MJTD

Thilawa Special Economic Zone (Zone B) Development

Environmental Monitoring Report Phase-2 & 3 (Construction Phase)

Myanmar Japan Thilawa Development Limited.

March 2019

CONTENTS

Appendix

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 September 2018 to November 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-2 Pre-construction Phase	December, 2017
6	Environmental Monitoring Report	Phase-1&2 Construction Phase	March, 2018
7	Environmental Monitoring Report	Phase-1&2 Construction Phase	June, 2018
8	Environmental Monitoring Report	Phase-1&2 Construction Phase	September, 2018
9	Environmental Monitoring Report	Phase-3 Pre-construction Phase	December, 2018
10	Environmental Monitoring Report	Phase-2&3 Construction Phase	March, 2019

Report (No.8) 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:

Neither accidents nor incidents happen during this monitoring period.

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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 F to H.

F. Monthly Progress Report for December, 2018

G. Monthly Progress Report for January, 2019

H. Monthly Progress Report for February, 2019

4. Monitoring Result

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

Monitoring Plan (Construction Phase)

Category	Item	Location	Frequency	Remark
Air Quality	NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}	Construction site (1 point)	Once/ 3month	September 2018, Air Quality Monitoring Report
Water Quality	Water temperature, pH, SS, DO, BOD_5, COD, coliforms, oil and grease, chromium	- Over flow of construction site to the creek (at least 3 sampling points/ mixing point: i) discharge water, ii) upstream water and iii) downstream water - Well near the construction site (1 point)	Once/ 2 month	August 2018, October 2018 Water and Wastewater Quality Monitoring Report
Waste	Amount and kind of solid waste	Construction site	Once/ 3 month	Monthly Progress Reports (September, October, November 2018)
Noise and Vibration	- Noise and vibration level - Traffic Count	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 September 2018 Traffic Count Monitoring Report September 2018
Ground Subsidence Hydrology	- Ground water level - Ground elevation level - Consumption of ground water amount	Representative (1 point)	Every week	Monthly Progress Reports (September, October, November 2018)
Risk for infectious disease such as AIDS/HIV	Status of measures of infectious disease	Construction site	Once/month	Monthly Progress Reports (September, October, November 2018)
Working conditions (including occupational safety)	Prehension of condition of occupational safety and health Prehension of infectious disease	Construction site	Once/ month	

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Category	Item	Location	Frequency	Remark
Accident	Existence of accident	Construction site	As occasion arise	

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 2 & 3

Environment Monitoring Form

Environment Monitoring Form

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

(1) General

1) Phase of the Project

- Please mark the current phase.

☐ Pre-Construction Phase ☑ Construction Phase ☐ Operation Phase

2) Obtainment of Environmental Permits

Name of permits	Expected issuance date	Actual issuance date	Concerned authority	Remarks (Conditions, etc.)
Approved letter for Environmental Impact Assessment (EIA) Report of Industrial Area, Thilawa Special Economic Zone (Zone-B)		29th December 2016	Thilawa SEZ Management Committee	
Notification of the comments of Ministry of Natural Resources and Environmental Conservation regarding with the Standard Change of Wastewater Quality of Industrial Zone, Internal Regulations of Thilawa SEZ Zone-A and Zone-B	5th January 2018	10th January 2018	Thilawa SEZ Management Committee	

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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 (December 2018)

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

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standard	Target value to be applied*1	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
AQ-1	NO_2	mg/m³	0.037	0.105	0.2 mg/m³ (1 Hour)	0.1 mg/m³ (24 Hour)	-	One time / 3 months	Haz-Scanner EPAS	Refer to air quality report
	SO_2*2	mg/m³	0.04	0.117	0.02 mg/m³ (24 Hours)	0.02 mg/m³ (24 Hours)	-			
	CO	mg/m³	0.203	0.318	-	10.26 mg/m³ (24 Hours)	-			
	PM2.5*3	mg/m³	0.047	0.058	0.025 mg/m³ (24 Hours)	0.025 mg/m³ (24 Hours)	-			
	PM10*3	mg/m³	0.068	0.083	0.05 mg/m³ (24 Hours)	0.05 mg/m³ (24 Hours)	-			

*1**Remarks:** Referred to the tentative target value of ambient air quality (EIA Report for industrial area, Table 2.4-1), Reference to the air quality monitoring report (September 2018)

*[2]**Remark:** The result of SO2 in AQ1 is excess than target value due to four expected reasons i) combustion of fuel for vehicle from nearby roads ii) operation activities of Myanmar International Terminal Thilawa Port iii) operation activities of local industrial zone iv) construction activities of Zone B. Total exceeding hour is 52 hours during construction period, 30 hours are come from Zone-B and 15 exceeded hours are come from outside of Zone-B. And then according to summary of wind direction at AQ-1, 80.8% are come from outside of Zone-B and 19.2% are come form inside of Zone B.

*[3]**Remark:** The result of PM 2.5 and PM 10 are excess than target value due to three expected reasons i) dust from unpaved vacant area ii) transportation in and around the monitoring area iii) construction activities of Zone-B.

Complaints from Residents

- Are there any complaints from residents regarding air quality in this monitoring period? ☐ Yes ☑ No

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

Contents of Complaints from Residents	Countermeasures

2) (a) Water Quality – December 2018

Measurement Point: Effluent of Wastewater (SW-2, SW-3 and SW-4 are attach as reference point only and they are natural creek water which are combine all the wastewater from the Local industrial water and domestic water from existing living environment. SW-7 is the main discharging point and SW-8 is mixing point of discharge water but in this monitoring time SW-7 and SW-8 location are almost same location. SW-9 is the downstream points after mixing point. GW-2 is also as reference point for monitoring of existing tube well located in the Monastery Compound near Zone-B area)

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

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

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Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
SW-2	Temperature	°C	24	< 3 (increase)	40		Instrument Analysis Method	
(reference	pH	-	8.2	6-9	6.0 - 9.0		Instrument Analysis Method	
point)	SS	mg/L	46	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	8.44	-	-		Instrument Analysis Method	
	BOD_5	mg/L	4.63	50	20	Once per	APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	20	250	70	2 months	APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100ml	160,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation	
	Oil and Grease	mg/L	<3.1	10	10		Technique)	
	Chromium	mg/L	≤0.002	0.5	0.5		APHA 5520 B (partition Gravimetric Method)	
							APHA (Inductively Coupled Plasma (ICP) Method)	
SW-3	Temperature	°C	24	< 3 (increase)	40		Instrument Analysis Method	
(reference	pH	-	8.1	6-9	6.0 - 9.0		Instrument Analysis Method	
point)	SS*3	mg/L	196	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	8.35	-	-		Instrument Analysis Method	
	BOD_5	mg/L	3.55	50	20	Once per	APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	16	250	70	2 months	APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100ml	35,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation	
	Oil and Grease	mg/L	<3.1	10	10		Technique)	
	Chromium	mg/L	0.014	0.5	0.5		APHA 5520 B (partition Gravimetric Method)	
							APHA (Inductively Coupled Plasma (ICP) Method)	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
SW-4	Temperature	°C	25	< 3 (increase)	40		Instrument Analysis Method	
(reference	pH	-	8.2	6-9	6.0 – 9.0		Instrument Analysis Method	
point)	SS*3	mg/L	154	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	7.77	-	-		Instrument Analysis Method	
	BOD_5	mg/L	2.58	50	20	Once per	APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	16	250	70	2 months	APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100ml	35,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation	
	Oil and Grease	mg/L	<3.1	10	10		Technique)	
	Chromium	mg/L	0.008	0.5	0.5		APHA 5520 B (partition Gravimetric Method)	
							APHA (Inductively Coupled Plasma (ICP) Method)	
SW-7	Temperature	°C	29	< 3 (increase)	40		Instrument Analysis Method	
	pH	-	8.2	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS*3	mg/L	142	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	8.53	-	-		Instrument Analysis Method	
	BOD_5	mg/L	21.4	50	20	Once per	APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	86	250	70	2 months	APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100ml	7,900	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	0.01	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
SW-8	Temperature	°C	No water for sampling	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-		6-9	6.0 - 9.0		Instrument Analysis Method	
	SS*3	mg/L		50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L		-	-		Instrument Analysis Method	
	BOD_5	mg/L		50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L		250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100ml		400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L		10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L		0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
SW-9	Temperature	°C	24	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	8.3	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS*3	mg/L	208	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	8.11	-	-		Instrument Analysis Method	
	BOD_5	mg/L	4.84	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	16.3	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100ml	92,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	< 3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	0.01	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
GW-2 (reference point)	Temperature	°C	27	< 3 (increase)	40		Instrument Analysis Method	
	pH	-	8	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	4	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	8.22	-	-		Instrument Analysis Method	
	BOD_5	mg/L	3.34	50	20	Once per	APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	7.1	250	70	2 months	APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform	MPN/100ml	< 1.8	400	400		APHA 9221 B (Standard Total Coliform Fermentation	
	Oil and Grease	mg/L	< 3.1	10	10		Technique)	
	Chromium	mg/L	≤ 0.002	0.5	0.5		APHA 5520 B (partition Gravimetric Method)	
							APHA (Inductively Coupled Plasma (ICP) Method)	

*1Remark: Reference to the Water and Wastewater Quality Monitoring Report (December 2018)

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

*3Remark: For the monitoring point of SW-3, SW-4, SW-7 and SW-9, the result of SS exceeded than the target value due to three expected reasons of 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.

*4Remark: For the monitoring point of SW-2, SW-3, SW-4, SW-7 and SW-9, the result of total coliform exceeded than the target value due to three expected reasons i) natural bacteria existed in discharged creek because there are various kinds of vegetation of 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. Total coliforms do not affect human health directly, self-monitoring was carried out to identify health impact by coliform bacteria. As for the result of E-Coli SW-2 was 6.8, SW-3 was 26, SW-4 was 32, SW-7 was 12 and SW-9 was 26. It is considered that there is no significant impact to human health.

2) (b) Water Quality – February 2019

Measurement Point: Effluent of Wastewater (SW-2, SW-3 and SW-4 are attach as reference point only and they are natural creek water which are combine all the wastewater from the Local industrial water and domestic water from existing living environment. SW-7 is the main discharging point and SW-8 is mixing point of discharge water but in this monitoring time SW-7 and SW-8 location are almost same location. SW-9 is the downstream points after mixing point. GW-2 is also as reference point for monitoring of existing tube well located in the Monastery Compound near Zone-B area)

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

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

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequency	Method	Note (Reason of excess of the standard)
SW-2 (reference point)	Temperature	°C	28	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7.8	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	28	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	3.97	-	-		Instrument Analysis Method	
	BOD_5	mg/L	15.41	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	119	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100ml	>160,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	<3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	≤ 0.002	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) 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*3	mg/L	254	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	5.63	-	-		Instrument Analysis Method	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
	BOD_5	mg/L	3.79	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	27.5	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100ml	24,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	3.2	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	0.012	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
SW-4 (reference point)	Temperature	°C	30	< 3 (increase)	40		Instrument Analysis Method	
	pH	-	7.8	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS*3	mg/L	164	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	5.43	-	-	Once per 2 months	Instrument Analysis Method	
	BOD_5	mg/L	2.89	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	21.1	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100ml	92,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	<3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	0.014	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
SW-7	Temperature	°C	33	< 3 (increase)	40		Instrument Analysis Method	
	pH	-	8.6	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	22	50	30	Once per 2 months	APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	6.68	-	-		Instrument Analysis Method	
	BOD_5	mg/L	4.81	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	120	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	

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Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
	Total Coliform	MPN/100ml	280	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	0.02	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
SW-8	Temperature	°C		< 3 (increase)	40		Instrument Analysis Method	
	pH	-		6-9	6.0 – 9.0		Instrument Analysis Method	
	SS*3	mg/L		50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L		-	-	Once per 2 months	Instrument Analysis Method	
	BOD_5	mg/L		50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L		250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100ml		400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L		10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L		0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
SW-9	Temperature	°C	28	< 3 (increase)	40		Instrument Analysis Method	
	pH	-	7.1	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS*3	mg/L	162	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	5.3	-	-	Once per	Instrument Analysis Method	
	BOD_5	mg/L	5.8	50	20	2 months	APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	40	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100ml	7,900	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)	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
	Chromium	mg/L	0.03	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
GW-2 (reference point)	Temperature	°C	30	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7.3	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	6	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	6.52	-	-		Instrument Analysis Method	
	BOD_5	mg/L	1.06	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	8.1	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*5	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 (October 2018)

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

*3Remark: For the monitoring points of SW-3, SW-4 and SW-9 exceeded in SS 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.

*4Remark: For the monitoring points of (SW-2, SW-3, SW-4 and SW-9) total coliform exceeded the target value due to three 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. Total coliforms do not affect human health directly, self-monitoring was carried out to identify health impact by coliform bacteria. As for the result of E-Coli SW-2 was 4, SW-3 was <1.8, SW-4 was 14, SW-7 was 2 and SW-9 was 9.2. It is considered that there is no significant impact to human health.

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 (December 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)	50	55	Refer to NEQG Article 1.3	75	Refer the section 2.4 in EIA main report	One time / 3 months		
	Leq (evening)	dB(A)	53	54		60				
	Leq(night)	dB(A)	51	53		55				
Along the road (NV-1)	Leq (day)	dB(A)	59	62		75				
	Leq(night)	dB(A)	51	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	10-Jan-2019	Construction Waste	Loads	2	Waste disposing to authorized waste collector (YCDC)
Amount of Sludge	6-Feb-2019	Construction Waste	Loads	2	Waste disposing to authorized waste collector (YCDC)
Amount of Sludge	15-Feb-2019	Construction Waste	Loads	2	Waste disposing to authorized waste collector (YCDC)

6) (a) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
6-Dec-2018	120	m^3/ week	+ 6.297	m	
13-Dec-2018	112	m^3/ week	+ 6.299	m	
20-Dec-2018	98	m^3/ week	+ 6.300	m	
27-Dec-2018	99	m^3/ week	+ 6.298	m	

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

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

6) (b) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
3-Jan-2019	112	m^3/ week	+ 6.300	m	
10-Jan-2019	105	m^3/ week	+ 6.299	m	
17-Jan-2019	123	m^3/ week	+ 6.301	m	
24-Jan-2019	128	m^3/ week	+ 6.298	m	
31-Jan 2019	104	m^3/ week	+ 6.297	m	

Remarks: Reference to Monthly Progress Report (January-2019)

6) (c) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
7-Feb-2019	114	m^3/ week	+ 6.299	m	
14-Feb-2019	103	m^3/ week	+ 6.297	m	
21-Feb-2019	95	m^3/ week	+ 6.298	m	
28-Feb-2019	115	m^3/ week	+ 6.299	m	

Remarks: Reference to Monthly Progress Report (February-2019)

7) Offensive Odor (only operation phase)

Complaints from Residents

- Are there any complaints from residents regarding offensive odor in this monitoring period? ☐ Yes, ☑ No
  If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures

Situations environmental report from tenants

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

Contents of Issues on Soil Contamination	Countermeasures

8) Infectious disease, Working Environment, Accident
Information from contractor (construction phase) or tenants (operation phase)

- Are there any incidents regarding infectious disease, Working Environment, Accident in this monitoring period? ☐ Yes, ☑ No
  If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Incidents	Countermeasures

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

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

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

Resentment Works		Progress in Narrative	Remarkable Issues
Projected Affected Persons	Land Acquisition and Relocation	The number of PAH who got the land compensation; • (26) PAHs from Zone-B Area(2-1)_Ex-2	

		The number of PAH who got the land compensation and relocated; • (2) PAHs from Zone-B Area(2-1)_Ex-2 • (2) PAH from Zone-B Area(2-1)_Ex-1 The number of PAH who already relocated; • (6) PAHs from Zone-B Area(2-1)_Ex-2 • (5) PAHs from Zone-B Area(2-1)_Ex-1 • (6) PAHs from Zone-B Area(3-1) The number of PAH who got the cultivation compensation; • (1) PAH from Zone-B Area(2-1)_Ex-1 • (1) PAH from Zone-B Area(3-1)	
	Income Restoration Program	1) New tube well digging at Zone B in Dec'18 2) Supporting for Valuable People Program at Zone B for every month 3) Fence renovation at Zone B in Dec'18 4) Drainage cleaning at Zone B in Feb'19	
Common Assets	**Relocation**		

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

Contents of Grievance	Response/ Countermeasures

10) CSR activities such as Community Support Program
- Are there any CSR activities implemented in this monitoring period? ■ Yes, ☐ No

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

Date	Activities	Description (Location, Participant etc)
December 2018	Monthly Free Tuberculosis diagnosis test in TSEZ	TSEZ - Zone A
	Donation for one storey school building	Aye Mya Thida School
January 2019	Donation for concrete paving to cemetery road	Shwe Pyouk Village Group
February 2019	Free Basic English Course for Grade 5 to Grade 9 students	Myaing Tar Yar School

End of Document

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 2 & 3

Appendix

Water and Waste Water Monitoring Report

December 2018

WATER QUALITY MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

IN THILAWA SEZ ZONE B

(PHASE 2 & 3 CONSTRUCTION STAGE)

(Bi-Monthly Monitoring)

December 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 six locations. (SW-8) was not carried out for water sampling because of there was no water during the monitoring period. Among the six locations, water flow measurement was carried out at one location (SW-4) where can be measured by current meter. Monitoring items and sampling points are summarized in Table 2.1-1.

Table 2.1-1 Monitoring Items for Water Quality

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

Source: Myanmar Koei International Ltd.

2.2 Description of Sampling Points

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

Table 2.2-1 Outline of Sampling Points

No.	Station	Detailed Information
1	SW-2	**Coordinate-** N-16° 40′ 20.69″, E- 96° 17′ 18.04″
		Location - Upstream of Shwe Pyauk Creek
		Survey Item – Surface water sampling
2	SW-3	**Coordinate-** N-16° 40′ 5.50″, E- 96° 16′ 41.60″
		Location - Upstream of Shwe Pyauk Creek, after mixing point of Thilawa SEZ Zone A and Zone B
		Survey Item – Surface water sampling
3	SW-4	**Coordinate-** N-16° 39′ 42.84″, E- 96° 16′ 27.42″
		Location - Downstream of Shwe Pyauk Creek
		Survey Item – Surface water sampling and water flow rate measurement
4	SW-7	**Coordinate-** N-16° 40′ 13.25″, E- 96° 17′ 5.66″
		Location - Outlet of retention pond of Zone B construction site before connect to Shwe Pyauk Creek
		Survey Item – Discharge water sampling
5	SW-8	**Coordinate -** N-16° 40′ 12.04″, E- 96° 17′ 2.81″
		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 in the northeast of Zone B area and in the south of Dagon-Thilawa road. The surrounding area are Zone A in the northwest and local industrial zone in the east 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 in the south of Zone A area and Dagon-Thilawa road. The surrounding area are Zone B in the south and local industrial zone in the east 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 in the southwest of Zone A area and in 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 outlet of retention pond of Zone B construction site, in the north of Zone B area and in the south of Dagon-Thilawa road. The surrounding area are Zone A in the north and local industrial zone in the east 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 in the north of Zone B area and in the south of Dagon-Thilawa road. The surrounding area are Zone A in the north and local industrial zone in the east 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 600 m downstream of SW-8. This sampling point is located in the south of Zone A area and Dagon-Thilawa road. The surrounding area are Zone B in the south and local industrial zone in the east 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 the north, Phalan village in the south and fields in the west and local industrial zone in the northeast, and construction of Thilawa SEZ Zone B in the east and north respectively.

2.3 Monitoring Method

All water samples were collected with cleaned sampling bottles 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 26 December 2018 and sampling time is shown in Table 2.4-1 to avoid tidal effect. The tide record for Yangon River, Myanmar on 26 December 2018 is shown in Table 2.4-2.

Table 2.4-1 Sampling Time of Each Station

No.	Station	Sampling Time
1	SW-2	26/12/2018 09:49
2	SW-3	26/12/2018 08:51
3	SW-4	26/12/2018 10:43
4	SW-7	26/12/2018 13:33
5	SW-8	-
6	SW-9	26/12/2018 09:21
7	GW-2	26/12/2018 11:24

Source: Myanmar Koei International Ltd.

