some possible reasons for exceeding the target values of SS and total coliform due to delivered from upstream area such as natural origin and wastewater from the local industrial zone outside of Thilawa SEZ, due to seasonal (dry season) effect, and delivered from surrounding area by tidal effect. However, it cannot reach to the conclusion of what is the reason to be exceeded the target values, the continuous monitoring and seasonal data and yearly trend analysis will be necessary.

End of the Document



APPENDIX-1 FIELD SURVEY PHOTOS



FOR DISCHARGING POINT OF THILAWA SEZ ZONE B



No water at SW-7



Surface water sampling and onsite measurement at SW-2



**FOR REFERENCE MONITORING POINTS FOR COMPARISON WITH
DISCHARGING POINT AND BASELINE OF DISCHARGED CREEK**



Surface water sampling and onsite measurement at SW-3



Surface water sampling and onsite measurement at SW-4



Ground water sampling and onsite measurement at GW-2



APPENDIX-2 LABORATORY RESULTS



FOR DISCHARGING POINT

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.

Lot No. 61, Thilawa SEZ Zone B, Yangon Region, the Union of Myanmar

Tel. 01-2396131 ~ 09 76935149

Report No. : GEM-LAB-201705053

Revision No. : 1

Report Date : 11 May, 2017

Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD. (MKI)
Address : No. 1A / 2B, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : -
Sample Description : -
Sample Name : MKI-SW-2-0426
Sample No. : W-1704075
Waste Profile No. : -

Sampling Date : 26 April, 2017
Sampling By : Customer
Sample Received Date : 26 April, 2017

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	156.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	11.80	0.00
3	COO (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	19.5	0.7
4	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	2.6	0.0
5	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.24	0.05
6	Color	APHA 2120C (Spectrophotometric Method)	TCU	19.20	0.00
7	Odor	APHA 2150 B (Threshold Odor Test)	TQN	1	-
8	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	3.67	3.1
9	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	> 160000	1.8
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.006	0.002

Remark : LOQ = Limit of Quantitation

APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd Edition



Analysed By :

Ni Ni Aye Lwin
Assistant supervisor



Approved By :

Tomoya Suzuki
Director

**FOR REFERENCE MONITORING POINTS FOR COMPARISON WITH
DISCHARGING POINTS AND BASELINE OF DISCHARGED CREEK**

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.

Lot No. E1, Shwepyithar Zone A, Yangon Region, the Union of Myanmar
Tel (01-238865) : 09 7869331, 19

Report No. : GEM-LAB-201705054

Revision No. : 1

Report Date : 11 May, 2017

Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)

Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.

Project Name : -

Sample Description

Sample Name : MKI-SW-3-0426

Sampling Date : 26 April, 2017

Sample No. : W-1704076

Sampling By : Customer

Waste Profile No. : -

Sample Received Date : 26 April, 2017

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	412.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	6.72	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	13.2	0.7
4	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	4.0	0.0
5	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.57	0.05
6	Color	APHA 2120C (Spectrophotometric Method)	TCU	17.04	0.00
7	Odor	APHA 2150 B (Threshold Odor Test)	TON	1	-
8	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	3.33	3.1
9	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	35000	1.8
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.032	0.002

Remark : LOQ - Limit of Quantitation

APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

Analysed By :

Ni Ni Aye Lwin
Assistant supervisor



Approved By :

Tomoya Suzuki
Director



DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD

Lot No. 11, Thilawa SEZ Zone A, Yangon Region, the Union of Myanmar
Tel (01) 23090511 ~ (01) 746935349

Report No. : GEM-LAB-201705056

Revision No. : 1

Report Date : 11 May, 2017

Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)

Address : No.1A /2B, Mya Thidar Housing, Ward 11, South Okkalapa,

Project Name : -

Sample Description:

Sample Name : MKI-SW-4-0426

Sampling Date : 26 April, 2017

Sample No. : W-1704078

Sampling By : Customer

Waste Profile No. : -

Sample Received Date : 26 April, 2017

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	302.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	8.00	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	14.6	0.7
4	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	2.6	0.0
5	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.43	0.05
6	Color	APHA 2120C (Spectrophotometric Method)	TCU	20.00	0.00
7	Odor	APHA 2150 B (Threshold Odor Test)	TON	1	-
8	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
9	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	54000	1.8
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.016	0.002

Remark : LOQ - Limit of Quantitation

APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition



Analysed By :

Ni Ni Aye Lwin
Assistant Supervisor



Approved By :

Tomoya Suzuki
Director

FOR REFERENCE TUBE WELL

DOWA

GOLDEN DOWA ECD-SYSTEM MYANMAR CO., LTD
Lot No. 19, Thilawa SEZ Zone A, Yangon Region, the Union of Myanmar
Tel 01-2319001-10 79435148

Report No. : GEM-LAB-201705057
Revision No. : 1
Report Date : 11 May, 2017
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : -
Sample Description :
Sample Name : MKI-GW-2-0426 Sampling Date : 26 April, 2017
Sample No. : W-1704079 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 26 April, 2017

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	10.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	1.47	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	< 0.2	0.7
4	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
5	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	± 0.002	0.002
6	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	23	1.8

Remark : LOQ = Limit of Quantitation

APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

Analysed By :

Ni Ni Aye Lwin
Assistant supervisor



Approved By :

Tomoya Suzuki
Director



**Thilawa Special Economic Zone (Zone B)
Development Project –Phase 1**

Appendix

Air Quality Monitoring Report

March 2017

AIR QUALITY MONITORING
REPORT
FOR DEVELOPMENT OF INDUSTRIAL AREA
THILAWA SEZ ZONE B
(PHASE 1 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

March 2017
Myanmar Koei International Ltd.



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CHAPTER 1: OUTLINES AND SUMMARY OF MONITORING PLAN

1.1 General

Thilawa Special Economic Zone (TSEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd. (MJTD) has a responsibility to carry out regular environmental monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report with Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area.

1.2 Outlines of Monitoring Plan

To assess the environmental condition under the construction of industrial area in and around Thilawa SEZ Zone B, Air quality had been monitored from 23rd March 2017 – 30th March 2017 as follows;

Table 1.2- 1 Outlines of Air Quality Monitoring Plan

Monitoring Date	Monitoring Item	Parameters	Number of Point	Duration	Monitoring Methodology
From 23 rd March– 30 th March, 2017	Air Quality	CO, NO ₂ , PM _{2.5} , PM ₁₀ , and SO ₂	1	7 Days	On site measurement by Haz-Scanner Environmental Perimeter Air Station (EPAS)



CHAPTER 2: AIR QUALITY MONITORING

2.1 Monitoring Item

The parameters for air quality monitoring were CO, NO₂, PM_{2.5}, PM₁₀, and SO₂.

2.2 Monitoring Location

The air quality measurement equipment, "Haz-Scanner Environmental Perimeter Air Station (EPAS)" was set up at the south of the Thilawa SEZ Zone B, N: 16°39'24.20", E: 96°17'15.80", inside the monastery compound of Phalan village, surrounded by the residential houses of Phalan village in the south and fields in west, Thilawa SEZ Zone A in north, local Thilawa Industrial Zone in northeast, and construction of Thilawa SEZ Zone B in east and northeast respectively. The air quality monitoring is carried out above location where is near to the residential houses of Phalan village. Possible emission sources are dust emissions from construction activities and exhaust emissions from construction fuel-burning equipments and daily human activities in Phalan village. The location of air quality monitoring is shown in the Figure 2.2-1.



