

Thilawa Special Economic
Zone (Zone B) Development

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



Myanmar Japan Thilawa
Development Limited.

September 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 June 2018 to August 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
6	Environmental Monitoring Report	Phase-1 &2 Construction Phase	June, 2018
7	Environmental Monitoring Report	Phase-1 &2 Construction Phase	September, 2018

Report (No.7) 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;
Depend on the exceeding parameters and situation
- d) Accidents or incidents relating to the occupational and community health and safety, and the environment;
Accidents 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 June, 2018
- B. Monthly Progress Report for July, 2018
- C. Monthly Progress Report for August, 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 _x , SO _x , CO, PM _{2.5} , PM ₁₀	Construction site (1 point)	Once/ 3month	June 2018, Air Quality Monitoring Report
Water Quality	Water temperature, pH, SS, DO, BOD ₅ , COD, coliforms, oil and grease, chromium	<ul style="list-style-type: none"> 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	June 2018 Water and Wastewater Quality Monitoring Report
Waste	Amount and kind of solid waste	Construction site	Once/ 3 month	Monthly Progress Reports (June, July, August 2018)
Noise and Vibration	<ul style="list-style-type: none"> Noise and vibration level Traffic Count 	<ul style="list-style-type: none"> Preservation area such as residence around the proposed construction site (at least 1 point) Preservation site such as residence along the route for on-site vehicles (1 point for noise and vibration and 2 points for traffic count) 	Once/ 3 month (peak period)	Noise and Vibration Monitoring Report June 2018 Traffic Count Monitoring Report June 2018
Ground Subsidence	<ul style="list-style-type: none"> Ground water level Ground elevation level 	Representative (1 point)	Every week	Monthly Progress Reports (June, July, August 2018)
Hydrology	Consumption of ground water amount			
Risk for infectious disease such as AIDS/HIV	Status of measures of infectious disease	Construction site	Once/month	Monthly Progress Reports (June, July, August 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	



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)		29 th 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	5 th January 2018	10 th January 2018	Thilawa SEZ Management Committee	

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 (June 2018)

NO₂, SO₂, CO, PM_{2.5}, PM₁₀

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	mg/m ³	0.083	0.089	0.2 mg/m ³ (1 Hour)	0.1 mg/m ³ (24 Hour)	-	One time / 3 months	Haz-Scanner EPAS	Refer to air quality report
	SO ₂ *2	mg/m ³	0.023	0.03	0.02 mg/m ³ (24 Hours)	0.02 mg/m ³ (24 Hours)	-			
	CO	mg/m ³	0.058	0.072	-	10.26 mg/m ³ (24 Hours)	-			
	PM _{2.5} *3	mg/m ³	0.02	0.032	0.025 mg/m ³ (24 Hours)	0.025 mg/m ³ (24 Hours)	-			
	PM ₁₀	mg/m ³	0.024	0.038	0.05 mg/m ³ (24 Hours)	0.05 mg/m ³ (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 (June 2018)

*2 Remarks: During monitoring periods, SO₂ measured value (mean) was exceeded than the standard. Regarding to monitoring results, the value of SO₂ measured for four

days results were exceeded than the target value. After detail analyzed the SO₂ exceeded time for construction period, according to the wind direction, all exceeded hours during seven days are come from another site of Zone-B.

*¹Remarks: During monitoring periods, PM_{2.5} measured value (max) was exceeded than the standard. Regarding to monitoring results, the value of PM_{2.5} measured for two days results were exceeded than the target value. After detail analyzed the PM_{2.5} for construction period according to 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 natural origin such as dust from unpaved vacant are and transportation in and around the monitoring area.

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

2) (a) Water Quality - June 2018

Measurement Point: Effluent of Wastewater (SW-2, SW-3 and SW-4 are attached as reference point only and they are natural creek water which are combined 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	28	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	8	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS ⁴	mg/L	98	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	4.92	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	4.54	50	20		APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	15.7	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform ³	MPN/100ml	92000	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)	
SW-3 (reference point)	Temperature	°C	27	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7.2	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS ⁴	mg/L	206	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	5.67	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	3.57	50	20		APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	8.5	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform ³	MPN/100ml	35000	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)	
SW-4 (reference point)	Temperature	°C	29	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7.6	6-9	6.0 - 9.0		Instrument Analysis Method	

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)
point)	SS ⁴	mg/L	370	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	8.38	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	3.33	50	20		APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	3.1	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform ³	MPN/100ml	92000	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	28	< 3 (increase)	40		Instrument Analysis Method	
	pH	-	7.6	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS ⁴	mg/L	604	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	7.82	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	3.31	50	20	Once per 2 months	APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	0.8	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform ³	MPN/100ml	>160000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	6.88	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	≤0.002	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
SW-8	Temperature	°C	29	< 3 (increase)	40		Instrument Analysis Method	
	pH	-	7.8	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS ⁴	mg/L	228	50	30	Once per 2 months	APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	8.21	-	-		Instrument Analysis Method	

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)
	BOD ₅	mg/L	3.81	50	20		APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	13	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform ³	MPN/100ml	>160000	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-9	Temperature	°C	28	< 3 (increase)	40		Instrument Analysis Method	
	pH	-	7.7	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS ⁴	mg/L	176	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	7.76	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	3.64	50	20	Once per 2 months	APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	15	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform ³	MPN/100ml	>160000	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)	
GW-2 (reference point)	Temperature	°C	27	< 3 (increase)	40		Instrument Analysis Method	
	pH	-	7.7	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS	mg/L	10	50	30	Once per 2 months	APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	7.5	-	-		Instrument Analysis Method	
	BOD ₅	mg/L	2.46	50	20		APHA 5210 B (5days BOD Test)	
	COD _{Cr}	mg/L	<0.7	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	

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)
	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 (June 2018)

²Remark: Reference to National Emission Quality Guideline NEQG 29th December 2015

³ Remark: For the monitoring point of (SW-2, SW-3, SW-4, SW-7, SW-8 and SW-9), the results of Total coliform were exceeded than the target value due to the excepted 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 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 reference value. Therefore, although the target value of total coliform was exceeded at monitoring point of SW-2, SW-3, SW-4, SW-5, SW-7, SW-8 and SW-9, but it is considered that there is no significant impact on human health.

⁴ Remark: For the monitoring point of (SW-2, SW-3, SW-4, SW-7, SW-8 and SW-9), the results of SS is excess than the target value due to the excepted reasons; i) surface water run-off from bare land in Zone-B, ii) delivered from upstream area such as natural origin and wastewater from local industrial zone outside of Thilawa SEZ, and iii) influence by water from the downstream of monitoring points due to flow back by tidal fluctuation.

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 (June 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)	58	60	Refer to NEQG Article 1.3	75	Refer the section 2.4 in EIA main report	One time / 3 months		
	Leq (evening)	dB(A)	55	56		60				
	Leq(night)	dB(A)	55	61		55				
Along the road (NV-1)	Leq (day)	dB(A)	58	61		75				
	Leq(night)	dB(A)	52	56		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	6-June-2018	Construction Waste	Load	2	Waste disposing to Authorized waste collector (YCDC)
Amount of Sludge	17-Jul-2018	Construction Waste	Load	2	Waste disposing to Authorized waste collector (YCDC)

6) (a) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
7-Jun-2018	120	m ³ /week	6.297	m	
14-Jun-2018	119	m ³ /week	6.297	m	
21-Jun-2018	143	m ³ /week	6.298	m	
28-Jun-2018	123	m ³ /week	6.298	m	

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

6) (b) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
5-Jul-2018	162	m ³ /week	6.297	m	
12-Jul-2018	164	m ³ /week	6.297	m	
19-Jul-2018	148	m ³ /week	6.298	m	
26-Jul-2018	151	m ³ /week	6.298	m	

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

6) (c) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
2-Aug-2018	139	m3/week	6.297	m	
9-Aug-2018	81	m3/week	6.297	m	
16-Aug-2018	116	m3/week	6.297	m	
23-Aug-2018	120	m3/week	6.297	m	
30-Aug-2018	114	m3/week	6.298	m	

Remarks: Reference to Monthly Progress Report (August-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
An accident occurred on 8th August 15:30PM at near BA-2 plot at outside area of Thilawa SEZ (B) on Thilawa Development road. A car from BA-3 site was broken its wheel while driving and crashed an excavator which was being worked by TPD company beside that road. Both a driver and a person from that site got big injury.	MJTD took the action as per following: - We called ambulance and Traffic Police. - Send the injured persons to hospital. - Traffic policeman solved this accident case."

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

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

Information from TSMC

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

Resettlement Works		Progress in Narrative	Remarkable Issues
Projected Affected Persons	Land Acquisition and Relocation	Land ownership identification processes and confirmation meetings	
		Land compensation to one of the PAP in Zone B (area 2_1)	
	Income Restoration Program	Driving cost for 15 PAPs	

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

☒ Yes, ☐ No

Contents of Grievance	Response/ Countermeasures
There were 16 grievances received during June to August 2018. The number of complaints under "Compensation" category is 2 , "Environmental" category is 2 , "Employee and worker behavior" is 1 , "Labor" issue is 3 , "Infrastructure related" category is 3 and "Others" as 5 .	Among 16 grievances, 11 complaints had been resolved and 5 grievances in under investigation.

