MJTD

Thilawa Special Economic Zone (Zone A) Development

Environmental Monitoring Report Phase - 2 (Construction Phase)

Myanmar Japan Thilawa Development Limited.

June 2016

Date: 2nd August 2016

Ref: MJTD/O/16-08-348

His Excellency Mr.Set Aung

Chairman, Thilawa SEZ Management Committee

Submission of Environmental Monitoring Report for Thilawa SEZ Zone A, Phase 2 Construction Phase (Report No.3)

Your Excellency,

Referring to the Environmental Impact Assessment (EIA) Report Appendix 1, Environmental Monitoring Plan for Thilawa SEZ Zone A(Construction Phase), we would like to submit Thilawa SEZ Zone A Development Project- Phase 2, Environmental Monitoring Report for Construction Phase as first time enclosed herewith this cover letter and six copies of attached documents:

- Environmental Monitoring Report for Phase 2,Construction Phase
- Water and Wastewater Monitoring Reports for May 2016
- Air Quality Monitoring Report for April 2016
- Noise and Vibration Monitoring Report for April 2016
- Monthly Progress Reports for March 2016
- Monthly Progress Reports for April 2016
- Monthly Progress Reports for May 2016

Yours Truly,

Takashi Yanai

President and CEO

Myanmar Japan Thilawa Development Limited

CONTENTS

Appendix

1. Executive Summary

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

The monitoring record from March 2016 to May 2016 according to the Environment Monitoring Plan is submitted in conformity with the provision of Chapter 9.1, Table 9.1-2 and 9.2, Table 9.2-2 Content of the EIA Report of Thilawa SEZ Development Project (Zone A).

2. Summary of Monitoring Activities

a) **Progress made to date on the implementation of the EMP against the submitted implementation schedule;**
We already summit EMP for Phase 2, Construction Phase Report(No.1, December 2015), Report (No.2, March 2016) and Report (No.3) is submitted this day attached with Construction Phase implementation schedule.

b) **Difficulties encountered in implementing of the EMP and recommendations for remedying those difficulties and steps proposed to prevent or avoid similar future difficulties;**
None

c) **Number and type of non-compliance with the EMP and proposed remedial measures and timelines for completion of remediation;**
None

d) **Accidents or incidents relating to the occupational and community health and safety, and the environment:**
Neither accidents nor incidents happen during this monitoring period.

e) **Monitoring data on environmental parameters and conditions as committed in the EMP or otherwise required.**
Please refer to the attached Environmental Monitoring Form.

3. Construction Progress

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

A. Monthly Progress Report for March, 2016

B. Monthly Progress Report for April, 2016

C. Monthly Progress Report for May, 2016

4. Monitoring Result

Environmental Monitoring plan report for Construction Phase implemented according to the following table, reference on Table 4.2-2, Chapter 4, EIA report.

Monitoring Plan (Construction Phase)

Category	Item	Location	Frequency	Remark
Air Quality	NO_2, SO_2, CO, TSP, PM_{10}	Construction site (1point)	Once/ 3month	April 2016, Monitoring Report
Water Quality	Water temperature, pH, SS, DO, BOD, COD, coliform count, oil and grease, chromium	Construction site (6 points) Well in the Monastery (1 point)	Once/2 month	May 2016, Monitoring Report
Waste	Amount of solid waste Management of solid waste of construction	Construction site	Once/3month	Monthly Progress Reports (March, April, May) 2016
Noise and Vibration	Noise and vibration level of construction	Preservation area such as residence around the proposed construction site (2 points)	Once/3moth (peak period)	Noise and Vibration Monitoring Report April 2016
		Preservation site such as residence along the route for on-site vehicles (2points)	Once (peak period)	
Ground Subsidence	Ground elevation Consumption of ground water amount	Representative (1 point)	Every week	Monthly Progress Reports (March, April, May) 2016
Hydrology				
Risk for infectious disease such as AIDS/HIV	Status of measures of infectious disease	Construction site	Once/month	Monthly Progress Reports (March, April, May)2016
Working conditions (including occupational safety)	Prehension of condition of occupational safety and health Prehension of infectious disease	Construction site	Once/ month	
Accident	Existence of accident	Construction site	As occasion arise	

Thilawa Special Economic Zone (Zone A)
Development Project –Phase 2

Environment Monitoring Form

Environment Monitoring Form

The latest results of the below monitoring items shall be submitted to Authorities on once at Pre-construction phase and on quarterly basis at Construction Phase, and on bi-annually base at Operation Phase. The items, standards to be applied, measurement points, and frequency for each monitoring parameter are established based on the EIA Report for Thilawa Special Economic Zone Development Project (Zone A). 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 (Not Applicable)

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

3) Response/Actions to Comments and Guidance from Government Authorities and the Public (Not Applicable)

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

(2) Monitoring Results

1) Ambient/ Air Quality – April 2016

NO_2, SO_2, CO, TSP, PM10

Location	Item	Unit	Measured Value (Mean)	Measured Value (Min~Max.)	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
Construction Area Near Thilawa Dam	NO_2	ppm	0.047	0.044-0.051	N/A	N/A	0.06	Once in three months	HAZSCANNER, EPAS	
	SO_2	ppm	0.009	0.007-0.012	N/A	N/A	0.04		HAZSCANNER, EPAS	
	CO	ppm	0.361	0.322-0.408	N/A	N/A	10		HAZSCANNER, EPAS	
	TSP	ppm	0.052	0.042-0.068	N/A	N/A	0.33		HAZSCANNER, EPAS	
	PM10	ppm	0.106	0.087-0.138	N/A	N/A	0.12		HAZSCANNER, EPAS	

*Remark: Referred to the Japan and Thailand Standard (EIA Report, Table 6.4-1)

Complains from Residents

- Are there any complains 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 Complains from Residents	Countermeasures

2) Water Quality – May 2016

Measurement Point: Effluent of Wastewater

- 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*2	Item	Unit	Measured Value	Country's Standard	Target value to be applied	*1Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
SW-2	pH	mg/l	7.16	None (Available Guideline Value determined by MOI)	5.0-9.0	>=4	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS	mg/l	123*3		Max.30			Gravimetric method	
	DO	mg/l	12.12		-			HI7609829-2,(D.O)sensor	
	COD_{Cr}	mg/l	555*4		Max. 70*3			Dichromate method	
	BOD	mg/l	116*5		Max. 20			Direct inoculation method	
	Oil and Grease	mg/l	<5		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	<0.02		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	9.3		Max 400			AOAC Petrifilm Method	
SW-3	pH	mg/l	7.48	None (Available Guideline Value determined by MOI)	5.0-9.0	>=4	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS	mg/l	350*3		Max.30			Gravimetric method	
	DO	mg/l	12.92		-			HI7609829-2,(D.O)sensor	
	COD	mg/l	560*3		Max. 70*3			Dichromate method	
	BOD	mg/l	96*5		Max. 20			Direct inoculation method	
	Oil and Grease	mg/l	<5		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	<0.02		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	4.5		Max 400			AOAC Petrifilm Method	

Location*2	Item	Unit	Measured Value	Country's Standard	Target value to be applied	*1Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
SW-4	pH	mg/l	7.87	None (Available Guideline Value determined by MOI)	5.0-9.0	>=4	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS	mg/l	180*3		Max.30			Gravimetric method	
	DO	mg/l	13.15		-			HI7609829-2,(D.O)sensor	
	COD	mg/l	545*3		Max. 70*5			Dichromate method	
	BOD	mg/l	99*4		Max. 20			Direct inoculation method	
	Oil and Grease	mg/l	<5		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	<0.02		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	<1.8		Max 400			AOAC Petrifilm Method	
GW-1	pH	mg/l	7.06	N/A	None (Available Guideline Value determined by MOI)	5.5~9.0	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS	mg/l	7.67			50		Gravimetric method	
	DO	mg/l	6.52			>=4		HI7609829-2,(D.O)sensor	
	COD_{Cr}	mg/l	45.5			60		Dichromate method	
	BOD	mg/l	23*3			15		Direct inoculation method	
	Oil and Grease	mg/l	<5			0.1		APHA-AWWA-WEF Method	
	Cr	mg/l	<0.02			0.04		APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	9.2			7.5×10^3		AOAC Petrifilm Method	

*1Remark: Referred to the Vietnam Standard (EIA Report), Reference to the Monitoring Report, May 2016.

*2Remark: Same locations with Phase (1) Operation Phase Water Quality monitoring because our Thilawa SEZ Zone A has only one main discharging gate.

*3Remark: Suspended solid content in all sampling points except GW-1 are higher than the standard from the submission of EIA (September 2013). The possible reasons is the increasing of insoluble particle particulate matter during run off or discharging that can be generated from the some construction activities and direct discharge of waste water disposal from the upstream area or the natural soil conditions around the area.

*4Remark: COD_{Cr} level is high at GW-1 point. COD value can be increase when the presences of natural elements increase in the ground water of that particular area. There was minimal wastewater discharge into the retention pond of the Thilawa SEZ, so the value of high COD is considered as not because of industrial wastewater sink into the aquifer.

*5Remark: According to the Letter Ref: No MJTD/O/15-01-105, we monitored COD by Dichromate values instead of COD by permanganate. Therefore, we have adopted target level of COD by Dichromate by Dichromate for effluent water quality discharging to the water body is 70 mg/L which is equivalent to 35mg/L COD by Permanganate from this EMP report.

