MJTD

Thilawa Special Economic Zone (Zone B) Development

Environmental Monitoring Report Phase-1 & 2 (Construction Phase)

Myanmar Japan Thilawa Development Limited.

June 2018

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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 2018 to May 2018 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 submitted EMP for TSEZ Zone-B as following table.

Report No.	Description	Phase	Submission
1	Environmental Monitoring Report	Phase-1 Pre-construction Phase	March, 2017
2	Environmental Monitoring Report	Phase-1 Construction Phase	June, 2017
3	Environmental Monitoring Report	Phase-1 Construction Phase	September, 2017
4	Environmental Monitoring Report	Phase-1 Construction Phase	December, 2017
5	Environmental Monitoring Report	Phase-1&2 Construction Phase	March, 2018

Report (No.6) is submitted this day attached with Construction Phase implementation schedule. Subsequent Construction Phase reports will be submitted on Quarterly.

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;

No.	Parameter	Type of Non-Compliance	Remedial Measures	Remarks
1	Total Coliform	Exceed target value	Discussed with environmental consultant and expert for the monitoring points sources to analysis the effect and impact	Refer to the attached report of water and wastewater quality report in appendix.

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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 C.

A. Monthly Progress Report for March, 2018
B. Monthly Progress Report for April, 2018
C. Monthly Progress Report for May, 2018

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, $PM_{2.5}$, PM_{10}	Construction site (1 point)	Once/ 3month	March 2018, Air Quality Monitoring Report
Water Quality	Water temperature, pH, SS, DO, BOD_5, COD, coliforms, oil and grease, chromium	- Over flow of construction site to the creek (at least 3 sampling points/ mixing point: i) discharge water, ii) upstream water and iii) downstream water - Well near the construction site (1 point)	Once/ 2 month	April 2018 Water and Wastewater Quality Monitoring Report
Waste	Amount and kind of solid waste	Construction site	Once/ 3 month	Monthly Progress Reports (March, April, May 2018)
Noise and Vibration	- Noise and vibration level - Traffic Count	Preservation area such as residence around the proposed construction site (at least 1 point)	Once/ 3 month (peak period)	Noise and Vibration Monitoring Report March 2018
		Preservation site such as residence along the route for on-site vehicles (1 point for noise and vibration and 2 points for traffic count)		Traffic Count Monitoring Report March 2018
Ground Subsidence	- Ground water level - Ground elevation level - Consumption of ground water amount	Representative (1 point)	Every week	Monthly Progress Reports (March, April, May 2018)
Hydrology				

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Category	Item	Location	Frequency	Remark
Risk for infectious disease such as AIDS/HIV	Status of measures of infectious disease	Construction site	Once/month	Monthly Progress Reports (March, April, May 2018)
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	

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Thilawa Special Economic Zone (Zone B) Development Project –Phase 1 & 2

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.)
Approved letter for Environmental Impact Assessment (EIA) Report of Industrial Area, Thilawa Special Economic Zone (Zone-B)		29th December 2016	Thilawa SEZ Management Committee	
Notification of the comments of Ministry of Natural Resources and Environmental Conservation regarding with the Standard Change of Wastewater Quality of Industrial Zone, Internal Regulations of Thilawa SEZ Zone-A and Zone-B	5th January 2018	10th January 2018	Thilawa SEZ Management Committee	As Attachment

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 2018)

NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standard	Target value to be applied*1	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
AQ-1	NO_2*2	mg/m³	0.097	0.138	0.2 mg/m³ (1 Hour)	0.1 mg/m³ (24 Hour)	-	One time / 3 months	Haz-Scanner EPAS	Refer to air quality report
	SO_2	mg/m³	0.011	0.08	0.02 mg/m³ (24 Hours)	0.02 mg/m³ (24 Hours)	-			
	CO	mg/m³	0.101	0.742	-	10.26 mg/m³ (24 Hours)	-			
	$PM_{2.5}$*3	mg/m³	0.041	0.106	0.025 mg/m³ (24 Hours)	0.025 mg/m³ (24 Hours)	-			
	PM_{10}	mg/m³	0.031	0.138	0.05 mg/m³ (24 Hours)	0.05 mg/m³ (24 Hours)	-			

*1**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 2018)

*2**Remarks:** During monitoring periods, NO_2 measured value (means) is excess than the standard. Regarding to monitoring results, concentration of NO_2 measured for 4 days exceeded than the target value. After detail analyzed the NO_2 exceed time for construction period according to the wind direction from Zone-B, all exceed hours during seven days are come from another site of Zone-B.

*3**Remarks**: During monitoring periods, $PM_{2.5}$ measured value (means) is excess than the standard. Regarding to monitoring results, construction of $PM_{2.5}$ measured for 7 days exceeded than the target value. After detail analyzed the $PM_{2.5}$ exceed time for construction period according to wind direction from Zone-B, only 4 hours exceeded are comes from the construction site of Zone-B.

Complaints from Residents

- Are there any complaints from residents regarding air quality 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

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2) (a) Water Quality – April 2018

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. SW-7 is the main discharging point and SW-8 is mixing point of discharge water but in this monitoring time SW-7 and SW-8 location are almost same location. SW-9 is the downstream points after mixing point. 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	22	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	8.8	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	10.93	-	-		Instrument Analysis Method	
	BOD_5	mg/L	9.48	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	83	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*3	MPN/100ml	> 160,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	3.5	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	≤ 0.002	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
SW-3 (reference point)	Temperature	°C	24	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7.7	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	8	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	9.95	-	-		Instrument Analysis Method	
	BOD_5	mg/L	2.32	50	20		APHA 5210 B (5days BOD Test)	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
	COD_{Cr}	mg/L	32.1	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*3	MPN/100ml	2,600	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)	
SW-4 (reference point)	Temperature	°C	25	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7.8	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	8	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	3.86	-	-		Instrument Analysis Method	
	BOD_5	mg/L	2.43	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	24.8	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform	MPN/100ml	350	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)	
SW-7	Temperature	°C	There is no water to sampling	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-		6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L		50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L		-	-		Instrument Analysis Method	
	BOD_5	mg/L		50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L		250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform	MPN/100ml		400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
	Oil and Grease	mg/L		10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L		0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
SW-8	Temperature	°C	There is no water to sampling	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-		6-9	6.0 – 9.0		Instrument Analysis Method	
	SS*3	mg/L		50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L		-	-		Instrument Analysis Method	
	BOD_5	mg/L		50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L		250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform	MPN/100ml		400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L		10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L		0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
SW-9	Temperature	°C	24	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	8.0	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	18	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	10.39	-	-		Instrument Analysis Method	
	BOD_5	mg/L	3.87	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	18	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*3	MPN/100ml	1,700	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)	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
GW-2 (reference point)	Temperature	°C	23.7	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7.8	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	4	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	10.7	-	-		Instrument Analysis Method	
	BOD_5	mg/L	1.6	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	1.9	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 2018)

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

*3Remark: For the monitoring point of SW-2, SW-3 and SW-9, 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 and iii) delivered from the surrounding area by tidal effect. In addition, the result of E-Coli of surface water, all of results were under reference value. Therefore, although the target value of total coliform was exceeded at monitoring point of SW-2, SW-3 and SW-9, but it is considered that there is no significant impact on human health.

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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 Level (March 2018)

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)	52	53	Refer to NEQG Article 1.3	75	Refer the section 2.4 in EIA main report	One time / 3 months		
	Leq (evening)	dB(A)	45	48		60				
	Leq(night)	dB(A)	43	49		55				
Along the road (NV-1)	Leq (day)	dB(A)	61	65		75				
	Leq(night)	dB(A)	52	57		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 2018)

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	Date	Generated from	Unit	Value	Solid Waste Management Activities
Amount of sludge	31-March-2018	Construction Waste	Loads	2	Waste disposing to authorized waste collector (YCDC)

6) (a) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
1-March-2018	120	m^3/ week	+6.297	m	
8-March-2018	139	m^3/ week	+6.298	m	
15-March-2018	175	m^3/ week	+6.298	m	
22-March-2018	173	m^3/ week	+6.298	m	
29-March-2018	131	m^3/ week	+6.297	m	

Remarks: Reference to Monthly Progress Report (March-2018)

6) (b) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
5-April-2018	124	m^3/ week	+6.297	m	
12-April-2018	-	m^3/ week	+6.298	m	
19-April-2018	-	m^3/ week	+6.298	m	
26-April-2018	367	m^3/ week	+6.297	m	

Remarks: Reference to Monthly Progress Report (April-2018)

6) (c) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
3-May-2018	177	m^3/ week	+6.297	m	
10-May-2018	113	m^3/ week	+6.298	m	
17-May-2018	130	m^3/ week	+6.298	m	
24-May-2018	134	m^3/ week	+6.297	m	
31-May-2018	140	m^3/ week	+6.298	m	

Remarks: Reference to Monthly Progress Report (May-2018)

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.

Resentment Works		Progress in Narrative	Remarkable Issues
Projected Affected Persons	Land Acquisition and Relocation	- 4 Land Owner agreed with Land Acquisition and Compensation - Cultivation Compensation provided to One Cultivator - No relocation PAH	
	Income Restoration Program	- Job Matching Program, Training (To be conducted job readiness and vocational training such as car driving, sewing etc…will be provide in May 2018. - Vulnerable People Program (Provided in-kind support to 20 PAH at Zone B relocated household.) - Planning Access to Credit Program	
Common Assets	Relocation		

- Are there any grievances submitted, solved and pending regarding resettlement works? ☐ Yes, ☑ No
  If yes, please describe the contents of grievances to fill in below the table.

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)
In March, 2018	Support to fill soil in school compound area due to the floods in rainy season	Thida Myaing (Kayat school)
In April, 2018	Donate to the elders in Myanmar new year as tradition	Thanlyin-Kyaut Tan township
In May, 2018	Back to School program (stationary donation)	About 2500 students from Shwe Pyi Tharyar, Thida Myaing, Aye Mya Thida, Padagyi, Alwan Sut, Shan Su and Myaing Tharyar villages
	Scholarship program	11 scholars from TSEZ neighbouring villages

End of Document

Thilawa Special Economic Zone (Zone B) Development Project –Phase 1 & 2

Appendix

Water and Waste Water Monitoring Report

April 2018

WATER QUALITY MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

IN THILAWA SEZ ZONE B

(PHASE 1 & 2 CONSTRUCTION STAGE)

(Bi-Monthly Monitoring)

April 2018

Myanmar Koei International Ltd.