Table 2.4-2 Tide Record for Yangon River, Myanmar

Date	Time	Height	Tide Conditions
26/12/2018	01:56	0.66	Low Tide
	06:31	5.78	High Tide
	14:46	0.38	Low Tide
	19:11	5.38	High 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-3, SW-4, SW-7 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, and SW-9) exceeded the target value due to three 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, 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	24	24	25	29	-	24	≤ 35
2	pH	-	8.2	8.1	8.2	8.2	-	8.3	6 ~ 9
3	Suspended solid (SS)	mg/L	46.00	196.00	154.00	142.00	-	208.00	50
4	Dissolved oxygen (DO)	mg/L	8.44	8.35	7.77	8.53	-	8.11	-
5	BOD (5)	mg/L	4.63	3.55	2.58	21.40	-	4.84	30
6	COD (Cr)	mg/L	20	16	16	86	-	16.3	125
7	Total coliform	MPN/ 100ml	160,000	35,000	35,000	7,900	-	92,000	400
8	Oil and grease	mg/L	< 3.1	< 3.1	< 3.1	< 3.1	-	< 3.1	10
9	Chromium	mg/L	≤ 0.002	0.014	0.008	0.01	-	0.01	0.5
10	Escherichia Coli	MPN/100ml* (SW)	6.8	26.0	32.0	12.0	-	26.0	(1000)* (CFU/100ml)
11	Flow rate	m^3/s	-	-	0.350	-	-	-	-

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	-	8.0	6 ~ 9
3	Suspended solid (SS)	mg/L	4.00	50
4	Dissolved oxygen (DO)	mg/L	8.22	-
5	BOD (5)	mg/L	3.34	30
6	COD (Cr)	mg/L	7.1	125
7	Total coliform	MPN/ 100ml	< 1.8	400
8	Oil and grease	mg/L	< 3.1	10
9	Chromium	mg/L	≤ 0.002	0.5
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/BTNMT) is set as a reference value of self-monitoring for ground water monitoring.
Source: Myanmar Koei International Ltd.

CHAPTER 3: CONCLUSION AND RECOMMENDATIONS

As described in Chapter 2 (Section 2.5), parameter of SS (SW-3, SW-4, SW-7 and SW-9) and total coliform (SW-2, SW-3, SW-4, SW-7 and SW-9) in surface water were exceeded the target value in this monitoring period for construction stage of Thilawa SEZ Zone B.

There are some possible reasons for exceeding the target values of SS (SW-3, SW-4, SW-7 and SW-9) and total coliform (SW-2, SW-3, SW-4, SW-7 and SW-9) 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 and iii) delivered from surrounding area by tidal effect. As mentioned in Section 2.5-1, the result of self-monitoring of E-Coli at SW-2, SW-3, SW-4, SW-7 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.

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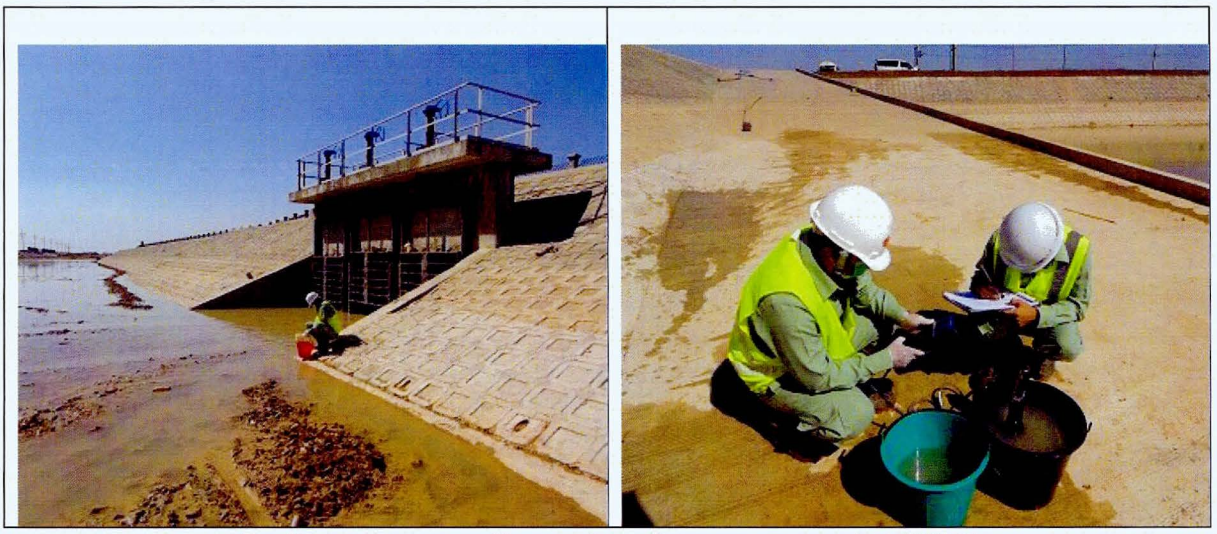
APPENDIX-1 FIELD SURVEY PHOTOS

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

Surface water sampling and onsite measurement at SW-9

Ground water sampling and onsite measurement at GW-2

APPENDIX-2 LABORATORY RESULTS

FOR DISCHARGING POINT

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.
Lot No E1. Thilawa SEZ Zone A, Yangon Region, Myanmar.
Phone No Fax No: (+95) 1 2309051

motivate our planet

Report No. : GEM-LAB-201901127
Revision No. : 1
Report Date : 14 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)

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

Project Name : MJTD

Sample Description

Sample Name : MKI-SW-7-1226 Sampling Date : 26 December, 2018

Sample No. : W-1812261 Sampling By : Customer

Waste Profile No. : - Sample Received Date : 26 December, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	142.00	_
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	21.40	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	86	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	7900	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	0.01	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

LAB Jan 14. 2019 GEM

Analysed By :

Ni Ni Aye Lwin
Supervisor

Approved By :

Tomoya Suzuki
Director Jan 14. 2019

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED ★ MJTD

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

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD
Lot No E1, Thilawa SEZ Zone A, Yangon Region, Myanmar.
Phone No. Fax No. (+95) 1 2309051

Report No. : GEM-LAB-201901124
Revision No. : 1
Report Date : 14 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa Township, Yangon. Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-2-1226 — Sampling Date : 26 December, 2018
Sample No. : W-1812258 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 26 December, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	46.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	4.63	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	20	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	160000	1.8
5	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
6	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	1.1	0
7	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	< 0.050	0.050
8	Color	APHA 2120C (Spectrophotometric Method)	TCU	4.13	0.00
9	Odor	APHA 2150 B (Threshold Odor Test)	TON	1.4	0
10	TDS	APHA 2540 C (Total Dissolved Solids Dried at 180'C Method)	mg/l	2768	-
11	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
12	Zinc	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
13	Arsenic	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.01	0.01
14	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
15	Cadmium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
16	Selenium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.01	0.01
17	Lead	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
18	Copper	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
19	Barium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.074	0.001
20	Nickel	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.006	0.002
21	Silver	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
22	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	1.462	0.002
23	Cyanide	HACH 8027 (Pyridine -Pyrazalone Method	mg/l	0.003	0.002
24	Ammonia	HACH Method 10205 (Silicylate TNT Plus Method)	mg/l	0.360	0.020
25	Hexavalent Chromium (Cr6+)	ISO 11083:1994 (Determination of chromium(VI) Spectrometric method using 1,5-diphenylcarbazide)	mg/l	< 0.05	0.05
26	Fluoride	APHA 4110 B (Ion Chromatography with Chemical Suppression of Eluent Conductivity)	mg/l	0.490	0.014
27	Total Chlorine	APHA 4500 CL G (DPD Colorimetric Method)	mg/l	0.1	0.1
28	Free Chlorine	APHA 4500 CL G (DPD Colorimetric Method)	mg/l	< 0.1	0.1
29	Sulphide	HACH 8131 (USEPA Methylene Blue Method)	mg/l	0.033	0.005
30	Formaldehyde	HACH 8110 (MBTH Method)	mg/l	0.028	0.003
31	Phenols	USEPA Method 420.1 (Phenolics (Spectrophotometric, Manual 4AAP With Distillation))	mg/l	0.4	0.1

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

LAB Jan 14, 2019 GEM

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MJTD DEVELOPMENT LIMITED MYANMAR JAPAN THILAWA

Report No. : GEM-LAB-201901125
Revision No. : 1
Report Date : 14 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa Township, Yangon. Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-3-1226 — Sampling Date : 26 December, 2018
Sample No. : W-1812259 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 26 December, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	196.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	3.55	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	16	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	35000	1.8
5	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
6	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	2.1	0
7	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	< 0.050	0.050
8	Color	APHA 2120C (Spectrophotometric Method)	TCU	3.22	0.00
9	Odor	APHA 2150 B (Threshold Odor Test)	TON	1	0
10	TDS	APHA 2540 C (Total Dissolved Solids Dried at 180'C Method)	mg/l	3540	-
11	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
12	Zinc	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
13	Arsenic	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.01	0.01
14	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.014	0.002
15	Cadmium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
16	Selenium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.01	0.01
17	Lead	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
18	Copper	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
19	Barium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.06	0.001
20	Nickel	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.022	0.002
21	Silver	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
22	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	9.232	0.002
23	Cyanide	HACH 8027 (Pyridine -Pyrazalone Method	mg/l	0.015	0.002
24	Ammonia	HACH Method 10205 (Salicylate TNT Plus Method)	mg/l	0.055	0.020
25	Hexavalent Chromium (Cr6+)	ISO 11083:1994 (Determination of chromium(VI) Spectrometric method using 1,5-diphenylcarbazide)	mg/l	< 0.05	0.05
26	Fluoride	APHA 4110 B (Ion Chromatography with Chemical Suppression of Eluent Conductivity)	mg/l	≤ 0.014	0.014
27	Total Chlorine	APHA 4500 CL G (DPD Colorimetric Method)	mg/l	0.1	0.1
28	Free Chlorine	APHA 4500 CL G (DPD Colorimetric Method)	mg/l	< 0.1	0.1
29	Sulphide	HACH 8131 (USEPA Methylene Blue Method)	mg/l	0.031	0.005
30	Formaldehyde	HACH 8110 (MBTH Method)	mg/l	0.014	0.003
31	Phenols	USEPA Method 420.1 (Phenolics (Spectrophotometric, Manual 4AAP With Distillation))	mg/l	< 0.1	0.1

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

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LAB GEM Jan 14, 2019

Approved By :

Tomoya Suzuki
Director Jan 14, 2019

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED ★ MJTD

DOWA

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Report No. : GEM-LAB-201901126
Revision No. : 1
Report Date : 14 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa Township, Yangon. Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-4-1226
Sample No. : W-1812260
Waste Profile No. : -

Sampling Date : 26 December, 2018
Sampling By : Customer
Sample Received Date : 26 December, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	154.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	2.58	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	16	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	35000	1.8
5	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
6	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	1.6	0
7	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	< 0.050	0.050
8	Color	APHA 2120C (Spectrophotometric Method)	TCU	2.63	0.00
9	Odor	APHA 2150 B (Threshold Odor Test)	TON	1.4	0
10	TDS	APHA 2540 C (Total Dissolved Solids Dried at 180°C Method)	mg/l	3592	-
11	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
12	Zinc	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
13	Arsenic	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.01	0.01
14	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.008	0.002
15	Cadmium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
16	Selenium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.01	0.01
17	Lead	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
18	Copper	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
19	Barium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.058	0.001
20	Nickel	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.014	0.002
21	Silver	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
22	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	6.708	0.002
23	Cyanide	HACH 8027 (Pyridine -Pyrazalone Method	mg/l	0.015	0.002
24	Ammonia	HACH Method 10205 (Salicylate TNT Plus Method)	mg/l	0.035	0.020
25	Hexavalent Chromium (Cr6+)	ISO 11083 1994 (Determination of chromium(VI) Spectrometric method using 1,5-diphenylcarbazide)	mg/l	< 0.05	0.05
26	Fluoride	APHA 4110 B (Ion Chromatography with Chemical Suppression of Eluent Conductivity)	mg/l	0.423	0.014
27	Total Chlorine	APHA 4500 CL G (DPD Colorimetric Method)	mg/l	0.1	0.1
28	Free Chlorine	APHA 4500 CL G (DPD Colorimetric Method)	mg/l	< 0.1	0.1
29	Sulphide	HACH 8131 (USEPA Methylene Blue Method)	mg/l	0.018	0.005
30	Formaldehyde	HACH 8110 (MBTH Method)	mg/l	0.022	0.003
31	Phenols	USEPA Method 420.1 (Phenolics (Spectrophotometric, Manual 4AAP With Distillation))	mg/l	0.17	0.1

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

Analysed By :

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Jan. 14, 2019

Approved By :

Tomoya Suzuki
Director Jan 14, 2019

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Report No. : GEM-LAB-201901130
Revision No. : 1
Report Date : 14 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa Township, Yangon. Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-9-1226 Sampling Date : 26 December, 2018
Sample No. : W-1812264 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 26 December, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	208.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	4.84	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	16.3	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	92000	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	0.01	0.002

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

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Report No. : GEM-LAB-201901128
Revision No. : 1
Report Date : 14 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)

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

Project Name : MJTD

Sample Description

Sample Name : MKI-GW-2-1226 Sampling Date : 26 December, 2018

Sample No. : W-1812262 Sampling By : Customer

Waste Profile No. : - Sample Received Date : 26 December, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	4.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	3.34	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	7.1	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	< 1.8	1.8
5	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
6	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002

Remark : LOQ - Limit of Quantitation

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

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Director Jan 14, 2019

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED
MJTD

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

FOR DISCHARGING POINT

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Doc No: GEM-LB-R004E/00
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Report No. : GEM-LAB-201901117
Revision No. : 1
Report Date : 15 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-7-1226 Sampling Date : 26 December, 2018
Sample No. : W-1812251 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 26 December, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	12.0	1.8

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

LAB Jan 15, 2019 GEM

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Approved By :

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Director Jan 15, 2019

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

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

DOWA

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Doc No: GEM-LB-R004E/00
Page1of1

Report No. : GEM-LAB-201901114
Revision No. : 1
Report Date : 15 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-2-1226 — Sampling Date : 26 December, 2018
Sample No. : W-1812248 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 26 December, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	6.8	1.8

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

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Doc No: GEM-LB-R004E/00
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Report No. : GEM-LAB-201901115
Revision No. : 1
Report Date : 15 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-3-1226 — Sampling Date : 26 December, 2018
Sample No. : W-1812249 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 26 December, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	26.0	1.8

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

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Doc No: GEM-LB-R004E/00
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Report No. : GEM-LAB-201901116
Revision No. : 1
Report Date : 15 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-4-1226 — Sampling Date : 26 December, 2018
Sample No. : W-1812250 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 26 December, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	32.0	1.8

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

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Doc No: GEM-LB-R004E/00
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Report No. : GEM-LAB-201901120
Revision No. : 1
Report Date : 15 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-9-1226 Sampling Date : 26 December, 2018
Sample No. : W-1812254 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 26 December, 2018

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	26.0	1.8

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

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Page1of1

Report No. : GEM-LAB-201901118
Revision No. : 1
Report Date : 15 January, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-GW-2-1226 Sampling Date : 26 December, 2018
Sample No. : W-1812252 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 26 December, 2018

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

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

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MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED ★ MJTD

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 2 & 3

Appendix

Water and Waste Water Monitoring Report

February 2019

WATER QUALITY MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

IN THILAWA SEZ ZONE B

(PHASE 1 OPERATION STAGE)

(Bi-Monthly Monitoring)

February 2019

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 discharged point of Zone B during the operation 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 six locations. (SW-8) was not carried out for water sampling because of there was no water during the monitoring period. Among the six locations, water flow measurement was carried out at one location (SW-4) where can be measured by current meter. Monitoring items and sampling points are summarized in Table 2.1-1.

Table 2.1-1 Monitoring Items for Water Quality

No.	Parameters	SW-2	SW-3	SW-4	SW-7	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	Color	○	○	○	○	-	○	○	Laboratory analysis
9	Odor	○	○	○	○	-	○	○	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' 20.69", E - 96° 17' 18.04"
		Location - Upstream of Shwe Pyauk Creek
		Survey Item - Surface water sampling.
2	SW-3	**Coordinate** - N - 16° 40' 5.50", E - 96° 16' 41.60"
		Location - Upstream of Shwe Pyauk Creek, after mixing point of Thilawa SEZ Zone A and Zone B
		Survey Item - Surface water sampling.
3	SW-4	**Coordinate**- N - 16° 39' 42.84", E - 96° 16' 27.42"
		Location - Downstream of Shwe Pyauk Creek
		Survey Item - Surface water sampling and water flow rate measurement.
4	SW-7	**Coordinate** - N - 16° 40' 13.25", E - 96° 17' 5.66"
		Location – Outlet of retention pond of Zone B construction site before connect to Shwe Pyauk Creek
		Survey Item - Discharge water sampling.
5	SW-8	**Coordinate** - N - 16° 40' 12.04", E - 96° 17' 2.81"
		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 areas are Zone A in the northwest and local industrial zone in the east 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 in the south of Zone A area and Dagon-Thilawa road. The surrounding areas are Zone B in the south and local industrial zone in the east 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 in the southwest of Zone A area and in the south of Dagon-Thilawa road. The surrounding areas are Zone B in the east, local industrial zone in the east and paddy fields in the south and west respectively.

SW-7 (Discharged Point)

SW-7 is main discharged point of Zone B during operation stage. This sampling point is located at outlet of retention pond of Zone B construction site, in the north of Zone B area and in the south of Dagon-Thilawa road. The surrounding areas are Zone A in the north and local industrial zone in the east 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 in the north of Zone B area and at the south of Dagon-Thilawa road. The surrounding areas are Zone A in the north and local industrial zone in the east 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 600 m downstream of SW-8. This sampling point is located in the south of Zone A area and Dagon-Thilawa road. The surrounding areas are Zone B in the south, local industrial zone in the east 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 areas are Thilawa SEZ Zone A in the north, Phalan village in the south and fields in the west and local industrial zone in the northeast, and construction of Thilawa SEZ Zone B in the east and northeast respectively.

2.3 Monitoring Method

All water samples were collected with cleaned sampling bottles 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	Color	APHA 2120C (Spectrophotometric Method)
9	Odor	APHA 2150 B (Threshold Odor Test)
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 13 February 2019 and sampling time is shown in Table 2.4-1 to avoid tidal effect. The tide record for Yangon River, Myanmar on 13 February 2019 is shown in Table 2.4-2.

Table 2.4-1 Sampling Time of Each Station

No.	Station	Sampling Time
1	SW-2	13/02/2019 14:31
2	SW-3	13/02/2019 09:26
3	SW-4	13/02/2019 13:24
4	SW-7	13/02/2019 15:22
5	SW-8	-
6	SW-9	13/02/2019 09:41
7	GW-2	13/02/2019 14:01

Source: Myanmar Koei International Ltd.

Table 2.4-2 Tide Record for Yangon River, Myanmar

Date	Time	Height	Tide Conditions
13/02/2019	04:27	0.76	Low Tide
	09:34	4.29	High Tide
	16:31	0.96	Low Tide
	22:04	4.64	High Tide

Source: Myanmar Port Authority, Tide Table for the Yangon River and Elephant Point, 2019

2.5 Monitoring Results

Results of water quality monitoring at discharged point and discharged creek are summarized in Table 2.5-1. Analytical results of the laboratory are described in Appendix-2 and Appendix-3. The results were compared with the target value of effluent water quality discharged to water body stipulated in the EIA report.

2.5.1 Results of Discharged Point and Discharged Creek

As the comparison with the target value, the results of SS and total coliform exceeded the target value. As for the result of SS, results at the surface water monitoring points (SW-3, SW-4 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, and SW-9) exceeded the target value due to three 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.