*6Remark: BOD levels of surface water points are higher than the standard during this monitoring. Organic matter such as dead plants, leaves, grass clipping, manure, sewage, or even food waste in the water body are decomposed by a lot of microorganisms such as bacteria. In this case, the demand for oxygen will be high due to all the bacteria, so the BOD level will be high. Because of the high temperature of summer season during a couple of month in the area, the organic waste such as dead plants, leaves and grass clipping along the Shwe Byauk Creek may be more rather than previous months. So, high BOD level is judged by the bacteria presents working to decompose the organic waste.

*7Remark: BOD level of ground water point (GW-1) is higher than the standard during this monitoring. BOD levels against with standard shall be evaluated as yearly average or 75 percentile among all of the data in a year. Thus assessment of water quality will be evaluated after 1 year's operation and slightly high BOD value is not related to construction activities.

*8Remark: The remaining two points, SW-1 and SW-5 cannot take the sample because the sampling location is less water and dry condition and no discharge to Shwe Byauk Creek.

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 –April 2016

Noise Level (Inside of the Thilawa Zone A expansion Area)

Location	Item	Unit	Measured Value (Mean)	Measured Value (Min~Max)	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
NV-1	Leq (day)	dB(A)	58	50-66	N/A	N/A	75	Once (peak period)	Sound Level Meter	
	Leq(eve)	dB(A)	53	50-63			65			
	Leq(night)	dB(A)	43	38-54			65			

*Remark: Referred to the Noise Regulation Law- Japan (EIA Report), Reference to the Noise and Vibration Report April 2016.

Noise Level (In front of Administrative Building, Thilawa SEZ Zone A)

Location	Item	Unit	Measured Value (Mean)	Measured Value (Min~Max)	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
NV-2	Leq (day)	dB(A)	69	47-76	N/A	N/A	75	Once (peak period)	Sound Level Meter	
	Leq(night)	dB(A)	57	47-66			70			

*Remark: Referred to the Noise Regulation Law- Japan (EIA Report), Reference to the Noise and Vibration Report April 2016.

Complains from Residents

- Are there any complains 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 Complains from Residents	Countermeasures

5) Solid Waste

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

- Are there any wastes of 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.

No.	Date	Description	No.of Loads	Remarks
1	11-Mar-16	Waste Disposal (Sewage Damage Pipe)	10	YCDC
2	6-Apr-16	Waste Disposal (Normal Construction Waste)	5	YCDC

Remark: Referred to Monthly Progress Report (March 2016, April 2016 and May 2016)

6) (a) Ground Subsidence and Hydrology- March 2016

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
3-Mar-16	107	m3/week	+6.997	m	Once a week	
10-Mar-16	220	m3/week	+6.995	m		
17-Mar-16	108	m3/week	+6.995	m		
24-Mar-16	111	m3/week	+6.990	m		
31-Mar-16	243	m3/week	+6.987	m		

*Reference to the Monthly Progress Report March 2016.

(b) Ground Subsidence and Hydrology- April 2016

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
7-Apr-16	118	m3/week	+6.990	m	Once a week	
14-Apr-16	130	m3/week	-	m		
21-Apr-16	90	m3/week	+6.992	m		

28-Apr-16	110	m3/week	+6.995	m		

*Reference to the Monthly Progress Report April 2016.

(c) Ground Subsidence and Hydrology- May 2016

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
5-May-16	120	m3/week	+6.989	m	Once a week	
12-May-16	180	m3/week	+6.987	m		
19-May-16	107	m3/week	+6.991	m		
26-May-16	169	m3/week	+6.994	m		

*Reference to the Monthly Progress Report May 2016.

7) Offensive Odor (only operation phase) Not Applicable at Construction Phase Report

Complains from Residents

- Are there any complains 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 Complains from Residents	Countermeasures

Situations environmental report from tenants Not Applicable at Construction Phase Report

- 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.

End of Document

Thilawa Special Economic Zone (Zone A)
Development Project –Phase 2

Appendix

Water and Waste Water Monitoring Report

May, 2015

MJTD MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED

WATER QUALITY MONITORING IN THILAWA SEZ (PHASE 2, CONSTRUCTION STAGE)

(Bi-Monthly Monitoring)

May 2016

Resource & Environment Myanmar Ltd. B-702/401 Delta Plaza Building, Shwegondaing Rd., Bahan, Yangon. MYANMAR

Tel: (959) 7301 3448; Fax: (951) 552901

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1. INTRODUCTION

The water quality sampling points are in the Thilawa SEZ area, which is located in the Thanlyin and Kyauktan townships, about 20 km southeast of Yangon city (Figure 1). Thilawa SEZ is surrounded by ring road and accompanied with the container ports along the Yangon River.

There are two ways to access to Thilawa SEZ from Yangon city, which are the route passing through Thanlyin Bridge and also through Dagon River.

Figure 1. Location map of Thilawa SEZ area and water quality sampling locations

2. FIELD SURVEY

Water quality sampling for May 2016 was conducted in 4 locations among proposed 7 locations.

Survey Item

Parameters for water quality survey are determined so as to cover the parameters of existing environmental standards. There were four locations for water quality survey as SW-2, SW-3, SW-4 and GW-1. The sample from the remaining two surface water points such as SW-1 and SW-2, cannot be collected because of no discharge from the surrounding as well as the dry condition due to no rainfall previously.

Summary of sampling points

The detail of the locations of monitoring points are shown below.

Table 1. Locations of water quality sampling points

No.	Station	Type	Coordinate	Location
1.	SW-2	Surface Water	16° 40' 06.0" N 96° 16' 43.1" E	Upstream of Shwe Byauk Creek, Thilawa SEZ
2.	SW-3	Surface Water	16° 40' 05.5" N 96° 16' 41.6" E	Upstream of Shwe Byauk Creek, Thilawa SEZ
3.	SW-4	Surface Water	16° 39' 54.6" N 96° 16' 26.4" E	Downstream of Shwe Byauk Creek, Thilawa SEZ
4.	GW-1	Ground Water	16° 40' 25.1" N 96° 16' 31.7" E	In Moegyoe Swan Monastery, Thilawa SEZ

Figure 2. Location map of water quality sampling points

SW-2

SW-2 was collected at the upstream of Shwe Byauk Creek which is flowing generally form east to west and then entering into the Yangon River. This sampling point is also located at south of Class A area and Dagon-Thilawa car road. The surrounding area are Class A in the north, industrial compound in the east and paddy field in the south and west respectively.

Figure 3. Surface water sampling at SW-2

SW-3

SW-3 was collected at the upstream of Shwe Byauk Creek which is flowing generally form east to west and then entering into the Yangon River. It is distanced about 60 m downstream of SW-2. This sampling point is also located at south of Class A area and Dagon-Thilawa car road. The surrounding area are Zone A in the north, industrial compound in the east and paddy field in the south and west respectively.

Figure 4. Surface water sampling at SW-3

SW-4

SW-4 was collected at the downstream of Shwe Byauk Creek, which is flowing generally form east to west and then entering into the Yangon River. It is distanced about 500 m downstream of SW-3. This sampling point is also located at south of Zone A area and Dagon-Thilawa car road. The surrounding area are Zone A in the north, industrial compound in the east and paddy field in the south and west respectively.

Figure 5. Surface water sampling at SW-4

GW-1

GW-1 was collected from tube well as ground water sample. It is located in the compound of Moegyoe Swan Monastery as well as in the Class A area. The transparency of the ground water is high.

Figure 6. Ground water sampling at GW-1

SW-1

SW-1 was collected at the drain from the retention pond, which is located in the east of Moegyoswan Monastery. This drainage is flowing from north to south and then connected to the Shwe Byauk Creek. The surrounding area is most of occupied by the building.

Figure 7. Condition of SW-1 and its surrounding

SW-5

SW-5 was collected at drain in front of main gate of MJTD Administrative Building. Most of the water collected in this drain is rain water and waste water from surrounding. This drain is also connected to the Shwe Byauk Creek. The surrounding area is most of occupied by the building.

Figure 8. Condition of SW-5 and its surrounding

Survey Period

Water quality survey was conducted on 4th May, 2016.

Sample Point	SW-2	SW-3	SW-4	GW-1
Sampling Time	9:40 AM	10:30 AM	11:05 AM	12:05 AM

Survey Method

Water samples were taken by Alpha horizontal water sampler and collected in sterilized sample containers. All sampling was in strict accordance with recognized standard procedures. The parameters as pH, temperature, velocity, dissolved oxygen (DO), electrical conductivity (EC), and turbidity were measured at each site concurrently with sample collection. All samples were kept in iced boxes and were transported to the laboratory and stored at 2-4 °C refrigerators.

Table 2. Field Equipment for river flow measurement and water quality survey

No.	Equipment	Manufacturer	Originate Country	Model
1	Multi-parameter (Temp., pH, EC, ORP, DO, TDS, Turbidity)	HANNA	USA	HI7609829 (with 3 sensors)
2	SmarTROLL multi-parameter	In-situ Inc.	USA	-
3	Alpha Bottle (Water Sampler)	Wildlife Supply Company®	Indonesia	-

Table 3. Container and preservation method of water samples for laboratory analysis

No.	Parameter	Container	Preservation
1	BOD, COD	1000 ml glass bottle	Refrigerate
2	Suspended solid	1000 ml plastic bottle	Refrigerate
3	Coliform	1000 ml glass bottle	Refrigerate
4	Other	2000 ml plastic bottle	Refrigerate

The following table provides the test method for water quality.