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED ★ MJTD

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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 seven sampling points are set for water quality survey, named SW-2, SW-3, SW-4, SW-7, SW-8, SW-9 and GW-2 have been monitored in Thilawa SEZ and its surrounding area in timely manner. Among the seven 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 seven locations. Among the seven locations, water flow measurement was carried out at one location (SW-2) 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	SW-8	SW-9	GW-2	Remarks
1	pH	O	O	O	O	O	O	O	On-site measurement
2	Water temperature	O	O	O	O	O	O	O	On-site measurement
3	DO	O	O	O	O	O	O	O	On-site measurement
4	BOD (5)	O	O	O	O	O	O	O	Laboratory analysis
5	COD (Cr)	O	O	O	O	O	O	O	Laboratory analysis
6	Suspended solids	O	O	O	O	O	O	O	Laboratory analysis
7	Total coliform	O	O	O	O	O	O	O	Laboratory analysis
8	Oil and grease	O	O	O	O	O	O	O	Laboratory analysis
9	Chromium	O	O	O	O	O	O	O	Laboratory analysis
10	Escherichia Coli (Self-monitoring)	O	O	O	-	-	O	O	Laboratory analysis
11	Flow Rate	O	-	-	-	-	-	-	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' 20.69", E- 96° 17' 18.04"
		Location - Upstream of Shwe Pyauk Creek
		Survey Item – Surface water sampling and water flowrate measurement.
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' 42.84", E- 96° 16' 27.42"
		Location - Downstream of Shwe Pyauk Creek
		Survey Item – Surface water sampling.
4	SW-7	**Coordinate-** N-16° 40' 17.40", E- 96° 17' 18.40"
		Location - Discharge drain of Zone B construction site before connect to Shwe Pyauk Creek
		Survey Item – Discharge water sampling.
5	SW-8	**Coordinate-** N-16° 40' 14.90", E- 96° 17' 7.90"
		Location – Upstream of Shwe Pyauk Creek, mixing point of SW-2 and discharge water from construction site of Zone B.
		Survey Item – Surface water sampling.
6	SW-9	**Coordinate-** N-16° 40' 6.21", E- 96° 16' 43.44"
		Location – Upstream of Shwe Pyauk Creek.
		Survey Item – Surface water sampling.
7	GW-2	**Coordinate-** N-16° 39' 25.30", E- 96° 17' 15.60"
		Location – In the monastery compound of Phalan village
		Survey Item – Ground water sampling.

Source: Myanmar Koei International Ltd.

SW-2 (Reference Point)

SW-2 was collected at the upstream of Shwe Pyauk creek. 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.

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 45 m downstream of SW-9. This sampling point is located at south of Zone A area and Dagon-Thilawa road. The surrounding area are 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 discharge 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 800 m downstream of SW-3. This sampling point is located at southwest of Zone A area and at the south of Dagon-Thilawa road. The surrounding area are Zone B in the east, 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. This sampling point is located at the east 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.

SW-8 (Reference Point)

SW-8 is mixing point of discharge water from Zone B construction site and local industrial zone, upstream of Shwe Pyauk creek. This sampling point is located at south of Zone A area and Dagon-Thilawa road. The surrounding area are Zone B in the south, local industrial zone in the east and paddy field in the south and west respectively.

SW-9 (Reference Point)

SW-9 was collected at the upstream of Shwe Pyauk creek which is flowing from east to west and then entering into the Yangon River. The distance is about 790 m downstream of SW-8. This sampling point is located at south of Zone A area and Dagon-Thilawa road. The surrounding area are Zone B in the south, local industrial zone in the east and paddy field in the south and 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	Escherichia Coli	APHA 9221 F (Escherichia Coli Procedure Using Fluorogenic Substrate)
11	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 25th April 2018 and sampling time is shown in Table 2.4-1 to avoid tidal effect. The tide record for Yangon River, Myanmar on 25th April 2018 is shown in Table 2.4-2.

Table 2.4-1 Sampling Time of Each Station

No.	Station	Sampling Time
1	SW-2	25/04/2018 09:50
2	SW-3	25/04/2018 08:43
3	SW-4	25/04/2018 10:23
4	SW-7	25/04/2018 10:58
5	SW-8	25/04/2018 10:53
6	SW-9	25/04/2018 09:07
7	GW-2	25/04/2018 12:38

Source: Myanmar Koei International Ltd.

Table 2.4-2 Tide Record for Yangon River, Myanmar

Date	Time	Height	Tide Conditions
25/04/2018	00:20	4.6	High Tide
	07:10	1.5	Low Tide
	13:10	4.6	High Tide
	19:50	1.6	Low Tide

Source: Myanmar Port Authority, Tide Table for the Yangon River and Elephant Point, 2018

2.5 Monitoring Results

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 points and Discharged Creek

As the comparison with the target value, the results of total coliform were exceeded than the target value.

As for the result of total coliform of surface water, results at surface water monitoring points (SW-2, SW-3 and SW-9) 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 and iii) delivered from surrounding area by tidal effect. In addition, the result of E. Coli of surface water, all of results were under the reference value. Therefore, although the target value of total coliform was exceeded at monitoring point of SW-2, SW-3 and SW-9, but it is considered that there is no significant impact on human health

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

No.	Parameters	Unit	SW-2	SW-3	SW-4	SW-7	SW-8	SW-9	Target Value (Reference Value for Self-Monitoring)
1	Temperature	°C	22	24	25	-	-	24	≤ 35
2	pH	-	8.8	7.7	7.8	-	-	8.0	6.0~9.0
3	Suspended solid (SS)	mg/L	10	8	8	-	-	18	50
4	Dissolved oxygen (DO)	mg/L	10.93	9.95	3.86	-	-	10.39	-
5	BOD (5)	mg/L	9.48	2.32	2.43	-	-	3.87	30.00
6	COD (Cr)	mg/L	83	32.1	24.8	-	-	18	125.0
7	Total coliform	MPN/ 100ml	>160,000	2,600	350	-	-	1,700	400
8	Oil and grease	mg/L	3.5	< 3.1	< 3.1	-	-	< 3.1	10.0
9	Chromium	mg/L	≤0.002	≤0.002	≤ 0.002	-	-	≤0.002	0.500
10	Escherichia Coli	MPN/100ml	6.1	9.3	14.0	-	-	< 1.8	(1000)* (CFU/100ml)
11	Flow rate	m^3/s	0.013	-	-	-	-	-	-

Note: Red color means exceeded value than target value.

*Note: Based on the water utilization at discharged creek, the quality standard for water baths in Japan, (Ministry of Environment, 1997) is set as a reference value for self-monitoring of E. coli for surface water monitoring. However, due to limitation of capacity for analytical laboratory in Myanmar, the method to analyze the "Colony Forming Unit (CFU)" is not available in Myanmar. Therefore, the results of "Most Probable Number (MPN)" are assumed similar to CFU values and compared with reference values. Once the method to analyze the CFU will be available in Myanmar, the analytical method will be changed.

Source: Myanmar Koei International Ltd.

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	Target Value (Reference Value for Self-Monitoring)
1	Temperature	°C	23.7	≤ 35
2	pH	-	7.8	6.0~9.0
3	Suspended solid (SS)	mg/L	4	50
4	Dissolved oxygen (DO)	mg/L	10.7	-
5	BOD (5)	mg/L	1.60	30.00
6	COD (Cr)	mg/L	1.9	125.0
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	Escherichia Coli	MPN/ 100 ml	< 1.8	(100)** (MPN/100ml)
11	Flow Rate	m^3/s	-	-

**Note: Based on the water utilization at monitoring point for ground water, B1(Irrigation water) of National Technical Regulation on Surface Water Quality in Vietnam (No. QCVN 08: 2008/BTNMT) is set as a reference value of self-monitoring for ground water monitoring.
Source: Myanmar Koei International Ltd.

CHAPTER 3: CONCLUSION AND RECOMMENDATIONS

As described in Chapter 2 (Section 2.5), parameter of total coliform for surface water monitoring was exceeded the target value at SW-2, SW-3 and SW-9 in this monitoring period for construction stage of Thilawa SEZ Zone B. Surface water monitoring points (SW-7 and SW-8) have no water for sampling during the monitoring period.

For SW-2, SW-3 and SW-9, there are some possible reasons for exceeding the target values of total coliform are by i) natural origin such as 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 and iii) delivered from surrounding area by tidal effect. As mentioned in Section 2.5-1, the result of self-monitoring of E-Coli at SW-2, SW-3 and SW-9 were under the reference value. Therefore, although the target value of total coliform was exceeded at reference monitoring point, but it is considered that there is no significant impact on human health. However, it cannot reach to the conclusion of what is the reason to be exceeded the target values, thus the continuous monitoring and yearly trend analysis will be necessary to carry out based on the rainy and dry season data.

As for future subject for main discharging points of Thilawa SEZ Zone B, the following action may be taken to carry out the appropriate water quality monitoring:

- To continue monitoring Escherichia coli (E. coli) level to identify health impact by coliform bacteria; and

- To monitor the possibility of the overflow water from construction sites.

End of the Document

APPENDIX-1 FIELD SURVEY PHOTOS

FOR DISCHARGING POINT OF THILAWA SEZ ZONE B

Surface water at SW-7 (No water during the monitoring period)

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

Surface water sampling and onsite measurement at SW-2

Surface water sampling and onsite measurement at SW-3

Surface water sampling and onsite measurement at SW-4

Surface water at SW-8 (No water during the monitoring period)

Surface water sampling and onsite measurement at SW-9

Ground water sampling and onsite measurement at GW-2

APPENDIX-2 LABORATORY RESULTS

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 ,ThilawaSEZ Zone A, Yangon Region, the Union of Myanmar
Tel:01-2309051/ 09 796915149

Report No. : GEM-LAB-201805069
Revision No. : 1
Report Date : 10 May, 2018
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-2-0425 Sampling Date : 25 April, 2018
Sample No. : W-1804143 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 25 April, 2018

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	9.48	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	83	0.7
4	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	5.1	0.0
5	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.577	0.05
6	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	> 160000	1.8
7	Color	APHA 2120C (Spectrophotometric Method)	TCU	88.40	0.00
8	Odor	APHA 2150 B (Threshold Odor Test)	TON	8	-
9	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	3.50	3.1
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	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

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Approved By :
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Director

JAPAN THILAWA DEVELOPMENT MJTD

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GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.
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Report No. : GEM-LAB-201805070
Revision No. : 1
Report Date : 10 May, 2018
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-3-0425
Sample No. : W-1804144
Waste Profile No. : -

Sampling Date : 25 April, 2018
Sampling By : Customer
Sample Received Date : 25 April, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	8.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	2.32	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	32.1	0.7
4	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	0.2	0.0
5	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.051	0.05
6	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	2600	1.8
7	Color	APHA 2120C (Spectrophotometric Method)	TCU	43.35	0.00
8	Odor	APHA 2150 B (Threshold Odor Test)	TON	1	-
9	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	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

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Lot No. E1 ,ThilawaSEZ Zone A, Yangon Region, the Union of Myanmar
Tel:01-2309051/ 09 796935149

Report No. : GEM-LAB-201805071
Revision No. : 1
Report Date : 10 May, 2018
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-4-0425 Sampling Date : 25 April, 2018
Sample No. : W-1804145 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 25 April, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	8.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	2.43	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	24.8	0.7
4	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	0.0	0.0
5	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	< 0.05	0.05
6	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	350	1.8
7	Color	APHA 2120C (Spectrophotometric Method)	TCU	42.46	0.00
8	Odor	APHA 2150 B (Threshold Odor Test)	TON	1	-
9	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	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

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Lot No. E1 ,ThilawaSEZ Zone A, Yangon Region, the Union of Myanmar
Tel:01-2309051/ 09 796935149