Since the composition of the total coliform include bacteria from natural origin, and even after total coliform do not affect human health directly, self-monitoring for E. Coli analysis was carried out to identify health impact by coliform bacteria. As for 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 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 Discharged 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	30	33	-	28	≤ 35
2	pH	-	7.8	7.2	7.8	8.6	-	7.1	6~9
3	Suspended Solid (SS)	mg/L	28.00	254.00	164.00	22.00	-	162.00	50
4	Dissolved Oxygen (DO)	mg/L	3.97	5.63	5.43	6.68	-	5.30	-
5	BOD (5)	mg/L	15.41	3.79	2.89	4.81	-	5.80	30
6	COD (Cr)	mg/L	119	27.5	21.1	120	-	40	125
7	Total Coliform	MPN/ 100ml	> 160,000	24,000	92,000	280	-	7,900	400
8	Color	TCU (True Color Unit)	21.86	3.49	2.63	2.53	-	3.60	150
9	Odor	TON (Threshold Odor Number)	2	2	2	2	-	2	-
10	Escherichia Coli	MPN/100ml	4.0	< 1.8	14.0	2.0	-	9.2	(1000)* (CFU/100ml)
11	Flow Rate	m^3/s	-	-	0.128	-	-	-	-

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 tube well monitoring point is shown in Table 2.5-2. All parameters of result were 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	30	≤ 35
2	pH	-	7.3	6 ~ 9
3	Suspended solid (SS)	mg/L	6.00	50
4	Dissolved oxygen (DO)	mg/L	6.52	-
5	BOD (5)	mg/L	1.06	30
6	COD (Cr)	mg/L	8.1	125
7	Total coliform	MPN/ 100ml	23	400
8	Color	TCU (True Color Unit)	12.08	150
9	Odor	TON (Threshold Odor Number)	1	-
10	Escherichia Coli	MPN/ 100 ml	< 1.8	(100)** (MPN/100ml)
11	Flow Rate	m^3/s	-	-

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

CHAPTER 3: CONCLUSION AND RECOMMENDATIONS

As described in Chapter 2 (Section 2.5), the results of SS (SW-3, SW-4 and SW-9) and total coliform (SW-2, SW-3, SW-4 and SW-9) in surface water exceeded the target value in this monitoring period for operation stage of Thilawa SEZ Zone B.

There are some possible reasons for exceeding the target values of SS (SW-3, SW-4 and SW-9) and total coliform (SW-2, SW-3, SW-4 and SW-9). They are by i) natural origin such as natural bacteria existed in discharged creek because there are various kinds of vegetation and creature such as birds, and small animals in and along the discharged creek and ii) wastewater from the local industrial zone outside of Thilawa SEZ and iii) delivered from surrounding area by tidal effect. Since the composition of the total coliform include bacteria from natural origin, and even after total coliform do not affect human health directly, self-monitoring for E. Coli analysis was carried out to identify health impact by coliform bacteria. As for 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 and SW-9, but it is considered that there is no significant impact on human health. However, it cannot reach to the conclusion of what the reason to be exceeded the target values is, thus the continuous monitoring and yearly trend analysis will be necessary to carry out based on the rainy and dry season data.

End of the Document

APPENDIX-1 FIELD SURVEY PHOTOS

FOR DISCHARGED POINT OF THILAWA SEZ ZONE B

Surface water sampling and onsite measurement at SW-7

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

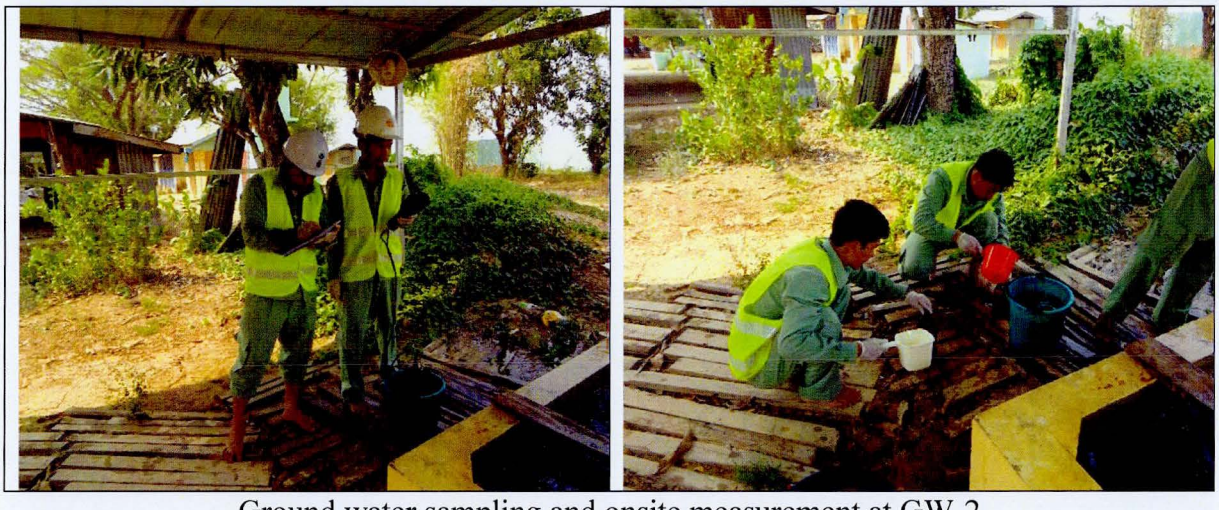
Surface water sampling and onsite measurement at SW-2

Surface water sampling and onsite measurement at SW-3

Surface water sampling and onsite measurement at SW-4

Surface water at SW-8 (There is no water during monitoring period)

Surface water sampling and onsite measurement at SW-9



Ground water sampling and onsite measurement at GW-2

APPENDIX-2 LABORATORY RESULTS

FOR DISCHARGED POINT

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Report No. : GEM-LAB-201902209
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Report Date : 27 February, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa Township, Yangon. Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-7-0213 Sampling Date : 13 February, 2019
Sample No. : W-1902127 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 13 February, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	22.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	4.81	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	120	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	280	1.8
5	Color	APHA 2120C (Spectrophotometric Method)	TCU	2.53	0.00
6	Odor	APHA 2150 B (Threshold Odor Test)	TON	2	0
7	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
8	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
Supervisor

LAB Feb 27, 2019 GEM

Approved By :

Tomoya Suzuki
Director Feb 27, 2019

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

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

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Report No. : GEM-LAB-201902204
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Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa Township, Yangon. Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-2-0213 Sampling Date : 13 February, 2019
Sample No. : W-1902122 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 13 February, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	28.00	_
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	15.41	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	119	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	> 160000	1.8
5	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	1.9	0
6	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.289	0.050
7	Color	APHA 2120C (Spectrophotometric Method)	TCU	21.86	0.00
8	Odor	APHA 2150 B (Threshold Odor Test)	TON	2	0
9	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002

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

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Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa Township, Yangon. Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-3-0213 Sampling Date : 13 February, 2019
Sample No. : W-1902123 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 13 February, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	254.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	3.79	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	27.5	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	24000	1.8
5	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	9.1	0
6	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.155	0.050
7	Color	APHA 2120C (Spectrophotometric Method)	TCU	3.49	0.00
8	Odor	APHA 2150 B (Threshold Odor Test)	TON	2	0
9	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	3.200	3.1
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.012	0.002

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

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Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa Township, Yangon. Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-4-0213 Sampling Date : 13 February, 2019
Sample No. : W-1902124 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 13 February, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	164.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	2.89	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	21.1	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	92000	1.8
5	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	4.1	0
6	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.103	0.050
7	Color	APHA 2120C (Spectrophotometric Method)	TCU	2.63	0.00
8	Odor	APHA 2150 B (Threshold Odor Test)	TON	2	0
9	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
10	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.014	0.002

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

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Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa Township, Yangon. Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-9-0213 Sampling Date : 13 February, 2019
Sample No. : W-1902128 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 13 February, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	162.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	5.80	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	40	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	7900	1.8
5	Color	APHA 2120C (Spectrophotometric Method)	TCU	3.60	0.00
6	Odor	APHA 2150 B (Threshold Odor Test)	TON	2	0
7	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
8	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.03	0.002

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

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Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa Township, Yangon. Myanmar.
Project Name : MJTD
Sample Description
Sample Name : MKI-GW-2-0213 Sampling Date : 13 February, 2019
Sample No. : W-1902130 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 13 February, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105'C Method)	mg/l	6.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	1.06	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	8.1	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	23	1.8
5	Color	APHA 2120C (Spectrophotometric Method)	TCU	12.08	0.00
6	Odor	APHA 2150 B (Threshold Odor Test)	TON	1	0
7	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
8	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
Supervisor

LAB GEM Feb 27, 2019

Approved By :

Tomoya Suzuki
Director Feb 27, 2019

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

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

FOR DISCHARGED POINT

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.
Lot No E1. Thilawa SEZ Zone A, Yangon Region, Myanmar.
Phone No Fax No: (+95) 1 2309051

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Doc No: GEM-LB-R004E/00
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Report No. : GEM-LAB-201902117
Revision No. : 1
Report Date : 19 February, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-7-0213 — Sampling Date : 13 February, 2019
Sample No. : W-1902117 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 13 February, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	2.0	1.8

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

Analysed By :

Ni Ni Aye Lwin
Supervisor

LAB Feb 19, 2019 GEM

Approved By :

Tomoya Suzuki
Director Feb 19, 2019

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

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

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.
Lot No E1. Thilawa SEZ Zone A, Yangon Region, Myanmar.
Phone No Fax No: (+95) 1 2309051

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Doc No: GEM-LB-R004E/00
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Report No. : GEM-LAB-201902112
Revision No. : 1
Report Date : 19 February, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-2-0213 Sampling Date : 13 February, 2019
Sample No. : W-1902112 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 13 February, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	4.0	1.8

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

Analysed By :

Ni Ni Aye Lwin
Supervisor

LAB
Feb 19, 2019
GEM

Approved By :

Tomoya Suzuki
Director Feb 19, 2019

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED
MJTD

DOWA

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Doc No: GEM-LB-R004E/00
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Report No. : GEM-LAB-201902113
Revision No. : 1
Report Date : 19 February, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-3-0213 — Sampling Date : 13 February, 2019
Sample No. : W-1902113 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 13 February, 2019

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

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

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Approved By :

Tomoya Suzuki
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MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

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Doc No: GEM-LB-R004E/00
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Report No. : GEM-LAB-201902114
Revision No. : 1
Report Date : 19 February, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-4-0213 Sampling Date : 13 February, 2019
Sample No. : W-1902114 Sampling By : Customer
Waste Profile No. : - Sample Received Date : 13 February, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	14.0	1.8

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

Analysed By :

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LAB
Feb 19. 2019
GEM

Approved By :

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Director Feb 19. 2019

MJTD MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED

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Doc No: GEM-LB-R004E/00
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Report No. : GEM-LAB-201902118
Revision No. : 1
Report Date : 19 February, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-SW-9-0213 — Sampling Date : 13 February, 2019
Sample No. : W-1902118 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 13 February, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	9.2	1.8

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

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MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED
MJTD

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Doc No: GEM-LB-R004E/00
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Report No. : GEM-LAB-201902120
Revision No. : 1
Report Date : 19 February, 2019
Application No. : 0049-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No.1A /28, Mya Thidar Housing, Ward 11, South Okkalapa.
Project Name : MJTD
Sample Description
Sample Name : MKI-GW-2-0213
Sample No. : W-1902120
Waste Profile No. : -
Sampling Date : 13 February, 2019
Sampling By : Customer
Sample Received Date : 13 February, 2019

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

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

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Director Feb 19, 2019

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED
MJTD

AIR QUALITY MONITORING

REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 2 & 3 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

December 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 10 December 2018 – 17 December 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 10 December– 17 December 2018	Air Quality	CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2	1	7 Days	On site measurement by Haz-Scanner Environmental Perimeter Air Station (EPAS)

CHAPTER 2: AIR QUALITY MONITORING

2.1 Monitoring Item

The parameters for air quality monitoring were CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2.

2.2 Monitoring Location

The air quality measurement equipment, "Haz-Scanner Environmental Perimeter Air Station (EPAS) was set up at the south of the Thilawa SEZ Zone B, N: 16°39'24.20", E: 96°17'15.80", inside the monastery compound of Phalan village, surrounded by the residential houses of Phalan village in the south and fields in west, Thilawa SEZ Zone A in north, local Thilawa Industrial Zone in northeast, and construction of Thilawa SEZ Zone B in east, north, north-northwest, northwest 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 10 December 2018 – 17 December 2018.

2.4 Monitoring Method

Monitoring of CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2 were conducted by referring to the recommendation of the United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner EPAS was used to collect ambient air pollutants. The EPAS measures automatically every five minutes and directly reads and records onsite for CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2. The state of air quality monitoring is shown in Figure 2.4-1.

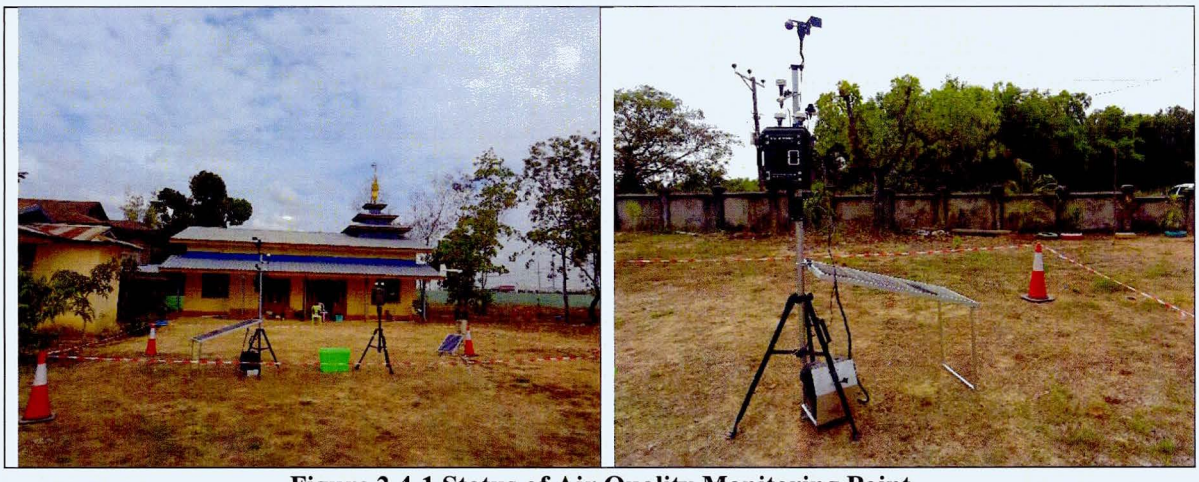

Figure 2.4-1 Status of Air Quality Monitoring Point

2.5 Monitoring Results

The daily average value of air quality monitoring results of CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2 are described in Table 2.5-1. Comparing with the target value of CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2 prescribed in EIA report for Thilawa SEZ development project Zone B, seven days average concentration of CO and NO_2 were lower than the target value, while seven days average concentration of $PM_{2.5}$, PM_{10} and SO_2 measured results exceeded than the target value. In addition, daily average concentration of NO_2 measured result for one day, daily average concentration of $PM_{2.5}$ and PM_{10} measured result for seven days and daily average concentration of SO_2 measured result for three days 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
10 ~ 11 Dec, 2018	0.206 (0.236 mg/m^3)	0.046 (0.086 mg/m^3)	0.048	0.066	0.045 (0.117 mg/m^3)
11 ~ 12 Dec, 2018	0.278 (0.318 mg/m^3)	0.056 (0.105 mg/m^3)	0.045	0.068	0.039 (0.101 mg/m^3)
12 ~ 13 Dec, 2018	0.127 (0.146 mg/m^3)	0.028 (0.053 mg/m^3)	0.039	0.057	0.018 (0.047 mg/m^3)
13 ~ 14 Dec, 2018	0.141 (0.162 mg/m^3)	0.048 (0.091 mg/m^3)	0.048	0.074	0.001 (0.003 mg/m^3)
14 ~ 15 Dec, 2018	0.179 (0.205 mg/m^3)	0.034 (0.063 mg/m^3)	0.058	0.083	0.000 (0.000 mg/m^3)
15 ~ 16 Dec, 2018	0.242 (0.277 mg/m^3)	0.009 (0.017 mg/m^3)	0.057	0.079	0.001 (0.002 mg/m^3)
16 ~ 17 Dec, 2018	0.245 (0.280 mg/m^3)	0.042 (0.079 mg/m^3)	0.035	0.052	0.004 (0.011 mg/m^3)
7 Days Average Value	0.203 (0.232 mg/m^3)	0.037 (0.071 mg/m^3)	0.047	0.068	0.015 (0.040 mg/m^3)
Target Value	9.000 (10.26 mg/m^3)*1	0.050 (0.1 mg/m^3)*1	0.025	0.050	0.008 (0.02 mg/m^3)*1

Note: The target value of CO, NO_2 and SO_2 were converted to ppm units from mg/m^3. Red color mentions the exceeded value for NO_2, $PM_{2.5}$, PM_{10} and SO_2.

Construction activities of Thilawa SEZ Zone B are described in Table 2.5-2. NO_2 result, $PM_{2.5}$ result, PM_{10} result and SO_2 result during construction period are described in Table 2.5-3, Table 2.5-4, Table 2.5-5 and Table 2.5-6. During construction period, seven days average value for NO_2 was lower than the target value and (Day 1 to Day 7) daily average results were also lower than the target value. During construction period, seven days average value for $PM_{2.5}$ and PM_{10} exceeded the target value and (Day 1 to Day 7) daily average results also exceeded the target value. During construction period, 7 days average value for SO_2 exceeded the target value and (Day 1 to Day 3) daily average results also exceeded the target value.

Table 2.5-2 Construction Activities of Thilawa SEZ Zone B

Date	Time	Location	Construction Activities
10 December 2018	8:30-23:40	Near monastery	Road 14,15 Canal excavation, BB8 Land Grading, Road 4a Canal soft soil removal, pipe line excavation, material delivery and installation, soil Delivery and general works, general works, General use, Compaction for road work, Land Grading work
11 December 2018	8:00-23:40	Near monastery	Road 14,15 Canal excavation, BB8 Land Grading, pipe line excavation, material delivery and installation, temporary access road preparation, road 14a soft soil removal, Road 14 levelling, Material delivery, General use, BD 4,5 Land Grading
12 December 2018	8:00-23:30	Near monastery	Road 14,15 Canal slope trimming, BB8 land grading, road 4a soft soil removal, Pipe line excavation, material delivery and installation, BD 4,5, BB8 soil levelling, BD 4,5 compaction, General use, Material delivery
13 December 2018	8:00-23:30	Near monastery	Road 14,15 Canal excavation and slope trimming, BB8 land grading, road work @ 9,10, road 4a canal soft soil removal and backfilling, BD5, BB8 levelling work, BD5 compaction work, Material delivery, General use
14 December 2018	8:00-23:30	Near monastery	BB8 land grading, road 13,14,15 canal excavation, road 9, 10 soil levelling, canal 4a backfilling and soft soil removal, pipe line excavation, delivery and installation, Material delivery, BH5 soil levelling, Bd 5,6, BE1,2, BH5 soil levelling, Bd 5,6, BE1,2, General use
15 December 2018	8:00-23:30	Near monastery	Road 13,14 canal excavation and slope trimming, BB8 slope trimming, road 10 soil levelling, pipe line excavation, delivery and installation, Material delivery, BD 5,6, BB8, BE7,10 soil levelling, BD 5,6 compaction work, General use.
16 December 2018	9:00-23:30	Near monastery	Road 13,15 canal excavation and slope trimming, BB8 slope trimming, road 9,10 sub-grade levelling, pipe line excavation, material delivery and installation, Material delivery, BD7, BB8, BE7,10 soil levelling, BE7, road 9 compaction work, General use
17 December 2018	8:30-23:30	Near monastery	Road 13,15 canal excavation and slope trimming, BE4 soil cutting, pipe line excavation, material delivery and installation, BJ1, BD7, BB8, BE7,10 soil levelling, Material delivery, BD7, road 9 soil compaction, General use

Table 2.5-3 NO_2 Results (During Construction Period)

Day	Construction Time for each day	NO_2
		ppm
Day 1	8:30-23:40	0.015
Day 2	8:00-23:40	0.042
Day 3	8:00-23:30	0.017
Day 4	8:00-23:30	0.026
Day 5	8:00-23:30	0.012
Day 6	8:00-23:30	0.011
Day 7	9:00-23:30	0.016
7 days Average value		0.020
Target Value	-	0.050

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

Day	Construction Time for each day	$PM_{2.5}$
		mg/m^3
Day 1	8:30-23:40	0.049
Day 2	8:00-23:40	0.040
Day 3	8:00-23:30	0.048
Day 4	8:00-23:30	0.036
Day 5	8:00-23:30	0.065
Day 6	8:00-23:30	0.047
Day 7	9:00-23:30	0.045
7 days Average value		0.047
Target Value	-	0.025

Note: Red color mentions the exceeded value than target value

Table 2.5-5 PM_{10} Results (During Construction Period)

Day	Construction Time for each day	PM_{10}
		mg/m^3
Day 1	8:30-23:40	0.058
Day 2	8:00-23:40	0.063
Day 3	8:00-23:30	0.069
Day 4	8:00-23:30	0.057
Day 5	8:00-23:30	0.089
Day 6	8:00-23:30	0.069
Day 7	9:00-23:30	0.059
7 days Average value		0.066
Target Value	-	0.050

Note: Red color mentions the exceeded value than target value

Table 2.5-6 SO_2 Results (During Construction Period)

Day	Construction Time for each day	SO_2
		ppm
Day 1	8:30-23:40	0.075
Day 2	8:00-23:40	0.056
Day 3	8:00-23:30	0.023
Day 4	8:00-23:30	0.005
Day 5	8:00-23:30	0.000
Day 6	8:00-23:30	0.001
Day 7	9:00-23:30	0.000
7 days Average value		0.023
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.