- 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)
June 2018	Trash collection activity	All residents in Alwan Sut village
	Benches donation	Shwe Pyaut school
	Stationary donation to Non-Formal Primary Education	All NFPE students in Kyaut Tan township
	Scholarship (yearly program)	11 high school students in Kyaut Tan township
July 2018	Tree planting activity	Near Thilawa SEZ
	Infrastructure support (drain system improvement)	Addutaw village, Shwe Pyaut ward
	Support computers and facilities to set up multimedia classroom	N0. (2) Basic Education High School (Thawka), Kyaut Tan township
	Scholarship (yearly program)	11 high school students in Kyaut Tan township
August 2018	Vocational training (sewing)	Fifteen women from SEZ's neighboring community
	Scholarship (yearly program)	11 high school students in Kyaut Tan township

End of Document

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

Appendix

Water and Waste Water Monitoring Report

June 2018

**WATER QUALITY MONITORING REPORT
FOR DEVELOPMENT OF INDUSTRIAL AREA
IN THILAWA SEZ ZONE B
(PHASE 1 & 2 CONSTRUCTION STAGE)**

(Bi-Monthly Monitoring)

June 2018

Myanmar Koei International Ltd.



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CHAPTER 1: INTRODUCTION

1.1 General

Thilawa Special Economic Zone (SEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd. (MJTD) has a responsibility to carry out regular monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report and Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area. As for the monitoring of the water quality, total 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 three locations (SW-2, SW-4 and SW-7) 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	○	○	○	○	○	○	○	On-site measurement
2	Water temperature	○	○	○	○	○	○	○	On-site measurement
3	DO	○	○	○	○	○	○	○	On-site measurement
4	BOD (5)	○	○	○	○	○	○	○	Laboratory analysis
5	COD (Cr)	○	○	○	○	○	○	○	Laboratory analysis
6	Suspended solids	○	○	○	○	○	○	○	Laboratory analysis
7	Total coliform	○	○	○	○	○	○	○	Laboratory analysis
8	Oil and grease	○	○	○	○	○	○	○	Laboratory analysis
9	Chromium	○	○	○	○	○	○	○	Laboratory analysis
10	Escherichia Coli (Self-monitoring)	○	○	○	○	○	○	○	Laboratory analysis
11	Flow Rate	○	-	○	○	-	-	-	On-site measurement

Source: Myanmar Koei International Ltd.

2.2 Description of Sampling Points

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

Table 2.2-1 Outline of Sampling Points

No.	Station	Detailed Information
1	SW-2	Coordinate- N-16° 40' 20.70", E- 96° 17' 18.70" Location - Upstream of Shwe Pyauk Creek Survey Item - Surface water sampling and water flow rate 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' 41.00", E- 96° 16' 26.50" Location - Downstream of Shwe Pyauk Creek Survey Item - Surface water sampling and water flow rate measurement.
4	SW-7	Coordinate- N-16° 40' 17.83", E- 96° 17' 18.46" Location - Discharge drain of Zone B construction site before connect to Shwe Pyauk Creek Survey Item - Discharge water sampling and water flow rate measurement.
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 11th June 2018 and sampling time is shown in Table 2.4-1 to avoid tidal effect. The tide record for Yangon River, Myanmar on 11th June 2018 is shown in Table 2.4-2.

Table 2.4-1 Sampling Time of Each Station

No.	Station	Sampling Time
1	SW-2	11/06/2018 10:02
2	SW-3	11/06/2018 08:48
3	SW-4	11/06/2018 11:46
4	SW-7	11/06/2018 10:31
5	SW-8	11/06/2018 11:04
6	SW-9	11/06/2018 09:31
7	GW-2	11/06/2018 12:20

Source: Myanmar Koei International Ltd.

Table 2.4-2 Tide Record for Yangon River, Myanmar

Date	Time	Height	Tide Conditions
11/06/2018	02:10	4.8	High Tide
	08:50	1.1	Low Tide
	14:30	5.4	High Tide
	21:30	0.7	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 SS and total coliform were exceeded than the target value. As for the result of SS, results at the surface water monitoring points (SW-2, SW-3, SW-4, SW-7, SW-8 and SW-9) exceeded the target value due to three expected reasons; i) surface water run-off from bare land in Zone B, ii) delivered from upstream area such as natural origin and wastewater from local industrial zone outside of Thilawa SEZ, and iii) influence by water from the downstream of monitoring points due to flow back by tidal fluctuation.

As for the result of total coliform of surface water, results at surface water monitoring points (SW-2, SW-3, SW-4, SW-7, SW-8 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, SW-4, SW-7, SW-8 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	28	27	29	28	29	28	≤ 35
2	pH	-	8.0	7.2	7.6	7.6	7.8	7.7	6.0-9.0
3	Suspended solid (SS)	mg/L	98	206	370	604	228	176	50
4	Dissolved oxygen (DO)	mg/L	4.92	5.67	8.38	7.82	8.21	7.76	-
5	BOD (5)	mg/L	4.54	3.57	3.33	3.31	3.81	3.64	30.00
6	COD (Cr)	mg/L	15.7	8.5	3.1	0.8	13	15	125.0
7	Total coliform	MPN/100ml	92,000	35,000	92,000	>160,000	>160,000	>160,000	400
8	Oil and grease	mg/L	< 3.1	< 3.1	< 3.1	6.88	< 3.1	< 3.1	10.00
9	Chromium	mg/L	≤ 0.002	≤ 0.002	≤ 0.002	≤ 0.002	≤ 0.002	≤ 0.002	0.500
10	Escherichia Coli	MPN/100ml* (SW)	3.6	1.8	< 1.8	4.0	< 1.8	< 1.8	(1000)* (CFU/100ml)
11	Flow rate	m ³ /s	6.05	-	5.76	0.50	-	-	-

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	27	≤ 35
2	pH	-	7.7	6.0-9.0
3	Suspended solid (SS)	mg/L	10	50
4	Dissolved oxygen (DO)	mg/L	7.5	-
5	BOD (5)	mg/L	2.46	30.00
6	COD (Cr)	mg/L	< 0.7	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/100ml** (GW)	< 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/BNMT) 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 SS and total coliform in surface water were exceeded the target value at SW-2, SW-3, SW-4, SW-7, SW-8 and SW-9 in this monitoring period for phase 1 and phase 2 construction stage of Thilawa SEZ Zone B.

For SW-2, SW-3, SW-4, SW-7, SW-8 and SW-9, there are some possible reasons for exceeding the target values of SS and 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 surface water run-off from bare land in Zone B 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, SW-4, SW-7, SW-8 and SW-9 were under the reference value. Therefore, although the target value of total coliform was exceeded at main discharging point and 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 sampling and onsite measurement at SW-7

**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 sampling and onsite measurement at SW-8



Surface water sampling and onsite measurement at SW-9



Ground water sampling and onsite measurement at GW-2

APPENDIX-2 LABORATORY RESULTS



FOR DISCHARGING POINT

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR LTD., LTD.
Lot No. 11, Bhalawadi Zone A, Yangon Region, the Union of Myanmar
1-551-230001 / 09-76401134

Report No. : GEM-LAB-201806204

Revision No. : 1

Report Date : 26 June, 2018

Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Ksei International LTD (MKI)
Address : No.1A /2R, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-7-0611
Sample No. : W-1806101
Waste Profile No. : -
Sampling Date : 11 June, 2018
Sampling By : Customer
Sample Received Date : 11 June, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	604.00	-
2	BOD (R)	APHA 5210 B (5 Days BOD-Test)	mg/l	3.21	0.00
3	COO (O)	APHA 5220D (Clove Reflux Colorimetric Method)	mg/l	0.8	0.7
4	Total Coliform	APHA 9221B (Standard Test Coliform Enumeration Techniques)	MPN/100ml	> 190000	1.8
5	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	5.88	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.