Report No. : GEM-LAB-201805073
Revision No. : 1
Report Date : 10 May, 2018
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-9-0425 Sampling Date : 25 April, 2018
Sample No. : W-1804147 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 25 April, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	18.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	3.87	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	18	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	1700	1.8
5	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
6	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	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

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Tel:01-2309051/ 09 796935149

Report No. : GEM-LAB-201805074
Revision No. : 1
Report Date : 10 May, 2018
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-2-0425 Sampling Date : 25 April, 2018
Sample No. : W-1804148 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 25 April, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105℃ Method)	mg/l	4.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	1.60	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	1.9	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	23	1.8
5	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
6	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	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

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APPENDIX-3 LABORATORY RESULT OF ESCHERICHIA COLI (SELF-MONITORING)

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

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD
Lot No. 11, Thilawa SEZ Zone A, Yangon Region, the Union of Myanmar
Tel 01-2309051, 09 796435139

Report No. : GEM-LAB-201804135
Revision No. : 1
Report Date : 30 April, 2018
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 : MJTD
Sample Description
Sample Name : MKI-SW-2-0425 Sampling Date : 25 April, 2018
Sample No. : W-1804152 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 25 April, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	6.1	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

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GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.
Lot No. E1, Thilawa SEZ Zone A, Yangon Region, the Union of Myanmar
Tel:01-2309651; 09 796915149

Report No. : GEM-LAB-201804136
Revision No. : 1
Report Date : 30 April, 2018
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 : MJTD
Sample Description
Sample Name : MKI-SW-3-0425
Sample No. : W-1804153
Waste Profile No. : -
Sampling Date : 25 April, 2018
Sampling By : Customer
Sample Received Date : 25 April, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	9.3	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

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GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD
Lot No. E1, Thilawa SEZ Zone A, Yangon Region, the Union of Myanmar
Tel:01-7509051, 09 796931149

Report No. : GEM-LAB-201804137
Revision No. : 1
Report Date : 30 April, 2018
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 : MJTD
Sample Description
Sample Name : MKI-SW-4-0425 Sampling Date : 25 April, 2018
Sample No. : W-1804154 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 25 April, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	14.0	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

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DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD
Lot No. E1 ,Thilawa SEZ Zone A, Yangon Region, the Union of Myanmar
Tel:01-2308061 ; 09 796935149

Report No. : GEM-LAB-201804139
Revision No. : 1
Report Date : 30 April, 2018
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 : MJTD
Sample Description
Sample Name : MKI-SW-9-0425
Sample No. : W-1804156
Waste Profile No. : -
Sampling Date : 25 April, 2018
Sampling By : Customer
Sample Received Date : 25 April, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	< 1.8	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 :
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MJTD

DOWA

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Report No. : GEM-LAB-201804140
Revision No. : 1
Report Date : 30 April, 2018
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 : MJTD
Sample Description
Sample Name : MKI-GW-2-0425 Sampling Date : 25 April, 2018
Sample No. : W-1804157 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 25 April, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	< 1.8	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

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MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED
MJTD

Thilawa Special Economic Zone (Zone B) Development Project –Phase 1 & 2

Appendix

Noise and Vibration Monitoring Report

March 2018

NOISE AND VIBRATION

MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 1 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

March 2018

Myanmar Koei International Ltd.

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED
MJTD

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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 had been monitored from 14th March 2018 – 16th March 2018 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 14th March – 15th March, 2018	Noise Level	L_{Aeq}(dB)	1 (NV-2)	24 hours	On-site measurement by "Rion NL-42 sound level meter"
From 15th March – 16th March, 2018	Noise Level	L_{Aeq}(dB)	1 (NV-1)	24 hours	On-site measurement by "Rion NL-42 sound level meter"
From 14th March – 15th March, 2018	Vibration Level	L_{v10} (dB)	1 (NV-2)	24 hours	On-site measurement by "Vibration Level Meter- VM-53A"
From 15th March – 16th March, 2018	Vibration Level	L_{v10} (dB)	1 (NV-1)	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, monitoring point (NV-1); N: 16°40'18.22", E: 96°17'18.18" 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 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. 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 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-42 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 (10-70) 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

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 measurement 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. Hourly noise level (L_{Aeq}) monitoring results at NV-1 and NV-2 are shown in Table 2.4-3 and Table 2.4-4. Figure 2.4-1 and 2.4-2 showed the results of noise level (L_{Aeq}) at NV-1 and NV-2. Comparing with the target value of noise level in construction stage prescribed in EIA report for Thilawa SEZ development project Zone B, all results were under the target values.

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)
15th March – 16th March, 2018	61	52
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)
14th March– 15th March, 2018	52	45	43
Target Value	75	60	55

Note: Target value is applied to the noise level during the construction stage in the EIA Report for Thilawa SEZ Development Project (Industrial Area of Zone B).

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	Remark
15th March– 16th March 2018	6:00-7:00	56	61	75	Soil cutting at BB2 to BB6. Canal slope trimming at Road 2. Soil carrying from BB2 &BB6 to BB4, BJ9, BJ10 and BJ4,5. Soil filling and dressing work at BJ4,5&10, excavated soil carrying from BB2 & BB6 to BB4, BJ9, BJ10 & BJ 4,5. Water pipe installation and backfilling work near BC 4.7 Soil carrying from BB2 & BB6 to BB4, BJ9, BJ10 & BJ 4,5. Soil filling and dressing work at BJ4, 5 & 11. Excavated soil carrying from BB5& BB2 to BB4, BJ9, BJ10 & BJ4,5.
	7:00-8:00	62			
	8:00-9:00	60			
	9:00-10:00	61			
	10:00-11:00	60			
	11:00-12:00	61			
	12:00-13:00	59			
	13:00-14:00	60			
	14:00-15:00	62			
	15:00-16:00	62			
	16:00-17:00	62			
	17:00-18:00	65			
	18:00-19:00	61			
	19:00-20:00	57			
	20:00-21:00	59			
	21:00-22:00	55			
	22:00-23:00	57	52	70	
	23:00-24:00	54			
	24:00-1:00	49			
	1:00-2:00	48			
	2:00-3:00	46			
	3:00-4:00	48			
	4:00-5:00	41			
	5:00-6:00	48			

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	Remark
14th March – 15th March 2018	7:00-8:00	49	52	75	BB6 soil cutting and excavation work. BJ4, BJ9 soil filling and levelling work at BB6, BJ4 BJ9, BJ10 and RBC 34.2, RBC 25.1 excavation work. BB2 area soil carrying work. Cutting soil transportation to BB6 and BB2 area and RBC 34.2, 25.1 excavated soil carrying work. Soil cutting at BB2 to BB6. Canal excavation at Road 2. Soil carrying from BB2 and BB6 to BB4, BJ9, BJ10 and BJ4, 5. Soil filling and dressing work at BJ4, 5 and 9. Excavated soil carrying from BB2 & BB6 to BB4, BJ9, BJ 10 & BJ 4,5
	8:00-9:00	53			
	9:00-10:00	52			
	10:00-11:00	53			
	11:00-12:00	52			
	12:00-13:00	48			
	13:00-14:00	51			
	14:00-15:00	52			
	15:00-16:00	53			
	16:00-17:00	52			
	17:00-18:00	52			
	18:00-19:00	51			
	19:00-20:00	48	45	60	
	20:00-21:00	44			
	21:00-22:00	41			
	22:00-23:00	42	43	55	
	23:00-24:00	42			
	24:00-1:00	40			
	1:00-2:00	40			
	2:00-3:00	41			
	3:00-4:00	40			
	4:00-5:00	41			
	5:00-6:00	44			
	6:00-7:00	49			

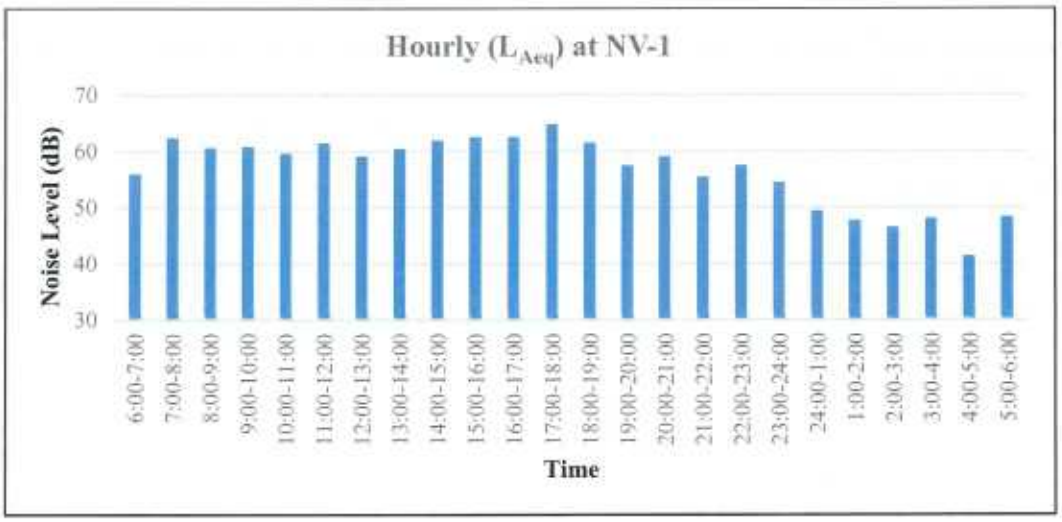

Figure 2.4-1 Results of Noise Levels (L_{Aeq}) Monitoring at NV-1

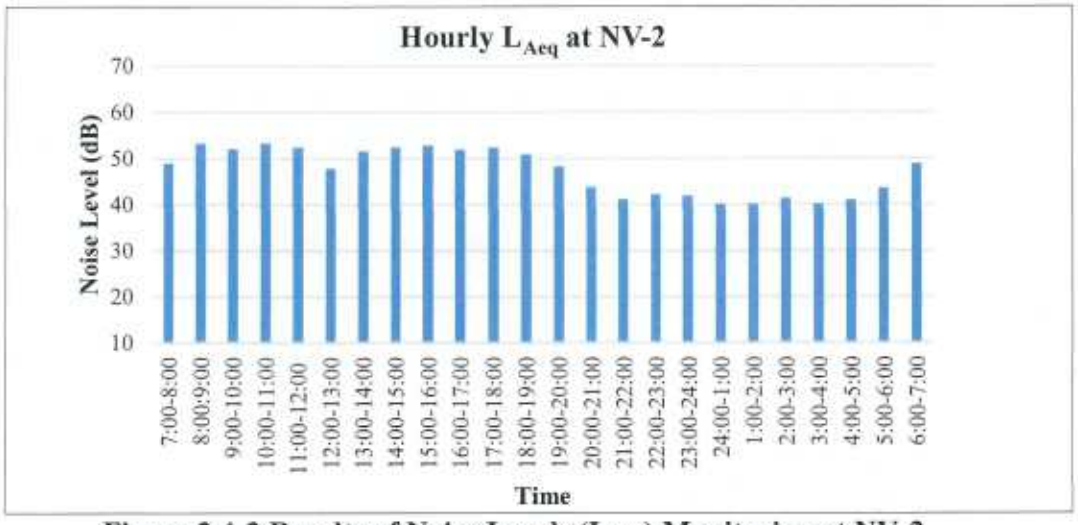

Figure 2.4-2 Results of Noise Levels (L_{Aeq}) Monitoring at NV-2

Vibration Monitoring Results

The results of vibration level (L_{v10}) monitoring at NV-1 and NV-2 are shown in Table 2.4-5 and Table 2.4-6. Hourly vibration level (L_{v10}) monitoring results at NV-1 and NV-2 are shown in Table 2.4-7 and Table 2.4-8. Figure 2.4-3 and Figure 2.4-4 showed the graph of vibration level monitoring results at NV-1 and NV-2. 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	15th – 16th March, 2018	48	44	38
Target Value		70	70	65

Note: Target value is applied to the noise level during the construction stage in the EIA Report for Thilawa SEZ Development Project (Industrial Area of Zone B).