Table 4. Analytical method for water quality

No.	Item	Analysis method	Sampling point
			SW-2, SW-3, SW-4, GW-1
1	Water Temperature	HI7609829-1 Sensor	✔
2	pH	HI7609829-1 Sensor	✔
3	Dissolved Oxygen (DO)	HI7609829-2 Sensor	✔
4	Suspended Solid	APHA-AWWA-WEF Method	✔
5	BOD	APHA-AWWA-WEF Method	✔
6	COD (Cr)	APHA 5220 D (Closed Reflux Colorimetric Method)	✔
7	Color	APHA-AWWA-WEF Method	✔
8	Odor	APHA-AWWA-WEF Method	✔
9	Total Nitrogen	APHA-AWWA-WEF Method	✔
10	Total Phosphorus	Photometric Method	✔
11	Total Coliform	APHA-AWWA-WEF Method	✔

Survey Result

Water samples were sent to SGS Myanmar and SGS Thailand laboratories. Water quality results are shown in following table.

This table reveals that all of the monitoring results. BOD levels of surface water points are obviously higher than the standard during this monitoring. Organic matter such as dead plants, leaves, grass clippings, manure, sewage, or even food waste in the water body are decomposed by a lot of microorganisms such as bacteria. In this case, the demand for oxygen will be high due to all the bacteria, so the BOD level will be high. Because of the high temperature of summer season during a couple of month in the area, organic waste such as dead plants, leaves and grass clippings along the Shwe Byauk Creek may be more rather than previous months. So, high BOD level is judged by the bacteria present working to decompose the organic waste.

Suspended Solid and COD(Cr) levels of surface water points are higher than the standard as previous times. Surface water sampling points at upstream area is totally influent and contaminated with Yangon River water. Since Yangon River is a tidal river, the COD(Cr) result at SW-2, SW-3 and SW-4 have possibilities of containing a large amount of chloride ions. Therefore, these results might have positive interfered by chloride ion. Certified analytical results from each laboratory are described in appendix.

Table 5. In-Situ Measurement and laboratory analysis of water quality (Phase 1, Operation Phase)

No.	Parameter	SW-2	SW-3	SW-4	GW-1	Standard
1	Water Temperature (C)	34.57	36.86	38.44	35.33	40
2	pH	7.16	7.48	7.87	7.06	5 - 9
3	Suspended solid (mg/l)	123	350	180	7.67	30
4	DO (mg/l)	12.12	12.92	13.15	6.52	-
5	EC (µs/cm)	8984.7	8809.2	9140.6	3570.1	-
6	Salinity (psu)	4.2	4.0	4.0	1.6	-
7	BOD (mg/l)	116	96	99	23	20
8	COD(Cr) (mg/l)	555	560	545	45.5	70
9	Color (Pt.Co)	Natural	Natural	Natural	Not Objectable	-
10	Odor	Natural	Natural	Natural	Not Objectable	-
11	Total nitrogen (mg/l)	<1	<1	<1	<1	-
12	Total phosphorus (mg/l)	0.054	<0.01	0.015	0.075	-
13	Total Coliform (MPN/100ml)	9.3	4.5	<1.8	9.2	400

This table reveals that all of the monitoring results. BOD levels of surface water points are obviously higher than the standard during this monitoring. Organic matter such as dead plants, leaves, grass clippings, manure, sewage, or even food waste in the water body are decomposed by a lot of microorganisms such as bacteria. In this case, the demand for oxygen will be high due to all the bacteria, so the BOD level will be high. Because of the high temperature of summer season during a couple of

month in the area, organic waste such as dead plants, leaves and grass clippings along the Shwe Byauk Creek may be more rather than previous months. So, high BOD level is judged by the bacteria present working to decompose the organic waste.

BOD level at GW-1 is slightly higher than the standard. BOD levels against with standard shall be evaluated as yearly average or 75 percentile among all of the data in a year. Thus assessment of water quality will be evaluated after 1 year's operation.

Suspended Solid and COD(Cr) levels of surface water points are higher than the standard as previous times. Surface water sampling points at upstream area is totally influent and contaminated with Yangon River water. Since Yangon River is a tidal river, the COD(Cr) result at SW-2, SW-3 and SW-4 have possibilities of containing a large amount of chloride ions. Therefore, these results might have positive interfered by chloride ion. Certified analytical results from each laboratory are described in appendix.

Table 6. In-Situ Measurement and laboratory analysis of water quality (Phase 2, Construction Phase)

No.	Parameter	SW-2	SW-3	SW-4	GW-1	Standard
1	Water Temperature (C)	34.57	36.86	38.44	35.33	40
2	pH	7.16	7.48	7.87	7.06	5 - 9
3	Suspended solid (mg/l)	123	350	180	7.67	30
4	DO (mg/l)	12.12	12.92	13.15	6.52	-
5	EC (µs/cm)	8984.7	8809.2	9140.6	3570.1	-
6	Salinity (psu)	4.2	4.0	4.0	1.6	-
7	BOD (mg/l)	116	96	99	23	20
8	COD(Cr) (mg/l)	555	560	545	45.5	70
9	Color (Pt.Co)	Natural	Natural	Natural	Not Objectable	-
10	Odor	Natural	Natural	Natural	Not Objectable	-
11	Total nitrogen (mg/l)	<1	<1	<1	<1	-
12	Total phosphorus (mg/l)	0.054	<0.01	0.015	0.075	-
13	Total Coliform (MPN/100ml)	9.3	4.5	<1.8	9.2	400
14	Chromium (mg/l)	<0.02	<0.02	<0.02	<0.02	0.5
15	Oil and grease (mg/l)	<5	<5	<5	<5	5

APPENDIX

LAB RESULTS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2405/2016
Date : 18.05.2016

Client Name	:	**RESOURCE AND ENVIRONMENT MYANMAR CO., LTD** B-702 Delta Plaza, Shwegondaing Rd, Bahan Township, Yangon, Myanmar
Project Name	:	Environmental Monitoring in Thilaw SEZ, Zone A (Phase I)
Sample Brought By	:	Client
Sample Location	:	Thilawa
Sample Received Date	:	05.05.2016
Analysed Date	:	05.05.2016

Results (mg/l)	Methods	Stations				Detection Limit
		SW-2 (4.5.16)	SW-3 (4.5.16)	SW-4 (4.5.16)	GW-1 (4.5.16)	
Lab Code	-	085/16	086/16	087/16	084/16	-
Commodity Name	-	Surface Water	Surface Water	Surface Water	Ground Water	-
Total Suspended Solid	Based on Standard methods for the examination of water & waste water APHA , AWWA & WEF,22nd ed, 2012; 2540 D	123	350	180	7.67	20
Total Nitrogen (organic)	Based on Standard methods for the examination of water & waste water APHA , AWWA & WEF,22nd ed, 2012; 4500-N_{org} C	<1	<1	<1	<1	1
Sulfide	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012; 4500-S^{2-} A&F.Iodometric Titration Method	<2	<2	<2	<2	2
Total Phosphorus	Laboratory Manual For the Physico-Chemical Analysis of Soil, Water and Plant ; Phototmetric (Ascorbic) Method	0.054	<0.01	0.015	0.075	0.01

SGS (MYANMAR) LIMITED (AFL)

SGS

ORIGINAL

Job Ref: 2405/2016
Date : 18.05.2016

Results (mg/l)	Methods	Stations				Detection Limit
		SW-2 (4.5.16)	SW-3 (4.5.16)	SW-4 (4.5.16)	GW-1 (4.5.16)	
Lab Code	-	085/16	086/16	087/16	084/16	-
Commodity Name	-	Surface Water	Surface Water	Surface Water	Ground Water	-
Copper	Based on Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012 ; 3111B (Direct Air- Acetylene Flame method)	<0.1	<0.1	<0.1	<0.1	0.1
Zinc	Based on Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012 ; 3111B (Direct Air- Acetylene Flame method)	<0.1	0.148	0.123	<0.1	0.1
Oil & Grease	Based on Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed, 2012 ; 5520 B	<5	<5	<5	<5	5
BOD	In-house method based on Standard methods for the examination of water & waste water, APHA , AWWA & WEF,22nd ed, 2012 ;5210 D (Respirometric) and manual of BOD System Ox direct (Lovibond)	116	96	99	23	2
COD	In-house method based on Standard methods for the examination of water & waste water APHA , AWWA & WEF,22nd ed, 2012; 5220 D(Closed Reflux ,Colorimetric) and manual of Photometer-system MD 100 and RD 125 Reactor(Lovibond)	555	560	545	45.5	10

**********End of report**********

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

SGS

Report No. : 2016-00597 / 001 (Page 1 of 1) Issued date : May 30, 2016

CLIENT : **RESOURCE AND ENVIRONMENT MYANMAR CO., LTD.**
CONTACT : Ms. Toe Toe Hlaing
ADDRESS : B702 Delta Plaza, Shwegondaing Rd., Bahan, Yangon, Myanmar
Tel. +959-73013448 Fax. +951-552901
E-mail : toetoehlainggeo@gmail.com

Analysis Report

PROJECT NAME : Environmental Monitoring in Thilaw SEZ, Zone A (Phase I)
SAMPLE DESIGNATED AS : Surface Water Quality **SAMPLING DATE** : May 4, 2016
SAMPLING LOCATION : Thilawa SEZ, Myanmar **SAMPLING BY** : Client