Figure 2.2-1 Location of Air Quality Monitoring Point

2.3 Monitoring Period

Air quality monitoring was conducted seven consecutive days from 23rd March – 30th March, 2017.



2.4 Monitoring Method

Monitoring of CO, NO₂, PM_{2.5}, PM₁₀, and SO₂ were conducted by referring to the recommendation of the United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner EPAS was used to collect ambient air pollutants. The EPAS measures automatically every one minute and directly read and recorded onsite for CO, NO₂, PM_{2.5}, PM₁₀, and SO₂. The state of air quality monitoring is shown in Figure 2.4-1.



Figure 2.4-1 Status of Air Quality Monitoring Point

2.5 Monitoring Results

The daily average value of air quality monitoring results of CO, NO₂, PM_{2.5}, PM₁₀, and SO₂ are described in Table 2.5-1. Comparing with the target value of CO, NO₂, PM_{2.5}, PM₁₀, and SO₂ prescribed in EIA report for Thilawa SEZ development project Zone B, concentration of CO, NO₂ and SO₂ were lower than the target value, while concentration of PM_{2.5} measured for seven days exceeded than the target value and concentration of PM₁₀ measured for four days were slightly higher than the target value.

Table 2.5- 1 Air Quality Monitoring Result (Daily Average)

Date	CO	NO ₂	PM _{2.5}	PM ₁₀	SO ₂
	ppm	ppm	mg/m ³	mg/m ³	ppm
23 ~24 Mar, 2017	0.246 (0.282 mg/m ³)	0.035 (0.066 mg/m ³)	0.046	0.052	0.007 (0.018 mg/m ³)
24 ~25 Mar, 2017	0.252 (0.289 mg/m ³)	0.038 (0.071 mg/m ³)	0.050	0.058	0.007 (0.018 mg/m ³)
25 ~26 Mar, 2017	0.173 (0.198 mg/m ³)	0.038 (0.071 mg/m ³)	0.043	0.048	0.003 (0.008 mg/m ³)
26 ~27 Mar, 2017	0.188 (0.215 mg/m ³)	0.037 (0.070 mg/m ³)	0.061	0.083	0.006 (0.016 mg/m ³)
27 ~28 Mar, 2017	0.144 (0.165 mg/m ³)	0.038 (0.071 mg/m ³)	0.059	0.082	0.003 (0.008 mg/m ³)
28 ~29 Mar, 2017	0.134 (0.153 mg/m ³)	0.032 (0.060 mg/m ³)	0.036	0.044	0.005 (0.013 mg/m ³)
29 ~30 Mar, 2017	0.148 (0.169 mg/m ³)	0.033 (0.062 mg/m ³)	0.030	0.038	0.006 (0.016 mg/m ³)
7 Days Average Value	0.183 (0.210 mg/m ³)	0.036 (0.067 mg/m ³)	0.046	0.058	0.005 (0.014 mg/m ³)
Target Value	9.000 (10.26 mg/m ³) [†]	0.050 (0.1 mg/m ³) [†]	0.025	0.050	0.008 (0.02 mg/m ³) [†]

Note: The target value of CO, NO₂ and SO₂ were converted to ppm units from mg/m³.

CHAPTER 3: CONCLUSION AND ISSUES TO BE SOLVED

The result of air quality of CO, NO₂ and SO₂ in each day were lower than the target value, thus there are no impacts on the surrounding environments. On the other hand, concentration of PM_{2.5} measured for seven days consecutive measurements in this survey period were higher than the target value and concentration of PM₁₀ measured for four days of seven days consecutive measurements in this survey period were slightly higher than the target values. Possible emission sources are affected from natural origin such as dust from unpaved vacant area and human activities from near the villages, vehicles used for construction activities in Zone B, and transportation in and around the project site. However, the results of seven days average of PM_{2.5} and the results of seven days average of PM₁₀ is less than the background level before start to develop of Zone B (0.047 and 0.122 mg/m³ in 10 to 17 December, 2015). Therefore, it is expected that there are no serious impacts on PM_{2.5} and PM₁₀ due to the construction work to the surrounding environment. Additionally, once unpaved area will be developed, air quality analysis results of PM_{2.5} and PM₁₀ will be improved.

In conclusion of this environmental survey, continuous monitoring for all of parameter will be necessary to grasp the environmental conditions in construction stage of Thilawa SEZ Zone B. Once enough environmental data will be collected for periods, the mitigation measures for environmental management will be reconsidered in future.



APPENDIX - HOURLY AIR RESULT



Date	Time	CO	NO ₂	PM _{2.5}	PM ₁₀	SO ₂
		ppm	ppm	mg/m ³	mg/m ³	ppm
		Hourly	Hourly	Hourly	Hourly	Hourly
23 Mar, 2017	11:30 ~ 12:29	0.000	0.016	0.002	0.002	0.035
23 Mar, 2017	12:30 ~ 13:29	0.043	0.022	0.005	0.007	0.032
23 Mar, 2017	13:30 ~ 14:29	0.212	0.025	0.003	0.015	0.020
23 Mar, 2017	14:30 ~ 15:29	0.169	0.032	0.028	0.024	0.016
23 Mar, 2017	15:30 ~ 16:29	0.179	0.045	0.081	0.051	0.000
23 Mar, 2017	16:30 ~ 17:29	0.260	0.046	0.039	0.037	0.000
23 Mar, 2017	17:30 ~ 18:29	0.470	0.038	0.046	0.043	0.000
23 Mar, 2017	18:30 ~ 19:29	0.627	0.037	0.038	0.042	0.003
23 Mar, 2017	19:30 ~ 20:29	0.651	0.036	0.056	0.061	0.002
23 Mar, 2017	20:30 ~ 21:29	0.458	0.035	0.047	0.060	0.008
23 Mar, 2017	21:30 ~ 22:29	0.385	0.041	0.035	0.061	0.002
23 Mar, 2017	22:30 ~ 23:29	0.351	0.046	0.041	0.045	0.000
23 Mar, 2017	23:30 ~ 0:29	0.175	0.042	0.030	0.039	0.000
24 Mar, 2017	0:30 ~ 1:29	0.230	0.045	0.047	0.059	0.003
24 Mar, 2017	1:30 ~ 2:29	0.244	0.048	0.117	0.070	0.004
24 Mar, 2017	2:30 ~ 3:29	0.207	0.036	0.068	0.082	0.002
24 Mar, 2017	3:30 ~ 4:29	0.200	0.032	0.071	0.097	0.002
24 Mar, 2017	4:30 ~ 5:29	0.209	0.037	0.077	0.114	0.001
24 Mar, 2017	5:30 ~ 6:29	0.328	0.040	0.087	0.120	0.009
24 Mar, 2017	6:30 ~ 7:29	0.364	0.041	0.076	0.096	0.007
24 Mar, 2017	7:30 ~ 8:29	0.096	0.029	0.059	0.064	0.000
24 Mar, 2017	8:30 ~ 9:29	0.044	0.022	0.022	0.031	0.000
24 Mar, 2017	9:30 ~ 10:29	0.000	0.023	0.015	0.020	0.001
24 Mar, 2017	10:30 ~ 11:29	0.007	0.029	0.005	0.019	0.007