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	14th – 15th March, 2018	47	42	26
Target Value		65	65	60

Note: Target value is applied to the noise level during the construction stage in the EIA Report for Thilawa SEZ Development Project (Industrial Area of Zone B).

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

Date	15th – 16th March 2018	(L_{v10}, dB) Each Category	(L_{v10}, dB) Target Value	Remark
Time	L_{v10} (NV-1)			
7:00-8:00	48	48	70	Soil cutting at BB2 to BB6. Canal slope trimming at Road 2. Soil carrying from BB2 &BB6 to BB4, BJ9, BJ10 and BJ4,5. Soil filling and dressing work at BJ4,5&10, excavated soil carrying from BB2 & BB6 to BB4, BJ9, BJ10 & BJ 4,5. Water pipe installation and backfilling work near BC 4.7 Soil carrying from BB2 & BB6 to BB4, BJ9, BJ10 & BJ 4,5. Soil filling and dressing work at BJ4, 5 & 11. Excavated soil carrying from BB5& BB2 to BB4, BJ9, BJ10 & BJ4,5.
8:00:9:00	46			
9:00-10:00	53			
10:00-11:00	46			
11:00-12:00	48			
12:00-13:00	46			
13:00-14:00	48			
14:00-15:00	48			
15:00-16:00	47			
16:00-17:00	48			
17:00-18:00	49			
18:00-19:00	48			
19:00-20:00	44	44	70	
20:00-21:00	45			
21:00-22:00	44			
22:00-23:00	45	38	65	
23:00-24:00	36			
24:00-1:00	33			
1:00-2:00	24			
2:00-3:00	26			
3:00-4:00	26			
4:00-5:00	25			
5:00-6:00	30			
6:00-7:00	43			

Table 2.4-8 Results of Hourly Vibration Levels (L_{v10}) Monitoring at NV-2

Date	15th – 16th Mar 2018	(L_{v10}, dB) Each Category	(L_{v10}, dB) Target Value	Remark
Time	L_{v10} (NV-2)			
7:00-8:00	41	47	65	BB6 soil cutting and excavation work. BJ4, BJ9 soil filling and levelling work at BB6, BJ4 BJ9, BJ10 and RBC 34.2, RBC 25.1 excavation work. BB2 area soil carrying work. Cutting soil transportation to BB6 and BB2 area and RBC 34.2, 25.1 excavated soil carrying work. Soil cutting at BB2 to BB6. Canal excavation at Road 2. Soil carrying from BB2 and BB6 to BB4, BJ9, BJ10 and BJ4, 5. Soil filling and dressing work at BJ4, 5 and 9. Excavated soil carrying from BB2 & BB6 to BB4, BJ9, BJ 10 & BJ 4,5
8:00-9:00	50			
9:00-10:00	50			
10:00-11:00	49			
11:00-12:00	46			
12:00-13:00	38			
13:00-14:00	45			
14:00-15:00	48			
15:00-16:00	48			
16:00-17:00	48			
17:00-18:00	48			
18:00-19:00	47			
19:00-20:00	47	42	65	
20:00-21:00	31			
21:00-22:00	26			
22:00-23:00	26	26	60	
23:00-24:00	23			
24:00-1:00	21			
1:00-2:00	21			
2:00-3:00	31			
3:00-4:00	21			
4:00-5:00	19			
5:00-6:00	25			
6:00-7:00	30			

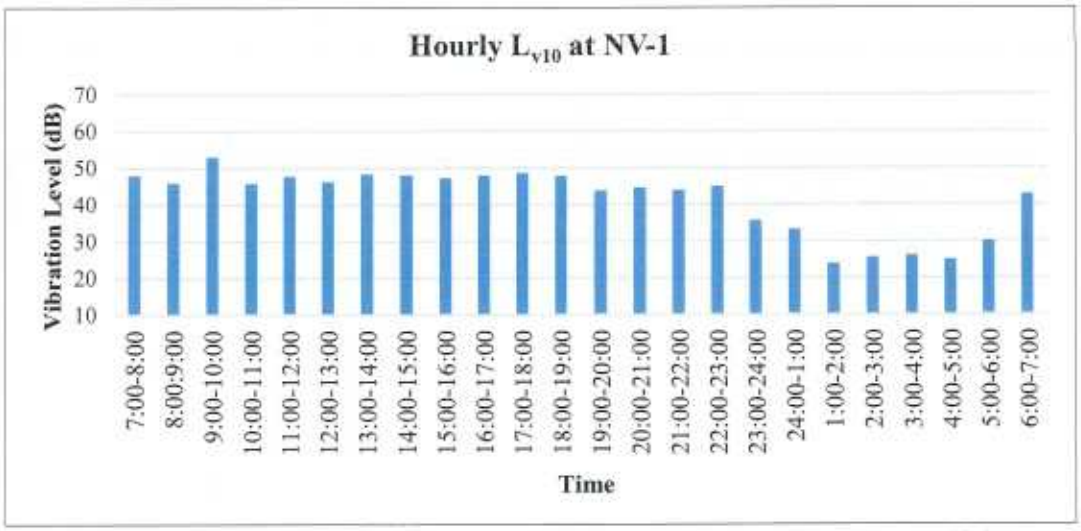

Figure 2.4-3 Results of Vibration Levels (L_{v10}) Monitoring at NV-1

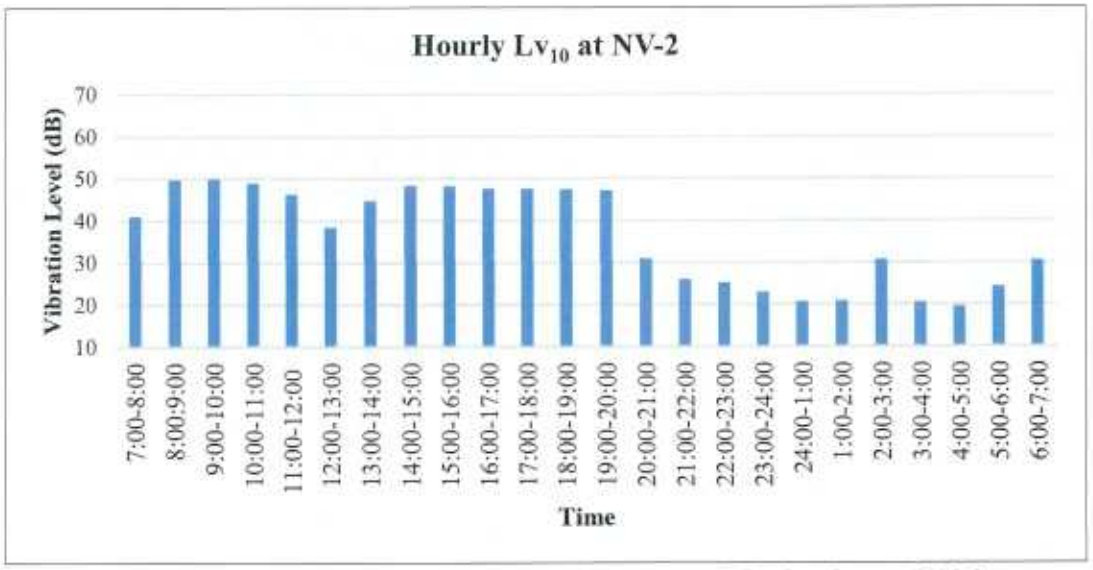

Figure 2.4-4 Results of Vibration Levels (L_{v10}) Monitoring at NV-2

CHAPTER 3: CONCLUSION AND RECOMMENDATION

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 at NV-1 and NV-2. As for the detailed analysis of noise level at NV-1 and NV-2 on 24 hours, all results were under the target value. The results of vibration level for NV-1 and NV-2 are also lower than 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 & 2

Appendix

Air Quality Monitoring Report

March 2018

AIR QUALITY MONITORING

REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 1 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

March 2018

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 14th March 2018 – 21th March 2018 as follows;

Table 1.2-1 Outlines of Air Quality Monitoring Plan

Monitoring Date	Monitoring Item	Parameters	Number of Point	Duration	Monitoring Methodology
From 14th March–21th March, 2018	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, NO_2, $PM_{2.5}$, PM_{10}, and SO_2.

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 gas emissions from construction fuel-burning equipment 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 14th March 2018 – 21th March, 2018.

2.4 Monitoring Method

Monitoring of CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2 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, NO_2, $PM_{2.5}$, PM_{10}, and SO_2. The state of air quality monitoring is shown in Figure 2.4-1.

Figure 1.4-1 Status of Air Quality Monitoring Point

2.5 Monitoring Results

The daily average value of air quality monitoring results of CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2 are described in Table 2.5-1. Comparing with the target value of CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2 prescribed in EIA report for Thilawa SEZ development project Zone B, concentration of CO, PM_{10} and SO_2 were lower than the target value, while concentration of NO_2 and $PM_{2.5}$ measured results were exceeded than the target value.

Table 2.5-1 Air Quality Monitoring Result (Daily Average) During Construction and Non-Construction Period

Date	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2
	Ppm	ppm	mg/m^3	mg/m^3	ppm
14 ~ 15 Mar, 2018	0.111 (0.127 mg/m^3)	0.051 (0.097 mg/m^3)	0.046	0.030	0.004 (0.011 mg/m^3)
15 ~ 16 Mar, 2018	0.118 (0.135 mg/m^3)	0.052 (0.098 mg/m^3)	0.047	0.039	0.006 (0.015 mg/m^3)
16 ~ 17 Mar, 2018	0.097 (0.111 mg/m^3)	0.050 (0.093 mg/m^3)	0.036	0.024	0.005 (0.012 mg/m^3)
17 ~ 18 Mar, 2018	0.078 (0.089 mg/m^3)	0.049 (0.092 mg/m^3)	0.038	0.032	0.005 (0.014 mg/m^3)
18 ~ 19 Mar, 2018	0.079 (0.090 mg/m^3)	0.050 (0.095 mg/m^3)	0.035	0.030	0.004 (0.009 mg/m^3)
19 ~ 20 Mar, 2018	0.062 (0.071 mg/m^3)	0.052 (0.098 mg/m^3)	0.041	0.029	0.003 (0.008 mg/m^3)
20 ~ 21 Mar, 2018	0.074 (0.084 mg/m^3)	0.054 (0.102 mg/m^3)	0.043	0.034	0.004 (0.011 mg/m^3)
7 Days Average Value	0.088 (0.101 mg/m^3)	0.051 (0.097 mg/m^3)	0.041	0.031	0.004 (0.011 mg/m^3)
Target Value	9.000 (10.26 mg/m^3) *1	0.050 (0.1 mg/m^3) *1	0.025	0.050	0.008 (0.02 mg/m^3) *1

Note: The target value of CO, NO_2 and SO_2 were converted to ppm units from mg/m^3. Red color mentions the exceeded value for NO_2 and $PM_{2.5}$.