Parameters	Units	LOQ	Results		
			SW-2	SW-3	SW-4
Color	Pt.Co	1	Natural	Natural	Natural
Odor	-	-	Natural	Natural	Natural
Phenol	mg/l	0.001	<0.001	<0.001	<0.001
Formaldehyde	mg/l	0.01	0.02	0.02	<0.01
Free Chlorine (Cl_2)	mg/l	0.01	<0.01	0.04	<0.01
Arsenic (As)	mg/l	0.002	0.006	0.004	<0.002
Barium (Ba)	mg/l	0.1	<0.1	<0.1	<0.1
Total Chromium (Cr)	mg/l	0.02	<0.02	<0.02	<0.02
Cadmium (Cd)	mg/l	0.0020	<0.0020	<0.0020	<0.0020
Lead (Pb)	mg/l	0.010	<0.010	<0.010	<0.010
Nickel (Ni)	mg/l	0.010	0.014	<0.010	<0.010
Mercury (Hg)	mg/l	0.0005	<0.0005	<0.0005	<0.0005
Selenium (Se)	mg/l	0.01	<0.01	<0.01	<0.01
Total Coliform Bacteria	MPN/100mL	-	9.3	4.5	<1.8

Remarks : - Analysis Methods followed the Standard Methods for the Examination of Water and Wastewater endorsed by American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF) except ;
- Odor followed ISO 6588-1987,
- Formaldehyde followed Water and Wastewater Analysis endorsed by Environmental Engineering Association of Thailand (EEAT).
- Mercury (Hg) followed U.S. EPA method 245.1.

- LOQ = Limit of Quantitation

(Siriporn Imwilaiwan)
Environmental Monitoring Manager

(Thepson Yommana)
Technical Manager

SGS (THAILAND) LIMITED

TY/Client/JC/Cj

SGS

Report No. : **2016-00597 / 002 (Page 1 of 1)** Issued date : May 30, 2016

CLIENT : **RESOURCE AND ENVIRONMENT MYANMAR CO., LTD.**
CONTACT : Ms. Toe Toe Hlaing
ADDRESS : B702 Delta Plaza, Shwegondaing Rd., Bahan, Yangon, Myanmar
Tel. +959-73013448 Fax. +951-552901
E-mail : toetoehlainggeo@gmail.com

Analysis Report

PROJECT NAME : Environmental Monitoring in Thilaw SEZ, Zone A (Phase I)
SAMPLE DESIGNATED AS : Groundwater Quality
SAMPLING LOCATION : Thilawa SEZ, Myanmar
SAMPLING DATE : May 4, 2016
SAMPLING BY : Client

Parameters	Units	LOQ	Results
			GW-1
Odor	-	-	Not objectable
Color	Pt.Co	1	Not objectable
Arsenic (As)	mg/l	0.001	<0.002
Cadmium (Cd)	mg/l	0.001	<0.002
Phenol	mg/l	0.001	<0.001
Chromium Hexavalent (Cr^{6+})	mg/l	0.02	<0.02
Lead (Pb)	mg/l	0.006	<0.010
Mercury (Hg)	mg/l	0.0005	<0.0005
Nickel (Ni)	mg/l	0.002	<0.010
Barium (Ba)	mg/l	0.1	<0.1
Free Chlorine (Cl_2)	mg/l	0.01	<0.01
Selenium (Se)	mg/l	0.01	<0.01
Formaldehyde	mg/l	0.01	<0.01
Total Coliform Bacteria	MPN/100mL	-	9.2

Remarks :
- Analysis Methods followed the Standard Methods for the Examination of Water and Wastewater endorsed by American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF) except Mercury (Hg) followed U.S. EPA method 245.1.
- Ammonium Nitrogen (NH_4-N) is from calculation and the field data (pH and Temperature) for the calculation was measured by client.
- LOQ = Limit of Quantitation

(Siriporn Imwilaiwan)
Environmental Monitoring Manager

(Thepson Yommana)
Technical Manager

SGS (THAILAND) LIMITED

TY/Client/JC/Cj

119734

Thilawa Special Economic Zone (Zone A)
Development Project –Phase 2

Appendix

Air Quality Monitoring Report

April, 2016

MJTD MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED

AIR QUALITY MONITORING IN THILAWA SEZ, (PHASE 2, CONSTRUCTION STAGE)

April 2016

Resource & Environment Myanmar Ltd. B-702/401 Delta Plaza Building, Shwegondaing Rd., Bahan, Yangon. MYANMAR

Tel: (959) 7301 3448; Fax: (951) 552901

www.enviromyanmar.net

Survey Item

Parameters for air quality survey were determined by referring environmental quality standard for air in Thailand and Japan as shown in following table.

As there is no environmental standard for ambient air quality in Republic of Myanmar, the survey result was evaluated by comparing with Japan and Thailand standards.

Table-1. Survey parameters and target levels for air quality

Parameters	Averaging Period	Value
SO_2	24 hours	0.12 ppm[1]
CO	24 hours	9 ppm[1]
NO_2	24 hours	0.04 – 0.06 ppm[2]
TSP	24 hours	0.33 mg/m3[1]
PM10	24 hours	0.12 g/m3[1]

Summary of sampling points

The detail of the location of air quality monitoring point is shown below.

Table-2. Location of air quality monitoring station.

Sampling Point	Coordinate	Detailed Location of Sampling Point
AQ-1	16°41′13.4″N, 96°15′51.9″E	In the Zone A area, Thilawa SEZ

Figure-1. Location map of air quality monitoring point

AQ-1

This station was installed in the flat area, in the northern part of Thilawa SEZ Zone A. AQ-1 is bounded by Thilawa dam in southeast, agricultural land and residential houses of Alwan sok village in north and garment factory in the west respectively. Possible emission source is from daily human activities in Alwan sok village far about 400 m from this monitoring location.

Figure-2. Air quality monitoring at AQ-1

Survey Period

Air quality monitoring was conducted seven consecutive days during April 2016. The measurement duration is shown in the following table.

Table-3. Sampling duration for air quality survey

Sampling Point	Period
AQ-1	2^{th} - 9^{th} April, 2016

Source: Resource & Environment Myanmar Co., Ltd.

Survey Method

Sampling and analysis of ambient air pollutants was conducted by referring to the recommendation of United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner Environmental Perimeter Air Station (EPAS) was used to collect ambient air monitoring data. The characteristics of the instrument are:

- Portable direct reading
- Configure up to 14 simultaneous air measurements including U.S. EPA criteria air pollutants
- Standard configuration measures PM2.5, PM10 or TSP particulates, CO, NO, NO_2, SO_2, temperature, and relative humidity
- Wind parameters are also measured by Haz-scanner EPAS and the required data are analyzed by using the WRPLOT View of AERMOD View (ver. 7.0) in which calm wind is defined below 0.5 m/s.

Table-4. Sampling and analysis method for air quality

No.	Parameter	Analysis Method
1	Sulfur dioxide (SO_2)	On site reading
2	Carbon monoxide (CO)	On site reading
3	Nitrogen dioxides (NO_2)	On site reading
4	Total Particle matter (TSP)	On site reading
5	Particle matter 10 (PM10)	On site reading

Source: Resource &Environment Myanmar Co., Ltd.

Survey Result

Daily average of ambient gases levels at AQ-1 for 7 consecutive are presented in following tables. All ambient gases levels and particulate matters in each day are lower than the environmental standard (1-day) referred. Generally, it indicated the area had few emission sources and it was certainly to say the measured data were baseline level in the area.

Table-5. Ambient air quality at AQ-1

	Date	Time	Co	NO2	TSP	PM (10)	SO2
	D.M.Y	Hours	ppm	ppm	mg/m3	mg/m3	ppm
1	2-3 April, 2016	24	0.332	0.046	0.043	0.089	0.007
2	3-4 April, 2016	24	0.326	0.048	0.042	0.087	0.009
3	4-5 April, 2016	24	0.351	0.046	0.047	0.097	0.010
4	5-6 April, 2016	24	0.394	0.045	0.052	0.107	0.011
5	6-7 April, 2016	24	0.397	0.051	0.051	0.110	0.009
6	7-8 April, 2016	24	0.408	0.046	0.068	0.138	0.012
7	8-9 April, 2016	24	0.322	0.044	0.056	0.111	0.007
Maximum		24	0.408	0.051	0.068	0.138	0.012
Average		24	0.361	0.047	0.052	0.106	0.009
Minimum		24	0.322	0.044	0.042	0.087	0.007
Target value		24	< 10	< 0.06	< 0.33	< 0.12	< 0.04