Max	0.651 (0.746 mg/m ³)	0.048 (0.090 mg/m ³)	0.117	0.120	0.035 (0.092 mg/m ³)
Avg	0.246 (0.282 mg/m ³)	0.035 (0.066 mg/m ³)	0.046	0.052	0.007 (0.018 mg/m ³)
Min	0.000 (0.000 mg/m ³)	0.016 (0.030 mg/m ³)	0.002	0.002	0.000 (0.000 mg/m ³)



Date	Time	CO	NO ₂	PM _{2.5}	PM ₁₀	SO ₂
		ppm	ppm	mg/m ³	mg/m ³	ppm
		Hourly	Hourly	Hourly	Hourly	Hourly
24 Mar, 2017	11:30 ~ 12:29	0.041	0.033	0.008	0.017	0.005
24 Mar, 2017	12:30 ~ 13:29	0.095	0.030	0.011	0.017	0.028
24 Mar, 2017	13:30 ~ 14:29	0.169	0.031	0.019	0.031	0.036
24 Mar, 2017	14:30 ~ 15:29	0.259	0.035	0.025	0.044	0.005
24 Mar, 2017	15:30 ~ 16:29	0.277	0.049	0.067	0.056	0.000
24 Mar, 2017	16:30 ~ 17:29	0.348	0.050	0.037	0.035	0.000
24 Mar, 2017	17:30 ~ 18:29	0.604	0.047	0.053	0.045	0.000
24 Mar, 2017	18:30 ~ 19:29	0.416	0.042	0.047	0.045	0.000
24 Mar, 2017	19:30 ~ 20:29	0.351	0.041	0.039	0.038	0.000
24 Mar, 2017	20:30 ~ 21:29	0.342	0.042	0.043	0.047	0.007
24 Mar, 2017	21:30 ~ 22:29	0.285	0.049	0.040	0.048	0.000
24 Mar, 2017	22:30 ~ 23:29	0.318	0.041	0.055	0.064	0.001
24 Mar, 2017	23:30 ~ 0:29	0.262	0.039	0.055	0.076	0.003
25 Mar, 2017	0:30 ~ 1:29	0.206	0.041	0.054	0.080	0.005
25 Mar, 2017	1:30 ~ 2:29	0.212	0.036	0.055	0.072	0.008
25 Mar, 2017	2:30 ~ 3:29	0.185	0.037	0.075	0.068	0.002
25 Mar, 2017	3:30 ~ 4:29	0.183	0.036	0.104	0.074	0.000
25 Mar, 2017	4:30 ~ 5:29	0.205	0.034	0.075	0.091	0.003
25 Mar, 2017	5:30 ~ 6:29	0.330	0.032	0.082	0.098	0.012
25 Mar, 2017	6:30 ~ 7:29	0.667	0.033	0.107	0.135	0.028
25 Mar, 2017	7:30 ~ 8:29	0.117	0.025	0.063	0.073	0.001
25 Mar, 2017	8:30 ~ 9:29	0.010	0.019	0.029	0.038	0.002
25 Mar, 2017	9:30 ~ 10:29	0.012	0.038	0.009	0.042	0.024
25 Mar, 2017	10:30 ~ 11:29	0.155	0.041	0.058	0.045	0.000

Max	0.667 (0.764 mg/m ³)	0.050 (0.094 mg/m ³)	0.107	0.135	0.036 (0.094 mg/m ³)
Avg	0.252 (0.289 mg/m ³)	0.038 (0.071 mg/m ³)	0.050	0.058	0.007 (0.018 mg/m ³)
Min	0.010 (0.011 mg/m ³)	0.019 (0.036 mg/m ³)	0.008	0.017	0.000 (0.000 mg/m ³)



Date	Time	CO	NO ₂	PM _{2.5}	PM ₁₀	SO ₂
		ppm	ppm	mg/m ³	mg/m ³	ppm
		Hourly	Hourly	Hourly	Hourly	Hourly
25 Mar, 2017	11:30 ~ 12:29	0.073	0.037	0.034	0.026	0.000
25 Mar, 2017	12:30 ~ 13:29	0.142	0.036	0.005	0.016	0.003
25 Mar, 2017	13:30 ~ 14:29	0.154	0.043	0.006	0.022	0.014
25 Mar, 2017	14:30 ~ 15:29	0.205	0.039	0.025	0.033	0.003
25 Mar, 2017	15:30 ~ 16:29	0.220	0.047	0.063	0.045	0.000
25 Mar, 2017	16:30 ~ 17:29	0.260	0.040	0.035	0.028	0.000
25 Mar, 2017	17:30 ~ 18:29	0.342	0.039	0.028	0.033	0.000
25 Mar, 2017	18:30 ~ 19:29	0.365	0.032	0.033	0.027	0.001
25 Mar, 2017	19:30 ~ 20:29	0.286	0.038	0.032	0.025	0.001
25 Mar, 2017	20:30 ~ 21:29	0.297	0.042	0.037	0.039	0.005
25 Mar, 2017	21:30 ~ 22:29	0.165	0.046	0.035	0.048	0.000
25 Mar, 2017	22:30 ~ 23:29	0.241	0.045	0.064	0.082	0.001
25 Mar, 2017	23:30 ~ 0:29	0.172	0.036	0.060	0.078	0.004
26 Mar, 2017	0:30 ~ 1:29	0.148	0.035	0.061	0.066	0.001
26 Mar, 2017	1:30 ~ 2:29	0.136	0.038	0.067	0.048	0.000
26 Mar, 2017	2:30 ~ 3:29	0.126	0.041	0.058	0.056	0.000
26 Mar, 2017	3:30 ~ 4:29	0.115	0.041	0.058	0.070	0.002
26 Mar, 2017	4:30 ~ 5:29	0.129	0.036	0.060	0.077	0.004
26 Mar, 2017	5:30 ~ 6:29	0.207	0.035	0.074	0.101	0.010
26 Mar, 2017	6:30 ~ 7:29	0.159	0.034	0.066	0.078	0.002
26 Mar, 2017	7:30 ~ 8:29	0.118	0.025	0.052	0.059	0.000
26 Mar, 2017	8:30 ~ 9:29	0.054	0.030	0.033	0.044	0.000
26 Mar, 2017	9:30 ~ 10:29	0.027	0.042	0.029	0.041	0.000
26 Mar, 2017	10:30 ~ 11:29	0.000	0.033	0.009	0.022	0.012

Max	0.365 (0.418 mg/m ³)	0.047 (0.088 mg/m ³)	0.074	0.101	0.014 (0.037 mg/m ³)
Avg	0.173 (0.198 mg/m ³)	0.038 (0.071 mg/m ³)	0.043	0.048	0.003 (0.008 mg/m ³)
Min	0.000 (0.000 mg/m ³)	0.025 (0.047 mg/m ³)	0.005	0.016	0.000 (0.000 mg/m ³)