Construction activities of Thilawa SEZ Zone B are described in Table 2.5-2. NO_2 result and $PM_{2.5}$ result during construction period are described in Table-2.5-3 and Table 2.5-4. During construction period, 7 days average value for NO_2 were equal to the target value and only two days (Day 2 and Day 7) average results were exceeded the target value. During construction period, 7 days average value for $PM_{2.5}$ were exceeded the target value and (Day 1to Day 7) daily average results were also exceeded the target value.

Table 2.5-2 Construction Activities of Thilawa SEZ Zone B

Date	Time	Location	Construction Activities
14th March, 2018	8:00-20:00	Near monastery	BB6 soil cutting and excavation work, BJ4, BJ9 soil filling and levelling work at BB6, BJ4 BJ9, BJ10 and RBC 34.2, RBC 25.1 excavation work, BB2 area soil carrying work, cutting soil transportation to BB6 and BB2 area and RBC 34.2, 25.1 excavated soil carrying work
15th March, 2018	8:00-21:00	Near monastery	Soil cutting at BB2 to BB6, canal excavation at Road 2, soil carrying from BB2 and BB6 to BB4, BJ9, BJ10 and BJ4, 5, soil filling and dressing work at BJ4, 5 and 9, excavated soil carrying from BB2 & BB6 to BB4, BJ9, BJ 10 & BJ 4,5
16th March, 2018	8:00-20:00	Near monastery	Soil cutting at BB2 to BB6, canal slope trimming at Road 2, soil carrying from BB2 &BB6 to BB4, BJ9, BJ10 and BJ4,5, soil filling and dressing work at BJ4,5&10, excavated soil carrying from BB2 & BB6 to BB4, BJ9, BJ10 & BJ 4,5.
17th March, 2018	8:00-23:00	Near monastery	Soil cutting at BB2 to BB6, water pipe installation and backfilling work near BC 4.7, soil carrying from BB2 & BB6 to BB4, BJ9, BJ10 & BJ 4,5, soil filling and dressing work at BJ4, 5 & 11, excavated soil carrying from BB5& BB2 to BB4, BJ9, BJ10 & BJ4,5.
18th March, 2018	8:00-23:00	Near monastery	Soil cutting at BB2 to BB5, road 15 canal excavation work, soil carrying from BB2 & BB5 to BB4 & BK4, soil filling and dressing work at BJ3, 4 & 5, excavated soil carrying from BB5&BB2 to BB4, BJ9, BJ10
19th March,2018	8:00-20:00	Near monastery	Soil cutting at BB2 to BB5, road 15 canal excavation work, excavated soil carrying from BB5 to BJ10 &BJ9, soil filling and dressing work at BJ3, 4 & 5, excavated soil carrying from BB5 and BB2 to BB4, BJ9, BJ10.
20th March, 2018	8:00-22:00	Near monastery	Soil cutting at BB7 & BB5, pond excavation at pond (Phase 2), base level dressing and cleaning at RBC 25.1, top soil removing and carrying from BB5& BB7 to BJ3 &4, general use, soil filling and dressing work at BJ3, 4 &5, excavated soil carrying from BB5& BB7 to BJ 3& 4
21st March, 2018	8:00-21:00	Near monastery	Soil cutting at BB5, 8 & 2, tenant area levelling at Road 5 & 4b, pond slope trimming and road 2 canal trimming work, excavated soil carrying from BB5&BB2 to BB4, general use, soil filling and dressing work at BB4, excavated soil carrying from BB5 & BB8, 2 to BB4, GI pipe and framework carrying work from OBC 27 to RBC 34.2.

Table 2.5-3 NO_2 Results (During Construction Period)

Day	Construction Time for each day	NO_2
		ppm
Day 1	8:00 - 20:00	0.050
Day 2	8:00 - 21:00	0.052
Day 3	8:00 - 20:00	0.046
Day 4	8:00 - 23:00	0.048
Day 5	8:00 - 23:00	0.048
Day 6	8:00 - 20:00	0.050
Day 7	8:00 - 22:00	0.053
7 days Average value	-	0.050
Target Value	-	0.050

Note: Red color mentions the exceeded value than target value

Table 2.5-4 $PM_{2.5}$ Results (During Construction Period)

Day	Construction Time for each day	$PM_{2.5}$
		mg/m^3
Day 1	8:00 - 20:00	0.045
Day 2	8:00 - 21:00	0.052
Day 3	8:00 - 20:00	0.033
Day 4	8:00 - 23:00	0.036
Day 5	8:00 - 23:00	0.033
Day 6	8:00 - 20:00	0.035
Day 7	8:00 - 22:00	0.041
7 days Average value	-	0.039
Target Value	-	0.025

Note: Red color mentions the exceeded value than target value

Wind direction and wind speed were measured at AQ-1. Hourly average values of measured wind direction and wind speed data are described in Appendix 1. Status of air quality monitoring point and wind direction are described in Figure 2.5-1. Depending on the wind direction, West-Northwest (WNW), Northwest (NW), North-Northwest (NNW), North (N), North-Northeast (NNE), Northeast (NE), East-Northeast (ENE) and East (E) directions are assumed come from the construction site of Zone B.

Figure 2.5-1 Status of Air Quality Monitoring Point and Wind Direction

Remark: **N** *North* **NNE** *North-Northeast* **NE** *Northeast* **ENE** *East-Northeast* **E** *East* **ESE** *East-Southeast* **SE** *Southeast* **SSE** *South-Southeast* **S** *South* **SSW** *South-Southwest* **SW** *Southwest* **WSW** *West-Southwest* **W** *West* **WNW** *West-Northwest* **NW** *Northwest* **NNW** *North-Northwest*

Overall summary of total exceeded hours for Day1 to Day 7 during construction and non-construction time for NO_2 and $PM_{2.5}$ are shown in Table 2.5-5 and Table 2.5-6. Based on the summary table of total exceeded hours for NO_2, the total exceeded hours for seven days during construction and non-construction time were 99 hours but exceeded hours for construction time was 48 hours. After detailed analyzed the NO_2 exceeded time for construction period according to the wind direction, all exceeded hours during seven days are come from another site of Zone B. So, there is no impact from the construction activities of Zone B. Possible emission sources are affected from power plant, motor vehicles exhaust and emission from generator used for construction of new building inside the monastery and human activities of the villages.

Based on the summary table of total exceeded hours for $PM_{2.5}$, the total exceeded hours for seven days during construction and non-construction were 148 hours but exceeded hours for construction time was 75 hours. After detailed analyzed the $PM_{2.5}$ exceeded time for construction period according to the wind direction from Zone B, only 4 hours exceeded are come from the construction site of Zone B. This is slightly impact from the construction activities of Zone B. Possible emission sources are affected from natural origin such as dust from unpaved vacant area, excavation and vehicles used for construction activities in Zone B, and transportation in and around the monitoring area.

Table 2.5-5 Summary of Total Exceeded Hours for Day 1 to Day 7 During construction and non-Construction Period for NO_2

NO_2								
	Construction Time for each day	Total Exceeded hours	Construction Period exceeded hours	Non-construction period exceeded hours	Non-construction period (wind from Zone B)	Non-construction period (wind from other sides)	Construction period (wind from Zone B)	Construction period (wind from other sides)
Day-1	8:00 - 20:00	12	6	6	2	4	0	6
Day-2	8:00 - 21:00	14	7	7	2	5	0	7
Day-3	8:00 - 20:00	15	5	10	0	10	0	5
Day-4	8:00 - 23:00	13	7	6	0	6	0	7
Day-5	8:00 - 23:00	15	7	8	0	8	0	7
Day-6	8:00 - 20:00	12	6	6	0	6	0	6
Day-7	8:00 - 22:00	18	10	8	0	8	0	10
Total		99	48	51	4	47	0	48

Note: Red color is referred to the construction period exceeded hours and construction period (wind from Zone B).

Table 2.5-6 Summary of Total Exceeded Hours for Day 1 to Day 7 During Construction and Non-Construction Period for $PM_{2.5}$

$PM_{2.5}$								
	Construction Time for each day	Total Exceeded Hours	Construction Period exceeded hours	Non-construction Period exceeded hours	Non-construction Period (wind from Zone B)	Non-construction Period (wind from other sides)	Construction Period (wind from Zone B)	Construction Period (wind from other sides)
Day-1	8:00 - 20:00	22	10	12	3	9	0	10
Day-2	8:00 - 21:00	23	12	11	3	8	2	10
Day-3	8:00 - 20:00	21	9	12	0	12	1	8
Day-4	8:00 - 23:00	20	11	9	0	9	1	10
Day-5	8:00 - 23:00	20	12	8	0	8	0	12
Day-6	8:00 - 20:00	21	9	12	0	12	0	9
Day-7	8:00 - 22:00	21	12	9	0	9	0	12
Total		148	75	73	6	67	4	71

Note: Red color is referred to the construction period exceeded hours and construction period (wind from Zone B).

CHAPTER 3: CONCLUSION AND RECOMMENDATION

The result of air quality of CO, PM_{10}, SO_2 during seven days monitoring were not exceeded the target value, thus there are no impacts on the surrounding environments. On the other hand, results of NO_2 and $PM_{2.5}$ level measured for seven days consecutive measurement in this monitoring period are higher than the target value.

During the seven days monitoring period, 99 hours results were exceeded for NO_2 totally. According to wind direction of Zone B during construction time, all exceeded hour (38 hours) are come from another site of Zone B. Therefore, it can be concluded there is no impact from the construction activities of Zone B. Possible emission sources are affected from power plant, motor vehicles exhaust and emission from generator used for construction of new building inside the monastery and human activities of the villages. Breathing air with a high concentration of NO_2 can irritate airways in the human respiratory system. Such exposure over short periods can aggravate respiratory diseases, particularly asthma, leading to respiratory symptoms (such as coughing, wheezing, or difficulty breathing). Longer exposures to elevated concentrations of NO_2 may contribute to the development of asthma and potentially increase susceptibility to respiratory infections.

During the seven days monitoring period, 148 hours results were exceeded for $PM_{2.5}$. According to wind direction of Zone B during the construction period, only 4 exceeded hours for $PM_{2.5}$ were observed. Therefore, it can be concluded most of the exceeded hours for $PM_{2.5}$ are come from another direction of Zone B. The monitoring point (near monastery) during the survey period are very close to the construction site of Zone B may be one of the reason for exceeded hours. Possible emission sources are affected from natural origin such as dust from unpaved vacant area, excavation and vehicles used for construction activities in Zone B, and transportation in and around the monitoring area. According to US Environmental Protection Agency (EPA) and WHO' health effect of particulate matter, there is no evidence of safe level of exposure or a threshold below which no adverse health effects occur. Exposure to $PM_{2.5}$ reduces the life expectancy of the population of the Region by about 8.6 months on average. Short term (hours, days) exposure to $PM_{2.5}$ can aggravate lung disease, causing asthma attacks and acute bronchitis, and may also increase susceptibility to respiratory infections. In people with heart disease, short term exposures have been linked to heart attacks and arrhythmias. However, healthy children and adults have not been reported to suffer serious effects from short term exposures. Long term exposures (months, years) have been associated with problems such as reduced lung function and the development of chronic bronchitis and even premature death.