Source: Resource & Environment Myanmar Co., Ltd

Appendix

Hourly Air Results

Date	Time	CO	NO2	PM10	TSP	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
2.4.2016	14:00-15:00	127.4000	38.2500	15.8667	44.1167	1.4167
2.4.2016	15:00-16:00	186.2333	43.8000	42.7167	84.6833	1.2667
2.4.2016	16:00-17:00	267.3500	37.2833	69.8667	150.7500	1.1833
2.4.2016	17:00-18:00	378.1500	39.0833	87.1500	169.5333	1.7333
2.4.2016	18:00-19:00	446.4500	55.8833	59.7667	120.2667	6.5167
2.4.2016	19:00-20:00	479.3500	36.9667	27.7000	59.3500	7.0667
2.4.2016	20:00-21:00	484.6000	58.9167	31.3333	72.4500	12.8333
2.4.2016	21:00-22:00	416.8000	66.1500	22.6333	49.6833	9.8833
2.4.2016	22:00-23:00	423.8833	56.5500	24.9167	50.4333	17.1667
2.4.2016	23:00-00:00	466.4833	53.5833	40.8333	87.6167	8.9333
3.4.2016	00:00-01:00	484.9500	71.1667	49.7667	103.6667	27.6667
3.4.2016	01:00-02:00	446.4167	59.9667	51.6833	107.4000	14.2000
3.4.2016	02:00-03:00	421.5333	60.6833	50.9833	106.5000	6.0500
3.4.2016	03:00-04:00	388.7333	59.2833	58.5000	115.2833	2.4667
3.4.2016	04:00-05:00	384.9333	48.5000	56.2833	109.6833	4.9333
3.4.2016	05:00-06:00	450.7500	47.2500	76.3833	144.9333	16.3000
3.4.2016	06:00-07:00	589.3833	62.5833	73.0833	145.9000	12.4667
3.4.2016	07:00-08:00	463.5500	61.9500	29.6500	77.1500	2.1167
3.4.2016	08:00-09:00	304.6667	28.6333	12.1000	42.4500	9.7167
3.4.2016	09:00-10:00	53.5833	4.8333	9.5333	18.8333	1.0000
3.4.2016	10:00-11:00	0.0000	5.5333	15.8500	34.5500	1.0000
3.4.2016	11:00-12:00	0.0000	27.5500	27.0833	54.4667	1.0000
3.4.2016	12:00-13:00	66.6667	44.8500	53.9833	93.1333	1.0000
3.4.2016	13:00-14:00	227.4167	37.1000	53.7833	98.5333	1.0000
MAX	**24hours**	589.3833	71.1667	87.1500	169.5333	27.6667
MIN	**24hours**	0.0000	4.8333	9.5333	18.8333	1.0000
Average	**24hours**	331.6368	46.0979	43.3938	89.2236	7.0382

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.589	0.071	0.087	0.170	0.028
MIN	24hours	0.000	0.005	0.010	0.019	0.001
Average	24hours	0.332	0.046	0.043	0.089	0.007

Date	Time	CO	NO2	PM10	TSP	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
3.4.2016	14:00-15:00	121.8833	35.9833	50.7500	93.5333	1.0000
3.4.2016	15:00-16:00	284.5500	37.4667	33.0167	64.8500	1.0000
3.4.2016	16:00-17:00	307.2333	58.4833	26.3667	72.0500	1.0000
3.4.2016	17:00-18:00	394.7167	54.6667	50.6833	117.8667	4.1500
3.4.2016	18:00-19:00	495.8167	43.1833	58.5333	121.6333	9.9667
3.4.2016	19:00-20:00	525.9833	53.8833	45.7500	94.9500	14.9833
3.4.2016	20:00-21:00	452.1333	68.6667	30.9667	67.6167	22.3500
3.4.2016	21:00-22:00	459.4500	62.1000	31.1833	68.4333	19.8667
3.4.2016	22:00-23:00	481.9833	59.5667	49.4833	110.5000	29.1000
3.4.2016	23:00-00:00	446.1167	54.6833	58.8167	121.8333	5.2000
4.4.2016	00:00-01:00	437.8500	62.3500	50.0667	106.7667	21.2333
4.4.2016	01:00-02:00	402.2833	55.2167	48.3500	102.9000	13.3500
4.4.2016	02:00-03:00	387.4333	62.2833	49.4833	105.6500	9.0500
4.4.2016	03:00-04:00	344.4167	65.3833	53.4833	107.3333	7.5667
4.4.2016	04:00-05:00	330.9500	64.6167	53.3667	99.1667	2.7833
4.4.2016	05:00-06:00	361.6667	66.1167	65.1500	120.4333	7.4000
4.4.2016	06:00-07:00	409.1667	66.2833	55.1333	116.7167	9.7333
4.4.2016	07:00-08:00	337.8667	60.0167	26.3833	63.8333	1.3833
4.4.2016	08:00-09:00	213.8500	24.0167	11.8500	31.0000	17.5833
4.4.2016	09:00-10:00	168.7000	12.5833	25.2000	55.2333	9.0833
4.4.2016	10:00-11:00	79.8000	13.0333	29.0000	59.6833	2.8000
4.4.2016	11:00-12:00	18.5500	23.5333	36.6500	58.7000	1.0000
4.4.2016	12:00-13:00	133.0333	22.8000	31.2500	42.3833	1.0000
4.4.2016	13:00-14:00	221.1000	27.6000	43.7500	77.9167	1.0000
MAX	**24hours**	525.9833	68.6667	65.1500	121.8333	29.1000
MIN	**24hours**	18.5500	12.5833	11.8500	31.0000	1.0000
Average	**24hours**	325.6889	48.1049	42.2778	86.7076	8.8993

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.526	0.069	0.065	0.122	0.029
MIN	24hours	0.019	0.013	0.012	0.031	0.001
Average	24hours	0.326	0.048	0.042	0.087	0.009

Date	Time	CO	NO2	PM10	TSP	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
4.4.2016	14:00-15:00	230.9333	26.0500	43.7000	78.1000	4.4667
4.4.2016	15:00-16:00	358.4500	33.0333	66.8333	125.0000	4.8833
4.4.2016	16:00-17:00	395.9167	50.9167	68.8000	144.7167	2.0500
4.4.2016	17:00-18:00	437.2833	50.1333	73.3000	150.8167	9.7667
4.4.2016	18:00-19:00	429.6333	57.2333	52.8167	105.9667	3.0667
4.4.2016	19:00-20:00	483.9333	61.8833	50.6333	101.3333	9.7333
4.4.2016	20:00-21:00	614.4500	68.4167	52.5000	112.8833	30.5500
4.4.2016	21:00-22:00	551.3833	64.0500	63.4000	131.3167	11.9833
4.4.2016	22:00-23:00	465.4833	51.8667	51.4500	108.0833	1.4167
4.4.2016	23:00-00:00	455.6667	56.0167	45.8000	94.0500	9.4667
5.4.2016	00:00-01:00	366.8167	51.0500	43.7167	91.6667	13.9500
5.4.2016	01:00-02:00	344.4500	56.9000	34.9667	81.3667	8.3167
5.4.2016	02:00-03:00	313.2000	55.7333	38.3667	81.5000	7.7167
5.4.2016	03:00-04:00	324.8667	60.6000	43.9667	90.8000	13.8667
5.4.2016	04:00-05:00	323.2667	60.4333	49.9000	101.8000	14.3500
5.4.2016	05:00-06:00	374.3167	57.5000	60.4333	118.1333	12.2667
5.4.2016	06:00-07:00	505.3000	69.9000	62.5333	131.5000	20.0167
5.4.2016	07:00-08:00	329.8833	44.6833	27.8167	64.1500	8.5333
5.4.2016	08:00-09:00	359.3333	42.5667	35.5167	76.0500	8.2167
5.4.2016	09:00-10:00	271.4167	25.1500	25.2667	61.5500	7.1000
5.4.2016	10:00-11:00	110.0000	21.1167	20.6000	51.3333	26.9333
5.4.2016	11:00-12:00	41.7833	14.3833	23.4500	38.5167	1.0000
5.4.2016	12:00-13:00	157.6833	15.4333	47.7333	87.8667	1.5667
5.4.2016	13:00-14:00	176.8333	16.5333	47.2667	89.4333	1.0000
MAX	**24hours**	614.4500	69.9000	73.3000	150.8167	30.5500
MIN	**24hours**	41.7833	14.3833	20.6000	38.5167	1.0000
Average	**24hours**	350.9285	46.3160	47.1153	96.5806	9.6757

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.614	0.070	0.073	0.151	0.031
MIN	24hours	0.042	0.014	0.021	0.039	0.001
Average	24hours	0.351	0.046	0.047	0.097	0.010

Date	Time	CO	NO2	PM10	TSP	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
5.4.2016	14:00-15:00	209.9000	26.8333	47.7667	99.0500	1.0000
5.4.2016	15:00-16:00	320.9500	41.6500	121.0000	225.2667	1.7167
5.4.2016	16:00-17:00	306.2167	33.1333	79.7667	155.2000	1.4667
5.4.2016	17:00-18:00	303.0667	42.7000	64.2333	124.5167	1.6833
5.4.2016	18:00-19:00	372.9000	44.4500	37.3833	80.7333	13.1667
5.4.2016	19:00-20:00	400.4667	59.0000	36.6500	71.9000	12.4000
5.4.2016	20:00-21:00	427.0667	63.0000	27.5667	55.9667	1.8833
5.4.2016	21:00-22:00	505.3667	52.4167	39.2000	88.0500	16.2000
5.4.2016	22:00-23:00	538.0000	60.2833	52.8833	114.4167	23.6667
5.4.2016	23:00-00:00	459.4667	53.9500	47.5500	103.3500	7.0333
6.4.2016	00:00-01:00	434.5500	60.1000	35.8667	76.6833	16.0167
6.4.2016	01:00-02:00	447.8333	68.9833	37.4000	80.2667	15.0167
6.4.2016	02:00-03:00	490.6000	69.9833	45.5667	94.4667	19.5667
6.4.2016	03:00-04:00	524.3167	58.8000	63.8667	138.7667	24.9167
6.4.2016	04:00-05:00	577.5333	56.7667	75.6333	157.6167	19.9000
6.4.2016	05:00-06:00	677.2000	59.0333	108.6000	219.9500	24.2000
6.4.2016	06:00-07:00	732.1667	68.0167	102.8667	219.0500	12.5167
6.4.2016	07:00-08:00	521.5500	59.5167	29.9333	78.5667	9.2833
6.4.2016	08:00-09:00	385.3333	43.9333	23.4833	56.9167	4.7167
6.4.2016	09:00-10:00	434.6167	17.7667	25.1833	57.2667	11.9167
6.4.2016	10:00-11:00	260.1000	5.6500	12.3667	30.8167	20.4000
6.4.2016	11:00-12:00	72.0333	11.9500	43.4000	90.8833	1.0000
6.4.2016	12:00-13:00	21.7833	12.0167	33.0667	68.6333	1.0000
6.4.2016	13:00-14:00	39.4167	21.2167	45.3500	90.3500	1.0000
MAX	**24hours**	732.1667	69.9833	121.0000	225.2667	24.9167
MIN	**24hours**	21.7833	5.6500	12.3667	30.8167	1.0000
Average	**24hours**	394.2681	45.4646	51.5243	107.4451	10.9028