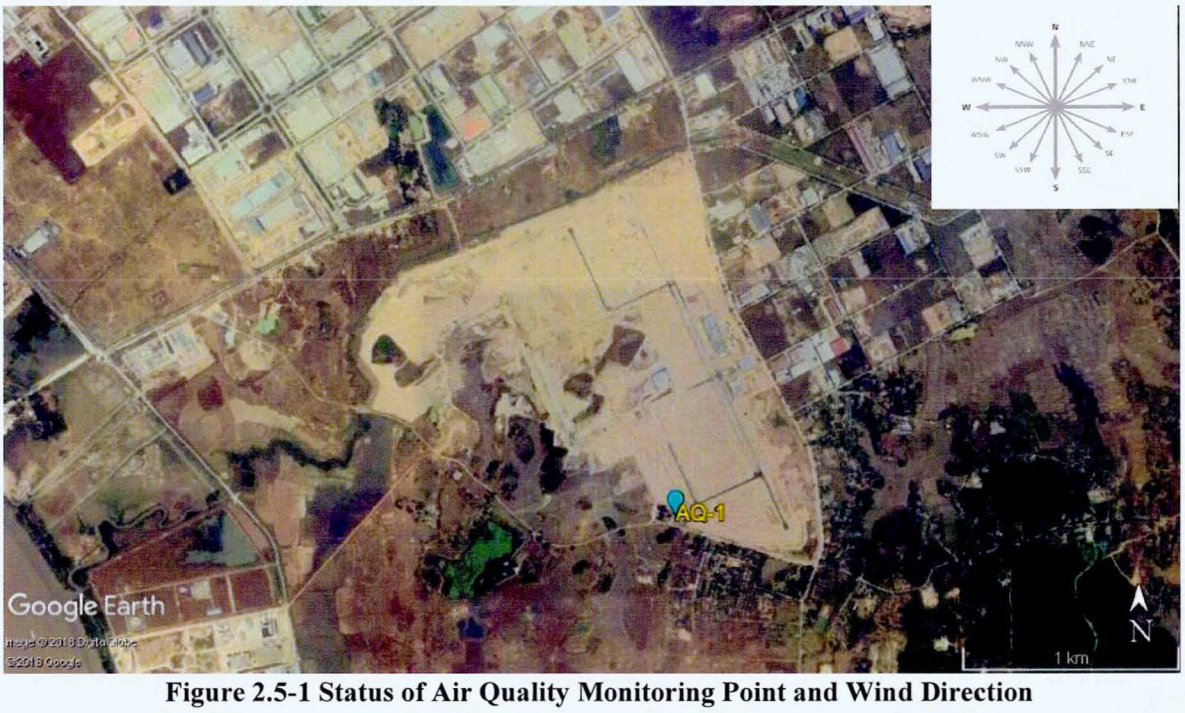

Figure 2.5-1 Status of Air Quality Monitoring Point and Wind Direction

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 Day1 to Day 7 during construction and non-construction time for $PM_{2.5}$, PM_{10} and SO_2 are shown in Table 2.5-7, Table 2.5-8 and Table 2.5-9. The summary of wind direction at AQ-1 is shown in Table 2.5-10. 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 time were 109 hours but exceeded hours for construction time was 65 hours. After detailed analyzed the $PM_{2.5}$ exceeded time according to the wind direction during construction period, 39 hours exceeded are come from the construction site of Zone B and 26 hours exceeded are come from other sides of Zone B.

Based on the summary table of total exceeded hours for PM_{10}, the total exceeded hours for seven days during construction and non-construction were 103 hours but exceeded hours for construction time was 65 hours. After detailed analyzed the PM_{10} exceeded time according to the wind direction during construction period, 41 hours exceeded are come from the construction site of Zone B and 24 hours exceeded are come from other sides of Zone B.

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 52 hours but exceeded hours for construction time was 45 hours. After detailed analyzed the SO_2 exceeded time according to the wind direction during construction period, 30 hours exceeded are come from the construction site of Zone B and 15 hours exceeded are come from other sides of Zone B.

According to the summary of wind direction at AQ-1, 80.8% come from inside of Zone B and 19.2% come from outside of Zone B.

Possible emission sources for $PM_{2.5}$ and PM_{10} are affected from natural origin such as dust from unpaved vacant area, transportation in and around the monitoring area and construction activities of Zone B.

Possible emission sources for SO_2 are affected from the combustion of fuel for vehicles from nearby roads, operation activities of Myanmar International Terminals Thilawa Port, operation activities of local industrial zone and construction activities of Zone B.

Table 2.5-7 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	8:30-23:40	19	11	8	6	2	1	10
Day-2	8:00-23:40	16	9	7	7	0	7	2
Day-3	8:00-23:30	14	9	5	5	0	9	0
Day-4	8:00-23:30	18	10	8	8	0	9	1
Day-5	8:00-23:30	18	10	8	7	1	3	7
Day-6	8:00-23:30	13	8	5	5	0	8	0
Day-7	9:00-23:30	11	8	3	3	0	2	6
Total		109	65	44	41	3	39	26

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

Table 2.5-8 Summary of Total Exceeded Hours for Day 1 to Day 7 During Construction and Non-Construction Period for PM_{10}

PM_{10}								
	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	8:30-23:40	18	10	8	6	2	1	9
Day-2	8:00-23:40	17	11	6	6	0	9	2
Day-3	8:00-23:30	10	9	1	1	0	9	0
Day-4	8:00-23:30	17	9	8	8	0	8	1
Day-5	8:00-23:30	16	9	7	6	1	2	7
Day-6	8:00-23:30	15	9	6	6	0	9	0
Day-7	9:00-23:30	10	8	2	2	0	3	5
Total		103	65	38	35	3	41	24

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

Table 2.5-9 Summary of Total Exceeded Hours for Day 1 to Day 7 During construction and non-Construction Period for SO_2

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	8:30-23:40	18	14	4	2	2	1	13
Day-2	8:00-23:40	15	13	2	2	0	11	2
Day-3	8:00-23:30	14	14	0	0	0	14	0
Day-4	8:00-23:30	1	1	0	0	0	1	0
Day-5	8:00-23:30	0	0	0	0	0	0	0
Day-6	8:00-23:30	2	1	1	1	0	1	0
Day-7	9:00-23:30	2	2	0	0	0	2	0
Total		52	45	7	5	2	30	15

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

Table 2.5-10 Summary of Wind Direction at AQ-1

Wind Direction	All Day	Day Time	Night Time	Inside/Outside Zone B	
N	5.1%	3.3%	6.8%	80.2%	Inside Zone B
NNE	42.8%	35.8%	49.7%		
NE	19.9%	23.3%	16.6%		
ENE	9.7%	16.8%	2.7%		
E	2.7%	2.3%	3.2%		
ESE	2.0%	3.0%	1.0%	19.2%	Outside Zone B
SE	10.9%	12.3%	9.5%		
SSE	0.1%	0.1%	0.1%		
S	0.4%	0.2%	0.6%		
SSW	1.6%	0.2%	3.0%		
SW	0.7%	0.8%	0.7%		
WSW	2.0%	0.9%	3.1%		
W	1.4%	0.8%	2.0%		
WNW	0.1%	0.1%	0.1%		
NW	0.4%	0.1%	0.7%	0.6%	Inside Zone B
NNW	0.2%	0.1%	0.3%		

CHAPTER 3: CONCLUSION AND RECOMMENDATION

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

During the seven days monitoring period, 109 hours results were exceeded for $PM_{2.5}$. According to wind direction of Zone B during the construction period, total 65 exceeded hours are during construction period, 39 exceeded hours are come from constriction site of Zone B and 26 exceeded hours are come from outside of Zone B. During the seven days monitoring period, 103 hours results were exceeded for PM_{10}. According to wind direction of Zone B during the construction period, total 65 exceeded hours are during construction period, 41 exceeded hours are come from constriction site of Zone B and 24 exceeded hours are come from outside of Zone B. Possible emission sources for $PM_{2.5}$ and PM_{10} are affected from natural origin such as dust from unpaved vacant area, transportation in and around the monitoring area and construction activities of Zone B. 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 $PM_{2.5}$ and PM_{10} reduces the life expectancy of the population of the Region by about 8.6 months on average. Short term (hours, days) exposure to $PM_{2.5}$ and PM_{10} 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, 52 hours results were exceeded for SO_2. According to wind direction of Zone B during the construction period, total 45 exceeded hours are during construction period, 30 exceeded hours are come from constriction site of Zone B and 15 exceeded hours are come from outside of Zone B. Possible emission sources for SO_2 are affected from the combustion of fuel for vehicles from nearby roads, operation activities of Myanmar International Terminals Thilawa Port, operation activities of local industrial zone and construction activities of Zone B. In the public health statement SO_2 reported by ATSDR (Agency for Toxic Substances and Disease Registry) in US, 100 ppm (261.8 mg/m^3) SO_2 is considered immediately dangerous to life and health (short term). Lung function changes observed when 0.4 to 3 ppm (1.05mg/m^3 to 7.85 mg/m^3) exposure for 20 years or more (long term).

According to the summary of wind direction at AQ-1, 80.8% come from inside of Zone B and 19.2% come from outside of Zone B.

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

1) To spray the water during construction period.
2) To control the speed limit of all machinery & vehicle (25km/hr) on site to avoid excessive dust creation and to minimize air pollution by the exhaust fumes.
3) To conduct the proper operation (stop idling while no operation).
4) To implement the regular maintenance of machine used for construction activities.
5) To give awareness training to workers on machinery.
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 and has to be reviewed in future.

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APPENDIX-1 HOURLY AIR RESULTS

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 Dec, 2018	11:00 ~ 12:00	0.000	0.002	0.002	0.014	0.129	2.13	119	ESE
10 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.016	0.028	0.087	2.09	119	ESE
10 Dec, 2018	13:00 ~ 14:00	0.006	0.002	0.001	0.003	0.105	1.91	118	ESE
10 Dec, 2018	14:00 ~ 15:00	0.000	0.002	0.050	0.028	0.116	1.23	144	SE
10 Dec, 2018	15:00 ~ 16:00	0.008	0.002	0.082	0.058	0.108	1.41	172	S
10 Dec, 2018	16:00 ~ 17:00	0.003	0.002	0.034	0.059	0.076	2.40	121	ESE
10 Dec, 2018	17:00 ~ 18:00	0.277	0.002	0.095	0.101	0.085	0.77	126	SE
10 Dec, 2018	18:00 ~ 19:00	0.220	0.002	0.065	0.077	0.063	0.00	126	SE
10 Dec, 2018	19:00 ~ 20:00	0.095	0.008	0.060	0.075	0.044	0.00	125	SE
10 Dec, 2018	20:00 ~ 21:00	0.417	0.026	0.064	0.072	0.046	0.00	125	SE
10 Dec, 2018	21:00 ~ 22:00	0.313	0.056	0.061	0.077	0.043	0.00	125	SE
10 Dec, 2018	22:00 ~ 23:00	0.373	0.072	0.052	0.083	0.037	0.00	125	SE
10 Dec, 2018	23:00 ~ 0:00	0.347	0.079	0.050	0.085	0.028	0.00	124	SE
11 Dec, 2018	0:00 ~ 1:00	0.348	0.088	0.054	0.086	0.019	0.00	124	SE
11 Dec, 2018	1:00 ~ 2:00	0.348	0.091	0.056	0.098	0.011	0.00	124	SE
11 Dec, 2018	2:00 ~ 3:00	0.330	0.094	0.061	0.104	0.006	0.00	56	ENE
11 Dec, 2018	3:00 ~ 4:00	0.278	0.091	0.070	0.096	0.008	0.34	20	NNE
11 Dec, 2018	4:00 ~ 5:00	0.243	0.089	0.048	0.075	0.010	0.14	19	NNE
11 Dec, 2018	5:00 ~ 6:00	0.258	0.088	0.075	0.093	0.006	0.58	23	NNE
11 Dec, 2018	6:00 ~ 7:00	0.263	0.091	0.053	0.069	0.004	0.09	30	NNE
11 Dec, 2018	7:00 ~ 8:00	0.314	0.095	0.058	0.087	0.009	0.40	32	NNE
11 Dec, 2018	8:00 ~ 9:00	0.244	0.079	0.042	0.072	0.008	1.18	32	NNE
11 Dec, 2018	9:00 ~ 10:00	0.172	0.036	0.011	0.048	0.006	0.83	50	NE
11 Dec, 2018	10:00 ~ 11:00	0.093	0.003	0.003	0.009	0.020	2.05	59	ENE

Max	0.417 (0.477 mg/m^3)	0.095 (0.179 mg/m^3)	0.095	0.104	0.129 (0.008 mg/m^3)
Avg	0.206 (0.236 mg/m^3)	0.046 (0.086 mg/m^3)	0.048	0.066	0.045 (0.117 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.002 (0.004 mg/m^3)	0.001	0.003	0.004 (0.010 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
11 Dec, 2018	11:00 ~ 12:00	0.000	0.002	0.004	0.020	0.048	1.45	57	ENE
11 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.011	0.070	0.086	0.94	73	ENE
11 Dec, 2018	13:00 ~ 14:00	0.000	0.002	0.021	0.023	0.114	0.58	54	NE
11 Dec, 2018	14:00 ~ 15:00	0.010	0.002	0.092	0.080	0.113	0.43	153	SSE
11 Dec, 2018	15:00 ~ 16:00	0.058	0.005	0.073	0.076	0.073	1.99	161	SSE
11 Dec, 2018	16:00 ~ 17:00	0.170	0.018	0.008	0.018	0.015	1.33	18	NNE
11 Dec, 2018	17:00 ~ 18:00	0.738	0.061	0.013	0.033	0.052	0.05	16	NNE
11 Dec, 2018	18:00 ~ 19:00	0.911	0.070	0.043	0.072	0.083	0.00	16	NNE
11 Dec, 2018	19:00 ~ 20:00	0.768	0.075	0.078	0.105	0.085	0.00	16	NNE
11 Dec, 2018	20:00 ~ 21:00	0.537	0.089	0.052	0.082	0.070	0.00	16	NNE
11 Dec, 2018	21:00 ~ 22:00	0.426	0.093	0.052	0.093	0.052	0.00	16	NNE
11 Dec, 2018	22:00 ~ 23:00	0.347	0.099	0.075	0.114	0.027	0.00	16	NNE
11 Dec, 2018	23:00 ~ 0:00	0.427	0.092	0.074	0.107	0.040	0.00	16	NNE
12 Dec, 2018	0:00 ~ 1:00	0.474	0.098	0.071	0.113	0.041	0.08	15	NNE
12 Dec, 2018	1:00 ~ 2:00	0.362	0.099	0.095	0.127	0.021	0.33	27	NNE
12 Dec, 2018	2:00 ~ 3:00	0.148	0.076	0.075	0.096	0.005	1.63	13	NNE
12 Dec, 2018	3:00 ~ 4:00	0.120	0.062	0.049	0.063	0.000	1.93	24	NNE
12 Dec, 2018	4:00 ~ 5:00	0.162	0.069	0.037	0.051	0.000	1.61	25	NNE
12 Dec, 2018	5:00 ~ 6:00	0.168	0.073	0.027	0.044	0.000	0.74	16	NNE
12 Dec, 2018	6:00 ~ 7:00	0.203	0.073	0.046	0.056	0.000	1.40	24	NNE
12 Dec, 2018	7:00 ~ 8:00	0.182	0.070	0.014	0.037	0.000	1.80	29	NNE
12 Dec, 2018	8:00 ~ 9:00	0.185	0.062	0.028	0.055	0.000	1.98	30	NNE
12 Dec, 2018	9:00 ~ 10:00	0.164	0.039	0.024	0.056	0.000	2.73	37	NE
12 Dec, 2018	10:00 ~ 11:00	0.113	0.007	0.015	0.040	0.004	4.30	34	NE

Max	0.911 (1.043 mg/m^3)	0.099 (0.187 mg/m^3)	0.095	0.127	0.114 (0.008 mg/m^3)
Avg	0.278 (0.318 mg/m^3)	0.056 (0.105 mg/m^3)	0.045	0.068	0.039 (0.101 mg/m^3)
Min	0.000 (0.000mg/m^3)	0.002 (0.004 mg/m^3)	0.004	0.018	0.000 (0.000 mg/m^3)

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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
12 Dec, 2018	11:00 ~ 12:00	0.041	0.002	0.005	0.018	0.021	3.34	39	NE
12 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.003	0.031	0.035	2.83	35	NE
12 Dec, 2018	13:00 ~ 14:00	0.000	0.000	0.000	0.000	0.000	2.70	51	NE
12 Dec, 2018	14:00 ~ 15:00	0.000	0.001	0.019	0.038	0.010	1.98	47	NE
12 Dec, 2018	15:00 ~ 16:00	0.002	0.002	0.084	0.126	0.040	0.62	34	NNE
12 Dec, 2018	16:00 ~ 17:00	0.055	0.002	0.074	0.089	0.037	0.93	25	NNE
12 Dec, 2018	17:00 ~ 18:00	0.170	0.002	0.094	0.113	0.040	0.18	32	NNE
12 Dec, 2018	18:00 ~ 19:00	0.432	0.002	0.112	0.144	0.066	0.00	39	NE
12 Dec, 2018	19:00 ~ 20:00	0.405	0.020	0.087	0.119	0.052	0.00	39	NE
12 Dec, 2018	20:00 ~ 21:00	0.174	0.032	0.064	0.080	0.028	0.11	30	NNE
12 Dec, 2018	21:00 ~ 22:00	0.104	0.032	0.052	0.062	0.014	0.08	20	NNE
12 Dec, 2018	22:00 ~ 23:00	0.173	0.043	0.051	0.067	0.015	1.16	16	NNE
12 Dec, 2018	23:00 ~ 0:00	0.093	0.041	0.047	0.051	0.005	2.48	16	NNE
13 Dec, 2018	0:00 ~ 1:00	0.149	0.049	0.037	0.049	0.006	0.57	27	NNE
13 Dec, 2018	1:00 ~ 2:00	0.143	0.057	0.033	0.044	0.001	0.47	34	NE
13 Dec, 2018	2:00 ~ 3:00	0.140	0.053	0.032	0.044	0.000	0.90	29	NNE
13 Dec, 2018	3:00 ~ 4:00	0.139	0.056	0.024	0.038	0.000	1.22	30	NNE
13 Dec, 2018	4:00 ~ 5:00	0.147	0.061	0.024	0.040	0.000	0.26	28	NNE
13 Dec, 2018	5:00 ~ 6:00	0.152	0.065	0.033	0.046	0.000	0.40	27	NNE
13 Dec, 2018	6:00 ~ 7:00	0.163	0.066	0.039	0.056	0.000	0.26	30	NNE
13 Dec, 2018	7:00 ~ 8:00	0.190	0.060	0.012	0.043	0.003	0.57	38	NE
13 Dec, 2018	8:00 ~ 9:00	0.131	0.021	0.008	0.039	0.009	1.10	47	NE
13 Dec, 2018	9:00 ~ 10:00	0.052	0.002	0.005	0.020	0.014	1.41	51	NE
13 Dec, 2018	10:00 ~ 11:00	0.000	0.002	0.002	0.020	0.034	2.33	79	E