Date	Time	CO	NO ₂	PM _{2.5}	PM ₁₀	SO ₂
		ppm	ppm	mg/m ³	mg/m ³	ppm
		Hourly	Hourly	Hourly	Hourly	Hourly
26 Mar, 2017	11:30 ~ 12:29	0.025	0.033	0.021	0.024	0.016
26 Mar, 2017	12:30 ~ 13:29	0.065	0.035	0.013	0.020	0.021
26 Mar, 2017	13:30 ~ 14:29	0.233	0.039	0.015	0.021	0.030
26 Mar, 2017	14:30 ~ 15:29	0.393	0.050	0.058	0.056	0.000
26 Mar, 2017	15:30 ~ 16:29	0.343	0.055	0.091	0.065	0.000
26 Mar, 2017	16:30 ~ 17:29	0.409	0.047	0.063	0.059	0.000
26 Mar, 2017	17:30 ~ 18:29	0.382	0.044	0.059	0.058	0.001
26 Mar, 2017	18:30 ~ 19:29	0.419	0.041	0.072	0.075	0.000
26 Mar, 2017	19:30 ~ 20:29	0.287	0.040	0.057	0.062	0.003
26 Mar, 2017	20:30 ~ 21:29	0.291	0.045	0.057	0.061	0.001
26 Mar, 2017	21:30 ~ 22:29	0.265	0.042	0.062	0.077	0.005
26 Mar, 2017	22:30 ~ 23:29	0.207	0.042	0.079	0.095	0.006
26 Mar, 2017	23:30 ~ 0:29	0.142	0.041	0.067	0.110	0.000
27 Mar, 2017	0:30 ~ 1:29	0.165	0.037	0.062	0.098	0.002
27 Mar, 2017	1:30 ~ 2:29	0.141	0.043	0.069	0.103	0.004
27 Mar, 2017	2:30 ~ 3:29	0.107	0.039	0.080	0.119	0.009
27 Mar, 2017	3:30 ~ 4:29	0.100	0.034	0.093	0.142	0.004
27 Mar, 2017	4:30 ~ 5:29	0.130	0.034	0.100	0.165	0.005
27 Mar, 2017	5:30 ~ 6:29	0.145	0.031	0.110	0.212	0.005
27 Mar, 2017	6:30 ~ 7:29	0.098	0.031	0.109	0.162	0.004
27 Mar, 2017	7:30 ~ 8:29	0.133	0.029	0.079	0.105	0.001
27 Mar, 2017	8:30 ~ 9:29	0.014	0.021	0.025	0.041	0.002
27 Mar, 2017	9:30 ~ 10:29	0.000	0.022	0.014	0.028	0.009
27 Mar, 2017	10:30 ~ 11:29	0.011	0.023	0.011	0.031	0.009

Max	0.419 (0.480 mg/m ³)	0.055 (0.103 mg/m ³)	0.110	0.212	0.030 (0.079 mg/m ³)
Avg	0.188 (0.215 mg/m ³)	0.037 (0.070 mg/m ³)	0.061	0.083	0.006 (0.016 mg/m ³)
Min	0.000 (0.000 mg/m ³)	0.021 (0.040 mg/m ³)	0.011	0.020	0.000 (0.000 mg/m ³)



Date	Time	CO	NO ₂	PM _{2.5}	PM ₁₀	SO ₂
		ppm	ppm	mg/m ³	mg/m ³	ppm
		Hourly	Hourly	Hourly	Hourly	Hourly
27 Mar, 2017	11:30 ~ 12:29	0.033	0.032	0.028	0.040	0.006
27 Mar, 2017	12:30 ~ 13:29	0.063	0.036	0.029	0.044	0.001
27 Mar, 2017	13:30 ~ 14:29	0.098	0.045	0.038	0.068	0.000
27 Mar, 2017	14:30 ~ 15:29	0.175	0.048	0.060	0.070	0.000
27 Mar, 2017	15:30 ~ 16:29	0.176	0.044	0.062	0.056	0.000
27 Mar, 2017	16:30 ~ 17:29	0.247	0.044	0.042	0.042	0.000
27 Mar, 2017	17:30 ~ 18:29	0.234	0.048	0.036	0.039	0.001
27 Mar, 2017	18:30 ~ 19:29	0.322	0.045	0.044	0.052	0.001
27 Mar, 2017	19:30 ~ 20:29	0.269	0.042	0.041	0.059	0.001
27 Mar, 2017	20:30 ~ 21:29	0.148	0.046	0.039	0.057	0.001
27 Mar, 2017	21:30 ~ 22:29	0.119	0.049	0.050	0.068	0.002
27 Mar, 2017	22:30 ~ 23:29	0.107	0.042	0.067	0.094	0.004
27 Mar, 2017	23:30 ~ 0:29	0.098	0.038	0.074	0.097	0.000
28 Mar, 2017	0:30 ~ 1:29	0.099	0.043	0.081	0.104	0.000
28 Mar, 2017	1:30 ~ 2:29	0.129	0.044	0.090	0.131	0.002
28 Mar, 2017	2:30 ~ 3:29	0.054	0.043	0.090	0.129	0.000
28 Mar, 2017	3:30 ~ 4:29	0.089	0.039	0.097	0.138	0.002
28 Mar, 2017	4:30 ~ 5:29	0.276	0.041	0.105	0.168	0.011
28 Mar, 2017	5:30 ~ 6:29	0.524	0.036	0.141	0.223	0.020
28 Mar, 2017	6:30 ~ 7:29	0.152	0.034	0.118	0.148	0.006
28 Mar, 2017	7:30 ~ 8:29	0.032	0.027	0.048	0.060	0.001
28 Mar, 2017	8:30 ~ 9:29	0.000	0.006	0.025	0.035	0.001
28 Mar, 2017	9:30 ~ 10:29	0.000	0.012	0.012	0.021	0.009
28 Mar, 2017	10:30 ~ 11:29	0.000	0.019	0.009	0.017	0.005

Max	0.524 (0.500 mg/m ³)	0.049 (0.092 mg/m ³)	0.141	0.223	0.020 (0.052 mg/m ³)
Avg	0.144 (0.165 mg/m ³)	0.038 (0.071 mg/m ³)	0.059	0.082	0.003 (0.008 mg/m ³)
Min	0.000 (0.000 mg/m ³)	0.006 (0.011 mg/m ³)	0.009	0.017	0.000 (0.000 mg/m ³)



Date	Time	CO	NO ₂	PM _{2.5}	PM ₁₀	SO ₂
		ppm	ppm	mg/m ³	mg/m ³	ppm
		Hourly	Hourly	Hourly	Hourly	Hourly
28 Mar, 2017	11:30 ~ 12:29	0.057	0.026	0.010	0.034	0.003
28 Mar, 2017	12:30 ~ 13:29	0.153	0.031	0.015	0.038	0.000
28 Mar, 2017	13:30 ~ 14:29	0.184	0.037	0.018	0.031	0.000
28 Mar, 2017	14:30 ~ 15:29	0.208	0.041	0.051	0.050	0.000
28 Mar, 2017	15:30 ~ 16:29	0.260	0.040	0.062	0.059	0.000
28 Mar, 2017	16:30 ~ 17:29	0.194	0.040	0.038	0.035	0.002
28 Mar, 2017	17:30 ~ 18:29	0.190	0.035	0.038	0.037	0.001
28 Mar, 2017	18:30 ~ 19:29	0.219	0.040	0.032	0.031	0.001
28 Mar, 2017	19:30 ~ 20:29	0.109	0.034	0.025	0.032	0.000
28 Mar, 2017	20:30 ~ 21:29	0.173	0.038	0.022	0.036	0.015
28 Mar, 2017	21:30 ~ 22:29	0.131	0.036	0.039	0.049	0.005
28 Mar, 2017	22:30 ~ 23:29	0.141	0.039	0.045	0.052	0.006
28 Mar, 2017	23:30 ~ 0:29	0.157	0.035	0.044	0.051	0.007
29 Mar, 2017	0:30 ~ 1:29	0.140	0.035	0.050	0.058	0.009
29 Mar, 2017	1:30 ~ 2:29	0.079	0.036	0.052	0.071	0.005
29 Mar, 2017	2:30 ~ 3:29	0.062	0.033	0.066	0.053	0.007
29 Mar, 2017	3:30 ~ 4:29	0.081	0.032	0.049	0.054	0.007
29 Mar, 2017	4:30 ~ 5:29	0.076	0.033	0.046	0.059	0.013
29 Mar, 2017	5:30 ~ 6:29	0.197	0.030	0.052	0.082	0.012
29 Mar, 2017	6:30 ~ 7:29	0.309	0.029	0.069	0.095	0.015
29 Mar, 2017	7:30 ~ 8:29	0.071	0.025	0.024	0.033	0.008
29 Mar, 2017	8:30 ~ 9:29	0.028	0.009	0.006	0.012	0.003
29 Mar, 2017	9:30 ~ 10:29	0.001	0.010	0.004	0.005	0.007
29 Mar, 2017	10:30 ~ 11:29	0.000	0.016	0.002	0.002	0.007