Analysed By :

Ni Ni Aye Lwin
Assistant supervisor



Approved By :

Kiei Nagata
Senior Manager

Water Quality Monitoring Report for Development of Industrial Area in Thilawa SEZ Zone B
(Bi-Monthly Monitoring in FY June-2018)

DOWA

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1000 x 1000 (1000) 1000 (1000) 1000
1000 x 1000 (1000) 1000 (1000) 1000

Report No. : DOW-LAB-201800000
Revision No. : 1
Report Date : 06 June, 2018
Application No. : DOW-0000

Analysis Report

Client Name : Myanmar Gas International LTD (MGIL)
Address : No. 14, 100, 104 Thilawa Housing, Phase 11, South Extension
Project Name : MJTD
Sample Description :
Sample Name : MGIL-W-1-2018
Sample No. : W-1-2018
Water Profile No. :

Sampling Date : 01 June, 2018
Sampling for : Contaminant
Sample Received Date : 01 June, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/L	285.00	-
2	SDI (3)	APHA 5210 B-15 (Nephelometric Turbidity)	mg/L	3.21	0.00
3	CO ₂ (CO ₂)	APHA 5120B (Closely Related Carbonic Method)	mg/L	8.3	0.7
4	Total Nitrogen	HACH Method 10073 (TNT Perchloric Digestion Method)	mg/L	1.2	0.0
5	Total Phosphorus	APHA 4500-P-E (Ascorbic Acid Method)	mg/L	0.30	0.00
6	Total Calcium	APHA 9221B (Standard Total Calcium Determination Technique)	mg/L	1000	1.0
7	Oil and Grease	APHA 1550B (Petroleum-Gravimetric Method)	mg/L	< 1.1	1.1
8	Color	APHA 1510C (Spectrophotometric Method)	PCU	24.30	0.00
9	Copper	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	1	0
10	Mercury	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
11	Zinc	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
12	Lead	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
13	Chromium	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
14	Cadmium	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
15	Selenium	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
16	Vanadium	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
17	Cobalt	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
18	Strontium	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
19	Barium	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
20	Silver	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
21	Iron	APHA 3100 B (Inductively Coupled Plasma (ICP) Method)	mg/L	0.000	0.000
22	Chloride	HACH 8007 (Mercuric Nitrate Method)	mg/L	0.000	0.000
23	Ammonia	HACH Method 10000 (Nesslerization Method)	mg/L	0.000	0.000
24	Perchlorate (Chlorate) (100%)	HACH Method 10000 (Nesslerization Method)	mg/L	0.000	0.000
25	Fluoride	APHA 4500-F (Ion Chromatography Method)	mg/L	0.000	0.000
26	Total Chlorine	APHA 4500-Cl ₂ (DPD Colorimetric Method)	mg/L	0.0	0.1
27	Free Chlorine	APHA 4500-Cl ₂ (DPD Colorimetric Method)	mg/L	0.0	0.1
28	Sulfide	HACH 8007 (Mercuric Nitrate Method)	mg/L	0.000	0.000
29	Formaldehyde	HACH 8007 (Mercuric Nitrate Method)	mg/L	0.000	0.000
30	THM	APHA 2540C (Total Dissolved Solids (TDS) at 180°C)	mg/L	73.00	-
31	Phenol	APHA Method 10000 (Spectrophotometric Method)	mg/L	0.000	0.000

Notes : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Research Foundation (WERF). Standard Methods for the Examination of Water and Wastewater, 19th edition.

Analyst's Signature
To Be Signed
Assistant Supervisor

**LAB
GEM**

Approved By
Signature
Lab Manager



DOWA

GOLDEN DOWA (ECO-SYSTEM) MYANMAR CO., LTD.
Lot No. 02, Thilawa SEZ Zone A, Hanger Road, the Union of Myanmar
Tel: 09-2598811, 09-2598812

Report No. : GEM-LAB-201806205
Revision No. : 1
Report Date : 26 June, 2018
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koen International LTD (MKI)
Address : No.1A /2B, Mya Thidar Housing, Ward 11, South Okkalapa
Project Name : MJTD
Sample Description :
Sample Name : MKI-SW-E-0611
Sample No. : W-1806102
Waste Profile No. : -
Sampling Date : 11 June, 2018
Sampling By : Customer
Sample Received Date : 11 June, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540B (Dry at 103-105°C Method)	mg/l	228.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	3.81	0.00
3	COD (Cr)	APHA 5220C (Close Reflux, Colorimetric Method)	mg/l	13	0.3
4	Total Coliform	APHA 9221B (Standard Test Coliform Membrane Technique)	MPN/100ml	> 150000	1.8
5	Oil and Grease	APHA 5520B (Particulate-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

Analysed By :



Ni Ni Aye Lwin
Assistant supervisor



Approved By :



Kei Nagata
Senior Manager



DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.

Lot No. 11, Thilawa SEZ Zone B, Taper Region, No. 1001 of Myanmar
Tel: 09-2308033 / 09-24022149

Report No. : GEM-LAB-20180629B

Revision No. : 1

Report Date : 26 June, 2018

Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A/2E, Mya Thadar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description :
Sample Name : MKI-SW-9-0611
Sample No. : W-1806105
Waste Profile No. : -

Sampling Date : 11 June, 2018

Sampling By : Customer

Sample Received Date : 11 June, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	175.00	-
2	BOD (5)	APHA 5210 B (5-Days BOD Test)	mg/l	3.94	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	15	0.7
4	Total Coliform	APHA 8220B (Standard Plate Count/Enumeration Technique)	MPN/100ml	> 160000	1.0
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

Analysed By :



Ni Ni Aye Lwin
Assistant supervisor



Approved By :



Kei Nagata
Senior Manager

DOWA

GOLDEN DOWA ECU-SYSTEM MYANMAR CO., LTD.
Lot No. 11, Thilawa SEZ Zone B, Yangon Region, the Union of Myanmar
Tel: 09-2324651 / 09-7949712-23

Report No. : GEM-LAB-201806206
Revision No. : 1
Report Date : 26 June, 2018
Application No. : 0048-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-2-0611
Sample No. : W-1806103
Waste Profile No. : -
Sampling Date : 11 June, 2018
Sampling By : Customer
Sample Received Date : 11 June, 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	3.48	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	< 0.7	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Membrane Filter 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

Analysed By :



Ni Ni Aye Lwin
Assistant supervisor



Approved By :



Kei Nagata
Senior Manager



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



FOR DISCHARGING POINT

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.
Lot No. 01, Thilawa SEZ Zone B, Thilawa Region, Union of Myanmar
Tel: 09-2588551, 09-78412121

Report No. : GEM-LAB-201806153
Revision No. : 1
Report Date : 25 June, 2018
Application No. : 0049-C001

Analysis Report

Client Name : Hyattstar Hotel International LTD (HKI)
Address : No. 1A / 28, Nya Thidar Housing, Ward 11, South Okkalapa
Project Name : HKI
Sample Description :
Sample Name : HKI (Site 7-061)
Sample No. : W-1805090
Water Profile No. : -
Sampling Date : 11 June, 2018
Sampling By : Customer
Sample Received Date : 11 June, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 8221 F Escherichia Coli Procedure using Phosphoric Substrate	MPN/100ml	4.8	3.8

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 :

No. Ni Aye Lwin
Assistant supervisor



Approved By :

Ko Naing
Senior Manager



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

DOWA

SOLUTION DOWA JCS SYSTEM MYANMAR CO., LTD.
(Address: 11, Thawadda, 20th A, Thawadda, Thawadda, Thawadda)
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Report No. : GEM-LAB-201806190
Revision No. : 1
Report Date : 25 June, 2018
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Kasei International LTD (MYK)
Address : No. 1A/28, Mya Thida Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description :
Sample Name : MYK-SW-2-0512
Sample No. : W-1806087
Waste Profile No. : -
Sampling Date : 11 June, 2018
Sampling By : Customer
Sample Received Date : 11 June, 2018

No.	Parameter	Method	Unit	Result	LDQ
1	Escherichia Coli	APHA 8222 F Coliforms Coli Membrane Using Membrane Surrogate	MPN/100ML	3.8	1.8

Remarks : LDQ - 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 :

Ms. Aye Lynn
Assistant Supervisor



Approved By :

Mr. Negata
Senior Manager



DOWA

GOLDEN DOWA ECOSYSTEM MYANMAR CO., LTD.
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500112000011-00 Taper Nagar


Report No. : GEM-LAB-201806191
Revision No. : 1
Report Date : 25 June, 2018
Application No. : 0049-C001

Analysis Report

Client Name : Hyattstar Koen International LTD (MIS)
Address : No 1A /2B, Mya Thidar Housing, Ward 11, South Okkalapa
Project Name : MJTD
Sample Description :
Sample Name : HNO-SW-3-0011
Sample No. : W-1806008
Water Profile No. : --
Sampling Date : 11 June, 2018
Sampling By : Customer
Sample Received Date : 11 June, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221.7 Escherichia Coli Membrane Using Fluorogenic Substrate	MPN/100ml	1.8	1.8

Remark : (LR) : 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 :

To: Ni Aye Lwin
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Approved By :

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DOWA

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Report No. : GEM-LAB-201806192

Revision No. : 1

Report Date : 29 June, 2018

Appraisal No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thida Housing, Ward 11, South Okkalapa
Project Name : MJTD
Sample Description :
Sample Name : MKI-SW-4-0611
Sample No. : W-1800085
Waste Profile No. :
Sampling Date : 11 June, 2018
Sampling By : Customer
Sample Received Date : 11 June, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 + Escherichia Coli Membrane Integ. Fluorescent Substrate	MPN/100ml	< 1.0	1.0

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, 19th edition

Analysed By :



N. N. Aye Lwin
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**LAB
GEM**

Approved By :


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DOWA

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Report No. : GEM-LAB-201806195
Revision No. : 1
Report Date : 25 June, 2018
Application No. : D049-C001

Analysis Report

Client Name : Myanmar Eco-International LTD (MEI)
Address : No. 1A / 2B, Mya Thida Housing, Ward 11, South Okkalapa
Project Name : MJTD
Sample Description :
Sample Name : HQ-2W-2-001
Sample No. : W-1906092
Water Profile No. : -
Sampling Date : 11 June, 2018
Sampling By : Customer
Sample Received Date : 11 June, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure using Turbidity 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 :

N. N. Aye Lwin
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Approved By :

Ken Nagata
Senior Manager



DOWA

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Report No. : GEM-LAB-201806157
Revision No. : 1
Report Date : 25 June, 2018
Application No. : 0049-C001


Analysis Report

Client Name : Myanmar Kirel International LTD (MKI)
Address : No. 3A /28, Mya Thida Housing, Ward 11, South Okkalapa,
Project Name : MJTD
Sample Description :
Sample Name : HKI-SW-2-2811
Sample No. : W-1800094
Sample Profile No. : -

Sampling Date : 11 June, 2018
Sampling By : Customer
Sample Received Date : 11 June, 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, 20th edition

Analysed By :

Ni Ni Aye Lwin
Assistant Supervisor



Approved By :

Kei Nagata
Senior Manager



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

Appendix

Air Quality Monitoring Report

June 2018

**AIR QUALITY MONITORING
REPORT
FOR DEVELOPMENT OF INDUSTRIAL AREA
THILAWA SEZ ZONE B
(PHASE 1 & 2 CONSTRUCTION STAGE)**

(QUARTERLY MONITORING)

**June 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 4th June 2018 – 11th June 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 4 th June- 11 th June, 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, NO₂, PM_{2.5}, PM₁₀, and SO₂.