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.732	0.070	0.121	0.225	0.025
MIN	24hours	0.022	0.006	0.012	0.031	0.001
Average	24hours	0.394	0.045	0.052	0.107	0.011

Date	Time	CO	NO2	PM10	TSP	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
6.4.2016	14:00-15:00	82.9167	40.0167	53.5500	111.1333	1.0000
6.4.2016	15:00-16:00	217.8000	45.6500	58.1167	117.3167	1.0000
6.4.2016	16:00-17:00	400.3500	52.7500	57.4500	126.8000	1.0000
6.4.2016	17:00-18:00	456.9167	52.5667	64.6500	146.6500	5.3500
6.4.2016	18:00-19:00	502.5500	44.9000	47.3500	101.5667	7.3000
6.4.2016	19:00-20:00	570.2333	50.4333	53.2833	111.6167	29.0667
6.4.2016	20:00-21:00	529.8167	66.2167	39.5167	81.9500	15.3667
6.4.2016	21:00-22:00	527.2167	78.2500	42.8500	89.7333	12.8167
6.4.2016	22:00-23:00	551.9667	71.9167	60.2333	126.3833	18.1500
6.4.2016	23:00-00:00	507.5000	63.9667	67.5000	145.3500	17.9833
7.4.2016	00:00-01:00	507.1833	73.7167	67.5667	150.7000	8.7667
7.4.2016	01:00-02:00	516.3667	69.2167	58.0500	120.9500	5.8167
7.4.2016	02:00-03:00	466.7500	63.1167	52.8167	113.4167	10.9333
7.4.2016	03:00-04:00	417.4500	59.9667	47.3167	100.5167	5.5000
7.4.2016	04:00-05:00	431.4667	71.6833	52.4167	107.8500	18.0500
7.4.2016	05:00-06:00	443.3667	63.2667	50.3333	103.5000	5.7667
7.4.2016	06:00-07:00	494.0500	72.4333	53.5500	112.4000	5.7000
7.4.2016	07:00-08:00	600.7167	55.9833	49.2333	113.6333	12.4000
7.4.2016	08:00-09:00	517.4333	48.5333	40.5167	88.7167	18.4333
7.4.2016	09:00-10:00	354.1000	19.5333	38.5000	88.6333	17.3333
7.4.2016	10:00-11:00	195.3000	4.6667	35.1000	79.5667	2.3167
7.4.2016	11:00-12:00	51.0333	3.6500	45.3833	100.6333	1.0000
7.4.2016	12:00-13:00	4.9500	25.2667	55.9667	110.7167	1.0000
7.4.2016	13:00-14:00	182.1667	20.8500	44.6667	93.6167	1.0000
MAX	**24hours**	600.7167	78.2500	67.5667	150.7000	29.0667
MIN	**24hours**	4.9500	3.6500	35.1000	79.5667	1.0000
Average	**24hours**	397.0667	50.7729	51.4965	110.1396	9.2938

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.601	0.078	0.068	0.151	0.029
MIN	24hours	0.005	0.004	0.035	0.080	0.001
Average	24hours	0.397	0.051	0.051	0.110	0.009

Date	Time	CO	NO2	PM10	TSP	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
7.4.2016	14:00-15:00	215.1833	37.2000	88.4167	186.9000	1.0000
7.4.2016	15:00-16:00	329.0667	45.9000	119.4333	235.7000	1.0167
7.4.2016	16:00-17:00	352.7333	49.7333	171.2667	329.4333	1.4833
7.4.2016	17:00-18:00	383.6500	42.8500	94.1667	177.4333	1.6333
7.4.2016	18:00-19:00	398.9333	42.9500	58.4833	117.9000	7.1667
7.4.2016	19:00-20:00	424.8667	55.7667	51.1333	101.4000	10.0833
7.4.2016	20:00-21:00	440.3667	65.3667	48.2333	99.2667	10.0000
7.4.2016	21:00-22:00	626.7333	55.8333	64.2667	137.0333	45.2667
7.4.2016	22:00-23:00	463.8833	57.9167	67.6833	140.3000	13.9333
7.4.2016	23:00-00:00	544.5000	57.9833	73.2167	145.0500	40.8500
8.4.2016	00:00-01:00	536.0833	65.3167	68.5500	142.9333	27.7833
8.4.2016	01:00-02:00	442.4500	73.3500	54.9333	110.5667	2.7333
8.4.2016	02:00-03:00	476.4000	63.9333	56.6667	118.6833	6.2667
8.4.2016	03:00-04:00	488.7500	57.7167	58.9667	125.8833	6.0833
8.4.2016	04:00-05:00	512.9667	61.5167	66.4833	142.3500	4.6833
8.4.2016	05:00-06:00	528.5833	58.9000	75.2000	154.5000	4.0167
8.4.2016	06:00-07:00	562.3500	66.4500	69.1333	149.9000	17.1333
8.4.2016	07:00-08:00	562.1500	45.6667	60.7167	127.7000	21.7667
8.4.2016	08:00-09:00	431.0667	29.9000	45.2000	92.1667	30.5000
8.4.2016	09:00-10:00	462.9667	23.2333	41.5167	84.0500	13.6500
8.4.2016	10:00-11:00	205.6667	9.0000	31.2500	59.6333	7.9000
8.4.2016	11:00-12:00	71.5667	16.2667	66.8167	142.5000	10.3500
8.4.2016	12:00-13:00	169.3500	5.6167	51.2000	92.6333	2.3000
8.4.2016	13:00-14:00	166.0167	11.1333	57.7500	104.3333	2.0833
MAX	**24hours**	626.7333	73.3500	171.2667	329.4333	45.2667
MIN	**24hours**	71.5667	5.6167	31.2500	59.6333	1.0000
Average	**24hours**	408.1785	45.8125	68.3618	138.2604	12.0701

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.627	0.073	0.171	0.329	0.045
MIN	24hours	0.072	0.006	0.031	0.060	0.001
Average	24hours	0.408	0.046	0.068	0.138	0.012

Date	Time	CO	NO2	PM10	TSP	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
8.4.2016	14:00-15:00	213.6333	32.1333	221.5167	443.4500	1.0500
8.4.2016	15:00-16:00	301.5167	30.1667	123.0500	230.8000	4.0167
8.4.2016	16:00-17:00	330.1167	43.8333	85.5167	156.7167	1.5167
8.4.2016	17:00-18:00	376.9333	41.7500	58.6333	112.9000	7.0500
8.4.2016	18:00-19:00	446.4333	57.3667	51.4167	105.2167	9.1500
8.4.2016	19:00-20:00	395.3500	52.7167	42.1833	85.5667	8.0333
8.4.2016	20:00-21:00	428.1333	61.4500	45.0333	88.8833	8.0833
8.4.2016	21:00-22:00	460.4000	73.9000	37.2500	74.6250	9.3000
8.4.2016	22:00-23:00	425.8500	68.7000	50.2833	102.0333	7.1667
8.4.2016	23:00-00:00	552.0625	69.3125	53.9688	106.3750	19.3438
9.4.2016	00:00-01:00	452.9167	64.6667	55.5500	111.1333	13.1667
9.4.2016	01:00-02:00	355.3167	60.1667	44.8000	92.2833	8.2667
9.4.2016	02:00-03:00	377.6000	77.7500	50.7667	102.6500	19.9833
9.4.2016	03:00-04:00	369.9167	61.3500	54.7000	108.1667	1.9833
9.4.2016	04:00-05:00	361.5833	55.5000	54.3167	106.2667	1.2333
9.4.2016	05:00-06:00	370.5333	65.6167	56.9000	111.9167	1.0667
9.4.2016	06:00-07:00	365.8167	61.5500	46.3167	96.9500	1.1667
9.4.2016	07:00-08:00	334.4667	40.2000	26.2500	62.4000	6.1333
9.4.2016	08:00-09:00	246.9833	15.9667	18.3000	48.3167	26.7000
9.4.2016	09:00-10:00	183.0333	6.9000	16.1333	39.1333	9.3667
9.4.2016	10:00-11:00	76.4833	2.0000	23.4167	37.9667	2.5167
9.4.2016	11:00-12:00	8.9000	2.7167	51.0167	92.6833	1.0000
9.4.2016	12:00-13:00	131.5333	7.5167	43.3333	77.4667	1.0000
9.4.2016	13:00-14:00	162.4545	10.7879	45.2424	76.7273	1.1818
MAX	**24hours**	552.0625	77.7500	221.5167	443.4500	26.7000
MIN	**24hours**	8.9000	2.0000	16.1333	37.9667	1.0000
Average	**24hours**	321.9986	44.3340	56.4956	111.2761	7.0615

		ppm	ppm	mg/m3	ppm	ppm
MAX	24hours	0.552	0.078	0.222	0.443	0.027
MIN	24hours	0.009	0.002	0.016	0.038	0.001
Average	24hours	0.322	0.044	0.056	0.111	0.007