As for future subject for air quality monitoring in Zone B, the following action may be taken to achieve the target level:

1) To sprinkle the water during construction period

2) To control the speed limit of all machinery & vehicle (25km/hr) on site to avoid excessive dust creation and to minimize air pollution by the exhaust fumes

3) To conduct the proper operation (stop idling while no operation)

4) To implement the regular maintenance of machine used for construction activities

5) To give the machinery awareness training to workers

6) To check and maintain the generator regularly

The continuous monitoring will be necessary to grasp the environmental conditions in construction stage of Thilawa SEZ Zone B. The mitigation measures for environmental management will be considered in collected periodical environmental data has been reviewed in future.

APPENDIX - HOURLY AIR RESULTS

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		ppm	ppm	mg/m³	mg/m³	ppm	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
14 Mar, 2018	10:00 ~ 10:59	0.002	0.056	0.050	0.045	0.000	1.37	138	SSE
14 Mar, 2018	11:00 ~ 11:59	0.020	0.045	0.021	0.014	0.001	1.48	169	S
14 Mar, 2018	12:00 ~ 12:59	0.105	0.042	0.024	0.010	0.005	1.52	175	S
14 Mar, 2018	13:00 ~ 13:59	0.047	0.041	0.031	0.009	0.003	1.88	156	SSE
14 Mar, 2018	14:00 ~ 14:59	0.014	0.055	0.045	0.005	0.000	1.72	151	SSE
14 Mar, 2018	15:00 ~ 15:59	0.079	0.042	0.033	0.015	0.000	1.65	143	SSE
14 Mar, 2018	16:00 ~ 16:59	0.107	0.052	0.045	0.025	0.000	1.43	150	SSE
14 Mar, 2018	17:00 ~ 17:59	0.213	0.057	0.062	0.043	0.000	1.23	139	SSE
14 Mar, 2018	18:00 ~ 18:59	0.221	0.061	0.043	0.034	0.000	1.00	139	SSE
14 Mar, 2018	19:00 ~ 19:59	0.346	0.064	0.055	0.045	0.004	0.38	129	SE
14 Mar, 2018	20:00 ~ 20:59	0.189	0.059	0.055	0.031	0.002	0.38	167	S
14 Mar, 2018	21:00 ~ 21:59	0.106	0.073	0.054	0.030	0.001	0.10	190	SSW
14 Mar, 2018	22:00 ~ 22:59	0.159	0.062	0.049	0.039	0.001	0.22	223	SW
14 Mar, 2018	23:00 ~ 23:59	0.014	0.041	0.056	0.041	0.001	0.17	212	SW
15 Mar, 2018	0:00 ~ 0:59	0.031	0.048	0.046	0.030	0.001	0.22	223	SW
15 Mar, 2018	1:00 ~ 1:59	0.058	0.052	0.035	0.018	0.003	0.38	240	WSW
15 Mar, 2018	2:00 ~ 2:59	0.066	0.053	0.029	0.014	0.004	0.15	278	WNW
15 Mar, 2018	3:00 ~ 3:59	0.073	0.049	0.029	0.014	0.003	0.28	283	WNW
15 Mar, 2018	4:00 ~ 4:59	0.094	0.050	0.037	0.022	0.013	0.25	279	WNW
15 Mar, 2018	5:00 ~ 5:59	0.036	0.052	0.034	0.021	0.015	0.12	163	S
15 Mar, 2018	6:00 ~ 6:59	0.137	0.047	0.047	0.040	0.011	0.23	144	SSE
15 Mar, 2018	7:00 ~ 7:59	0.470	0.045	0.097	0.092	0.031	0.08	190	SSW
15 Mar, 2018	8:00 ~ 8:59	0.051	0.044	0.091	0.064	0.002	0.43	228	WSW
15 Mar, 2018	9:00 ~ 9:59	0.036	0.042	0.042	0.027	0.001	0.48	85	E

Max	0.470 (0.538 mg/m³)	0.073 (0.137 mg/m³)	0.097	0.092	0.031 (0.081 mg/m³)
Avg	0.111 (0.127 mg/m³)	0.051 (0.097 mg/m³)	0.046	0.030	0.004 (0.011 mg/m³)
Min	0.002 (0.002 mg/m³)	0.041 (0.078 mg/m³)	0.021	0.005	0.000 (0.000 mg/m³)

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		ppm	ppm	mg/m³	mg/m³	ppm	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
15 Mar, 2018	10:00 ~ 10:59	0.042	0.038	0.049	0.038	0.000	0.57	148	SSE
15 Mar, 2018	11:00 ~ 11:59	0.021	0.040	0.041	0.016	0.000	0.93	76	E
15 Mar, 2018	12:00 ~ 12:59	0.001	0.038	0.031	0.004	0.000	0.94	110	ESE
15 Mar, 2018	13:00 ~ 13:59	0.028	0.046	0.025	0.012	0.000	1.18	239	WSW
15 Mar, 2018	14:00 ~ 14:59	0.128	0.067	0.048	0.024	0.000	1.93	195	SSW
15 Mar, 2018	15:00 ~ 15:59	0.176	0.065	0.088	0.033	0.000	1.98	144	SSE
15 Mar, 2018	16:00 ~ 16:59	0.245	0.073	0.067	0.033	0.000	1.88	154	SSE
15 Mar, 2018	17:00 ~ 17:59	0.170	0.056	0.049	0.035	0.000	1.13	204	SW
15 Mar, 2018	18:00 ~ 18:59	0.263	0.060	0.052	0.040	0.000	0.85	211	SW
15 Mar, 2018	19:00 ~ 19:59	0.264	0.060	0.040	0.022	0.009	0.58	182	SSW
15 Mar, 2018	20:00 ~ 20:59	0.147	0.056	0.041	0.024	0.004	0.40	178	S
15 Mar, 2018	21:00 ~ 21:59	0.136	0.061	0.028	0.016	0.012	0.70	202	SSW
15 Mar, 2018	22:00 ~ 22:59	0.098	0.056	0.032	0.019	0.013	1.12	251	W
15 Mar, 2018	23:00 ~ 23:59	0.044	0.058	0.031	0.020	0.008	0.78	260	W
16 Mar, 2018	0:00 ~ 0:59	0.044	0.053	0.041	0.030	0.002	0.52	270	W
16 Mar, 2018	1:00 ~ 1:59	0.025	0.055	0.039	0.034	0.010	0.30	272	WNW
16 Mar, 2018	2:00 ~ 2:59	0.025	0.056	0.029	0.027	0.007	0.15	289	WNW
16 Mar, 2018	3:00 ~ 3:59	0.034	0.052	0.032	0.030	0.004	0.02	96	ESE
16 Mar, 2018	4:00 ~ 4:59	0.029	0.046	0.038	0.048	0.003	0.50	59	ENE
16 Mar, 2018	5:00 ~ 5:59	0.042	0.048	0.035	0.042	0.012	0.08	102	ESE
16 Mar, 2018	6:00 ~ 6:59	0.172	0.043	0.052	0.086	0.014	0.02	93	ESE
16 Mar, 2018	7:00 ~ 7:59	0.648	0.046	0.082	0.130	0.031	0.28	137	SSE
16 Mar, 2018	8:00 ~ 8:59	0.021	0.038	0.106	0.138	0.002	0.40	51	ENE
16 Mar, 2018	9:00 ~ 9:59	0.029	0.042	0.042	0.031	0.002	0.63	186	SSW

Max	0.648 (0.742 mg/m³)	0.073 (0.138 mg/m³)	0.106	0.138	0.031 (0.080 mg/m³)
Avg	0.118 (0.135 mg/m³)	0.052 (0.098 mg/m³)	0.047	0.039	0.006 (0.015 mg/m³)
Min	0.001 (0.001 mg/m³)	0.038 (0.071 mg/m³)	0.025	0.004	0.000 (0.000 mg/m³)

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Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		ppm	ppm	mg/m³	mg/m³	ppm	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
16 Mar, 2018	10:00 ~ 10:59	0.001	0.041	0.027	0.020	0.000	1.15	211	SW
16 Mar, 2018	11:00 ~ 11:59	0.002	0.038	0.012	0.013	0.000	1.08	184	SSW
16 Mar, 2018	12:00 ~ 12:59	0.000	0.031	0.009	0.008	0.000	1.30	167	S
16 Mar, 2018	13:00 ~ 13:59	0.000	0.035	0.011	0.005	0.000	1.45	156	SSE
16 Mar, 2018	14:00 ~ 14:59	0.002	0.043	0.030	0.004	0.000	1.60	147	SSE
16 Mar, 2018	15:00 ~ 15:59	0.001	0.051	0.038	0.017	0.000	2.07	142	SSE
16 Mar, 2018	16:00 ~ 16:59	0.113	0.051	0.053	0.036	0.000	1.98	143	SSE
16 Mar, 2018	17:00 ~ 17:59	0.174	0.069	0.051	0.041	0.000	1.58	142	SSE
16 Mar, 2018	18:00 ~ 18:59	0.153	0.068	0.042	0.036	0.000	0.87	158	S
16 Mar, 2018	19:00 ~ 19:59	0.314	0.062	0.037	0.019	0.001	0.38	189	SSW
16 Mar, 2018	20:00 ~ 20:59	0.206	0.060	0.035	0.006	0.006	0.47	227	WSW
16 Mar, 2018	21:00 ~ 21:59	0.129	0.058	0.030	0.008	0.008	0.97	248	W
16 Mar, 2018	22:00 ~ 22:59	0.041	0.053	0.027	0.024	0.010	0.97	246	WSW
16 Mar, 2018	23:00 ~ 23:59	0.079	0.057	0.035	0.031	0.008	1.03	250	W
17 Mar, 2018	0:00 ~ 0:59	0.091	0.055	0.046	0.038	0.008	0.68	234	WSW
17 Mar, 2018	1:00 ~ 1:59	0.028	0.051	0.042	0.032	0.004	0.60	239	WSW
17 Mar, 2018	2:00 ~ 2:59	0.050	0.051	0.043	0.031	0.005	0.65	220	SW
17 Mar, 2018	3:00 ~ 3:59	0.044	0.047	0.044	0.026	0.008	0.15	207	SW
17 Mar, 2018	4:00 ~ 4:59	0.015	0.050	0.035	0.021	0.006	1.10	244	WSW
17 Mar, 2018	5:00 ~ 5:59	0.056	0.051	0.033	0.013	0.003	0.87	252	W
17 Mar, 2018	6:00 ~ 6:59	0.097	0.052	0.036	0.027	0.015	0.03	179	S
17 Mar, 2018	7:00 ~ 7:59	0.475	0.052	0.050	0.044	0.019	0.32	90	ESE
17 Mar, 2018	8:00 ~ 8:59	0.191	0.025	0.050	0.048	0.007	0.40	77	E
17 Mar, 2018	9:00 ~ 9:59	0.061	0.043	0.038	0.033	0.002	0.80	128	SE