2.2 Monitoring Location

The air quality measurement equipment, "Haz-Scanner Environmental Perimeter Air Station (EPAS)" was set up at the south of the Thilawa SEZ Zone B, N: 16°39'24.20", E: 96°17'15.80", inside the monastery compound of Phalan village, surrounded by the residential houses of Phalan village in the south and fields in west, Thilawa SEZ Zone A in north, local Thilawa Industrial Zone in northeast, and construction of Thilawa SEZ Zone B in east and northeast respectively. The air quality monitoring is carried out above location where is near to the residential houses of Phalan village. Possible emission sources are dust emissions from construction activities and exhaust 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 4th June 2018 – 11th June, 2018.

2.4 Monitoring Method

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



Figure 2.4-1 Status of Air Quality Monitoring Point

2.5 Monitoring Results

The daily average value of air quality monitoring results of CO, NO₂, PM_{2.5}, PM₁₀, and SO₂ are described in Table 2.5-1. Comparing with the target value of CO, NO₂, PM_{2.5}, PM₁₀, and SO₂ prescribed in EIA report for Thilawa SEZ development project Zone B, concentration of CO, NO₂ and PM₁₀ were lower than the target value, while concentration of PM_{2.5} measured result for two days and concentration of SO₂ measured result for four days 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
4 ~ 5 Jun, 2018	0.062 (0.071 mg/m ³)	0.044 (0.082 mg/m ³)	0.032	0.022	0.011 (0.030 mg/m ³)
5 ~ 6 Jun, 2018	0.040 (0.045 mg/m ³)	0.042 (0.079 mg/m ³)	0.014	0.011	0.012 (0.030 mg/m ³)
6 ~ 7 Jun, 2018	0.039 (0.045 mg/m ³)	0.042 (0.078 mg/m ³)	0.012	0.013	0.009 (0.022 mg/m ³)
7 ~ 8 Jun, 2018	0.052 (0.060 mg/m ³)	0.044 (0.083 mg/m ³)	0.017	0.019	0.010 (0.026 mg/m ³)
8 ~ 9 Jun, 2018	0.063 (0.072 mg/m ³)	0.042 (0.080 mg/m ³)	0.027	0.031	0.008 (0.021 mg/m ³)
9 ~ 10 Jun, 2018	0.047 (0.054 mg/m ³)	0.047 (0.089 mg/m ³)	0.018	0.036	0.006 (0.017 mg/m ³)
10 ~ 11 Jun, 2018	0.051 (0.058 mg/m ³)	0.047 (0.089 mg/m ³)	0.017	0.038	0.006 (0.015 mg/m ³)
7 Days Average Value	0.051 (0.058 mg/m ³)	0.044 (0.083 mg/m ³)	0.020	0.024	0.009 (0.023 mg/m ³)
Target Value	9.000 (10.26 mg/m ³) ^{a)}	0.050 (0.1 mg/m ³) ^{a)}	0.025	0.050	0.008 (0.02 mg/m ³) ^{a)}

Note: The target value of CO, NO₂ and SO₂ were converted to ppm units from mg/m³. Red color mentions the exceeded value for NO₂ and PM_{2.5}.

Construction activities of Thilawa SEZ Zone B are described in Table 2.5-2. PM_{2.5} result and SO₂ result during construction period are described in Table 2.5-3 and Table 2.5-4. During construction period, 7 days average value for PM_{2.5} was exceeded the target value and two days (Day 1 and Day 5) daily average results were also exceeded the target value. During construction period, 7 days average value for SO₂ was equal the target value and three days (Day 1, Day 2 and Day 4) daily average results were also exceeded the target value.

Table 2.5-2 Construction Activities of Thilawa SEZ Zone B

Date	Time	Type	Construction Activities
4 th June 2018	8:30-20:00	Excavator, Skat, Water Bowser, Crane	Road 6b, 2a soft soil removing work Road 8 tenant area levelling work Road 1 crushing stone laying work Crushing stone delivery and general use
5 th June 2018	8:00-20:00	Excavator, Skat, Dump Truck, Water Bowser, Crane	Zone A water pipe line soil removing work Box culverts soft soil removing work Access road repair work Crushing stone removing work Crushing stone delivery and general use Material delivery
6 th June 2018	8:00-20:00	Excavator, Skat, Roller Compactor, Water Bowser, Dump Truck	Zone A water pipe line soil removing work Box culverts soft soil removing work Access road repair work Crushing stone removing work Crushing stone delivery and general use Road-1 crushing stone laying and compaction work Material delivery
7 th June 2018	8:00-17:30	Excavator, Skat, Roller Compactor, Crane, Wheel Loader	Road 7,9,10,13,14 soil filling, dressing OBC 34.4 and RBC 34.2 backfilling work Water pipe backfilling work, general use Road 7,9,10,13,14 compaction work
8 th June 2018	8:00 – 17:30	Excavator, Skat, Crane, Water Bowser	Water pipe backfilling work Road 6,8 walkway repairing work and general use
9 th June 2018	9:00 – 17:00	Excavator, Skat, Crane, Water Bowser	Road 1,6,9 backfilling work, RBC 25.1 slope trimming work, RBC 34.2 soft soil removal and general use
10 th June 2018	9:00 – 17:00	Excavator, Skat, Crane, Water Bowser	Road 4b backfilling, Road 11 level dressing works and general use
11 th June 2018	8:10 – 18:00	Excavator, Skat, Dump Truck, Crane	RBC 25 excavation and slope trimming work, Road 5,12 level dressing work, general use GI pipe delivery from RBC 25 to phase -2 area

Table 2.5-3 PM_{2.5} Results (During Construction Period)

Day	Construction Time for each day	PM _{2.5}
		mg/m ³
Day 1	8:30 - 20:00	0.037
Day 2	8:00 - 20:00	0.020
Day 3	8:00 - 20:00	0.014
Day 4	8:00 - 17:30	0.023
Day 5	8:00 - 17:30	0.048
Day 6	9:00 - 17:00	0.024
Day 7	9:00 - 17:00	0.017
7 days Average value	-	0.026
Target Value	-	0.025

Note: Red color mentions the exceeded value than target value

Table 2.5-4 SO₂ Results (During Construction Period)

Day	Construction Time for each day	SO ₂
		ppm
Day 1	8:30 - 20:00	0.011
Day 2	8:00 - 20:00	0.011
Day 3	8:00 - 20:00	0.006
Day 4	8:00 - 17:30	0.011
Day 5	8:00 - 17:30	0.006
Day 6	9:00 - 17:00	0.008
Day 7	9:00 - 17:00	0.004
7 days Average value	-	0.008
Target Value	-	0.008

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 Day 1 to Day 7 during construction and non-construction time for $PM_{2.5}$ and SO_2 are shown in Table 2.5-5 and Table 2.5-6. 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 31 hours but exceeded hours for construction time was 20 hours. After detailed analyzed the $PM_{2.5}$ 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 natural origin such as dust from unpaved vacant area and transportation in and around the monitoring area.

Based on the summary table of total exceeded hours for SO_2 the total exceeded hours for seven days during construction and non-construction were 77 hours but exceeded hours for construction time was 27 hours. After detailed analyzed the SO_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 the combustion of fuel for vehicles from nearby roads.

Table 2.5-5 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	8:30 - 20:00	11	4	7	0	7	0	4
Day-2	8:00 - 20:00	4	4	0	0	0	0	4
Day-3	8:00 - 20:00	0	0	0	0	0	0	0
Day-4	8:00 - 17:30	2	2	0	0	0	0	2
Day-5	8:00 - 17:30	4	4	0	0	0	0	4
Day-6	9:00 - 17:00	5	4	1	0	1	0	4
Day-7	9:00 - 17:00	5	2	3	0	3	0	2
Total		31	20	11	0	11	0	20

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 SO₂

SO 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	8:30 - 20:00	12	6	6	0	6	0	6
Day-2	8:00 - 20:00	16	7	9	0	9	0	7
Day-3	8:00 - 20:00	12	4	8	0	8	0	4
Day-4	8:00 - 17:30	10	3	7	0	7	0	3
Day-5	8:00 - 17:30	12	2	10	0	10	0	2
Day-6	9:00 - 17:00	8	4	4	0	4	0	4
Day-7	9:00 - 17:00	7	1	6	0	6	0	1
Total		77	27	50	0	50	0	27

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, NO₂ and PM₁₀ 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 PM_{2.5} measured result for two days and concentration of SO₂ measured result for four days were exceeded than the target value. In addition, SO₂ level measured for seven days consecutive measurement in this monitoring period are higher than the target value.