Max	0.309 (0.354 mg/m ³)	0.041 (0.077 mg/m ³)	0.069	0.095	0.015 (0.039 mg/m ³)
Avg	0.134 (0.153 mg/m ³)	0.032 (0.060 mg/m ³)	0.036	0.044	0.005 (0.013 mg/m ³)
Min	0.000 (0.000 mg/m ³)	0.009 (0.017 mg/m ³)	0.002	0.002	0.000 (0.000 mg/m ³)



Date	Time	CO	NO ₂	PM _{2.5}	PM ₁₀	SO ₂
		ppm	ppm	mg/m ³	mg/m ³	ppm
		Hourly	Hourly	Hourly	Hourly	Hourly
29 Mar, 2017	11:30 ~ 12:29	0.004	0.025	0.003	0.007	0.009
29 Mar, 2017	12:30 ~ 13:29	0.076	0.028	0.002	0.012	0.015
29 Mar, 2017	13:30 ~ 14:29	0.208	0.031	0.008	0.032	0.001
29 Mar, 2017	14:30 ~ 15:29	0.085	0.044	0.037	0.040	0.000
29 Mar, 2017	15:30 ~ 16:29	0.165	0.045	0.053	0.039	0.000
29 Mar, 2017	16:30 ~ 17:29	0.220	0.041	0.040	0.035	0.000
29 Mar, 2017	17:30 ~ 18:29	0.319	0.042	0.041	0.042	0.000
29 Mar, 2017	18:30 ~ 19:29	0.246	0.041	0.024	0.024	0.005
29 Mar, 2017	19:30 ~ 20:29	0.224	0.042	0.029	0.027	0.006
29 Mar, 2017	20:30 ~ 21:29	0.164	0.042	0.020	0.024	0.004
29 Mar, 2017	21:30 ~ 22:29	0.165	0.039	0.031	0.036	0.003
29 Mar, 2017	22:30 ~ 23:29	0.133	0.041	0.033	0.037	0.007
29 Mar, 2017	23:30 ~ 0:29	0.114	0.040	0.027	0.033	0.007
30 Mar, 2017	0:30 ~ 1:29	0.106	0.038	0.033	0.041	0.006
30 Mar, 2017	1:30 ~ 2:29	0.109	0.039	0.041	0.053	0.007
30 Mar, 2017	2:30 ~ 3:29	0.099	0.033	0.054	0.059	0.009
30 Mar, 2017	3:30 ~ 4:29	0.070	0.031	0.058	0.058	0.003
30 Mar, 2017	4:30 ~ 5:29	0.145	0.034	0.048	0.083	0.011
30 Mar, 2017	5:30 ~ 6:29	0.450	0.031	0.057	0.121	0.021
30 Mar, 2017	6:30 ~ 7:29	0.377	0.035	0.062	0.085	0.016
30 Mar, 2017	7:30 ~ 8:29	0.069	0.015	0.009	0.014	0.004
30 Mar, 2017	8:30 ~ 9:29	0.013	0.006	0.002	0.003	0.004
30 Mar, 2017	9:30 ~ 10:29	0.000	0.010	0.002	0.003	0.008
30 Mar, 2017	10:30 ~ 11:29	0.001	0.023	0.002	0.002	0.008

Max	0.450 (0.515 mg/m ³)	0.045 (0.085 mg/m ³)	0.062	0.121	0.021 (0.055 mg/m ³)
Avg	0.148 (0.169 mg/m ³)	0.033 (0.062 mg/m ³)	0.030	0.038	0.006 (0.016 mg/m ³)
Min	0.000 (0.000 mg/m ³)	0.006 (0.011 mg/m ³)	0.002	0.002	0.000 (0.000 mg/m ³)



**Thilawa Special Economic Zone (Zone B)
Development Project –Phase 1**

Appendix

Noise and Vibration Monitoring Report

March 2017

**NOISE AND VIBRATION
MONITORING REPORT
FOR DEVELOPMENT OF INDUSTRIAL AREA
THILAWA SEZ ZONE B
(PHASE 1 CONSTRUCTION STAGE)**

(QUARTERLY MONITORING)

March 2017

Myanmar Koei International Ltd.



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CHAPTER 1: OUTLINES AND SUMMARY OF MONITORING PLAN

1.1 General

Thilawa Special Economic Zone (TSEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd. (MJTD) has a responsibility to carry out regular environmental monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report with Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area.

1.2 Outlines of Monitoring Plan

To assess the environmental condition under the construction of industrial area in and around Thilawa SEZ Zone B, noise and vibration levels volume had been monitored from 23rd March 2017 – 30th March 2017 as follows;

Table 1.2-1 Outlines of Noise and Vibration Level Monitoring

Monitoring Date	Monitoring Item	Parameters	Number of Points	Duration	Monitoring Methodology
From 29 th March–30 th March, 2017	Noise Level	$L_{Aeq}(dB)$	1 site (NV1)	24 hours	On-site measurement by “Rion NL-22 sound level meter”
From 23 rd March–24 th March, 2017	Noise Level	$L_{Aeq}(dB)$	1 site (NV2)	24 hours	On-site measurement by “Rion NL-22 sound level meter”
From 29 th March–30 th March, 2017	Vibration Level	$L_{v10}(dB)$	1 site (NV1)	24 hours	On-site measurement by “Vibration Level Meter- VM-53A”
From 23 rd March–24 th March, 2017	Vibration Level	$L_{v10}(dB)$	1 site (NV2)	24 hours	On-site measurement by “Vibration Level Meter- VM-53A”



CHAPTER 2: NOISE AND VIBRATION LEVEL MONITORING

2.1 Monitoring Item

The noise and vibration level monitoring items are shown in Table 2.1-1.

Table 2.1-1 Monitoring Parameters for Noise and Vibration Level

No.	Item	Parameter
1	Noise	A-weighted loudness equivalent (L_{Aeq})
2	Vibration	Vibration level, vertical, percentile (L_{v10})

2.2 Monitoring Location

Noise and vibration levels were measured at the northeast corner of the Thilawa SEZ Zone B, sampling point (NV-1); N: 16°40'17.90", E: 96°17'18.20" for traffic noise concerned and at the south of the Thilawa SEZ Zone B, sampling point (NV-2); N: 16°39'24.90", E: 96°17'16.70", inside the monastery compound of Phalan village. The location of the noise and vibration monitoring points are shown in Figure 2.2-1.