Max	0.432 (0.494 mg/m^3)	0.066 (0.125 mg/m^3)	0.112	0.144	0.066 (0.008 mg/m^3)
Avg	0.127 (0.146 mg/m^3)	0.028 (0.053 mg/m^3)	0.039	0.057	0.018 (0.047 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.000 (0.000mg/m^3)	0.000	0.000	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
13 Dec, 2018	11:00 ~ 12:00	0.000	0.002	0.002	0.028	0.019	1.27	64	ENE
13 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.007	0.034	0.000	1.86	28	NNE
13 Dec, 2018	13:00 ~ 14:00	0.000	0.002	0.043	0.063	0.000	0.96	100	E
13 Dec, 2018	14:00 ~ 15:00	0.009	0.002	0.057	0.058	0.000	1.30	231	SW
13 Dec, 2018	15:00 ~ 16:00	0.029	0.002	0.004	0.022	0.000	3.10	246	WSW
13 Dec, 2018	16:00 ~ 17:00	0.084	0.002	0.030	0.041	0.000	0.98	286	WNW
13 Dec, 2018	17:00 ~ 18:00	0.067	0.002	0.069	0.076	0.000	1.30	67	ENE
13 Dec, 2018	18:00 ~ 19:00	0.208	0.018	0.077	0.074	0.000	0.36	15	NNE
13 Dec, 2018	19:00 ~ 20:00	0.353	0.056	0.060	0.074	0.000	0.00	297	WNW
13 Dec, 2018	20:00 ~ 21:00	0.288	0.082	0.041	0.056	0.000	0.08	63	ENE
13 Dec, 2018	21:00 ~ 22:00	0.423	0.095	0.041	0.076	0.000	0.00	10	N
13 Dec, 2018	22:00 ~ 23:00	0.258	0.096	0.067	0.136	0.000	0.03	20	NNE
13 Dec, 2018	23:00 ~ 0:00	0.194	0.092	0.092	0.141	0.000	0.67	29	NNE
14 Dec, 2018	0:00 ~ 1:00	0.201	0.093	0.102	0.159	0.000	0.53	30	NNE
14 Dec, 2018	1:00 ~ 2:00	0.146	0.087	0.080	0.120	0.000	0.33	27	NNE
14 Dec, 2018	2:00 ~ 3:00	0.128	0.080	0.057	0.082	0.000	0.47	37	NE
14 Dec, 2018	3:00 ~ 4:00	0.143	0.080	0.058	0.088	0.000	0.49	33	NNE
14 Dec, 2018	4:00 ~ 5:00	0.152	0.079	0.062	0.092	0.000	0.81	28	NNE
14 Dec, 2018	5:00 ~ 6:00	0.158	0.080	0.064	0.099	0.000	0.13	41	NE
14 Dec, 2018	6:00 ~ 7:00	0.187	0.080	0.074	0.115	0.000	0.21	35	NE
14 Dec, 2018	7:00 ~ 8:00	0.158	0.082	0.042	0.068	0.000	1.12	30	NNE
14 Dec, 2018	8:00 ~ 9:00	0.133	0.040	0.008	0.031	0.000	1.50	39	NE
14 Dec, 2018	9:00 ~ 10:00	0.068	0.002	0.010	0.014	0.004	3.43	33	NNE
14 Dec, 2018	10:00 ~ 11:00	0.005	0.002	0.006	0.019	0.000	2.54	39	NE

Max	0.423 (0.484 mg/m^3)	0.096 (0.181 mg/m^3)	0.102	0.159	0.019 (0.008 mg/m^3)
Avg	0.141 (0.162 mg/m^3)	0.048 (0.091 mg/m^3)	0.048	0.074	0.001 (0.003 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.002 (0.004 mg/m^3)	0.002	0.014	0.000 (0.000 mg/m^3)

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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
14 Dec, 2018	11:00 ~ 12:00	0.000	0.002	0.012	0.039	0.000	2.41	42	NE
14 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.002	0.024	0.000	2.47	59	ENE
14 Dec, 2018	13:00 ~ 14:00	0.000	0.002	0.007	0.029	0.000	2.12	56	ENE
14 Dec, 2018	14:00 ~ 15:00	0.000	0.002	0.032	0.048	0.000	1.87	64	ENE
14 Dec, 2018	15:00 ~ 16:00	0.000	0.002	0.094	0.093	0.000	1.46	86	E
14 Dec, 2018	16:00 ~ 17:00	0.000	0.002	0.065	0.068	0.000	0.71	86	E
14 Dec, 2018	17:00 ~ 18:00	0.378	0.002	0.103	0.121	0.000	0.03	115	ESE
14 Dec, 2018	18:00 ~ 19:00	0.362	0.002	0.129	0.148	0.000	0.03	139	SE
14 Dec, 2018	19:00 ~ 20:00	0.313	0.009	0.087	0.128	0.000	0.00	137	SE
14 Dec, 2018	20:00 ~ 21:00	0.525	0.022	0.107	0.157	0.000	0.00	137	SE
14 Dec, 2018	21:00 ~ 22:00	0.475	0.037	0.094	0.142	0.000	0.00	137	SE
14 Dec, 2018	22:00 ~ 23:00	0.258	0.051	0.168	0.222	0.000	0.00	137	SE
14 Dec, 2018	23:00 ~ 0:00	0.288	0.059	0.113	0.154	0.000	0.00	137	SE
15 Dec, 2018	0:00 ~ 1:00	0.206	0.062	0.058	0.081	0.000	0.01	131	SE
15 Dec, 2018	1:00 ~ 2:00	0.194	0.072	0.047	0.068	0.000	0.15	17	NNE
15 Dec, 2018	2:00 ~ 3:00	0.173	0.077	0.028	0.048	0.000	0.06	15	NNE
15 Dec, 2018	3:00 ~ 4:00	0.162	0.071	0.032	0.051	0.000	0.07	18	NNE
15 Dec, 2018	4:00 ~ 5:00	0.171	0.075	0.051	0.069	0.000	0.11	40	NE
15 Dec, 2018	5:00 ~ 6:00	0.153	0.074	0.054	0.071	0.000	0.43	34	NE
15 Dec, 2018	6:00 ~ 7:00	0.164	0.072	0.045	0.067	0.000	0.53	31	NNE
15 Dec, 2018	7:00 ~ 8:00	0.175	0.066	0.028	0.053	0.000	1.01	32	NNE
15 Dec, 2018	8:00 ~ 9:00	0.145	0.038	0.015	0.049	0.000	3.36	28	NNE
15 Dec, 2018	9:00 ~ 10:00	0.098	0.003	0.010	0.034	0.000	2.99	29	NNE
15 Dec, 2018	10:00 ~ 11:00	0.065	0.002	0.003	0.019	0.000	2.43	41	NE

Max	0.525 (0.601 mg/m^3)	0.077 (0.146 mg/m^3)	0.168	0.222	0.000 (0.000 mg/m^3)
Avg	0.179 (0.205 mg/m^3)	0.034 (0.063 mg/m^3)	0.058	0.083	0.000 (0.000 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.002 (0.004mg/m^3)	0.002	0.019	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
15 Dec, 2018	11:00 ~ 12:00	0.009	0.002	0.001	0.002	0.000	1.43	41	NE
15 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.001	0.003	0.000	1.80	58	ENE
15 Dec, 2018	13:00 ~ 14:00	0.000	0.002	0.002	0.027	0.000	1.93	51	NE
15 Dec, 2018	14:00 ~ 15:00	0.000	0.002	0.001	0.037	0.000	1.78	44	NE
15 Dec, 2018	15:00 ~ 16:00	0.000	0.002	0.011	0.053	0.000	1.27	64	ENE
15 Dec, 2018	16:00 ~ 17:00	0.002	0.003	0.108	0.089	0.009	2.22	19	NNE
15 Dec, 2018	17:00 ~ 18:00	0.132	0.002	0.111	0.113	0.000	1.16	16	NNE
15 Dec, 2018	18:00 ~ 19:00	1.156	0.002	0.107	0.147	0.000	0.00	20	NNE
15 Dec, 2018	19:00 ~ 20:00	0.728	0.012	0.153	0.206	0.000	0.00	20	NNE
15 Dec, 2018	20:00 ~ 21:00	0.541	0.025	0.094	0.128	0.000	0.00	20	NNE
15 Dec, 2018	21:00 ~ 22:00	0.241	0.031	0.081	0.102	0.000	0.00	20	NNE
15 Dec, 2018	22:00 ~ 23:00	0.153	0.039	0.031	0.057	0.000	0.01	17	NNE
15 Dec, 2018	23:00 ~ 0:00	0.009	0.002	0.001	0.002	0.000	1.43	41	NE
16 Dec, 2018	0:00 ~ 1:00	0.000	0.002	0.001	0.003	0.000	1.80	58	ENE
16 Dec, 2018	1:00 ~ 2:00	0.000	0.002	0.002	0.027	0.000	1.93	51	NE
16 Dec, 2018	2:00 ~ 3:00	0.000	0.002	0.001	0.037	0.000	1.78	44	NE
16 Dec, 2018	3:00 ~ 4:00	0.000	0.002	0.011	0.053	0.000	1.27	64	ENE
16 Dec, 2018	4:00 ~ 5:00	0.002	0.003	0.108	0.089	0.009	2.22	19	NNE
16 Dec, 2018	5:00 ~ 6:00	0.132	0.002	0.111	0.113	0.000	1.16	16	NNE
16 Dec, 2018	6:00 ~ 7:00	1.156	0.002	0.107	0.147	0.000	0.00	20	NNE
16 Dec, 2018	7:00 ~ 8:00	0.728	0.012	0.153	0.206	0.000	0.00	20	NNE
16 Dec, 2018	8:00 ~ 9:00	0.541	0.025	0.094	0.128	0.000	0.00	20	NNE
16 Dec, 2018	9:00 ~ 10:00	0.241	0.031	0.081	0.102	0.000	0.00	20	NNE
16 Dec, 2018	10:00 ~ 11:00	0.041	0.002	0.001	0.015	0.000	2.29	41	NE

Max	1.156 (1.324 mg/m^3)	0.039 (0.074 mg/m^3)	0.153	0.206	0.009 (0.008 mg/m^3)
Avg	0.242 (0.277 mg/m^3)	0.009 (0.017 mg/m^3)	0.057	0.079	0.001 (0.002 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.002 (0.004 mg/m^3)	0.001	0.002	0.000 (0.000 mg/m^3)

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Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		ppm	ppm	mg/m³	mg/m³	ppm	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
16 Dec, 2018	11:00 ~ 12:00	0.003	0.002	0.019	0.029	0.000	2.69	44	NE
16 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.002	0.038	0.000	2.91	42	NE
16 Dec, 2018	13:00 ~ 14:00	0.000	0.002	0.008	0.018	0.000	2.23	40	NE
16 Dec, 2018	14:00 ~ 15:00	0.000	0.002	0.001	0.069	0.000	2.03	40	NE
16 Dec, 2018	15:00 ~ 16:00	0.000	0.002	0.002	0.012	0.000	1.57	141	SE
16 Dec, 2018	16:00 ~ 17:00	0.000	0.002	0.105	0.048	0.000	2.43	246	WSW
16 Dec, 2018	17:00 ~ 18:00	0.092	0.002	0.094	0.077	0.000	0.11	219	SW
16 Dec, 2018	18:00 ~ 19:00	0.420	0.002	0.064	0.078	0.000	0.00	201	SSW
16 Dec, 2018	19:00 ~ 20:00	0.472	0.008	0.047	0.073	0.000	0.01	240	WSW
16 Dec, 2018	20:00 ~ 21:00	0.614	0.024	0.043	0.051	0.000	0.00	280	W
16 Dec, 2018	21:00 ~ 22:00	0.676	0.063	0.097	0.068	0.000	0.00	162	SSE
16 Dec, 2018	22:00 ~ 23:00	0.526	0.075	0.055	0.108	0.000	0.00	72	ENE
16 Dec, 2018	23:00 ~ 0:00	0.518	0.089	0.074	0.114	0.000	0.00	72	ENE
17 Dec, 2018	0:00 ~ 1:00	0.361	0.090	0.065	0.096	0.000	0.00	72	ENE
17 Dec, 2018	1:00 ~ 2:00	0.283	0.089	0.042	0.061	0.000	0.00	67	ENE
17 Dec, 2018	2:00 ~ 3:00	0.213	0.077	0.022	0.035	0.000	0.08	52	NE
17 Dec, 2018	3:00 ~ 4:00	0.215	0.075	0.014	0.023	0.000	0.14	22	NNE
17 Dec, 2018	4:00 ~ 5:00	0.252	0.079	0.012	0.029	0.000	0.02	22	NNE
17 Dec, 2018	5:00 ~ 6:00	0.281	0.089	0.030	0.044	0.000	0.33	27	NNE
17 Dec, 2018	6:00 ~ 7:00	0.233	0.092	0.014	0.030	0.000	1.92	31	NNE
17 Dec, 2018	7:00 ~ 8:00	0.258	0.087	0.010	0.039	0.000	2.29	35	NE
17 Dec, 2018	8:00 ~ 9:00	0.219	0.050	0.005	0.035	0.004	3.37	39	NE
17 Dec, 2018	9:00 ~ 10:00	0.171	0.004	0.006	0.035	0.081	2.85	39	NE
17 Dec, 2018	10:00 ~ 11:00	0.069	0.002	0.008	0.029	0.016	2.78	39	NE

Max	0.676 (0.774 mg/m³)	0.092 (0.173 mg/m³)	0.105	0.114	0.081 (0.008 mg/m³)
Avg	0.245 (0.280 mg/m³)	0.042 (0.079 mg/m³)	0.035	0.052	0.004 (0.011 mg/m³)
Min	0.000 (0.000 mg/m³)	0.002 (0.004 mg/m³)	0.001	0.012	0.000 (0.000 mg/m³)

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 2 & 3

Appendix

Air Quality Monitoring Report

December 2018

AIR QUALITY MONITORING

REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 2 & 3 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

December 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 10 December 2018 – 17 December 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 10 December– 17 December 2018	Air Quality	CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2	1	7 Days	On site measurement by Haz-Scanner Environmental Perimeter Air Station (EPAS)

CHAPTER 2: AIR QUALITY MONITORING

2.1 Monitoring Item

The parameters for air quality monitoring were CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2.

2.2 Monitoring Location

The air quality measurement equipment, "Haz-Scanner Environmental Perimeter Air Station (EPAS) was set up at the south of the Thilawa SEZ Zone B, N: 16°39'24.20", E: 96°17'15.80", inside the monastery compound of Phalan village, surrounded by the residential houses of Phalan village in the south and fields in west, Thilawa SEZ Zone A in north, local Thilawa Industrial Zone in northeast, and construction of Thilawa SEZ Zone B in east, north, north-northwest, northwest 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 10 December 2018 – 17 December 2018.

2.4 Monitoring Method

Monitoring of CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2 were conducted by referring to the recommendation of the United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner EPAS was used to collect ambient air pollutants. The EPAS measures automatically every five minutes and directly reads and records onsite for CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2. The state of air quality monitoring is shown in Figure 2.4-1.

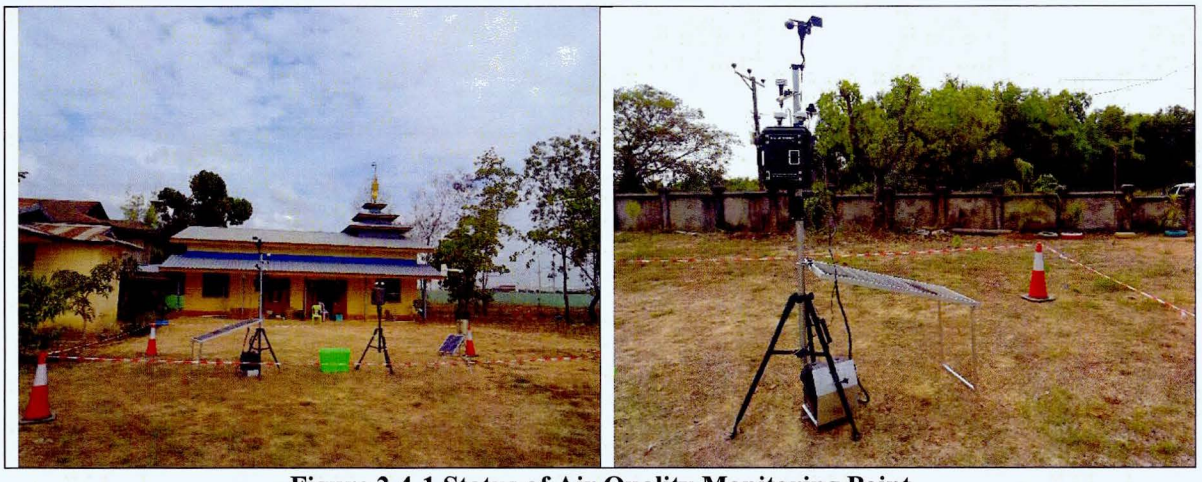

Figure 2.4-1 Status of Air Quality Monitoring Point

2.5 Monitoring Results

The daily average value of air quality monitoring results of CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2 are described in Table 2.5-1. Comparing with the target value of CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2 prescribed in EIA report for Thilawa SEZ development project Zone B, seven days average concentration of CO and NO_2 were lower than the target value, while seven days average concentration of $PM_{2.5}$, PM_{10} and SO_2 measured results exceeded than the target value. In addition, daily average concentration of NO_2 measured result for one day, daily average concentration of $PM_{2.5}$ and PM_{10} measured result for seven days and daily average concentration of SO_2 measured result for three days 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
10 ~ 11 Dec, 2018	0.206 (0.236 mg/m^3)	0.046 (0.086 mg/m^3)	0.048	0.066	0.045 (0.117 mg/m^3)
11 ~ 12 Dec, 2018	0.278 (0.318 mg/m^3)	0.056 (0.105 mg/m^3)	0.045	0.068	0.039 (0.101 mg/m^3)
12 ~ 13 Dec, 2018	0.127 (0.146 mg/m^3)	0.028 (0.053 mg/m^3)	0.039	0.057	0.018 (0.047 mg/m^3)
13 ~ 14 Dec, 2018	0.141 (0.162 mg/m^3)	0.048 (0.091 mg/m^3)	0.048	0.074	0.001 (0.003 mg/m^3)
14 ~ 15 Dec, 2018	0.179 (0.205 mg/m^3)	0.034 (0.063 mg/m^3)	0.058	0.083	0.000 (0.000 mg/m^3)
15 ~ 16 Dec, 2018	0.242 (0.277 mg/m^3)	0.009 (0.017 mg/m^3)	0.057	0.079	0.001 (0.002 mg/m^3)
16 ~ 17 Dec, 2018	0.245 (0.280 mg/m^3)	0.042 (0.079 mg/m^3)	0.035	0.052	0.004 (0.011 mg/m^3)
7 Days Average Value	0.203 (0.232 mg/m^3)	0.037 (0.071 mg/m^3)	0.047	0.068	0.015 (0.040 mg/m^3)
Target Value	9.000 (10.26 mg/m^3) *1	0.050 (0.1 mg/m^3) *1	0.025	0.050	0.008 (0.02 mg/m^3) *1

Note: The target value of CO, NO_2 and SO_2 were converted to ppm units from mg/m^3. Red color mentions the exceeded value for NO_2, $PM_{2.5}$, PM_{10} and SO_2.

Construction activities of Thilawa SEZ Zone B are described in Table 2.5-2. NO_2 result, $PM_{2.5}$ result, PM_{10} result and SO_2 result during construction period are described in Table 2.5-3, Table 2.5-4, Table 2.5-5 and Table 2.5-6. During construction period, seven days average value for NO_2 was lower than the target value and (Day 1 to Day 7) daily average results were also lower than the target value. During construction period, seven days average value for $PM_{2.5}$ and PM_{10} exceeded the target value and (Day 1 to Day 7) daily average results also exceeded the target value. During construction period, 7 days average value for SO_2 exceeded the target value and (Day 1 to Day 3) daily average results also exceeded the target value.