During the seven days monitoring period, 31 hours results were exceeded for PM_{2.5}. According to wind direction of Zone B during the construction period, 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 natural origin such as dust from unpaved vacant area 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.

During the seven days monitoring period, 77 hours results were exceeded for SO₂. According to wind direction of Zone B during the construction period, 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 the combustion of fuel for vehicles from nearby roads. In the public health statement SO₂ reported by ATSDR (Agency for Toxic Substances and Disease Registry) in US, 100 ppm (261.8 mg/m³) SO₂ is considered immediately dangerous to life and health (short term). Lung function changes observed when 0.4 to 3 ppm (1.05mg/m³ to 7.85 mg/m³) exposure for 20 years or more (long term). Therefore, the significant impact on SO₂ contamination was not expected.

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 (25 km/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 _x	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
04 Jun, 2018	10:00 ~ 10:59	0.015	0.066	0.042	0.057	0.001	0.57	139	SE
04 Jun, 2018	11:00 ~ 11:59	0.253	0.070	0.007	0.006	0.018	1.07	148	SSE
04 Jun, 2018	12:00 ~ 12:59	0.044	0.033	0.020	0.013	0.003	1.15	171	S
04 Jun, 2018	13:00 ~ 13:59	0.014	0.046	0.020	0.007	0.006	1.43	142	SE
04 Jun, 2018	14:00 ~ 14:59	0.050	0.052	0.015	0.006	0.012	1.67	159	SSE
04 Jun, 2018	15:00 ~ 15:59	0.081	0.045	0.010	0.002	0.025	1.50	154	SSE
04 Jun, 2018	16:00 ~ 16:59	0.104	0.038	0.023	0.022	0.017	1.58	154	SSE
04 Jun, 2018	17:00 ~ 17:59	0.320	0.037	0.067	0.070	0.027	1.43	177	S
04 Jun, 2018	18:00 ~ 18:59	0.183	0.044	0.098	0.059	0.017	0.68	169	SSE
04 Jun, 2018	19:00 ~ 19:59	0.051	0.043	0.099	0.062	0.005	0.75	157	SSE
04 Jun, 2018	20:00 ~ 20:59	0.002	0.036	0.085	0.049	0.011	0.80	147	SSE
04 Jun, 2018	21:00 ~ 21:59	0.024	0.040	0.052	0.011	0.008	0.55	195	SSW
04 Jun, 2018	22:00 ~ 22:59	0.013	0.044	0.035	0.011	0.006	0.42	190	S
04 Jun, 2018	23:00 ~ 23:59	0.017	0.040	0.031	0.015	0.009	0.33	137	SE
05 Jun, 2018	0:00 ~ 0:59	0.076	0.030	0.028	0.021	0.025	0.58	143	SE
05 Jun, 2018	1:00 ~ 1:59	0.116	0.035	0.025	0.020	0.028	0.38	132	SE
05 Jun, 2018	2:00 ~ 2:59	0.017	0.028	0.026	0.018	0.017	0.33	197	SSW
05 Jun, 2018	3:00 ~ 3:59	0.000	0.037	0.018	0.009	0.017	0.20	170	S
05 Jun, 2018	4:00 ~ 4:59	0.000	0.043	0.012	0.009	0.008	0.05	195	SSW
05 Jun, 2018	5:00 ~ 5:59	0.003	0.037	0.009	0.013	0.003	0.33	76	ENE
05 Jun, 2018	6:00 ~ 6:59	0.011	0.061	0.005	0.010	0.003	0.27	81	E
05 Jun, 2018	7:00 ~ 7:59	0.010	0.039	0.002	0.003	0.002	0.97	132	SE
05 Jun, 2018	8:00 ~ 8:59	0.008	0.039	0.004	0.010	0.001	1.52	127	SE
05 Jun, 2018	9:00 ~ 9:59	0.079	0.061	0.037	0.019	0.003	1.92	125	SE

Max	0.320 (0.367 mg/m ³)	0.070 (0.133 mg/m ³)	0.099	0.070	0.028 (0.074 mg/m ³)
Avg	0.062 (0.071 mg/m ³)	0.044 (0.082 mg/m ³)	0.032	0.022	0.011 (0.030 mg/m ³)
Min	0.000 (0.000 mg/m ³)	0.028 (0.053 mg/m ³)	0.002	0.002	0.001 (0.002 mg/m ³)



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
05 Jun, 2018	10:00 ~ 10:59	0.105	0.049	0.045	0.024	0.005	1.88	113	ESE
05 Jun, 2018	11:00 ~ 11:59	0.074	0.051	0.034	0.018	0.006	1.88	120	ESE
05 Jun, 2018	12:00 ~ 12:59	0.075	0.048	0.014	0.007	0.008	2.02	139	SE
05 Jun, 2018	13:00 ~ 13:59	0.067	0.049	0.012	0.003	0.017	1.72	148	SSE
05 Jun, 2018	14:00 ~ 14:59	0.084	0.036	0.007	0.008	0.016	1.45	135	SE
05 Jun, 2018	15:00 ~ 15:59	0.030	0.049	0.006	0.009	0.012	1.95	149	SSE
05 Jun, 2018	16:00 ~ 16:59	0.071	0.046	0.007	0.014	0.019	1.43	162	SSE
05 Jun, 2018	17:00 ~ 17:59	0.078	0.035	0.026	0.032	0.020	1.17	187	S
05 Jun, 2018	18:00 ~ 18:59	0.011	0.031	0.024	0.017	0.016	0.98	183	S
05 Jun, 2018	19:00 ~ 19:59	0.007	0.040	0.013	0.001	0.014	0.95	187	S
05 Jun, 2018	20:00 ~ 20:59	0.020	0.047	0.011	0.004	0.014	0.82	181	S
05 Jun, 2018	21:00 ~ 21:59	0.018	0.045	0.010	0.008	0.013	0.50	186	S
05 Jun, 2018	22:00 ~ 22:59	0.007	0.042	0.012	0.007	0.019	0.42	185	S
05 Jun, 2018	23:00 ~ 23:59	0.026	0.045	0.012	0.010	0.020	0.25	202	SSW
06 Jun, 2018	0:00 ~ 0:59	0.021	0.031	0.013	0.007	0.016	0.25	241	WSW
06 Jun, 2018	1:00 ~ 1:59	0.043	0.043	0.016	0.009	0.019	1.67	252	WSW
06 Jun, 2018	2:00 ~ 2:59	0.032	0.036	0.013	0.010	0.013	0.38	232	SW
06 Jun, 2018	3:00 ~ 3:59	0.000	0.042	0.006	0.004	0.009	0.78	251	WSW
06 Jun, 2018	4:00 ~ 4:59	0.000	0.038	0.003	0.004	0.006	0.60	234	SW
06 Jun, 2018	5:00 ~ 5:59	0.001	0.031	0.005	0.006	0.002	0.30	230	SW
06 Jun, 2018	6:00 ~ 6:59	0.002	0.039	0.003	0.005	0.001	0.18	186	S
06 Jun, 2018	7:00 ~ 7:59	0.004	0.040	0.006	0.013	0.010	0.17	125	SE
06 Jun, 2018	8:00 ~ 8:59	0.102	0.046	0.028	0.021	0.002	0.53	114	ESE
06 Jun, 2018	9:00 ~ 9:59	0.070	0.047	0.020	0.019	0.001	0.72	92	E

Max	0.105 (0.120 mg/m ³)	0.051 (0.095 mg/m ³)	0.045	0.032	0.020 (0.053 mg/m ³)
Avg	0.040 (0.045 mg/m ³)	0.042 (0.079 mg/m ³)	0.014	0.011	0.012 (0.030 mg/m ³)
Min	0.000 (0.000 mg/m ³)	0.031 (0.058 mg/m ³)	0.003	0.001	0.0005 (0.001 mg/m ³)