Max	0.475 (0.544 mg/m³)	0.069 (0.130 mg/m³)	0.053	0.048	0.019 (0.050 mg/m³)
Avg	0.097 (0.111 mg/m³)	0.050 (0.093 mg/m³)	0.036	0.024	0.005 (0.012 mg/m³)
Min	0.000 (0.000 mg/m³)	0.025 (0.047 mg/m³)	0.009	0.004	0.000 (0.000 mg/m³)

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		ppm	ppm	mg/m³	mg/m³	ppm	kph	Deg	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
17 Mar, 2018	10:00 ~ 10:59	0.023	0.039	0.025	0.014	0.003	1.18	166	S
17 Mar, 2018	11:00 ~ 11:59	0.011	0.039	0.012	0.008	0.001	1.40	158	S
17 Mar, 2018	12:00 ~ 12:59	0.002	0.030	0.012	0.008	0.000	1.62	142	SSE
17 Mar, 2018	13:00 ~ 13:59	0.001	0.037	0.020	0.009	0.000	1.95	139	SSE
17 Mar, 2018	14:00 ~ 14:59	0.004	0.045	0.026	0.011	0.002	1.83	148	SSE
17 Mar, 2018	15:00 ~ 15:59	0.067	0.047	0.028	0.016	0.000	1.95	142	SSE
17 Mar, 2018	16:00 ~ 16:59	0.113	0.050	0.046	0.031	0.000	1.55	151	SSE
17 Mar, 2018	17:00 ~ 17:59	0.153	0.059	0.045	0.038	0.000	1.22	154	SSE
17 Mar, 2018	18:00 ~ 18:59	0.196	0.056	0.045	0.039	0.000	0.42	158	S
17 Mar, 2018	19:00 ~ 19:59	0.380	0.059	0.055	0.045	0.006	0.28	188	SSW
17 Mar, 2018	20:00 ~ 20:59	0.146	0.053	0.045	0.030	0.003	0.23	209	SW
17 Mar, 2018	21:00 ~ 21:59	0.047	0.056	0.046	0.031	0.000	0.78	244	WSW
17 Mar, 2018	22:00 ~ 22:59	0.024	0.060	0.043	0.013	0.002	1.53	242	WSW
17 Mar, 2018	23:00 ~ 23:59	0.044	0.056	0.041	0.025	0.004	1.63	242	WSW
18 Mar, 2018	0:00 ~ 0:59	0.043	0.053	0.041	0.028	0.009	1.37	242	WSW
18 Mar, 2018	1:00 ~ 1:59	0.048	0.055	0.041	0.023	0.013	0.37	193	SSW
18 Mar, 2018	2:00 ~ 2:59	0.134	0.052	0.044	0.044	0.014	0.08	152	SSE
18 Mar, 2018	3:00 ~ 3:59	0.070	0.053	0.039	0.048	0.007	0.02	204	SW
18 Mar, 2018	4:00 ~ 4:59	0.050	0.052	0.042	0.044	0.007	0.17	195	SSW
18 Mar, 2018	5:00 ~ 5:59	0.125	0.046	0.043	0.051	0.009	0.07	150	SSE
18 Mar, 2018	6:00 ~ 6:59	0.054	0.045	0.038	0.054	0.010	0.03	96	ESE
18 Mar, 2018	7:00 ~ 7:59	0.101	0.041	0.054	0.066	0.020	0.30	53	ENE
18 Mar, 2018	8:00 ~ 8:59	0.017	0.052	0.051	0.046	0.010	0.52	93	ESE
18 Mar, 2018	9:00 ~ 9:59	0.015	0.042	0.041	0.044	0.003	0.82	151	SSE

Max	0.380 (0.435 mg/m³)	0.060 (0.112 mg/m³)	0.055	0.066	0.020 (0.052 mg/m³)
Avg	0.078 (0.089 mg/m³)	0.049 (0.092 mg/m³)	0.038	0.032	0.005 (0.014 mg/m³)
Min	0.001 (0.001 mg/m³)	0.030 (0.056 mg/m³)	0.012	0.008	0.000 (0.000 mg/m³)

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Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		ppm	ppm	mg/m³	mg/m³	ppm	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
18 Mar, 2018	10:00 ~ 10:59	0.002	0.039	0.027	0.015	0.000	1.12	204	SW
18 Mar, 2018	11:00 ~ 11:59	0.000	0.032	0.011	0.009	0.000	1.47	137	SSE
18 Mar, 2018	12:00 ~ 12:59	0.004	0.028	0.014	0.007	0.000	1.32	180	SSW
18 Mar, 2018	13:00 ~ 13:59	0.002	0.038	0.016	0.005	0.000	1.72	162	S
18 Mar, 2018	14:00 ~ 14:59	0.037	0.044	0.031	0.008	0.004	2.05	143	SSE
18 Mar, 2018	15:00 ~ 15:59	0.080	0.044	0.040	0.013	0.002	2.23	142	SSE
18 Mar, 2018	16:00 ~ 16:59	0.073	0.041	0.042	0.022	0.000	1.60	153	SSE
18 Mar, 2018	17:00 ~ 17:59	0.103	0.044	0.039	0.024	0.000	1.47	143	SSE
18 Mar, 2018	18:00 ~ 18:59	0.215	0.058	0.044	0.048	0.001	1.12	133	SE
18 Mar, 2018	19:00 ~ 19:59	0.237	0.058	0.040	0.035	0.003	0.65	135	SE
18 Mar, 2018	20:00 ~ 20:59	0.295	0.062	0.041	0.038	0.018	0.02	241	WSW
18 Mar, 2018	21:00 ~ 21:59	0.109	0.056	0.042	0.034	0.004	0.05	204	SW
18 Mar, 2018	22:00 ~ 22:59	0.197	0.058	0.032	0.027	0.005	0.70	245	WSW
18 Mar, 2018	23:00 ~ 23:59	0.086	0.050	0.043	0.037	0.007	1.32	247	WSW
19 Mar, 2018	0:00 ~ 0:59	0.017	0.056	0.040	0.026	0.001	1.52	246	WSW
19 Mar, 2018	1:00 ~ 1:59	0.028	0.057	0.037	0.022	0.000	1.20	241	WSW
19 Mar, 2018	2:00 ~ 2:59	0.032	0.055	0.035	0.021	0.003	1.57	243	WSW
19 Mar, 2018	3:00 ~ 3:59	0.049	0.052	0.038	0.026	0.005	1.18	240	WSW
19 Mar, 2018	4:00 ~ 4:59	0.060	0.054	0.043	0.040	0.004	1.03	240	WSW
19 Mar, 2018	5:00 ~ 5:59	0.086	0.055	0.046	0.048	0.006	0.92	236	WSW
19 Mar, 2018	6:00 ~ 6:59	0.105	0.054	0.046	0.063	0.010	1.13	241	WSW
19 Mar, 2018	7:00 ~ 7:59	0.039	0.062	0.020	0.071	0.010	0.82	248	W
19 Mar, 2018	8:00 ~ 8:59	0.013	0.059	0.029	0.049	0.000	0.60	243	WSW
19 Mar, 2018	9:00 ~ 9:59	0.021	0.056	0.044	0.039	0.002	0.60	112	ESE

Max	0.295 (0.338 mg/m³)	0.062 (0.117 mg/m³)	0.046	0.071	0.018 (0.048 mg/m³)
Avg	0.079 (0.090 mg/m³)	0.050 (0.095 mg/m³)	0.035	0.030	0.004 (0.009 mg/m³)
Min	0.000 (0.000 mg/m³)	0.028 (0.053 mg/m³)	0.011	0.005	0.000 (0.000 mg/m³)

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		ppm	ppm	mg/m^3	mg/m^3	ppm	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
19 Mar, 2018	10:00 ~ 10:59	0.025	0.047	0.025	0.028	0.000	0.63	58	ENE
19 Mar, 2018	11:00 ~ 11:59	0.000	0.039	0.014	0.004	0.001	0.68	191	SSW
19 Mar, 2018	12:00 ~ 12:59	0.032	0.054	0.051	0.021	0.004	1.02	176	S
19 Mar, 2018	13:00 ~ 13:59	0.016	0.034	0.030	0.012	0.000	1.48	250	W
19 Mar, 2018	14:00 ~ 14:59	0.015	0.043	0.026	0.019	0.001	1.53	157	SSE
19 Mar, 2018	15:00 ~ 15:59	0.118	0.059	0.056	0.044	0.000	2.17	142	SSE
19 Mar, 2018	16:00 ~ 16:59	0.136	0.060	0.042	0.026	0.001	2.08	148	SSE
19 Mar, 2018	17:00 ~ 17:59	0.140	0.066	0.042	0.018	0.000	1.88	148	SSE
19 Mar, 2018	18:00 ~ 18:59	0.094	0.055	0.036	0.013	0.004	1.23	151	SSE
19 Mar, 2018	19:00 ~ 19:59	0.087	0.056	0.034	0.016	0.001	0.85	158	S
19 Mar, 2018	20:00 ~ 20:59	0.067	0.059	0.037	0.014	0.007	0.70	169	S
19 Mar, 2018	21:00 ~ 21:59	0.045	0.063	0.041	0.014	0.007	0.40	174	S
19 Mar, 2018	22:00 ~ 22:59	0.115	0.057	0.044	0.027	0.004	0.90	234	WSW
19 Mar, 2018	23:00 ~ 23:59	0.039	0.049	0.046	0.027	0.005	0.98	244	WSW
20 Mar, 2018	0:00 ~ 0:59	0.007	0.058	0.037	0.024	0.001	0.50	224	SW
20 Mar, 2018	1:00 ~ 1:59	0.091	0.049	0.058	0.052	0.008	1.28	246	WSW
20 Mar, 2018	2:00 ~ 2:59	0.067	0.045	0.054	0.054	0.016	1.25	238	WSW
20 Mar, 2018	3:00 ~ 3:59	0.064	0.047	0.045	0.054	0.006	0.32	198	SSW
20 Mar, 2018	4:00 ~ 4:59	0.058	0.063	0.031	0.050	0.003	0.10	216	SW
20 Mar, 2018	5:00 ~ 5:59	0.109	0.061	0.043	0.061	0.004	0.63	242	WSW
20 Mar, 2018	6:00 ~ 6:59	0.055	0.054	0.063	0.048	0.001	0.15	174	S
20 Mar, 2018	7:00 ~ 7:59	0.071	0.049	0.054	0.042	0.000	0.23	105	ESE
20 Mar, 2018	8:00 ~ 8:59	0.039	0.048	0.043	0.027	0.000	0.38	197	SSW
20 Mar, 2018	9:00 ~ 9:59	0.010	0.038	0.023	0.012	0.000	0.83	95	ESE

Max	0.140 (0.160 mg/m^3)	0.066 (0.124 mg/m^3)	0.063	0.061	0.016 (0.042 mg/m^3)
Avg	0.062 (0.070 mg/m^3)	0.052 (0.098 mg/m^3)	0.041	0.029	0.003 (0.008 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.034 (0.065 mg/m^3)	0.014	0.004	0.000 (0.000 mg/m^3)