Table 2.5-2 Construction Activities of Thilawa SEZ Zone B

Date	Time	Location	Construction Activities
10 December 2018	8:30-23:40	Near monastery	Road 14,15 Canal excavation, BB8 Land Grading, Road 4a Canal soft soil removal, pipe line excavation, material delivery and installation, soil Delivery and general works, general works, General use, Compaction for road work, Land Grading work
11 December 2018	8:00-23:40	Near monastery	Road 14,15 Canal excavation, BB8 Land Grading, pipe line excavation, material delivery and installation, temporary access road preparation, road 14a soft soil removal, Road 14 levelling, Material delivery, General use, BD 4,5 Land Grading
12 December 2018	8:00-23:30	Near monastery	Road 14,15 Canal slope trimming, BB8 land grading, road 4a soft soil removal, Pipe line excavation, material delivery and installation, BD 4,5, BB8 soil levelling, BD 4,5 compaction, General use, Material delivery
13 December 2018	8:00-23:30	Near monastery	Road 14,15 Canal excavation and slope trimming, BB8 land grading, road work @ 9,10, road 4a canal soft soil removal and backfilling, BD5, BB8 levelling work, BD5 compaction work, Material delivery, General use
14 December 2018	8:00-23:30	Near monastery	BB8 land grading, road 13,14,15 canal excavation, road 9, 10 soil levelling, canal 4a backfilling and soft soil removal, pipe line excavation, delivery and installation, Material delivery, BH5 soil levelling, Bd 5,6, BE1,2, BH5 soil levelling, Bd 5,6, BE1,2, General use
15 December 2018	8:00-23:30	Near monastery	Road 13,14 canal excavation and slope trimming, BB8 slope trimming, road 10 soil levelling, pipe line excavation, delivery and installation, Material delivery, BD 5,6, BB8, BE7,10 soil levelling, BD 5,6 compaction work, General use.
16 December 2018	9:00-23:30	Near monastery	Road 13,15 canal excavation and slope trimming, BB8 slope trimming, road 9,10 sub-grade levelling, pipe line excavation, material delivery and installation, Material delivery, BD7, BB8, BE7,10 soil levelling, BE7, road 9 compaction work, General use
17 December 2018	8:30-23:30	Near monastery	Road 13,15 canal excavation and slope trimming, BE4 soil cutting, pipe line excavation, material delivery and installation, BJ1, BD7, BB8, BE7,10 soil levelling, Material delivery, BD7, road 9 soil compaction, General use

Table 2.5-3 NO_2 Results (During Construction Period)

Day	Construction Time for each day	NO_2
		ppm
Day 1	8:30-23:40	0.015
Day 2	8:00-23:40	0.042
Day 3	8:00-23:30	0.017
Day 4	8:00-23:30	0.026
Day 5	8:00-23:30	0.012
Day 6	8:00-23:30	0.011
Day 7	9:00-23:30	0.016
7 days Average value		0.020
Target Value	-	0.050

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

Day	Construction Time for each day	$PM_{2.5}$
		mg/m^3
Day 1	8:30-23:40	0.049
Day 2	8:00-23:40	0.040
Day 3	8:00-23:30	0.048
Day 4	8:00-23:30	0.036
Day 5	8:00-23:30	0.065
Day 6	8:00-23:30	0.047
Day 7	9:00-23:30	0.045
7 days Average value		0.047
Target Value	-	0.025

Note: Red color mentions the exceeded value than target value

Table 2.5-5 PM_{10} Results (During Construction Period)

Day	Construction Time for each day	PM_{10}
		mg/m^3
Day 1	8:30-23:40	0.058
Day 2	8:00-23:40	0.063
Day 3	8:00-23:30	0.069
Day 4	8:00-23:30	0.057
Day 5	8:00-23:30	0.089
Day 6	8:00-23:30	0.069
Day 7	9:00-23:30	0.059
7 days Average value		0.066
Target Value	-	0.050

Note: Red color mentions the exceeded value than target value

Table 2.5-6 SO_2 Results (During Construction Period)

Day	Construction Time for each day	SO_2
		ppm
Day 1	8:30-23:40	0.075
Day 2	8:00-23:40	0.056
Day 3	8:00-23:30	0.023
Day 4	8:00-23:30	0.005
Day 5	8:00-23:30	0.000
Day 6	8:00-23:30	0.001
Day 7	9:00-23:30	0.000
7 days Average value		0.023
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 Day1 to Day 7 during construction and non-construction time for $PM_{2.5}$, PM_{10} and SO_2 are shown in Table 2.5-7, Table 2.5-8 and Table 2.5-9. The summary of wind direction at AQ-1 is shown in Table 2.5-10. 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 time were 109 hours but exceeded hours for construction time was 65 hours. After detailed analyzed the $PM_{2.5}$ exceeded time according to the wind direction during construction period, 39 hours exceeded are come from the construction site of Zone B and 26 hours exceeded are come from other sides of Zone B.

Based on the summary table of total exceeded hours for PM_{10}, the total exceeded hours for seven days during construction and non-construction were 103 hours but exceeded hours for construction time was 65 hours. After detailed analyzed the PM_{10} exceeded time according to the wind direction during construction period, 41 hours exceeded are come from the construction site of Zone B and 24 hours exceeded are come from other sides of Zone B.

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 52 hours but exceeded hours for construction time was 45 hours. After detailed analyzed the SO_2 exceeded time according to the wind direction during construction period, 30 hours exceeded are come from the construction site of Zone B and 15 hours exceeded are come from other sides of Zone B.

According to the summary of wind direction at AQ-1, 80.8% come from inside of Zone B and 19.2% come from outside of Zone B.

Possible emission sources for $PM_{2.5}$ and PM_{10} are affected from natural origin such as dust from unpaved vacant area, transportation in and around the monitoring area and construction activities of Zone B.

Possible emission sources for SO_2 are affected from the combustion of fuel for vehicles from nearby roads, operation activities of Myanmar International Terminals Thilawa Port, operation activities of local industrial zone and construction activities of Zone B.

Table 2.5-7 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	8:30-23:40	19	11	8	6	2	1	10
Day-2	8:00-23:40	16	9	7	7	0	7	2
Day-3	8:00-23:30	14	9	5	5	0	9	0
Day-4	8:00-23:30	18	10	8	8	0	9	1
Day-5	8:00-23:30	18	10	8	7	1	3	7
Day-6	8:00-23:30	13	8	5	5	0	8	0
Day-7	9:00-23:30	11	8	3	3	0	2	6
Total		109	65	44	41	3	39	26

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

Table 2.5-8 Summary of Total Exceeded Hours for Day 1 to Day 7 During Construction and Non-Construction Period for PM_{10}

PM_{10}								
	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	8:30-23:40	18	10	8	6	2	1	9
Day-2	8:00-23:40	17	11	6	6	0	9	2
Day-3	8:00-23:30	10	9	1	1	0	9	0
Day-4	8:00-23:30	17	9	8	8	0	8	1
Day-5	8:00-23:30	16	9	7	6	1	2	7
Day-6	8:00-23:30	15	9	6	6	0	9	0
Day-7	9:00-23:30	10	8	2	2	0	3	5
Total		103	65	38	35	3	41	24

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

Table 2.5-9 Summary of Total Exceeded Hours for Day 1 to Day 7 During construction and non-Construction Period for SO_2

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	8:30-23:40	18	14	4	2	2	1	13
Day-2	8:00-23:40	15	13	2	2	0	11	2
Day-3	8:00-23:30	14	14	0	0	0	14	0
Day-4	8:00-23:30	1	1	0	0	0	1	0
Day-5	8:00-23:30	0	0	0	0	0	0	0
Day-6	8:00-23:30	2	1	1	1	0	1	0
Day-7	9:00-23:30	2	2	0	0	0	2	0
Total		52	45	7	5	2	30	15

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

Table 2.5-10 Summary of Wind Direction at AQ-1

Wind Direction	All Day	Day Time	Night Time	Inside/Outside Zone B	
N	5.1%	3.3%	6.8%		
NNE	42.8%	35.8%	49.7%		
NE	19.9%	23.3%	16.6%	80.2%	Inside Zone B
ENE	9.7%	16.8%	2.7%		
E	2.7%	2.3%	3.2%		
ESE	2.0%	3.0%	1.0%		
SE	10.9%	12.3%	9.5%		
SSE	0.1%	0.1%	0.1%		
S	0.4%	0.2%	0.6%		
SSW	1.6%	0.2%	3.0%	19.2%	Outside Zone B
SW	0.7%	0.8%	0.7%		
WSW	2.0%	0.9%	3.1%		
W	1.4%	0.8%	2.0%		
WNW	0.1%	0.1%	0.1%		
NW	0.4%	0.1%	0.7%	0.6%	Inside Zone B
NNW	0.2%	0.1%	0.3%		

CHAPTER 3: CONCLUSION AND RECOMMENDATION

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

During the seven days monitoring period, 109 hours results were exceeded for $PM_{2.5}$. According to wind direction of Zone B during the construction period, total 65 exceeded hours are during construction period, 39 exceeded hours are come from constriction site of Zone B and 26 exceeded hours are come from outside of Zone B. During the seven days monitoring period, 103 hours results were exceeded for PM_{10}. According to wind direction of Zone B during the construction period, total 65 exceeded hours are during construction period, 41 exceeded hours are come from constriction site of Zone B and 24 exceeded hours are come from outside of Zone B. Possible emission sources for $PM_{2.5}$ and PM_{10} are affected from natural origin such as dust from unpaved vacant area, transportation in and around the monitoring area and construction activities of Zone B. 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 $PM_{2.5}$ and PM_{10} reduces the life expectancy of the population of the Region by about 8.6 months on average. Short term (hours, days) exposure to $PM_{2.5}$ and PM_{10} 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, 52 hours results were exceeded for SO_2. According to wind direction of Zone B during the construction period, total 45 exceeded hours are during construction period, 30 exceeded hours are come from constriction site of Zone B and 15 exceeded hours are come from outside of Zone B. Possible emission sources for SO_2 are affected from the combustion of fuel for vehicles from nearby roads, operation activities of Myanmar International Terminals Thilawa Port, operation activities of local industrial zone and construction activities of Zone B. In the public health statement SO_2 reported by ATSDR (Agency for Toxic Substances and Disease Registry) in US, 100 ppm (261.8 mg/m^3) SO_2 is considered immediately dangerous to life and health (short term). Lung function changes observed when 0.4 to 3 ppm (1.05mg/m^3 to 7.85 mg/m^3) exposure for 20 years or more (long term).

According to the summary of wind direction at AQ-1, 80.8% come from inside of Zone B and 19.2% come from outside of Zone B.

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

1) To spray the water during construction period.
2) To control the speed limit of all machinery & vehicle (25km/hr) on site to avoid excessive dust creation and to minimize air pollution by the exhaust fumes.
3) To conduct the proper operation (stop idling while no operation).
4) To implement the regular maintenance of machine used for construction activities.
5) To give awareness training to workers on machinery.
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 and has to be reviewed in future.

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
	Chromium	mg/L	0.03	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
GW-2 (reference point)	Temperature	°C	30	< 3 (increase)	40	Once per 2 months	Instrument Analysis Method	
	pH	-	7.3	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	6	50	30		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	6.52	-	-		Instrument Analysis Method	
	BOD_5	mg/L	1.06	50	20		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	8.1	250	70		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*5	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 (October 2018)

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

*3Remark: For the monitoring points of SW-3, SW-4 and SW-9 exceeded in SS 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.

*4Remark: For the monitoring points of (SW-2, SW-3, SW-4 and SW-9) total coliform exceeded the target value due to three 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. Total coliforms do not affect human health directly, self-monitoring was carried out to identify health impact by coliform bacteria. As for the result of E-Coli SW-2 was 4, SW-3 was <1.8, SW-4 was 14, SW-7 was 2 and SW-9 was 9.2. It is considered that there is no significant impact to human health.

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 (December 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)	50	55	Refer to NEQG Article 1.3	75	Refer the section 2.4 in EIA main report	One time / 3 months		
	Leq (evening)	dB(A)	53	54		60				
	Leq(night)	dB(A)	51	53		55				
Along the road (NV-1)	Leq (day)	dB(A)	59	62		75				
	Leq(night)	dB(A)	51	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.

APPENDIX-1 HOURLY AIR RESULTS

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 Dec, 2018	11:00 ~ 12:00	0.000	0.002	0.002	0.014	0.129	2.13	119	ESE
10 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.016	0.028	0.087	2.09	119	ESE
10 Dec, 2018	13:00 ~ 14:00	0.006	0.002	0.001	0.003	0.105	1.91	118	ESE
10 Dec, 2018	14:00 ~ 15:00	0.000	0.002	0.050	0.028	0.116	1.23	144	SE
10 Dec, 2018	15:00 ~ 16:00	0.008	0.002	0.082	0.058	0.108	1.41	172	S
10 Dec, 2018	16:00 ~ 17:00	0.003	0.002	0.034	0.059	0.076	2.40	121	ESE
10 Dec, 2018	17:00 ~ 18:00	0.277	0.002	0.095	0.101	0.085	0.77	126	SE
10 Dec, 2018	18:00 ~ 19:00	0.220	0.002	0.065	0.077	0.063	0.00	126	SE
10 Dec, 2018	19:00 ~ 20:00	0.095	0.008	0.060	0.075	0.044	0.00	125	SE
10 Dec, 2018	20:00 ~ 21:00	0.417	0.026	0.064	0.072	0.046	0.00	125	SE
10 Dec, 2018	21:00 ~ 22:00	0.313	0.056	0.061	0.077	0.043	0.00	125	SE
10 Dec, 2018	22:00 ~ 23:00	0.373	0.072	0.052	0.083	0.037	0.00	125	SE
10 Dec, 2018	23:00 ~ 0:00	0.347	0.079	0.050	0.085	0.028	0.00	124	SE
11 Dec, 2018	0:00 ~ 1:00	0.348	0.088	0.054	0.086	0.019	0.00	124	SE
11 Dec, 2018	1:00 ~ 2:00	0.348	0.091	0.056	0.098	0.011	0.00	124	SE
11 Dec, 2018	2:00 ~ 3:00	0.330	0.094	0.061	0.104	0.006	0.00	56	ENE
11 Dec, 2018	3:00 ~ 4:00	0.278	0.091	0.070	0.096	0.008	0.34	20	NNE
11 Dec, 2018	4:00 ~ 5:00	0.243	0.089	0.048	0.075	0.010	0.14	19	NNE
11 Dec, 2018	5:00 ~ 6:00	0.258	0.088	0.075	0.093	0.006	0.58	23	NNE
11 Dec, 2018	6:00 ~ 7:00	0.263	0.091	0.053	0.069	0.004	0.09	30	NNE
11 Dec, 2018	7:00 ~ 8:00	0.314	0.095	0.058	0.087	0.009	0.40	32	NNE
11 Dec, 2018	8:00 ~ 9:00	0.244	0.079	0.042	0.072	0.008	1.18	32	NNE
11 Dec, 2018	9:00 ~ 10:00	0.172	0.036	0.011	0.048	0.006	0.83	50	NE
11 Dec, 2018	10:00 ~ 11:00	0.093	0.003	0.003	0.009	0.020	2.05	59	ENE

Max	0.417 (0.477 mg/m^3)	0.095 (0.179 mg/m^3)	0.095	0.104	0.129 (0.008 mg/m^3)
Avg	0.206 (0.236 mg/m^3)	0.046 (0.086 mg/m^3)	0.048	0.066	0.045 (0.117 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.002 (0.004 mg/m^3)	0.001	0.003	0.004 (0.010 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
11 Dec, 2018	11:00 ~ 12:00	0.000	0.002	0.004	0.020	0.048	1.45	57	ENE
11 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.011	0.070	0.086	0.94	73	ENE
11 Dec, 2018	13:00 ~ 14:00	0.000	0.002	0.021	0.023	0.114	0.58	54	NE
11 Dec, 2018	14:00 ~ 15:00	0.010	0.002	0.092	0.080	0.113	0.43	153	SSE
11 Dec, 2018	15:00 ~ 16:00	0.058	0.005	0.073	0.076	0.073	1.99	161	SSE
11 Dec, 2018	16:00 ~ 17:00	0.170	0.018	0.008	0.018	0.015	1.33	18	NNE
11 Dec, 2018	17:00 ~ 18:00	0.738	0.061	0.013	0.033	0.052	0.05	16	NNE
11 Dec, 2018	18:00 ~ 19:00	0.911	0.070	0.043	0.072	0.083	0.00	16	NNE
11 Dec, 2018	19:00 ~ 20:00	0.768	0.075	0.078	0.105	0.085	0.00	16	NNE
11 Dec, 2018	20:00 ~ 21:00	0.537	0.089	0.052	0.082	0.070	0.00	16	NNE
11 Dec, 2018	21:00 ~ 22:00	0.426	0.093	0.052	0.093	0.052	0.00	16	NNE
11 Dec, 2018	22:00 ~ 23:00	0.347	0.099	0.075	0.114	0.027	0.00	16	NNE
11 Dec, 2018	23:00 ~ 0:00	0.427	0.092	0.074	0.107	0.040	0.00	16	NNE
12 Dec, 2018	0:00 ~ 1:00	0.474	0.098	0.071	0.113	0.041	0.08	15	NNE
12 Dec, 2018	1:00 ~ 2:00	0.362	0.099	0.095	0.127	0.021	0.33	27	NNE
12 Dec, 2018	2:00 ~ 3:00	0.148	0.076	0.075	0.096	0.005	1.63	13	NNE
12 Dec, 2018	3:00 ~ 4:00	0.120	0.062	0.049	0.063	0.000	1.93	24	NNE
12 Dec, 2018	4:00 ~ 5:00	0.162	0.069	0.037	0.051	0.000	1.61	25	NNE
12 Dec, 2018	5:00 ~ 6:00	0.168	0.073	0.027	0.044	0.000	0.74	16	NNE
12 Dec, 2018	6:00 ~ 7:00	0.203	0.073	0.046	0.056	0.000	1.40	24	NNE
12 Dec, 2018	7:00 ~ 8:00	0.182	0.070	0.014	0.037	0.000	1.80	29	NNE
12 Dec, 2018	8:00 ~ 9:00	0.185	0.062	0.028	0.055	0.000	1.98	30	NNE
12 Dec, 2018	9:00 ~ 10:00	0.164	0.039	0.024	0.056	0.000	2.73	37	NE
12 Dec, 2018	10:00 ~ 11:00	0.113	0.007	0.015	0.040	0.004	4.30	34	NE

Max	0.911 (1.043 mg/m^3)	0.099 (0.187 mg/m^3)	0.095	0.127	0.114 (0.008 mg/m^3)
Avg	0.278 (0.318 mg/m^3)	0.056 (0.105 mg/m^3)	0.045	0.068	0.039 (0.101 mg/m^3)
Min	0.000 (0.000mg/m^3)	0.002 (0.004 mg/m^3)	0.004	0.018	0.000 (0.000 mg/m^3)