Figure 2.2-1 Location of Noise and Vibration Level Monitoring Points



NV-1

NV-1 is located in front of temporary gate of construction site of Thilawa SEZ Zone B and next to Pyunt Phyay road. The surrounding area are Zone A in the northwest, Local Thilawa Industrial Zone in the east and paddy field in the west respectively. Possible sources of noise and vibration is generated from construction activities and road traffic.

NV-2

NV-2 is located at the south of the Thilawa SEZ Zone B, inside the monastery compound of Phalan village, surrounded by the residential houses of Phalan village in the south and fields in west, Thilawa SEZ Zone A in north, Local Thilawa Industrial Zone in northeast respectively. Possible sources of noise and vibration is generated from construction activities from Zone B and daily human activities from nearby Phalan village.

2.3 Monitoring Method

Noise level was measured by "Rion NL-22 sound level meter" and automatically recorded every 10 minutes in a memory card. The vibration level meter was, VM-53A (Rion Co. Ltd., Japan), accompanied by a 3-axis accelerometer PV-83C (Rion Co. Ltd.) was placed on solid soil ground. Vertical vibration (Z axis), L_v , was measured every 10 minutes within the adaptable range of (10-70) dB at NV-1 and (20-80) dB at NV-2 and recorded to a memory card.

The measurement period of noise and vibration was 24 hours for each monitoring point. The status of the noise and vibration level monitoring on NV-1 and NV-2 are shown in Figure 2.3-1.



Figure 2.3-1 Status of Noise and Vibration Level Monitoring at NV-1 and NV-2



2.4 Monitoring Results

Noise monitoring results are separated daytime (6:00 AM to 10:00 PM), evening time (10:00 PM to 6:00 AM) time frames for NV-1 and daytime (7:00 AM to 7:00 PM), evening time (7:00 PM to 10:00 PM), and night time (10:00 PM to 7:00 AM) time frames respectively for NV-2. Noise measurements was carried out for one location on a 24-hour basis. The monitoring results are summarized in Table 2.4-1 and Table 2.4-2. Comparing with the target value of noise level in construction stage prescribed in EIA report for Thilawa SEZ development project Zone B, all of the result are under target value.

Table 2.4-1 Results of Noise Levels (L_{Aeq}) Monitoring at NV-1

Date	(Traffic Noise Level) Equivalent Noise Level (L_{Aeq} dB)	
	Day Time (6:00 AM – 10:00 PM)	Night Time (10:00 PM – 6:00 AM)
29 th March– 30 th March, 2017	62	57
Target Value	75	70

Note: Target value is applied to the noise standard along main road stipulated in the Noise Regulation Law (Japan) (Law No. 98 of 1968, Latest Amendment by Law No.91 of 2000).

Table 2.4-2 Results of Noise Levels (L_{Aeq}) Monitoring at NV-2

Date	(Residential area & monastery located less than 150m from the construction site) Equivalent Noise Level (L_{Aeq} dB)		
	Day Time (7:00 AM – 7:00 PM)	Evening Time (7:00 PM – 10:00 PM)	Night Time (10:00 PM – 7:00 AM)
23 rd March– 24 th March, 2017	57	51	43
Target Value	75	60	55

Note: Target value is applied to the noise level during the construction stage in the the EIA report for Thilawa SEZ Development Project (Zone A) (September 2013): Residential houses and monastery located less than 150m from the construction site comply with the middle range of the Singapore standard (categorized as “Residential buildings located less than 150m”).

Table 2.4-3 Hourly Noise Level (L_{Aeq}) Monitoring Results at NV-1

Date	Time	(L_{Aeq} dB)	(L_{Aeq} dB) Each Category	(L_{Aeq} dB) Target Value	Construction Activity
29 th March – 30 th March, 2017	6:00-7:00	58	62	75	No Activity
	7:00-8:00	60			Building temporary office, Land grading, Asphalt pavement casting
	8:00-9:00	59			No Activity
	9:00-10:00	70			Building temporary office, Land grading, Asphalt pavement casting
	10:00-11:00	65			No Activity
	11:00-12:00	60			Building temporary office, Land grading, Asphalt pavement casting
	12:00-13:00	56			No Activity
	13:00-14:00	64			Building temporary office, Land grading, Asphalt pavement casting
	14:00-15:00	61			No Activity
	15:00-16:00	61			Building temporary office, Land grading, Asphalt pavement casting
	16:00-17:00	63			No Activity
	17:00-18:00	62			Building temporary office, Land grading, Asphalt pavement casting
	18:00-19:00	59	57	70	No Activity
	19:00-20:00	56			No Activity
	20:00-21:00	55			No Activity
	21:00-22:00	55			No Activity
	22:00-23:00	53			No Activity
	23:00-24:00	63			No Activity
	24:00-1:00	50			No Activity
	1:00-2:00	51			No Activity
	2:00-3:00	53			No Activity
	3:00-4:00	50			No Activity
	4:00-5:00	50			No Activity
	5:00-6:00	61			No Activity



Table 2.4-4 Hourly Noise Level (L_{Aeq}) Monitoring Results at NV-2

Date	Time	(L_{Aeq} dB)	(L_{Aeq} dB) Each Category	(L_{Aeq} dB) Target Value	Construction Activities
23 rd March – 24 th March, 2017	7:00-8:00	49	57	75	No Activity
	8:00-9:00	47			Pile breaking
	9:00-10:00	51			progress, Land
	10:00-11:00	55			grading
	11:00-12:00	53			No Activity
	12:00-13:00	50			Pile breaking
	13:00-14:00	47			progress, Land
	14:00-15:00	63			grading
	15:00-16:00	62			No Activity
	16:00-17:00	61			Pile breaking
	17:00-18:00	60			progress, Land
	18:00-19:00	54			grading
	19:00-20:00	53	51	60	No Activity
	20:00-21:00	49			No Activity
	21:00-22:00	51			No Activity
	22:00-23:00	48			No Activity
	23:00-24:00	39	43	55	No Activity
	24:00-1:00	41			No Activity
	1:00-2:00	42			No Activity
	2:00-3:00	42			No Activity
	3:00-4:00	40			No Activity
	4:00-5:00	40			No Activity
	5:00-6:00	44			No Activity
	6:00-7:00	46			No Activity

The results of vibration level are shown in Table 2.4-5 and Table 2.4-6. By comparing with the target vibration level in construction stage in EIA report for Thilawa SEZ development project Zone B, all of results were under the target values.

Table 2.4-5 Results of Vibration Levels (L_{v10}) Monitoring at NV-1

Location	Date	(Residential and commercial and industrial areas) Equivalent Vibration Level (L_{v10} dB)		
		Day Time (7:00 AM – 7:00 PM)	Evening Time (7:00 PM – 10:00 PM)	Night Time (10:00 PM – 7:00 AM)
NV-1	29 th – 30 th March, 2017	56	35	33
	Target Value	70	70	65

Note: Target value is applied to the noise level during the construction stage in the the EIA report for Thilawa SEZ Development Project (Zone A) (September 2013): Office, commercial facilities, and factories areas shall comply with the Japanese standard for mixed areas including residential and commercial and industrial areas.