Thilawa Special Economic Zone (Zone A) Development Project –Phase 2

Appendix

Noise and Vibration Monitoring Report

April, 2016

MJTD MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED

NOISE AND VIBRATION MONITORING IN THILAWA SEZ (PHASE 2, CONSTRUCTION STAGE)

April 2016

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1. INTRODUCTION

The monitoring points are sited in the Thilawa SEZ area, which is located in the Thanlyin and Kyauktan townships, about 20 km southeast of Yangon city (Figure 1). Thilawa SEZ is surrounded by ring road and accompanied with the container ports along the Yangon River.

There are two ways to access to Thilawa SEZ from Yangon city, which are the route passing through Thanlyin Bridge and also through Dagon River.

Figure 1. Location map of Thilawa SEZ area and monitoring locations

2. ENVIROMENTAL STANDARD

(A) Noise

Construction Phase

There is no noise standard of construction activities to receptors in Myanmar and International Organization's standards such as WHO and Environmental, Health, and Safety (EHS) Guidelines prepared by International Fiancé Cooperation (IFC) in a group member of World Bank, therefore the target noise level at construction stage is set based on the standard in the other foreign countries.

In the south-east Asia countries, only Singapore has the noise standard of construction activities to receptors categorized area to be quiet, residential area, and the other areas. On the basis of the above information, target noise level is set as following concept.

- Residential houses and monastery located less than 150m from the construction site comply with the middle range of the Singapore standard (categorized as "Residential buildings located less than 150m"), or

- Residential houses and monastery located more than 150m from the construction site, office, commercial facilities, and factories shall comply with the moderate range of standard Singapore standard (categorized as "Other buildings").

- Noise level from traffic is different characteristic from ambient noise, and higher. Though the noise level for living area is set, there is no target level specified for traffic noise along the road. Therefore, tentative target levels for traffic noise along the road are set in accordance with the Japanese traffic noise target level.

This target noise level is shown in Table 1 and 2, and is not so much difference comparing with noise standard at construction stage in the other countries as shown in Table 2.

Table 1. Target noise level in construction phase

Category	Day time (Leq) (7am-7pm)	Evening Time (Leq) (7pm-10pm)	Night time (Leq) (10pm-7am)
Residential houses and monastery located less than 150m	75 dB	60 dB	55 dB
Residential houses and monastery located more than 150m from the construction site, office, commercial facilities, and factories	75 dB	65 dB	65 dB

Note) Evaluation point is at boundary of building

Table 2. Target traffic noise level in construction phase

Category	Day time (Leq) (6am-10pm)	Night Time (Leq) (10pm-6am)
Along the Four Lane road	75 dB	70 dB

Note: Applied "proximity to major arterial roads"

Source: Noise Regulation Law (Japan) (Law No.98 of 1986, latest Amendement by Law No.91 of 2000)

Table 3. Noise standard at construction stage in various countries

Items		Day time (Leq)	Night time (Leq)
Japan	Using heavy equipments with high noise level (piling, excavating etc.)	85 dB (Maximum)	-
Singapore	Hospitals, schools, institutions of higher learning, homes for the aged sick, etc.	60 dB (7am – 7pm, 12hrs)	50 dB (7pm – 7am, 12hrs)
	Residential buildings located less than 150m from the construction site where the noise is being emitted	75 dB (7am – 7pm, 12hrs)	60 dB (7pm – 10pm, 3hr) 55 dB (10pm – 7am, 9hr)
	Other Buildings	75 dB (7am – 7pm, 12hrs)	65 dB (7pm – 7am, 12hrs)
UK	In rural, suburban and urban areas away from main road traffic and industrial noise.	70 dB (8:00-18:00)	-
	Urban areas near main roads	72 dB (8:00-18:00)	-

Items		Day time (Leq)	Night time (Leq)
USA	Residential	80 dB (8hrs)	70 dB (8hrs)
	Commercial	85 dB (8hrs)	85 dB (8hrs)
	Urban Area with high ambient noise level (>65 dB)	Ambient Noise Level +10dB	

Source: Noise Regulation Act, Japan (Law No.98, 1968, Amended No.33, 2006)
Environmental Protection and Management Act in Singapore (Chap.94A, Section 77, revised in 2008)
British Standard 5228: 1997 "Noise and vibration control on open and construction sites"
Transit Noise and Vibration Impact Assessment, U.S. Department of Transportation in USA, 1995

Operation Phase

There is no ambient noise standard to receptors in Myanmar. However, most of the countries in south-east Asia have the ambient noise standard to receptors categorized land use or requirement of quiet as well as in Japan. International standard is also available in the EHS Guidelines prepared by IFC. On the basis of the above information, target noise level is set as following concept and target ambient noise level.

- Ambient noise standard for sensitive areas of Japan and International Organization, relatively high in comparison with the results of baseline survey especially during night time.

- Thus, the target ambient noise level for sensitive and residential area is set in accordance with the noise standard in Singapore which is similar to the ambient noise level of the baseline survey.

The target noise level is shown in Table 4 and the target noise level is not so much difference comparing with ambient noise standard as shown in Table 5.

Table 4. Target noise level in operation phase

Category	Day Time (Leq) (7am-7pm)	Evening Time (Leq) (7pm-10pm)	Night Time (Leq) (10pm-7am)
Sensitive area such as Monastery	60 dB	55 dB	50 dB
Residential houses	65 dB	60 dB	55 dB
Commercial and Industrial Areas	70 dB	65 dB	60 dB

Note) Evaluation point is at boundary of building

Table 5. Noise standard at operation stage in South-East Asia Countries

Items		Day time (Leq)	Night time (Leq)
Indonesia	Noise standard for sensitive areas such as residences, hospitals, schools, places of religious worships	55 dB	
	Noise standard for office and commercial	65 dB	
	Noise standard for commercial and service	70 dB	
Malaysia	Sensitive Areas/ Low Density Residential Areas	55 dB (7am – 10pm, 15hrs)	50 dB (10pm – 7am, 9hrs)
	Sub Urban Residential	60 dB (7am – 10pm, 15hrs)	55 dB (10pm – 7am, 9hrs)
	Urban Residential	65 dB (7am – 10pm, 15hrs)	60 dB (10pm – 7am, 9hrs)
	Commercial and Business	70 dB (7am – 10pm, 15hrs)	60 dB (10pm – 7am, 9hrs)
Singapore	Sensitive Areas	60 dB (7am – 7pm, 12hrs)	55 dB (7pm – 10pm, 3hr) 50 dB (10pm – 7am, 9hr)
	Residential Areas	65 dB (7am – 7pm, 12hrs)	60 dB (7pm – 10pm, 3hr) 55 dB (10pm – 7am, 9hr)
	Commercial Areas	70 dB (7am – 7pm, 12hrs)	65 dB (7pm – 10pm, 3hr) 60 dB (10pm – 7am, 9hr)
Thailand	Noise standard	70 dB (24hrs)	
Japan	Sensitive Area (Class AA)	50 dB (6am – 10pm, 16hrs)	40 dB (10pm – 6pm, 8hrs)
	Residential Area (Class A and Class B)	55 dB (6am – 10pm, 16hrs)	45 dB (10pm – 6pm, 8hrs)
	Commercial and Industrial Area (Class C)	60 dB (6am – 10pm, 16hrs)	50 dB (10pm – 6pm, 8hrs)
IFC	Residential; institutional, educational	55 dB (7am – 10pm, 15hrs)	45 dB (10pm – 7am, 9hrs)
	Industrial; commercial	70 dB (7am – 10pm, 15hrs)	70 dB (10pm – 7am, 9hrs)

Source: Noise Standard in Indonesia (KEP-48/MENLH/11/1996)
Effect of Traffic Noise on Sleep: A Case Study in Serdang Raya, Selangor, Malaysia, Environment Asia, 2010
Environmental Protection and Management Act in Singapore (Chap.94A, Section 77, revised in 2008)
Notification of Environmental Board No. 15 B.E.2540(1997) under the Conservation and Enhancement of National Environmental Quality Act B.E.2535 (1992) dated March 12, B.E.2540 (1997) and Notification of Pollution Control Department ; Subject: Calculation of Noise Level Dated August 11, B.E. 2540 (1997) in Thailand

(B) Vibration

As there is no vibration standard to receptors in Myanmar, the target vibration level at construction phase shall be set based on the standards in some foreign countries. Accordingly, the target level of vibration is set based on the following policies.