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		ppm	ppm	mg/m^3	mg/m^3	ppm	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
12 Dec, 2018	11:00 ~ 12:00	0.041	0.002	0.005	0.018	0.021	3.34	39	NE
12 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.003	0.031	0.035	2.83	35	NE
12 Dec, 2018	13:00 ~ 14:00	0.000	0.000	0.000	0.000	0.000	2.70	51	NE
12 Dec, 2018	14:00 ~ 15:00	0.000	0.001	0.019	0.038	0.010	1.98	47	NE
12 Dec, 2018	15:00 ~ 16:00	0.002	0.002	0.084	0.126	0.040	0.62	34	NNE
12 Dec, 2018	16:00 ~ 17:00	0.055	0.002	0.074	0.089	0.037	0.93	25	NNE
12 Dec, 2018	17:00 ~ 18:00	0.170	0.002	0.094	0.113	0.040	0.18	32	NNE
12 Dec, 2018	18:00 ~ 19:00	0.432	0.002	0.112	0.144	0.066	0.00	39	NE
12 Dec, 2018	19:00 ~ 20:00	0.405	0.020	0.087	0.119	0.052	0.00	39	NE
12 Dec, 2018	20:00 ~ 21:00	0.174	0.032	0.064	0.080	0.028	0.11	30	NNE
12 Dec, 2018	21:00 ~ 22:00	0.104	0.032	0.052	0.062	0.014	0.08	20	NNE
12 Dec, 2018	22:00 ~ 23:00	0.173	0.043	0.051	0.067	0.015	1.16	16	NNE
12 Dec, 2018	23:00 ~ 0:00	0.093	0.041	0.047	0.051	0.005	2.48	16	NNE
13 Dec, 2018	0:00 ~ 1:00	0.149	0.049	0.037	0.049	0.006	0.57	27	NNE
13 Dec, 2018	1:00 ~ 2:00	0.143	0.057	0.033	0.044	0.001	0.47	34	NE
13 Dec, 2018	2:00 ~ 3:00	0.140	0.053	0.032	0.044	0.000	0.90	29	NNE
13 Dec, 2018	3:00 ~ 4:00	0.139	0.056	0.024	0.038	0.000	1.22	30	NNE
13 Dec, 2018	4:00 ~ 5:00	0.147	0.061	0.024	0.040	0.000	0.26	28	NNE
13 Dec, 2018	5:00 ~ 6:00	0.152	0.065	0.033	0.046	0.000	0.40	27	NNE
13 Dec, 2018	6:00 ~ 7:00	0.163	0.066	0.039	0.056	0.000	0.26	30	NNE
13 Dec, 2018	7:00 ~ 8:00	0.190	0.060	0.012	0.043	0.003	0.57	38	NE
13 Dec, 2018	8:00 ~ 9:00	0.131	0.021	0.008	0.039	0.009	1.10	47	NE
13 Dec, 2018	9:00 ~ 10:00	0.052	0.002	0.005	0.020	0.014	1.41	51	NE
13 Dec, 2018	10:00 ~ 11:00	0.000	0.002	0.002	0.020	0.034	2.33	79	E

Max	0.432 (0.494 mg/m^3)	0.066 (0.125 mg/m^3)	0.112	0.144	0.066 (0.008 mg/m^3)
Avg	0.127 (0.146 mg/m^3)	0.028 (0.053 mg/m^3)	0.039	0.057	0.018 (0.047 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.000 (0.000mg/m^3)	0.000	0.000	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
13 Dec, 2018	11:00 ~ 12:00	0.000	0.002	0.002	0.028	0.019	1.27	64	ENE
13 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.007	0.034	0.000	1.86	28	NNE
13 Dec, 2018	13:00 ~ 14:00	0.000	0.002	0.043	0.063	0.000	0.96	100	E
13 Dec, 2018	14:00 ~ 15:00	0.009	0.002	0.057	0.058	0.000	1.30	231	SW
13 Dec, 2018	15:00 ~ 16:00	0.029	0.002	0.004	0.022	0.000	3.10	246	WSW
13 Dec, 2018	16:00 ~ 17:00	0.084	0.002	0.030	0.041	0.000	0.98	286	WNW
13 Dec, 2018	17:00 ~ 18:00	0.067	0.002	0.069	0.076	0.000	1.30	67	ENE
13 Dec, 2018	18:00 ~ 19:00	0.208	0.018	0.077	0.074	0.000	0.36	15	NNE
13 Dec, 2018	19:00 ~ 20:00	0.353	0.056	0.060	0.074	0.000	0.00	297	WNW
13 Dec, 2018	20:00 ~ 21:00	0.288	0.082	0.041	0.056	0.000	0.08	63	ENE
13 Dec, 2018	21:00 ~ 22:00	0.423	0.095	0.041	0.076	0.000	0.00	10	N
13 Dec, 2018	22:00 ~ 23:00	0.258	0.096	0.067	0.136	0.000	0.03	20	NNE
13 Dec, 2018	23:00 ~ 0:00	0.194	0.092	0.092	0.141	0.000	0.67	29	NNE
14 Dec, 2018	0:00 ~ 1:00	0.201	0.093	0.102	0.159	0.000	0.53	30	NNE
14 Dec, 2018	1:00 ~ 2:00	0.146	0.087	0.080	0.120	0.000	0.33	27	NNE
14 Dec, 2018	2:00 ~ 3:00	0.128	0.080	0.057	0.082	0.000	0.47	37	NE
14 Dec, 2018	3:00 ~ 4:00	0.143	0.080	0.058	0.088	0.000	0.49	33	NNE
14 Dec, 2018	4:00 ~ 5:00	0.152	0.079	0.062	0.092	0.000	0.81	28	NNE
14 Dec, 2018	5:00 ~ 6:00	0.158	0.080	0.064	0.099	0.000	0.13	41	NE
14 Dec, 2018	6:00 ~ 7:00	0.187	0.080	0.074	0.115	0.000	0.21	35	NE
14 Dec, 2018	7:00 ~ 8:00	0.158	0.082	0.042	0.068	0.000	1.12	30	NNE
14 Dec, 2018	8:00 ~ 9:00	0.133	0.040	0.008	0.031	0.000	1.50	39	NE
14 Dec, 2018	9:00 ~ 10:00	0.068	0.002	0.010	0.014	0.004	3.43	33	NNE
14 Dec, 2018	10:00 ~ 11:00	0.005	0.002	0.006	0.019	0.000	2.54	39	NE

Max	0.423 (0.484 mg/m^3)	0.096 (0.181 mg/m^3)	0.102	0.159	0.019 (0.008 mg/m^3)
Avg	0.141 (0.162 mg/m^3)	0.048 (0.091 mg/m^3)	0.048	0.074	0.001 (0.003 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.002 (0.004 mg/m^3)	0.002	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
14 Dec, 2018	11:00 ~ 12:00	0.000	0.002	0.012	0.039	0.000	2.41	42	NE
14 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.002	0.024	0.000	2.47	59	ENE
14 Dec, 2018	13:00 ~ 14:00	0.000	0.002	0.007	0.029	0.000	2.12	56	ENE
14 Dec, 2018	14:00 ~ 15:00	0.000	0.002	0.032	0.048	0.000	1.87	64	ENE
14 Dec, 2018	15:00 ~ 16:00	0.000	0.002	0.094	0.093	0.000	1.46	86	E
14 Dec, 2018	16:00 ~ 17:00	0.000	0.002	0.065	0.068	0.000	0.71	86	E
14 Dec, 2018	17:00 ~ 18:00	0.378	0.002	0.103	0.121	0.000	0.03	115	ESE
14 Dec, 2018	18:00 ~ 19:00	0.362	0.002	0.129	0.148	0.000	0.03	139	SE
14 Dec, 2018	19:00 ~ 20:00	0.313	0.009	0.087	0.128	0.000	0.00	137	SE
14 Dec, 2018	20:00 ~ 21:00	0.525	0.022	0.107	0.157	0.000	0.00	137	SE
14 Dec, 2018	21:00 ~ 22:00	0.475	0.037	0.094	0.142	0.000	0.00	137	SE
14 Dec, 2018	22:00 ~ 23:00	0.258	0.051	0.168	0.222	0.000	0.00	137	SE
14 Dec, 2018	23:00 ~ 0:00	0.288	0.059	0.113	0.154	0.000	0.00	137	SE
15 Dec, 2018	0:00 ~ 1:00	0.206	0.062	0.058	0.081	0.000	0.01	131	SE
15 Dec, 2018	1:00 ~ 2:00	0.194	0.072	0.047	0.068	0.000	0.15	17	NNE
15 Dec, 2018	2:00 ~ 3:00	0.173	0.077	0.028	0.048	0.000	0.06	15	NNE
15 Dec, 2018	3:00 ~ 4:00	0.162	0.071	0.032	0.051	0.000	0.07	18	NNE
15 Dec, 2018	4:00 ~ 5:00	0.171	0.075	0.051	0.069	0.000	0.11	40	NE
15 Dec, 2018	5:00 ~ 6:00	0.153	0.074	0.054	0.071	0.000	0.43	34	NE
15 Dec, 2018	6:00 ~ 7:00	0.164	0.072	0.045	0.067	0.000	0.53	31	NNE
15 Dec, 2018	7:00 ~ 8:00	0.175	0.066	0.028	0.053	0.000	1.01	32	NNE
15 Dec, 2018	8:00 ~ 9:00	0.145	0.038	0.015	0.049	0.000	3.36	28	NNE
15 Dec, 2018	9:00 ~ 10:00	0.098	0.003	0.010	0.034	0.000	2.99	29	NNE
15 Dec, 2018	10:00 ~ 11:00	0.065	0.002	0.003	0.019	0.000	2.43	41	NE

Max	0.525 (0.601 mg/m^3)	0.077 (0.146 mg/m^3)	0.168	0.222	0.000 (0.000 mg/m^3)
Avg	0.179 (0.205 mg/m^3)	0.034 (0.063 mg/m^3)	0.058	0.083	0.000 (0.000 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.002 (0.004mg/m^3)	0.002	0.019	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
15 Dec, 2018	11:00 ~ 12:00	0.009	0.002	0.001	0.002	0.000	1.43	41	NE
15 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.001	0.003	0.000	1.80	58	ENE
15 Dec, 2018	13:00 ~ 14:00	0.000	0.002	0.002	0.027	0.000	1.93	51	NE
15 Dec, 2018	14:00 ~ 15:00	0.000	0.002	0.001	0.037	0.000	1.78	44	NE
15 Dec, 2018	15:00 ~ 16:00	0.000	0.002	0.011	0.053	0.000	1.27	64	ENE
15 Dec, 2018	16:00 ~ 17:00	0.002	0.003	0.108	0.089	0.009	2.22	19	NNE
15 Dec, 2018	17:00 ~ 18:00	0.132	0.002	0.111	0.113	0.000	1.16	16	NNE
15 Dec, 2018	18:00 ~ 19:00	1.156	0.002	0.107	0.147	0.000	0.00	20	NNE
15 Dec, 2018	19:00 ~ 20:00	0.728	0.012	0.153	0.206	0.000	0.00	20	NNE
15 Dec, 2018	20:00 ~ 21:00	0.541	0.025	0.094	0.128	0.000	0.00	20	NNE
15 Dec, 2018	21:00 ~ 22:00	0.241	0.031	0.081	0.102	0.000	0.00	20	NNE
15 Dec, 2018	22:00 ~ 23:00	0.153	0.039	0.031	0.057	0.000	0.01	17	NNE
15 Dec, 2018	23:00 ~ 0:00	0.009	0.002	0.001	0.002	0.000	1.43	41	NE
16 Dec, 2018	0:00 ~ 1:00	0.000	0.002	0.001	0.003	0.000	1.80	58	ENE
16 Dec, 2018	1:00 ~ 2:00	0.000	0.002	0.002	0.027	0.000	1.93	51	NE
16 Dec, 2018	2:00 ~ 3:00	0.000	0.002	0.001	0.037	0.000	1.78	44	NE
16 Dec, 2018	3:00 ~ 4:00	0.000	0.002	0.011	0.053	0.000	1.27	64	ENE
16 Dec, 2018	4:00 ~ 5:00	0.002	0.003	0.108	0.089	0.009	2.22	19	NNE
16 Dec, 2018	5:00 ~ 6:00	0.132	0.002	0.111	0.113	0.000	1.16	16	NNE
16 Dec, 2018	6:00 ~ 7:00	1.156	0.002	0.107	0.147	0.000	0.00	20	NNE
16 Dec, 2018	7:00 ~ 8:00	0.728	0.012	0.153	0.206	0.000	0.00	20	NNE
16 Dec, 2018	8:00 ~ 9:00	0.541	0.025	0.094	0.128	0.000	0.00	20	NNE
16 Dec, 2018	9:00 ~ 10:00	0.241	0.031	0.081	0.102	0.000	0.00	20	NNE
16 Dec, 2018	10:00 ~ 11:00	0.041	0.002	0.001	0.015	0.000	2.29	41	NE

Max	1.156 (1.324 mg/m^3)	0.039 (0.074 mg/m^3)	0.153	0.206	0.009 (0.008 mg/m^3)
Avg	0.242 (0.277 mg/m^3)	0.009 (0.017 mg/m^3)	0.057	0.079	0.001 (0.002 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.002 (0.004 mg/m^3)	0.001	0.002	0.000 (0.000 mg/m^3)

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		ppm	ppm	mg/m^3	mg/m^3	ppm	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
16 Dec, 2018	11:00 ~ 12:00	0.003	0.002	0.019	0.029	0.000	2.69	44	NE
16 Dec, 2018	12:00 ~ 13:00	0.000	0.002	0.002	0.038	0.000	2.91	42	NE
16 Dec, 2018	13:00 ~ 14:00	0.000	0.002	0.008	0.018	0.000	2.23	40	NE
16 Dec, 2018	14:00 ~ 15:00	0.000	0.002	0.001	0.069	0.000	2.03	40	NE
16 Dec, 2018	15:00 ~ 16:00	0.000	0.002	0.002	0.012	0.000	1.57	141	SE
16 Dec, 2018	16:00 ~ 17:00	0.000	0.002	0.105	0.048	0.000	2.43	246	WSW
16 Dec, 2018	17:00 ~ 18:00	0.092	0.002	0.094	0.077	0.000	0.11	219	SW
16 Dec, 2018	18:00 ~ 19:00	0.420	0.002	0.064	0.078	0.000	0.00	201	SSW
16 Dec, 2018	19:00 ~ 20:00	0.472	0.008	0.047	0.073	0.000	0.01	240	WSW
16 Dec, 2018	20:00 ~ 21:00	0.614	0.024	0.043	0.051	0.000	0.00	280	W
16 Dec, 2018	21:00 ~ 22:00	0.676	0.063	0.097	0.068	0.000	0.00	162	SSE
16 Dec, 2018	22:00 ~ 23:00	0.526	0.075	0.055	0.108	0.000	0.00	72	ENE
16 Dec, 2018	23:00 ~ 0:00	0.518	0.089	0.074	0.114	0.000	0.00	72	ENE
17 Dec, 2018	0:00 ~ 1:00	0.361	0.090	0.065	0.096	0.000	0.00	72	ENE
17 Dec, 2018	1:00 ~ 2:00	0.283	0.089	0.042	0.061	0.000	0.00	67	ENE
17 Dec, 2018	2:00 ~ 3:00	0.213	0.077	0.022	0.035	0.000	0.08	52	NE
17 Dec, 2018	3:00 ~ 4:00	0.215	0.075	0.014	0.023	0.000	0.14	22	NNE
17 Dec, 2018	4:00 ~ 5:00	0.252	0.079	0.012	0.029	0.000	0.02	22	NNE
17 Dec, 2018	5:00 ~ 6:00	0.281	0.089	0.030	0.044	0.000	0.33	27	NNE
17 Dec, 2018	6:00 ~ 7:00	0.233	0.092	0.014	0.030	0.000	1.92	31	NNE
17 Dec, 2018	7:00 ~ 8:00	0.258	0.087	0.010	0.039	0.000	2.29	35	NE
17 Dec, 2018	8:00 ~ 9:00	0.219	0.050	0.005	0.035	0.004	3.37	39	NE
17 Dec, 2018	9:00 ~ 10:00	0.171	0.004	0.006	0.035	0.081	2.85	39	NE
17 Dec, 2018	10:00 ~ 11:00	0.069	0.002	0.008	0.029	0.016	2.78	39	NE

Max	0.676 (0.774 mg/m^3)	0.092 (0.173 mg/m^3)	0.105	0.114	0.081 (0.008 mg/m^3)
Avg	0.245 (0.280 mg/m^3)	0.042 (0.079 mg/m^3)	0.035	0.052	0.004 (0.011 mg/m^3)
Min	0.000 (0.000 mg/m^3)	0.002 (0.004 mg/m^3)	0.001	0.012	0.000 (0.000 mg/m^3)

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 2 & 3

Appendix

Noise and Vibration Monitoring Report

December 2018

NOISE AND VIBRATION

MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 2 & 3 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

December 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 10 December 2018 – 12 December 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 10– 11 December 2018	Noise Level	LAeq(dB)	1 (NV-2)	24 hours	On-site measurement by "Rion NL-42 sound level meter"
From 11 – 12 December 2018	Noise Level	LAeq(dB)	1 (NV-1)	24 hours	On-site measurement by "Rion NL-42 sound level meter"
From 10 – 11 December 2018	Vibration Level	L_{v10} (dB)	1 (NV-2)	24 hours	On-site measurement by "Vibration Level Meter- VM-53A"
From 11 – 12 December 2018	Vibration Level	L_{v10} (dB)	1 (NV-1)	24 hours	On-site measurement by "Vibration Level Meter- VM-53A"

CHAPTER 2: NOISE AND VIBRATION LEVEL MONITORING

2.1 Monitoring Item

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

Table 2.1-1 Monitoring Parameters for Noise and Vibration Level

No.	Item	Parameter
1	Noise	A-weighted loudness equivalent (L_{Aeq})
2	Vibration	Vibration level, vertical, percentile (L_{V10})

2.2 Monitoring Location

Noise and vibration levels were measured at the northeast corner of the Thilawa SEZ Zone B, monitoring point (NV-1); N: 16°40'18.22", E: 96°17'18.18" for traffic noise concerned and at the south of the Thilawa SEZ Zone B, 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 respectively. Possible sources of noise and vibration is generated from construction activities and road traffic.

NV-2

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

2.3 Monitoring Method

Noise level was measured by "Rion NL-42 sound level meter" and automatically recorded every 10 minutes in a memory card. The vibration level meter was, VM-53A (Rion Co., Ltd., Japan), accompanied by a 3-axis accelerometer PV-83C (Rion Co., Ltd.) was placed on solid soil ground. Vertical vibration (Z axis), L_v, was measured every 10 minutes within the adaptable range of (10-70) dB at NV-1 and (10-70) dB at NV-2 and recorded to a memory card.
The measurement period of noise and vibration was 24 hours for each monitoring point. The status of the noise and vibration level monitoring on NV-1 and NV-2 are shown in Figure 2.3-1.

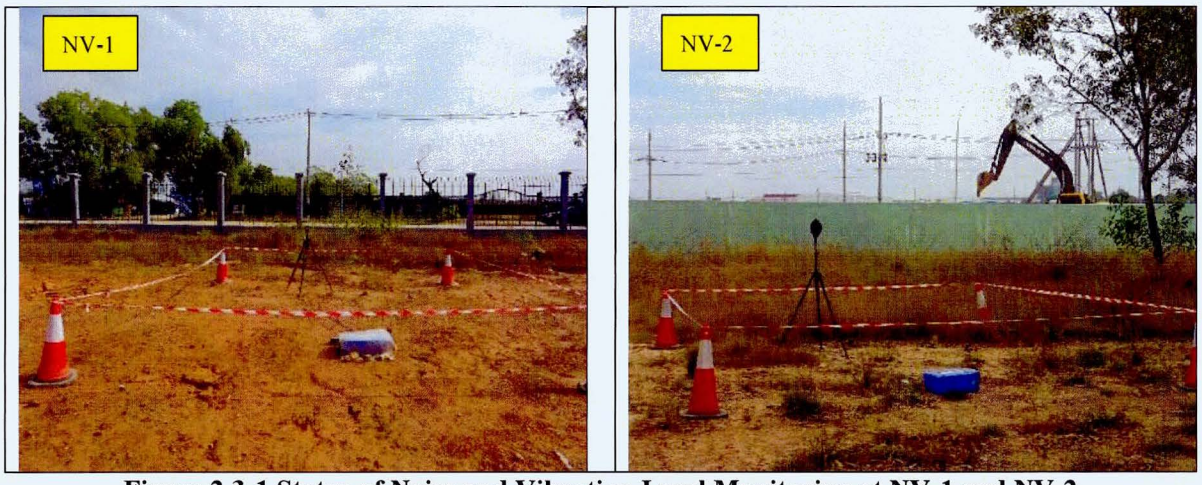

Figure 2.3-1 Status of Noise and Vibration Level Monitoring at NV-1 and NV-2

2.4 Monitoring Results

Noise Monitoring Results

Noise monitoring results are separated daytime (6:00 AM to 10:00 PM), evening time (10:00 PM to 6:00 AM) time frames for NV-1 and daytime (7:00 AM to 7:00 PM), evening time (7:00 PM to 10:00 PM), and night time (10:00 PM to 7:00 AM) time frames respectively for NV-2. Noise measurement was carried out for one location on a 24-hour basis. The monitoring results are summarized in Table 2.4-1 and Table 2.4-2. Hourly noise level (LAeq) monitoring results at NV-1 and NV-2 are shown in Table 2.4-3and Table 2.4-4. Figure 2.4-1 and Figure 2.4-2 showed the results of noise level (LAeq) at NV-1 and NV-2. Comparing with the target value of noise level in construction stage prescribed in EIA report for Thilawa SEZ development project Zone B, all results were under the target values.