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
06 Jun, 2018	10:00 ~ 10:59	0.023	0.043	0.023	0.020	0.001	1.12	159	SSE
06 Jun, 2018	11:00 ~ 11:59	0.056	0.046	0.025	0.018	0.001	1.33	158	SSE
06 Jun, 2018	12:00 ~ 12:59	0.093	0.047	0.025	0.017	0.006	1.47	139	SE
06 Jun, 2018	13:00 ~ 13:59	0.068	0.055	0.015	0.007	0.008	1.63	139	SE
06 Jun, 2018	14:00 ~ 14:59	0.066	0.051	0.008	0.006	0.006	1.68	140	SE
06 Jun, 2018	15:00 ~ 15:59	0.055	0.040	0.003	0.002	0.011	1.60	161	SSE
06 Jun, 2018	16:00 ~ 16:59	0.026	0.047	0.003	0.004	0.002	1.12	154	SSE
06 Jun, 2018	17:00 ~ 17:59	0.029	0.027	0.008	0.015	0.009	1.23	163	SSE
06 Jun, 2018	18:00 ~ 18:59	0.045	0.037	0.013	0.012	0.007	1.12	181	S
06 Jun, 2018	19:00 ~ 19:59	0.069	0.045	0.015	0.016	0.009	1.18	204	SSW
06 Jun, 2018	20:00 ~ 20:59	0.040	0.043	0.015	0.018	0.015	0.82	237	WSW
06 Jun, 2018	21:00 ~ 21:59	0.027	0.052	0.016	0.018	0.014	0.88	255	WSW
06 Jun, 2018	22:00 ~ 22:59	0.040	0.049	0.015	0.017	0.017	1.55	257	WSW
06 Jun, 2018	23:00 ~ 23:59	0.028	0.039	0.013	0.017	0.021	1.55	246	WSW
07 Jun, 2018	0:00 ~ 0:59	0.028	0.038	0.013	0.025	0.016	1.77	248	WSW
07 Jun, 2018	1:00 ~ 1:59	0.093	0.040	0.015	0.024	0.010	1.68	249	WSW
07 Jun, 2018	2:00 ~ 2:59	0.037	0.038	0.009	0.017	0.012	0.35	249	WSW
07 Jun, 2018	3:00 ~ 3:59	0.001	0.025	0.004	0.002	0.003	0.05	225	SW
07 Jun, 2018	4:00 ~ 4:59	0.001	0.034	0.002	0.003	0.008	0.02	207	SSW
07 Jun, 2018	5:00 ~ 5:59	0.000	0.034	0.005	0.006	0.003	0.53	239	WSW
07 Jun, 2018	6:00 ~ 6:59	0.000	0.046	0.003	0.008	0.011	1.03	245	WSW
07 Jun, 2018	7:00 ~ 7:59	0.002	0.053	0.019	0.014	0.001	0.30	229	SW
07 Jun, 2018	8:00 ~ 8:59	0.075	0.044	0.021	0.023	0.010	1.57	238	WSW
07 Jun, 2018	9:00 ~ 9:59	0.043	0.044	0.005	0.012	0.006	1.18	249	WSW

Max	0.093 (0.107 mg/m ³)	0.055 (0.103 mg/m ³)	0.025	0.025	0.021 (0.055 mg/m ³)
Avg	0.039 (0.045 mg/m ³)	0.042 (0.080 mg/m ³)	0.012	0.013	0.009 (0.022 mg/m ³)
Min	0.000 (0.000 mg/m ³)	0.025 (0.047 mg/m ³)	0.002	0.002	0.001 (0.002 mg/m ³)



Date	Time	CO	NO ₂	PM ₁₀	PM _{2.5}	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
09 Jun, 2018	10:00 ~ 10:59	0.063	0.043	0.032	0.063	0.001	1.57	173	S
09 Jun, 2018	11:00 ~ 11:59	0.084	0.043	0.031	0.040	0.010	1.28	180	S
09 Jun, 2018	12:00 ~ 12:59	0.069	0.050	0.024	0.026	0.005	1.40	163	SSE
09 Jun, 2018	13:00 ~ 13:59	0.163	0.053	0.018	0.033	0.020	1.43	210	SSW
09 Jun, 2018	14:00 ~ 14:59	0.029	0.050	0.014	0.017	0.004	1.87	252	WSW
09 Jun, 2018	15:00 ~ 15:59	0.079	0.050	0.004	0.015	0.009	1.97	255	WSW
09 Jun, 2018	16:00 ~ 16:59	0.192	0.046	0.038	0.067	0.013	2.13	247	WSW
09 Jun, 2018	17:00 ~ 17:59	0.033	0.047	0.033	0.020	0.006	1.73	253	WSW
09 Jun, 2018	18:00 ~ 18:59	0.058	0.046	0.018	0.019	0.009	2.15	256	WSW
09 Jun, 2018	19:00 ~ 19:59	0.040	0.048	0.019	0.015	0.008	3.33	257	WSW
09 Jun, 2018	20:00 ~ 20:59	0.022	0.047	0.019	0.018	0.005	0.72	260	W
09 Jun, 2018	21:00 ~ 21:59	0.058	0.047	0.023	0.029	0.012	0.03	269	W
09 Jun, 2018	22:00 ~ 22:59	0.047	0.048	0.023	0.029	0.009	0.02	175	S
09 Jun, 2018	23:00 ~ 23:59	0.012	0.049	0.014	0.019	0.007	0.15	102	ESE
10 Jun, 2018	0:00 ~ 0:59	0.015	0.046	0.015	0.025	0.013	0.83	125	SE
10 Jun, 2018	1:00 ~ 1:59	0.034	0.044	0.013	0.023	0.006	0.65	121	ESE
10 Jun, 2018	2:00 ~ 2:59	0.001	0.043	0.011	0.023	0.008	0.27	93	E
10 Jun, 2018	3:00 ~ 3:59	0.000	0.041	0.005	0.017	0.003	0.52	134	SE
10 Jun, 2018	4:00 ~ 4:59	0.004	0.039	0.003	0.015	0.001	0.85	163	SSE
10 Jun, 2018	5:00 ~ 5:59	0.007	0.044	0.003	0.064	0.001	1.13	245	WSW
10 Jun, 2018	6:00 ~ 6:59	0.009	0.051	0.011	0.064	0.004	1.32	253	WSW
10 Jun, 2018	7:00 ~ 7:59	0.000	0.051	0.004	0.014	0.000	0.78	226	SW
10 Jun, 2018	8:00 ~ 8:59	0.036	0.056	0.017	0.087	0.001	0.98	198	SSW
10 Jun, 2018	9:00 ~ 9:59	0.081	0.054	0.029	0.130	0.000	1.37	220	SW

Max	0.192 (0.220 mg/m ³)	0.056 (0.105 mg/m ³)	0.038	0.130	0.020 (0.052 mg/m ³)
Avg	0.047 (0.054 mg/m ³)	0.047 (0.089 mg/m ³)	0.018	0.036	0.006 (0.017 mg/m ³)
Min	0.000 (0.000 mg/m ³)	0.039 (0.073 mg/m ³)	0.003	0.014	0.000 (0.000 mg/m ³)



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
10 Jun, 2018	10:00 ~ 10:59	0.076	0.051	0.037	0.051	0.000	1.67	227	SW
10 Jun, 2018	11:00 ~ 11:59	0.030	0.043	0.006	0.028	0.001	2.20	256	WSW
10 Jun, 2018	12:00 ~ 12:59	0.124	0.051	0.024	0.043	0.000	2.15	254	WSW
10 Jun, 2018	13:00 ~ 13:59	0.165	0.054	0.017	0.046	0.005	2.00	244	WSW
10 Jun, 2018	14:00 ~ 14:59	0.067	0.052	0.011	0.021	0.001	2.57	246	WSW
10 Jun, 2018	15:00 ~ 15:59	0.037	0.046	0.008	0.025	0.008	2.92	252	WSW
10 Jun, 2018	16:00 ~ 16:59	0.034	0.049	0.007	0.017	0.009	2.03	250	WSW
10 Jun, 2018	17:00 ~ 17:59	0.045	0.045	0.013	0.024	0.006	0.93	226	SW
10 Jun, 2018	18:00 ~ 18:59	0.082	0.045	0.023	0.034	0.009	2.37	237	WSW
10 Jun, 2018	19:00 ~ 19:59	0.105	0.042	0.034	0.044	0.018	0.95	250	WSW
10 Jun, 2018	20:00 ~ 20:59	0.061	0.044	0.038	0.039	0.014	2.00	256	WSW
10 Jun, 2018	21:00 ~ 21:59	0.032	0.046	0.034	0.031	0.005	1.50	215	SW
10 Jun, 2018	22:00 ~ 22:59	0.007	0.048	0.023	0.031	0.008	0.63	211	SSW
10 Jun, 2018	23:00 ~ 23:59	0.045	0.055	0.024	0.043	0.010	0.88	214	SSW
11 Jun, 2018	0:00 ~ 0:59	0.005	0.051	0.020	0.031	0.003	1.00	209	SSW
11 Jun, 2018	1:00 ~ 1:59	0.035	0.050	0.016	0.028	0.010	1.12	194	SSW
11 Jun, 2018	2:00 ~ 2:59	0.117	0.036	0.013	0.064	0.010	1.48	228	SW
11 Jun, 2018	3:00 ~ 3:59	0.000	0.039	0.008	0.019	0.004	1.57	257	WSW
11 Jun, 2018	4:00 ~ 4:59	0.000	0.047	0.004	0.014	0.001	1.77	244	WSW
11 Jun, 2018	5:00 ~ 5:59	0.001	0.036	0.004	0.037	0.001	1.52	242	WSW
11 Jun, 2018	6:00 ~ 6:59	0.006	0.049	0.003	0.017	0.005	1.55	259	W
11 Jun, 2018	7:00 ~ 7:59	0.044	0.051	0.004	0.055	0.005	2.05	251	WSW
11 Jun, 2018	8:00 ~ 8:59	0.075	0.057	0.012	0.126	0.007	1.70	253	WSW
11 Jun, 2018	9:00 ~ 9:59	0.027	0.050	0.034	0.047	0.000	2.07	255	WSW