Table 2.4-6 Results of Vibration Levels (L_{v10}) Monitoring at NV-2

Location	Date	(Monastery and residential area) Equivalent Vibration Level (L_{v10} dB)		
		Day Time (7:00 AM – 7:00 PM)	Evening Time (7:00 PM – 10:00 PM)	Night Time (10:00 PM – 7:00 AM)
NV-2	23 rd – 24 th March, 2017	45	35	17
	Target Value	65	65	60

Note: Target value is applied to the noise level during the construction stage in the the EIA report for Thilawa SEZ Development Project (Zone A) (September 2013): Monastery and residential house where are necessary to keep quiet and sleep shall comply with the Japanese standard for residential area.



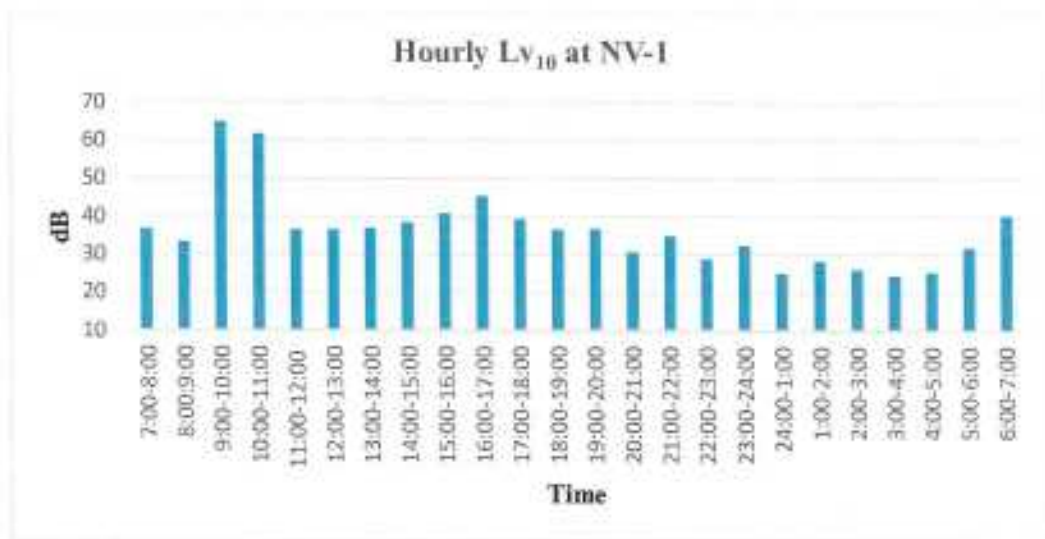


Figure 2.4-1 Results of Vibration Levels (L_{v10}) Monitoring at NV-1

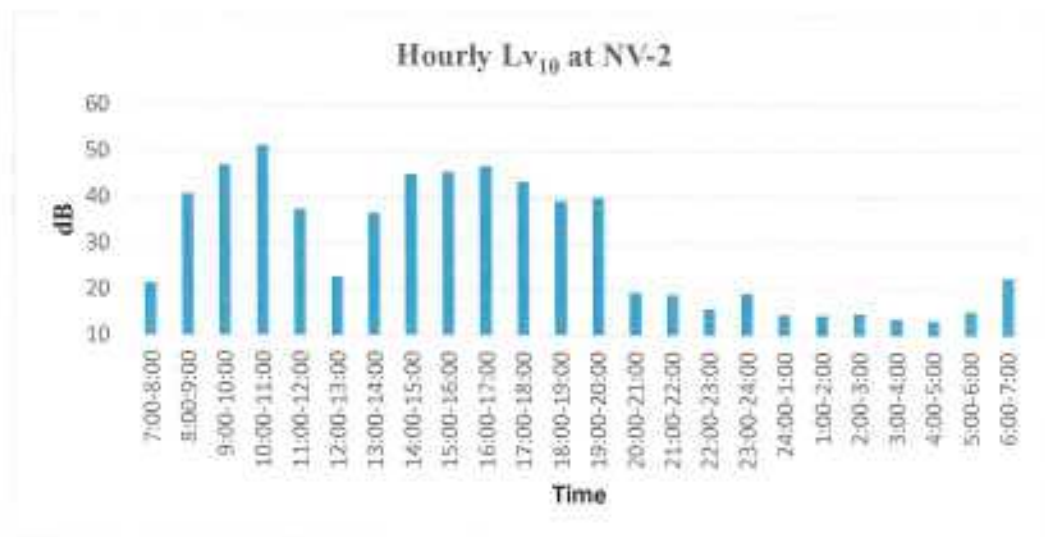


Figure 2.4-2 Results of Vibration Levels (L_{v10}) Monitoring at NV-2



Table 2.4-7 Results of Hourly Vibration Levels (L_{v10}) Monitoring at NV-1 and NV-2

Date	29 th – 30 th Mar 2017	23 rd – 24 th Mar 2017	(L _{v10} , dB) (NV-1) Each Category	(L _{v10} , dB) Target Value	(L _{v10} , dB) (NV-2) Each Category	(L _{v10} , dB) Target Value	Construction Activity (NV-1 and NV-2)
Time	L _{v10} (NV-1)	L _{v10} (NV-2)					
7:00-8:00	37	21	56	70	45	65	No activity
8:00-9:00	33	41					-Building temporary office, Land grading, Asphalt pavement casting at near NV-1 -Pile breaking progress, Land grading at near NV-2
9:00-10:00	65	47					
10:00-11:00	62	51					
11:00-12:00	37	37					
12:00-13:00	37	23					No activity
13:00-14:00	37	37					-Building temporary office, Land grading, Asphalt pavement casting at near NV-1. -Pile breaking progress, Land grading at near NV-2.
14:00-15:00	38	45					
15:00-16:00	41	45					
16:00-17:00	45	47					
17:00-18:00	39	43					
18:00-19:00	37	39	No activity				
19:00-20:00	37	40	35	70	35	65	No activity
20:00-21:00	31	19					
21:00-22:00	35	19					
22:00-23:00	29	16	33	65	17	60	No activity
23:00-24:00	32	19					
24:00-1:00	25	15					
1:00-2:00	28	14					
2:00-3:00	26	15					
3:00-4:00	24	14					
4:00-5:00	25	13					
5:00-6:00	32	15					
6:00-7:00	40	23					



CHAPTER 3: CONCLUSION AND ISSUES TO BE SOLVED

By comparing with the target noise and vibration level in construction stage in EIA report for Thilawa SEZ development project Zone B, all results were under the target values. Construction activities of Zone B is already started but the results of noise level at NV-1 and NV-2 are lower than the target values and the results of vibration level for NV-1 and NV-2 are approximately half of the target levels. Thus, there is no negative impact on noise and vibration from construction activities of Zone B to the surrounding environment.

In conclusion of this environmental monitoring, there are no specific noise and vibration impacts to the surrounding area of industrial area of Thilawa SEZ Zone B during the monitoring period.



**Thilawa Special Economic Zone (Zone B)
Development Project –Phase 1**

Appendix

Traffic Volume Monitoring Report

March 2017

**TRAFFIC VOLUME MONITORING REPORT
FOR DEVELOPMENT OF INDUSTRIAL AREA
THILAWA SEZ ZONE B
(PHASE 1 CONSTRUCTION STAGE)**

(QUARTERLY MONITORING)

March 2017

Myanmar Koei International Ltd.



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CHAPTER 1: OUTLINES AND SUMMARY OF MONITORING PLAN

1.1 General

Thilawa Special Economic Zone (TSEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd. (MJTD) has a responsibility to carry out regular environmental monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report with Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area.