Table 2.4-1 Results of Noise Levels (LAeq) Monitoring at NV-1

Date	(Traffic Noise Level) Equivalent Noise Level (LAeq, dB)	
	Day Time (6:00 AM – 10:00 PM)	Night Time (10:00 PM – 6:00 AM)
11 – 12 December 2018	59	51
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 (LAeq) Monitoring at NV-2

Date	(Residential area & monastery located less than 150m from the construction site) Equivalent Noise Level (LAeq, 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)
10– 11 December 2018	50	53	51
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 (LAeq) Monitoring Results at NV-1

Date	Time	(LAeq, dB)	(LAeq, dB) Each Category	(LAeq, dB) Target Value	Remark
11 - 12 December 2018	6:00-7:00	53	59	75	No construction Activities
	7:00-8:00	60			
	8:00:9:00	59			Constructional activities of Zone B (Canal and road excavation, land grading, material delivery and installation etc,.)
	9:00-10:00	59			
	10:00-11:00	60			
	11:00-12:00	59			
	12:00-13:00	58			
	13:00-14:00	60			
	14:00-15:00	60			
	15:00-16:00	62			
	16:00-17:00	60			
	17:00-18:00	60			
	18:00-19:00	57			
	19:00-20:00	56			
	20:00-21:00	54			
	21:00-22:00	55			
	22:00-23:00	56	51	70	No construction Activities
	23:00-24:00	51			
	24:00-1:00	53			
	1:00-2:00	52			
	2:00-3:00	47			
	3:00-4:00	48			
	4:00-5:00	46			
	5:00-6:00	48			

Table 2.4-4 Hourly Noise Level (LAeq) Monitoring Results at NV-2

Date	Time	(LAeq, dB)	(LAeq, dB) Each Category	(LAeq, dB) Target Value	Remark
10 - 11 December 2018	7:00-8:00	47	50	75	No construction Activities
	8:00:9:00	55			Constructional Activities of Zone B (Canal and pipeline excavation, land grading, material delivery and installation etc.,)
	9:00-10:00	46			
	10:00-11:00	51			
	11:00-12:00	47			
	12:00-13:00	43			
	13:00-14:00	47			
	14:00-15:00	48			
	15:00-16:00	48			
	16:00-17:00	53			
	17:00-18:00	50			
	18:00-19:00	50			
	19:00-20:00	53	53	60	
	20:00-21:00	54			
	21:00-22:00	52			
	22:00-23:00	52	51	55	No construction Activities
	23:00-24:00	53			
	24:00-1:00	53			
	1:00-2:00	52			
	2:00-3:00	48			
	3:00-4:00	50			
	4:00-5:00	47			
	5:00-6:00	47			
	6:00-7:00	48			

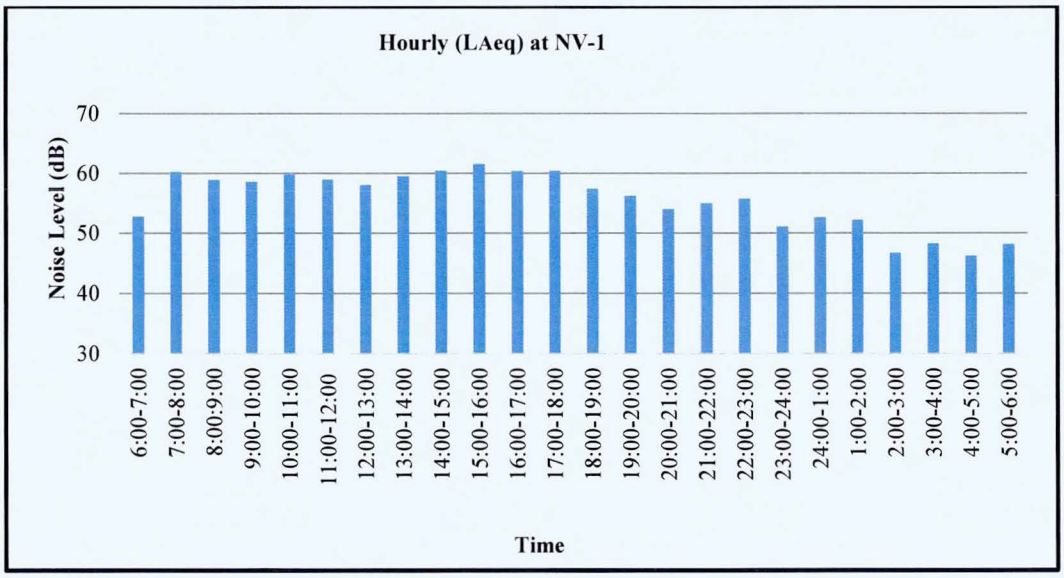

Figure 2.4-1 Results of Noise Levels (LAeq) Monitoring at NV-1

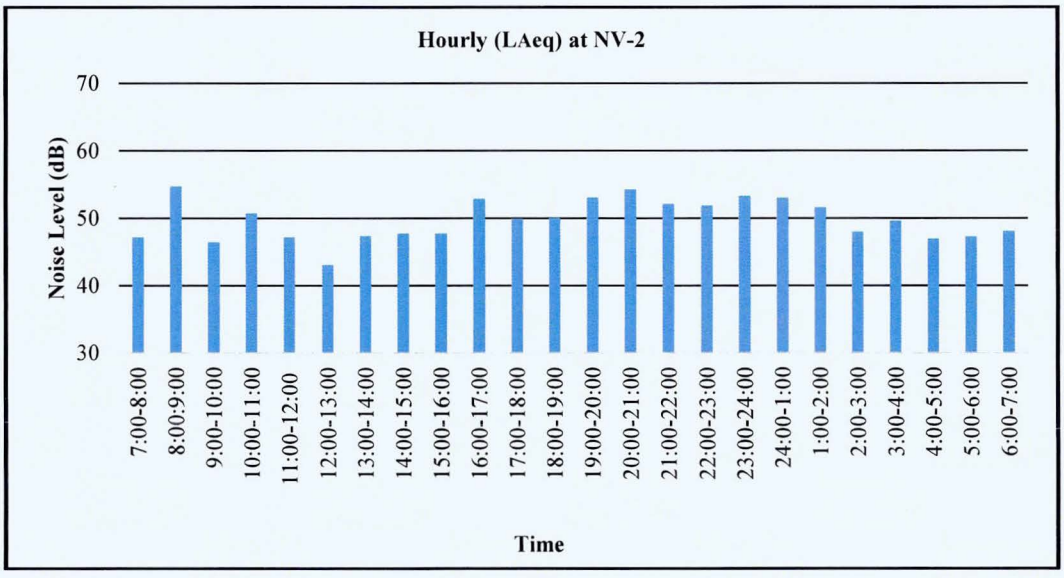

Figure 2.4-2 Results of Noise Levels (LAeq) Monitoring at NV-2

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 2.4-7and 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

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)
11 – 12 December 2018	40	36	33
Target Value	70	70	65

Note: Target value is applied to the vibration 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

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)
10 – 11 December 2018	38	22	15
Target Value	65	65	60

Note: Target value is applied to the vibration 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	11 – 12 December 2018	(L_{v10}, dB) Each Category	(L_{v10}, dB) Target Value	Remark
Time	L_{v10}			
7:00-8:00	38	40	70	No construction Activities
8:00:9:00	41			Constructional activities of Zone B (Canal and road excavation, land grading, material delivery and installation etc,.)
9:00-10:00	39			
10:00-11:00	41			
11:00-12:00	41			
12:00-13:00	41			
13:00-14:00	41			
14:00-15:00	41			
15:00-16:00	40			
16:00-17:00	38			
17:00-18:00	40			
18:00-19:00	37			
19:00-20:00	35	36	70	
20:00-21:00	36			
21:00-22:00	36			
22:00-23:00	38	33	65	
23:00-24:00	33			
24:00-1:00	35			No construction Activities
1:00-2:00	34			
2:00-3:00	28			
3:00-4:00	27			
4:00-5:00	28			
5:00-6:00	29			
6:00-7:00	31			

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

Date	10 – 11 December 2018	(L_{v10}, dB) Each Category	(L_{v10}, dB) Target Value	Remark
Time	L_{v10}			
7:00-8:00	22	38	65	No operation Activities
8:00:9:00	43			Constructional Activities of Zone B (Canal and pipeline excavation, land grading, material delivery and installation etc.,)
9:00-10:00	32			
10:00-11:00	42			
11:00-12:00	39			
12:00-13:00	24			
13:00-14:00	38			
14:00-15:00	41			
15:00-16:00	40			
16:00-17:00	38			
17:00-18:00	32			
18:00-19:00	21			
19:00-20:00	26	22	65	
20:00-21:00	17			
21:00-22:00	16			
22:00-23:00	16	15	60	
23:00-24:00	14			
24:00-1:00	14			No operation activities
1:00-2:00	12			
2:00-3:00	12			
3:00-4:00	13			
4:00-5:00	12			
5:00-6:00	15			
6:00-7:00	19			

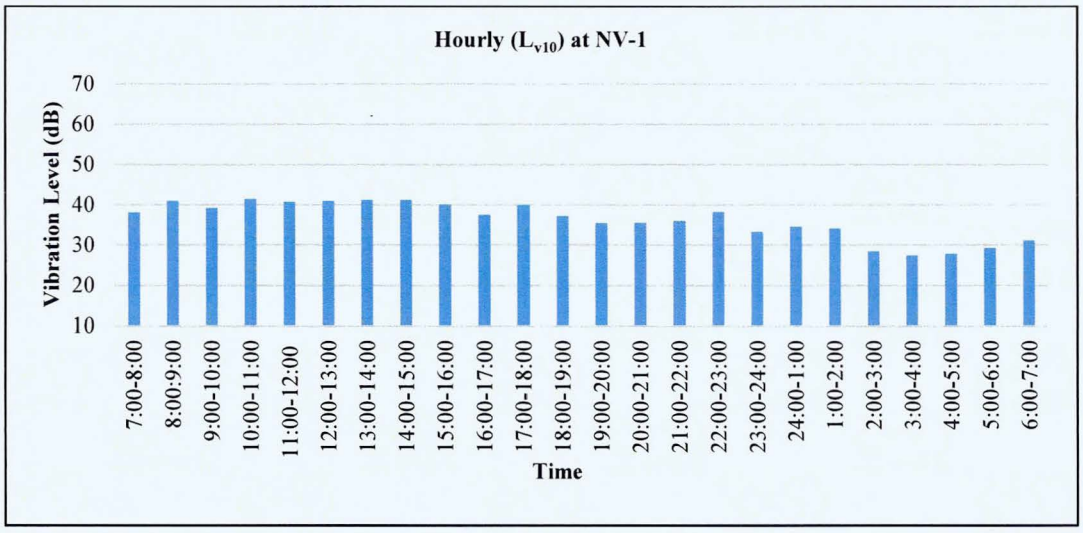

Figure 2.4-3 Results of Vibration Levels (L_{v10}) Monitoring at NV-1

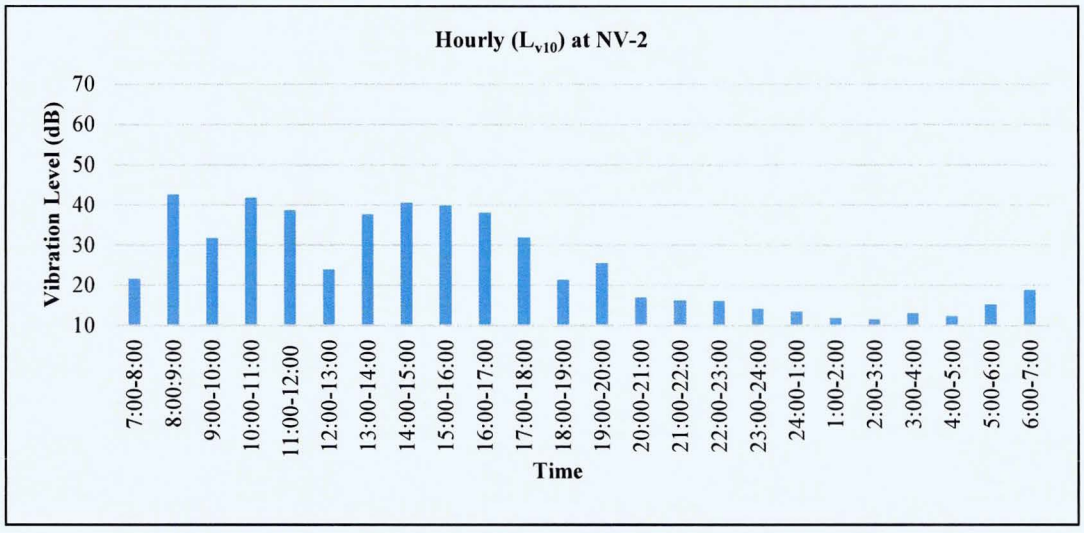

Figure 2.4-4 Results of Vibration Levels (L_{v10}) Monitoring at NV-2

CHAPTER 3: CONCLUSION AND RECOMMENDATION

By comparing with the target noise and vibration level in construction stage in EIA report for Thilawa SEZ development project Zone B, all results were under the target values at NV-1 and NV-2. As for the detailed analysis of noise level at NV-1 and NV-2 on 24 hours, all results were under the target value. The results of vibration level for NV-1 and NV-2 are also lower than the target levels. Thus, there is no negative impact on noise and vibration from construction activities of Zone B to the surrounding environment.

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

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 2 & 3

Appendix

Traffic Volume Monitoring Report

December 2018

TRAFFIC VOLUME MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 2 & 3 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

December 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 11 December 2018 to 12 December 2018 as follows;

Table 1.2-1 Outlines of Traffic Volume Monitoring

Monitoring Date	Monitoring Item	Parameters	Number of Points	Duration	Monitoring Methodology
11 December 2018 - 12 December 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 and local industrial zone in the east 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.

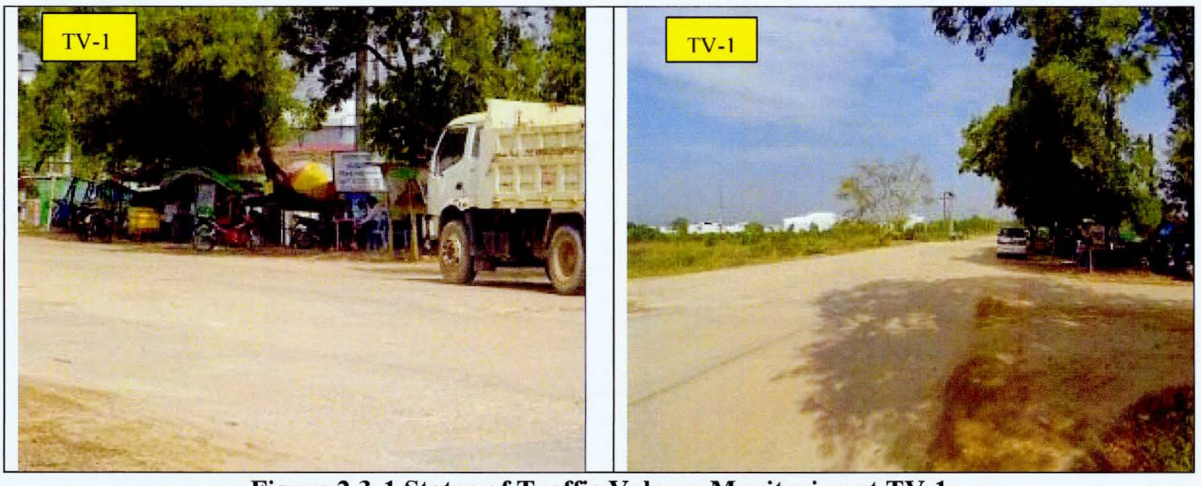

Figure 2.3-1 Status of Traffic Volume Monitoring at TV-1

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	11 December 2018-12 December 2018	Tuesday & Wednesday	2404	865	371	50	3690
	Dagon-Thilawa road to Phalan village			2388	944	384	65	3781

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 9:00 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	77	30	5	257
13:00	14:00	85	61	26	5	177
14:00	15:00	85	50	28	8	171
15:00	16:00	93	68	34	5	200
16:00	17:00	145	62	20	3	230
17:00	18:00	280	88	19	6	393
18:00	19:00	193	54	7	0	254
19:00	20:00	81	31	9	1	122
20:00	21:00	46	16	10	0	72
21:00	22:00	34	7	8	1	50
22:00	23:00	27	14	7	0	48
23:00	00:00	16	3	3	0	22
00:00	1:00	3	2	4	0	9
1:00	2:00	9	4	13	0	26
2:00	3:00	6	1	2	0	9
3:00	4:00	6	6	2	0	14
4:00	5:00	7	9	5	0	21
5:00	6:00	18	11	2	0	31
6:00	7:00	140	23	18	0	181
7:00	8:00	455	49	15	3	522
8:00	9:00	187	55	23	4	269
9:00	10:00	101	48	27	4	180
10:00	11:00	123	60	33	3	219
11:00	12:00	119	66	26	2	213
Total		2404	865	371	50	3690

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	133	78	30	5	246
13:00	14:00	153	93	38	8	292
14:00	15:00	92	78	26	7	203
15:00	16:00	71	41	22	5	139
16:00	17:00	126	38	16	2	182
17:00	18:00	345	81	26	2	454
18:00	19:00	175	34	13	3	225
19:00	20:00	92	26	8	3	129
20:00	21:00	47	20	5	0	72
21:00	22:00	26	15	19	0	60
22:00	23:00	18	12	14	0	44
23:00	00:00	20	6	2	0	28
00:00	1:00	8	7	6	0	21
1:00	2:00	4	0	4	0	8
2:00	3:00	1	2	4	0	7
3:00	4:00	10	5	2	0	17
4:00	5:00	5	3	3	0	11
5:00	6:00	15	14	3	0	32
6:00	7:00	68	16	3	1	88
7:00	8:00	378	65	14	8	465
8:00	9:00	239	104	34	6	383
9:00	10:00	122	63	13	3	201
10:00	11:00	120	75	43	8	246
11:00	12:00	120	68	36	4	228
Total		2388	944	384	65	3781

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 two years 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 of December 2018 are the highest compared with other quarterly monitoring surveys from Phalan village to Dagon Thilawa Road and from Dagon Thilawa Road to Phalan village.

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 Mar-30 Mar 2017	Wednesday & Thursday	1,712	545	216	29	2,502
		22 June-23 June 2017	Thursday & Friday	1,402	528	352	47	2,329
		19 September-20 September 2017	Tuesday & Wednesday	1,254	509	393	17	2,173
		7 December-8 December 2017	Thursday & Friday	1,800	652	339	43	2,834
		15 March 2018 – 16 March 2018	Thursday and Friday	2,210	830	360	52	3,452
		5th June 2018 – 6th June 2018	Tuesday & Wednesday	2,253	847	323	54	3,477
		5 September 2018 – 6 September 2018	Wednesday & Thursday	2146	826	242	41	3255
		11 December 2018 – 12 December 2018	Tuesday & Wednesday	2404	865	371	50	3690

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 Mar-30 Mar 2017	Wednesday & Thursday	1,534	500	236	28	2,298
		22 June-23 June 2017	Thursday & Friday	1,291	542	357	43	2,233
		19 September-20 September 2017	Tuesday & Wednesday	1,195	486	372	19	2,072
		7 December-8 December 2017	Thursday & Friday	1,695	682	322	40	2,739
		15 March 2018 – 16 March 2018	Thursday and Friday	2,062	812	312	48	3,234
		5 June 2018 – 6 June 2018	Tuesday & Wednesday	2,048	799	322	52	3,221
		5 September 2018 – 6 September 2018	Wednesday & Thursday	2117	865	250	41	3273
		11 December 2018 – 12 December 2018	Tuesday & Wednesday	2388	944	384	65	3781

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 of December 2018 are the highest compared with other quarterly monitoring surveys from Phalan village to Dagon Thilawa Road and from Dagon Thilawa Road to Phalan village.

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