Max	0.165 (0.189 mg/m ³)	0.057 (0.106 mg/m ³)	0.038	0.126	0.018 (0.047 mg/m ³)
Avg	0.051 (0.058 mg/m ³)	0.047 (0.089 mg/m ³)	0.017	0.038	0.006 (0.015 mg/m ³)
Min	0.000 (0.000 mg/m ³)	0.036 (0.067 mg/m ³)	0.003	0.014	0.000 (0.000 mg/m ³)

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

Appendix

Noise and Vibration Monitoring Report

June 2018

**NOISE AND VIBRATION
MONITORING REPORT
FOR DEVELOPMENT OF INDUSTRIAL AREA
THILAWA SEZ ZONE B
(PHASE 1 & 2 CONSTRUCTION STAGE)**

(QUARTERLY MONITORING)

June 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, noise and vibration levels had been monitored from 4th June 2018 – 6th June 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 4 th June – 5 th June, 2018	Noise Level	$L_{Aeq}(dB)$	1 (NV-2)	24 hours	On-site measurement by "Rion NL-42 sound level meter"
From 5 th June – 6 th June, 2018	Noise Level	$L_{Aeq}(dB)$	1 (NV-1)	24 hours	On-site measurement by "Rion NL-42 sound level meter"
From 4 th June – 5 th June, 2018	Vibration Level	$L_{v10}(dB)$	1 (NV-2)	24 hours	On-site measurement by "Vibration Level Meter- VM-53A"
From 5 th June – 6 th June, 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 ($L_{v(10)}$)

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, monitoring 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_w , 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.

Although all results were under the target value, at NV-2 hourly noise levels from 4:00 AM to 7:00 AM are exceeded 55 dB. There were no construction activities in Zone B in night time (from 10:00 PM to 7:00 AM). In addition, the noise sources other than crowing of rooster and birds and motorcycles in surrounding village were not confirmed. Therefore, the result in early morning (4:00 AM to 7:00 AM) at NV-2 was exceeded the target value due to sound from crowing of rooster, crowing of birds, passing of motorcycles and motorcycles horn, etc. in surrounding village.

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)
5 th June – 6 th June, 2018	58	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)
4 th June– 5 th June, 2018	58	55	55
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
5 th June- 6 th June 2018	6:00-7:00	61	58	75	No Construction Activity
	7:00-8:00	59			Soil removing work, Box culverts soft soil removing work Access road repair work Crushing stone removing work Road-1 crushing stone laying and Compaction work
	8:00-9:00	58			
	9:00-10:00	59			
	10:00-11:00	58			
	11:00-12:00	57			
	12:00-13:00	59			
	13:00-14:00	58			
	14:00-15:00	59			
	15:00-16:00	59			
	16:00-17:00	60			
	17:00-18:00	59			
	18:00-19:00	57			
	19:00-20:00	55			
	20:00-21:00	55			
	21:00-22:00	56	52	70	No Construction Activity
	22:00-23:00	53			
	23:00-24:00	52			
	24:00-1:00	51			
	1:00-2:00	54			
	2:00-3:00	52			
	3:00-4:00	48			
	4:00-5:00	49			
	5:00-6:00	56			

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
4 th June – 5 th June 2018	7:00-8:00	58	58	75	No Construction Activity
	8:00-9:00	59			Road 6b, 2a soft soil removing work Road 8 tenant area levelling work Road 1 crushing stone laying work Soil removing work Box culverts soft soil removing work, Access road repair work Crushing stone removing work
	9:00-10:00	58			
	10:00-11:00	57			
	11:00-12:00	59			
	12:00-13:00	58			
	13:00-14:00	59			
	14:00-15:00	59			
	15:00-16:00	60			
	16:00-17:00	59			
	17:00-18:00	57			
	18:00-19:00	55			
	19:00-20:00	55	55	60	
	20:00-21:00	56			
	21:00-22:00	53	55	55	No Construction Activity
	22:00-23:00	52			
	23:00-24:00	51			
	24:00-1:00	54			
	1:00-2:00	52			
	2:00-3:00	48			
	3:00-4:00	49			
	4:00-5:00	56			
	5:00-6:00	61			
	6:00-7:00	59			

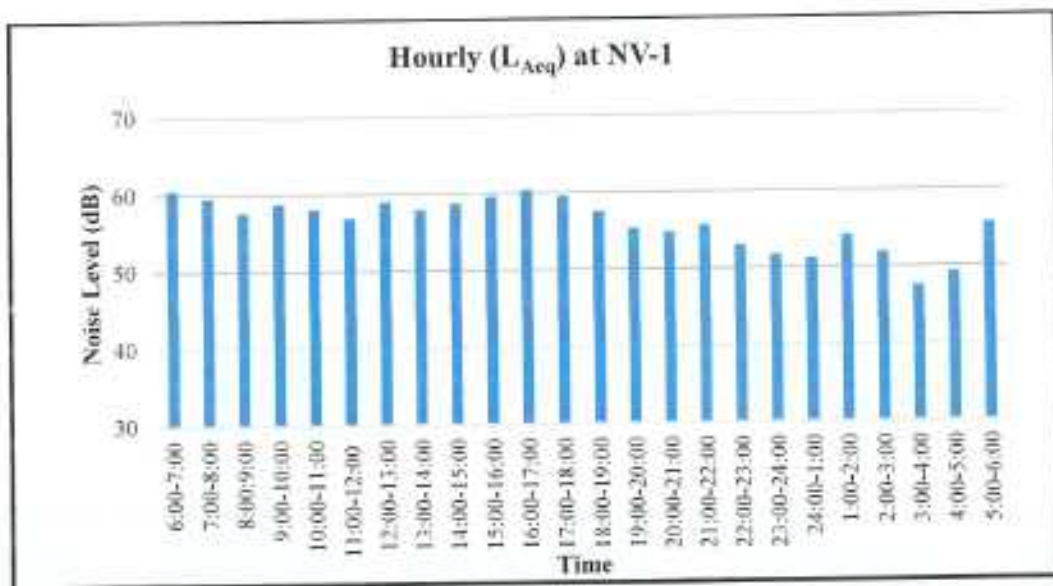


Figure 2.4-1 Results of Noise Levels (L_{Aeq}) Monitoring at NV-1

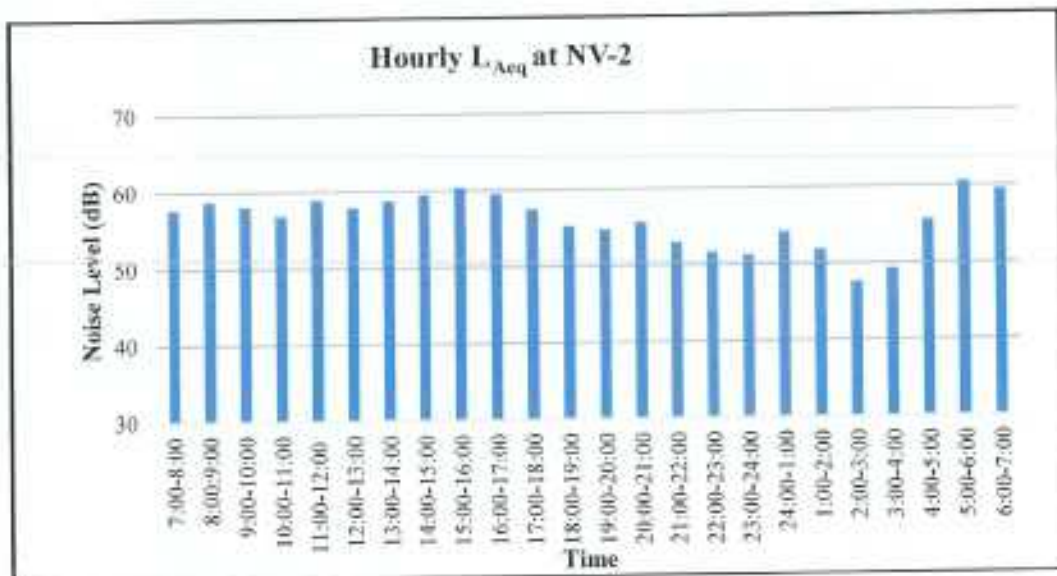


Figure 2.4-2 Results of Noise Levels (L_{Aeq}) Monitoring at NV-2

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	5 th – 6 th June, 2018	42	34	35
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	4 th – 5 th June, 2018	24	17	14
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	5 th – 6 th June 2018	(L _{v10} , dB) Each Category	(L _{v10} , dB) Target Value	Remark	
Time	L _{v10} (NV-1)				
7:00-8:00	43	42	70	No Construction Activity	
8:00-9:00	44			Soil removing work, Box culverts soft soil removing work Access road repair work Crushing stone removing work Road-1 crushing stone laying and Compaction work	
9:00-10:00	41				
10:00-11:00	38				
11:00-12:00	39				
12:00-13:00	41				
13:00-14:00	41				
14:00-15:00	43				
15:00-16:00	47				
16:00-17:00	41				
17:00-18:00	38				
18:00-19:00	40				
19:00-20:00	34	34	70	No Construction Activity	
20:00-21:00	36				
21:00-22:00	30				
22:00-23:00	25				
23:00-24:00	28				
24:00-1:00	21				
1:00-2:00	21				
2:00-3:00	26				
3:00-4:00	26	35	65		
4:00-5:00	37				
5:00-6:00	40				
6:00-7:00	41				