1.2 Outlines of Monitoring Plan

To assess the environmental condition under the construction of industrial area in and around Thilawa SEZ Zone B, Traffic volume had been monitored from 29th March 2017 – 30th March 2017 as follows;

Table 1.2-1 Outlines of Traffic Volume Monitoring

Monitoring Date	Monitoring Item	Parameters	Number of Point	Duration	Monitoring Methodology
From 29 th March– 30 th March, 2017	Traffic Volume	-	1 (TV-1)	24 hours	Manual Count



CHAPTER 2: TRAFFIC VOLUME MONITORING









2.1 Monitoring Item

The traffic volume monitoring item are shown in Table 2.1-1. All vehicles were classified into four types as detailed in Table 2.1-2.

Table 2.1-1 Monitoring Parameters for Traffic Volume

No.	Item	Parameter
1	Traffic volume	Number of Vehicle (4 Types)

Table 2.1-2 Classification of Vehicles Types

No.	Classification		Description
1	Two-wheeled vehicle		Motorbike, Motorcycle taxi
2	Four-wheeled light vehicle	  	Pick-up car, Jeep, Taxi, Saloon car, Light truck (under 2 tons)
3	Four-wheeled heavy vehicle	  	Medium bus, Express, Big bus, Medium truck, Heavy truck
4	Others		Tractor



2.2 Monitoring Location

Traffic volume was measured at the northeast corner of the Thilawa SEZ Zone B, monitoring point (TV-1); N: 16°40'17.90", E: 96°17'18.20". The location of the traffic volume monitoring point is shown in Figure 2.2-1.



Figure 2.2-1 Location of Traffic Volume Monitoring Point

TV-1

TV-1 is located in front of main gate of construction site of Thilawa SEZ Zone B and next to Thilawa Development road. The surrounding area are Zone A in the northwest, local industrial zone in the east and paddy field in the west respectively.



2.3 Monitoring Method

The traffic volume monitoring was conducted for 24 hours at the same time as the traffic noise and vibration level monitoring. Traffic volume monitoring was conducted to count the numbers of vehicles moving in each direction. Manual count method is used and data are recorded using tally sheets. The status of the traffic volume monitoring on TV-1 is shown in Figure 2.3-1.



Figure 2.3-1 Status of Traffic Volume Monitoring at TV-1



2.4 Monitoring Results

The traffic volume monitoring results are summarized in Table 2.4-1. Hourly quantities of each type of vehicle were recorded. The table 2.4-1 shows that the number of 2-wheel vehicles and 4-wheel light vehicles passing TV-1 are higher than 4-wheel heavy vehicles and others for each direction. It seems that commuting vehicles are much utilized during this monitoring period as compare with construction related heavy vehicles (4-wheel heavy vehicles).

Table 2.4-1 Summary of Traffic Volume Recorded at TV-1

Survey Point	Direction	Date	Weekday	2-wheel Vehicles	4-wheel Light Vehicles	4-wheel Heavy Vehicles	Others	Total
TV-1	Phalan village to Dagon-Thilawa road	29 th Mar-30 th Mar 2017	Wednesday & Thursday	1712	545	216	29	2502
	Dagon-Thilawa road to Phalan village			1534	500	236	28	2298

The summary monitoring results of hourly traffic volume at TV-1 is shown in Table 2.4-2 and Table 2.4-3, respectively. Compare the result of each direction in morning peak hours as 6:00 to 10:00 and in the evening peak hours as 17:00 to 18:00, traffic volume from Phalan village to Dagon-Thilawa road is higher than another direction in the morning peak hours. In the evening peak hours, traffic volume from Dagon-Thilawa road to Phalan village is higher than another direction. It may be possible commuting vehicles are passing from Phalan village to Dagon-Thilawa road in the morning peak hours and returning from Dagon-Thilawa road to Phalan village in the evening peak hours in this monitoring period.



Table 2.4-2 Hourly Traffic Volume Results at TV-1 (From Phalan Village to Dagon-Thilawa Road)

From	To	Classification				Total
		Type of vehicles				
		Two-wheeled vehicle	Four-wheeled light vehicle	Four-wheeled heavy vehicle	Others	
10:00	11:00	82	36	17	4	139
11:00	12:00	101	43	15	3	162
12:00	13:00	54	29	9	0	92
13:00	14:00	69	35	13	2	117
14:00	15:00	75	30	12	3	120
15:00	16:00	77	27	19	1	124
16:00	17:00	66	42	13	1	122
17:00	18:00	108	47	19	1	175
18:00	19:00	174	41	16	3	234
19:00	20:00	41	21	5	0	67
20:00	21:00	76	30	9	1	116
21:00	22:00	31	9	2	0	42
22:00	23:00	5	2	1	0	8
23:00	0:00	1	9	9	0	19
0:00	1:00	2	3	1	0	6
1:00	2:00	0	4	0	0	4
2:00	3:00	1	2	2	0	5
3:00	4:00	1	0	2	0	3
4:00	5:00	5	2	1	0	8
5:00	6:00	12	8	4	0	24
6:00	7:00	163	37	14	2	216
7:00	8:00	327	35	9	5	386
8:00	9:00	127	26	15	2	170
9:00	10:00	104	27	11	1	143
Total		1712	545	216	29	2502

Table 2.4-3 Hourly Traffic Volume Results at TV-1 (From Dagon-Thilawa Road to Phalan Village)

From	To	Classification				Total
		Type of vehicles				
		Two-wheeled vehicle	Four-wheeled light vehicle	Four-wheeled heavy vehicle	Others	
10:00	11:00	79	43	23	1	146
11:00	12:00	72	43	30	2	137
12:00	13:00	67	32	13	3	115
13:00	14:00	69	31	13	0	113
14:00	15:00	78	29	12	1	120
15:00	16:00	49	28	17	1	95
16:00	17:00	60	34	19	3	116
17:00	18:00	193	37	25	2	257
18:00	19:00	191	45	15	3	254
19:00	20:00	79	22	11	1	113
20:00	21:00	80	15	11	1	107
21:00	22:00	34	16	4	0	54
22:00	23:00	3	5	3	0	11
23:00	0:00	4	2	0	0	6
0:00	1:00	3	3	4	0	10
1:00	2:00	2	1	3	0	5
2:00	3:00	1	1	4	0	6
3:00	4:00	2	0	0	0	2
4:00	5:00	2	1	0	0	3
5:00	6:00	12	8	1	0	21
6:00	7:00	58	19	8	1	86
7:00	8:00	170	28	8	1	207
8:00	9:00	138	25	7	2	172
9:00	10:00	88	32	16	6	142
Total		1534	500	236	28	2298



CHAPTER 3: CONCLUSION AND ISSUES TO BE SOLVED

The results of the traffic volume show that the number of 2-wheel vehicles and 4-wheel light vehicles passing TV-1 are higher than 4-wheel heavy vehicles for each direction. It seems that commuting vehicles are much utilized during this monitoring period as compare with construction related heavy vehicles (4-wheel heavy vehicles). Therefore, there is no negative impact on construction vehicles of Zone B to the surrounding environment.

The continuous monitoring will be necessary to grasp the traffic volume data in construction stage of Thilawa SEZ Zone B. Once enough traffic volume data will be collected, the mitigation measures for traffic volume management will be considered in future.



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