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		ppm	ppm	mg/m³	mg/m³	ppm	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
20 Mar, 2018	10:00 ~ 10:59	0.012	0.037	0.019	0.009	0.001	1.22	190	SSW
20 Mar, 2018	11:00 ~ 11:59	0.000	0.051	0.036	0.019	0.000	1.20	181	SSW
20 Mar, 2018	12:00 ~ 12:59	0.026	0.034	0.017	0.011	0.017	1.63	213	SW
20 Mar, 2018	13:00 ~ 13:59	0.037	0.046	0.031	0.013	0.008	1.37	164	S
20 Mar, 2018	14:00 ~ 14:59	0.089	0.041	0.067	0.038	0.000	1.93	151	SSE
20 Mar, 2018	15:00 ~ 15:59	0.148	0.051	0.057	0.028	0.000	2.02	141	SSE
20 Mar, 2018	16:00 ~ 16:59	0.181	0.063	0.057	0.048	0.001	1.70	147	SSE
20 Mar, 2018	17:00 ~ 17:59	0.147	0.067	0.054	0.036	0.001	1.58	141	SSE
20 Mar, 2018	18:00 ~ 18:59	0.051	0.065	0.046	0.019	0.000	1.25	153	SSE
20 Mar, 2018	19:00 ~ 19:59	0.015	0.066	0.047	0.028	0.000	0.98	170	S
20 Mar, 2018	20:00 ~ 20:59	0.009	0.066	0.043	0.030	0.000	0.83	238	WSW
20 Mar, 2018	21:00 ~ 21:59	0.069	0.062	0.041	0.020	0.000	0.75	249	W
20 Mar, 2018	22:00 ~ 22:59	0.068	0.055	0.039	0.017	0.001	1.20	246	WSW
20 Mar, 2018	23:00 ~ 23:59	0.059	0.056	0.034	0.031	0.005	0.70	249	W
21 Mar, 2018	0:00 ~ 0:59	0.082	0.058	0.046	0.044	0.015	1.00	246	WSW
21 Mar, 2018	1:00 ~ 1:59	0.052	0.055	0.049	0.050	0.007	0.65	243	WSW
21 Mar, 2018	2:00 ~ 2:59	0.053	0.060	0.046	0.055	0.003	0.23	179	S
21 Mar, 2018	3:00 ~ 3:59	0.099	0.059	0.041	0.036	0.005	0.05	175	S
21 Mar, 2018	4:00 ~ 4:59	0.162	0.056	0.048	0.060	0.012	0.03	189	SSW
21 Mar, 2018	5:00 ~ 5:59	0.276	0.053	0.048	0.069	0.009	0.03	189	SSW
21 Mar, 2018	6:00 ~ 6:59	0.109	0.054	0.061	0.068	0.004	0.08	179	S
21 Mar, 2018	7:00 ~ 7:59	0.005	0.050	0.041	0.038	0.000	0.67	225	WSW
21 Mar, 2018	8:00 ~ 8:59	0.010	0.056	0.034	0.026	0.000	0.95	247	WSW
21 Mar, 2018	9:00 ~ 9:59	0.012	0.044	0.025	0.015	0.000	0.80	211	SW

Max	0.276 (0.316 mg/m³)	0.067 (0.125 mg/m³)	0.067	0.069	0.017 (0.043 mg/m³)
Avg	0.074 (0.084 mg/m³)	0.054 (0.102 mg/m³)	0.043	0.034	0.004 (0.010 mg/m³)
Min	0.000 (0.000 mg/m³)	0.034 (0.063 mg/m³)	0.017	0.009	0.000 (0.000 mg/m³)

Thilawa Special Economic Zone (Zone B) Development Project –Phase 1 & 2

Appendix

Traffic Volume Monitoring Report

April 2018

TRAFFIC VOLUME MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 1 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

March 2018

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 15th March 2018 to 16th March 2018 as follows;

Table 1.2-1 Outlines of Traffic Volume Monitoring

Monitoring Date	Monitoring Item	Parameters	Number of Points	Duration	Monitoring Methodology
15th March 2018 - 16th March 2018	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.

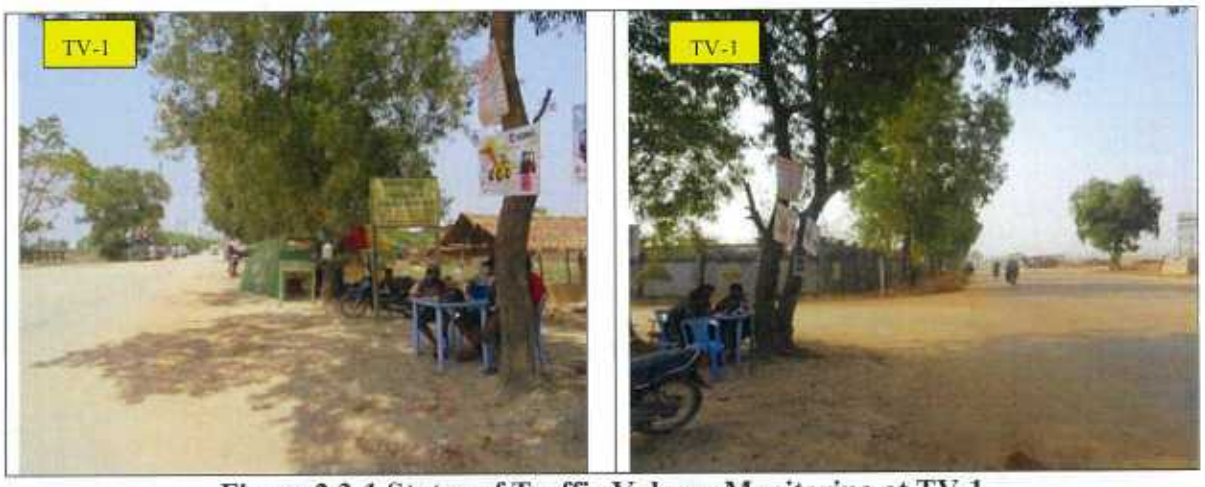

Figure 2.3-1 Status of Traffic Volume Monitoring at TV-1

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 are distinctly higher utilized in weekdays. The number of 4-wheel heavy vehicles are two times lower than the number of 4-wheel light vehicles for each direction.

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	15th March 2018 – 16th March 2018	Thursday and Friday	2210	830	360	52	3,452
	Dagon-Thilawa road to Phalan village			2062	812	312	48	3,234

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 16:00 to 19:00, 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	
12:00	13:00	135	68	23	2	228
13:00	14:00	90	57	27	1	175
14:00	15:00	82	56	30	1	169
15:00	16:00	93	51	17	5	166
16:00	17:00	96	58	28	7	189
17:00	18:00	191	68	25	5	289
18:00	19:00	196	62	32	4	294
19:00	20:00	64	35	8	1	108
20:00	21:00	47	26	12	0	85
21:00	22:00	20	11	19	3	53
22:00	23:00	24	9	10	1	44
23:00	00:00	3	2	4	0	9
00:00	1:00	2	5	6	0	13
1:00	2:00	6	3	1	0	10
2:00	3:00	3	1	0	0	4
3:00	4:00	4	1	1	0	6
4:00	5:00	2	0	0	0	2
5:00	6:00	10	6	1	1	18
6:00	7:00	123	37	10	3	173
7:00	8:00	495	61	25	4	585
8:00	9:00	173	49	15	6	243
9:00	10:00	125	45	22	4	196
10:00	11:00	87	56	21	1	165
11:00	12:00	139	63	23	3	228
Total		2210	830	360	52	3,452

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	
12:00	13:00	110	69	15	0	194
13:00	14:00	127	47	26	3	203
14:00	15:00	65	52	28	4	149
15:00	16:00	85	59	20	4	168
16:00	17:00	101	54	22	5	182
17:00	18:00	301	51	31	7	390
18:00	19:00	146	57	12	2	217
19:00	20:00	54	19	10	1	84
20:00	21:00	63	30	13	0	106
21:00	22:00	56	22	10	3	91
22:00	23:00	28	13	15	0	56
23:00	00:00	22	6	7	0	35
00:00	1:00	2	2	3	0	7
1:00	2:00	6	2	0	0	8
2:00	3:00	0	1	1	0	2
3:00	4:00	2	0	0	0	2
4:00	5:00	3	0	0	0	3
5:00	6:00	14	5	1	0	20
6:00	7:00	53	15	2	3	73
7:00	8:00	312	66	11	5	394
8:00	9:00	179	72	16	5	272
9:00	10:00	125	61	13	1	200
10:00	11:00	88	52	20	1	161
11:00	12:00	120	57	36	4	217
Total		2062	812	312	48	3,234

The summary of traffic volume results during quarterly monitoring at TV-1 is shown in Table 2.4-4 and Table 2.4-5, respectively. In the summary traffic volume results during quarterly monitoring surveys at TV-1, comparison of traffic volume results for one year was described. Among the traffic monitoring surveys (quarterly), traffic volume results for September 2017 is the lowest compared with other quarterly monitoring surveys. Traffic volume results are increasing start from December 2017. Traffic volume results for March 2018 is the highest among the quarterly surveys.

Table 2.4-4 Summary of traffic volume results during quarterly monitoring surveys at TV-1 (From Phalan Village to Dagon Thilawa Road)

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	29th Mar-30th Mar 2017	Wednesday & Thursday	1,712	545	216	29	2,502
		22nd June-23rd June 2017	Thursday & Friday	1,402	528	352	47	2,329
		19th September-20th September 2017	Tuesday & Wednesday	1,254	509	393	17	2,173
		7th December-8th December 2017	Thursday & Friday	1,800	652	339	43	2,834
		15th March 2018 – 16th March 2018	Thursday and Friday	2,210	830	360	52	3,452

Table 2.4-5 Summary of traffic volume results during quarterly monitoring surveys at TV-1 (From Dagon-Thilawa Road to Phalan Village)

Survey Point	Direction	Date	Weekday	2-wheel Vehicles	4-wheel Light Vehicles	4-wheel Heavy Vehicles	Others	Total
TV-1	Dagon-Thilawa road to Phalan village	29th Mar-30th Mar 2017	Wednesday & Thursday	1,534	500	236	28	2,298
		22nd June-23rd June 2017	Thursday & Friday	1,291	542	357	43	2,233
		19th September-20th September 2017	Tuesday & Wednesday	1,195	486	372	19	2,072
		7th December-8th December 2017	Thursday & Friday	1,695	682	322	40	2,739
		15th March 2018 – 16th March 2018	Thursday and Friday	2,062	812	312	48	3,234

CHAPTER 3: CONCLUSION AND RECOMMENDATION

The results of the traffic volume show that the number of 2-wheel vehicles are distinctly higher utilized in this monitoring period. The number of 4-wheel heavy vehicles are significantly lower than the number of 4-wheel light vehicles for each direction. It seems that commuting vehicles are much utilized during this monitoring period as compare with construction related vehicles (4-wheel heavy vehicles). By comparing the previous quarterly traffic surveys, the traffic volume is increasing start from December 2017. Traffic volume results for March 2018 is the highest one compared with previous quarterly traffic surveys.
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.

End of Document

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