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

Date	4 th - 5 th June 2018	(L _{v10} , dB) Each Category	(L _{v10} , dB) Target Value	Remark
Time	L _{v10} (NV-2)			
7:00-8:00	18	24	65	No Construction Activity
8:00-9:00	22			Road 6b, 2a soft soil removing work Road 8 tenant area levelling work Road 1 crushing stone laying work Soil removing work Box culverts soft soil removing work, Access road repair work Crushing stone removing work
9:00-10:00	24			
10:00-11:00	18			
11:00-12:00	18			
12:00-13:00	18			
13:00-14:00	19			
14:00-15:00	21			
15:00-16:00	21			
16:00-17:00	22			
17:00-18:00	29			
18:00-19:00	29			
19:00-20:00	18	17	65	No Construction Activity
20:00-21:00	16			
21:00-22:00	17			
22:00-23:00	15	14	60	
23:00-24:00	14			
24:00-1:00	17			
1:00-2:00	13			
2:00-3:00	13			
3:00-4:00	13			
4:00-5:00	13			
5:00-6:00	14			
6:00-7:00	16			



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

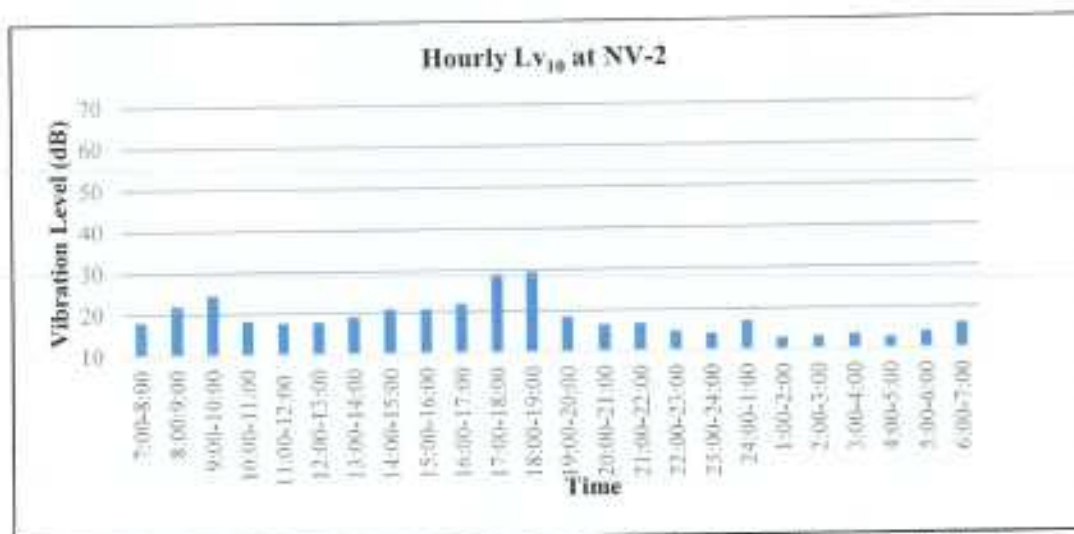


Figure 2.4-4 Results of Vibration Levels (L_{v10}) Monitoring at NV-2

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. Although all results were under the target value, at NV-2 hourly noise levels from 4:00 AM to 7:00 AM are exceeded 55 dB. There were no construction activities in Zone B in night time (from 10:00 PM to 7:00 AM). In addition, the noise sources other than crowing of rooster and birds and motorcycles in surrounding village were not confirmed. Therefore, the result in early morning (4:00 AM to 7:00 AM) at NV-2 was exceeded the target value due to sound from crowing of rooster, crowing of birds, passing of motorcycles and motorcycles horn, etc. in surrounding village. 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

Traffic Volume Monitoring Report

June 2018

**TRAFFIC VOLUME MONITORING REPORT
FOR DEVELOPMENT OF INDUSTRIAL AREA
THILAWA SEZ ZONE B
(PHASE 1 & 2 CONSTRUCTION STAGE)**

(QUARTERLY MONITORING)

June 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 5th June 2018 to 6th June 2018 as follows;

Table 1.2-1 Outlines of Traffic Volume Monitoring

Monitoring Date	Monitoring Item	Parameters	Number of Points	Duration	Monitoring Methodology
5 th June 2018 - 6 th June 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	5 th June 2018 – 6 th June 2018	Tuesday and Wednesday	2253	847	323	54	3,477
	Dagon-Thilawa road to Phalan village			2048	799	322	52	3,221

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 18:00, traffic volume from Phalan village to Dagon-Thilawa road is higher than another direction in the morning peak hours. In the evening peak hours, traffic volume from Dagon-Thilawa road to Phalan village is higher than another direction. It may be possible commuting vehicles are passing from Phalan village to Dagon-Thilawa road in the morning peak hours and returning from Dagon-Thilawa road to Phalan village in the evening peak hours in this monitoring period.

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

From	To	Classification				Total
		Type of vehicles				
		Two-wheeled vehicle	Four-wheeled light vehicle	Four-wheeled heavy vehicle	Others	
12:00	13:00	145	71	19	5	240
13:00	14:00	100	54	24	2	180
14:00	15:00	90	67	24	7	188
15:00	16:00	115	72	27	8	222
16:00	17:00	114	30	22	1	167
17:00	18:00	168	59	25	1	252
18:00	19:00	178	63	30	2	273
19:00	20:00	132	48	16	4	199
20:00	21:00	70	28	14	1	113
21:00	22:00	21	7	7	2	37
22:00	23:00	8	6	11	0	25
23:00	00:00	11	4	2	0	17
00:00	1:00	10	2	2	0	14
1:00	2:00	6	1	0	0	7
2:00	3:00	1	0	1	0	2
3:00	4:00	4	4	1	0	9
4:00	5:00	9	2	0	0	11
5:00	6:00	25	9	2	0	34
6:00	7:00	142	30	9	0	181
7:00	8:00	396	62	14	5	477
8:00	9:00	557	41	16	5	619
9:00	10:00	139	49	17	2	207
10:00	11:00	117	54	23	5	199
11:00	12:00	117	65	17	4	203
Total		2253	847	323	54	3477

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	87	61	17	1	166
13:00	14:00	103	81	20	3	207
14:00	15:00	81	57	20	5	163
15:00	16:00	86	76	23	2	181
16:00	17:00	155	49	42	6	252
17:00	18:00	255	57	26	5	323
18:00	19:00	122	43	30	4	199
19:00	20:00	93	24	11	0	128
20:00	21:00	82	29	13	0	124
21:00	22:00	16	5	4	1	26
22:00	23:00	27	3	8	0	38
23:00	00:00	8	4	0	0	12
00:00	1:00	7	3	1	0	11
1:00	2:00	8	3	4	0	15
2:00	3:00	1	0	0	0	1
3:00	4:00	5	2	1	0	8
4:00	5:00	14	4	4	0	22
5:00	6:00	28	6	0	0	34
6:00	7:00	56	19	8	4	85
7:00	8:00	304	80	20	5	409
8:00	9:00	239	52	21	7	319
9:00	10:00	105	40	14	3	162
10:00	11:00	78	47	22	5	152
11:00	12:00	112	60	15	1	188
Total		2048	599	322	52	3221

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 June 2018 is slightly higher than other quarterly monitoring surveys from Phalan village to Dagon Thilawa Road. However, traffic volume results from Dagon Thilawa Road to Phalan village June 2018 is lower than March 2018.

**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	29 th Mar-30 th Mar 2017	Wednesday & Thursday	1,712	545	216	29	2,502
		22 nd June-23 rd June 2017	Thursday & Friday	1,402	528	352	47	2,329
		19 th September-20 th September 2017	Tuesday & Wednesday	1,254	509	393	17	2,173
		7 th December-8 th December 2017	Thursday & Friday	1,800	652	339	43	2,834
		15 th March 2018 – 16 th March 2018	Thursday and Friday	2,210	830	360	52	3,452
		5 th June 2018 – 6 th June 2018	Tuesday & Wednesday	2,253	847	323	54	3,477

**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	29 th Mar-30 th Mar 2017	Wednesday & Thursday	1,534	500	236	28	2,298
		22 nd June-23 rd June 2017	Thursday & Friday	1,291	542	357	43	2,233
		19 th September-20 th September 2017	Tuesday & Wednesday	1,195	486	372	19	2,072
		7 th December-8 th December 2017	Thursday & Friday	1,695	682	322	40	2,739
		15 th March 2018 – 16 th March 2018	Thursday and Friday	2,062	812	312	48	3,234
		5 th June 2018 – 6 th June 2018	Tuesday & Wednesday	2,048	799	322	52	3,221

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 June 2018 is slightly higher than other quarterly monitoring surveys from Phalan village to Dagon Thilawa Road. However, traffic volume results from Dagon Thilawa Road to Phalan village for June 2018 is lower than March 2018.

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