- Monastery and residential house where are necessary to keep quiet and sleep shall comply with the Japanese standard for residential area,
- Office, commercial facilities, and factories areas shall comply with the Japanese standard for mixed areas including residential and commercial and industrial areas, and
- The category of times divided into three types in a manner consistency with target noise level for construction.

3. FIELD SURVEY

The survey included noise and vibration monitoring for three locations in Thilawa SEZ area.

Survey Item

(A) Noise

Parameter for noise level survey was determined by referring the environmental quality standards in Japan and other countries for operation stage as shown in Table 6.

Table 6. Survey parameters for noise level

<table>
<tr><th>No.</th><th>Parameter</th><th>Category</th><th>Day Time (Leq)
(7am-7pm)</th><th>Evening Time (Leq)
(7pm-10pm)</th><th>Night Time (Leq)
(10pm-7am)</th></tr>
<tr><td>1</td><td rowspan="2">A-weighted loudness equivalent (LAeq)</td><td>Residential houses and monastery located more than 150m from the construction site, office, commercial facilities, and factories</td><td>75 dB</td><td>65 dB</td><td>65 dB</td></tr>
<tr><td>2</td><td rowspan="2">Along the four lane road which was 15m distance from the Admin Compound</td><td colspan="2">Day time (Leq)
(6am-10pm)</td><td>Night Time (Leq)
(10pm-6am)</td></tr>
<tr><td colspan="2">75 dB</td><td>70 dB</td></tr>
</table>

(B) Vibration

Vibration can be defined as regularly repeated movement of a physical object about a fixed point. The parameter normally used to assess the ground vibration is the Peak Particle Velocity (PPV) expressed in millimeters per second (mm/s).

Vibration can cause varying degrees of damage in buildings and affect vibration-sensitive machinery or equipment. Its effect on people may be to cause disturbance or annoyance or, at higher levels, to affect a person's ability to work.

Typical levels measured during construction activities are shown below:

Construction Activity	**Typical Ground Vibration Level**
Vibratory roller	Up to 1.5mms @ 25m
Hydraulic rock breakers	4.5 mm/s @ 5m, 0.4 @ 20m, 0.1 @ 50m
Compactor	20mm/s @ 5m, <0.3mm/s @30m
Pile driving	1-3mm/s @ 50m depending on soil conditions and piling technique
Bulldozer	1-2mm/s @ 5m, 0.1 @ 50m
Truck traffic (smooth surface) Truck traffic (rough surface)	<0.2mm/s @ 20m <2mm/s @ 20m

Summary of sampling points

The details of the locations of monitoring points are shown below.

Table 7. Locations of noise and vibration monitoring stations

Sampling Point	Coordinates	Description of Sampling Point
NV-1	16° 41' 12.43" N 96° 15' 54.11" E	Inside of the Thilawa class A expansion compound
NV-2	16° 40' 10.86" N 96° 16' 31.36" E	In front of Administrative Building, Thilawa SEZ Class A (traffic noise concerned)

Figure 2. Location map of noise and vibration monitoring locations

NV-1

NV-1 was an open area located within the Class A expansion area, north of Class A. It is surrounded by Thilawa dam in the south, residential area in the northeast and garment factory in the west respectively. There is an access road situated north of NV-1 and which is paved with moderately traffic volume. Dominant source of noise was vehicular traffic activity nearby the site. Noise and vibration monitoring at NV-1 is shown in figure 3.

Figure 3. Noise and vibration monitoring at NV-1.

NV-2

NV-2 was sited in front of Administrative Building in Thilawa SEZ Class A. It is an opened area and close to Dagon-Thilawa road, distanced about 15m away. The road was paved with moderate to highly traffic volume during not only the day time but also the night time, by passing of dump truck, loader vehicles and others construction machines. Dominant sources of noise were vehicle traffic during the day time. Noise and vibration monitoring at NV-2 is shown in figure 4.

Figure 4. Noise and vibration monitoring at NV-2.

Survey Period

Sampling and monitoring of surrounding sound and vibration level at NV-1 and NV-2 were conducted during 4th - 6th April, 2016.

Sampling Point	Survey Period
NV-1	4th - 5th April, 2016 (24 hours)
NV-2	5th - 6th April, 2016 (24 hours)

Survey Method

Sampling and monitoring of surrounding sound and vibration level were conducted by using following instrument for 24 hours/1 day measurement.

Instrument	Brand	Model	Measurement unit
Sound Level Meter	Lutron	SL-0423SD	dB
Vibration Meter	Lutron	VB-8206SD	mm/s, cm/s

Survey Result

(A) Noise

Noise levels (L_{Aeq}) of the monitoring points were presented in Table 7. One day L_{Aeq} was calculated by using the following array formula in the excel sheet. This formula is firstly used for hourly L_{Aeq} and then for the 24 hours L_{Aeq}.

10*LOG10(AVERGAE(10^((RANGE)/10)))

By means of the calculated results, all noise levels found lower than the environmental standard (1-day) of the target value. Previously, the target noise level for NV-1 result is within the ambient noise level standard which was located within the Class A expansion area, north of Class A. Previously, the target noise level for NV-2 was targeted the ambient noise level at the Phase 2, Construction Phase Report (No.1). However, since the location of NV-2 is located in Admin building compound which is close to the public main road distance 15m, the target noise level should be changed to the Traffic Noise level standard. Noise level (L_{Aeq}) in present monitoring period was presented in Table 8 to 11.

Table 8. Hourly L_{Aeq} value at NV-1 (Ambient noise)

Unit: dBA

Time	NV-1
	2nd - 3rd April 2016
7:00-8:00	66
8:00:9:00	62
9:00-10:00	56
10:00-11:00	50
11:00-12:00	61
12:00-13:00	54
13:00-14:00	61
14:00-15:00	57
15:00-16:00	60
16:00-17:00	57
17:00-18:00	58
18:00-19:00	56
Day L_{Aeq}	58
19:00-20:00	50
20:00-21:00	45
21:00-22:00	63
Evening L_{Aeq}	53
22:00-23:00	43
23:00-24:00	41
24:00-1:00	38
1:00-2:00	41
2:00-3:00	37
3:00-4:00	40
4:00-5:00	43
5:00-6:00	51
6:00-7:00	54
Night L_{Aeq}	43

Table 9. Hourly L_{Aeq} value at NV-2 (Traffic noise)

Unit: dBA

Time	NV-2
	5 – 6 April 2016
6:00-7:00	48
7:00-8:00	48
8:00:9:00	48
9:00-10:00	48
10:00-11:00	75
11:00-12:00	72
12:00-13:00	76
13:00-14:00	65
14:00-15:00	49
15:00-16:00	71
16:00-17:00	75
17:00-18:00	56
18:00-19:00	55
19:00-20:00	56
20:00-21:00	47
21:00-22:00	48
Day L_{Aeq}	69
22:00-23:00	66
23:00-24:00	49
24:00-1:00	49
1:00-2:00	50
2:00-3:00	49
3:00-4:00	49
4:00-5:00	48
5:00-6:00	47
Night L_{Aeq}	57

Table 10. A-weighted Loudness Equivalent (L_{Aeq}) Level of NV-1
Unit: dB(A)

Date	4th - 5th April 2016		
	NV-1 (Ambient Noise)		
	Day Time	Evening Time	Night Time
Average Result	58	53	43
Target Noise Level	75	65	65

Table 11. A-weighted Loudness Equivalent (L_{Aeq}) Level of NV-2
Unit: dB(A)

Date	5th - 6th April 2016	
	NV-2 (Traffic Noise)	
	Day Time	Night Time
Average Result	69	57
Target Noise Level from Traffic	75	70

(B) Vibration

Vibration results were presented in Figure 5 and 6. Table of observed vibration level is presented in Appendix.

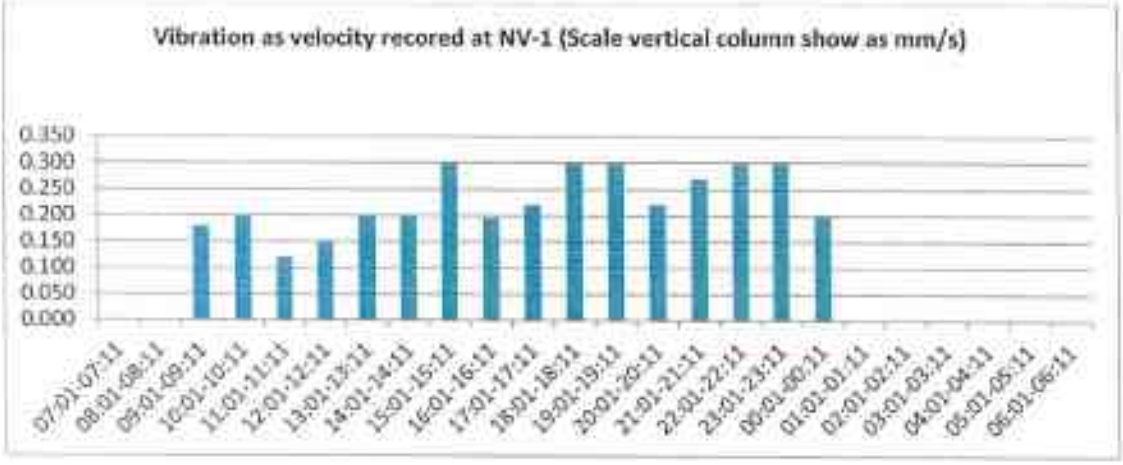

Figure 5. Vibration result of NV-1.

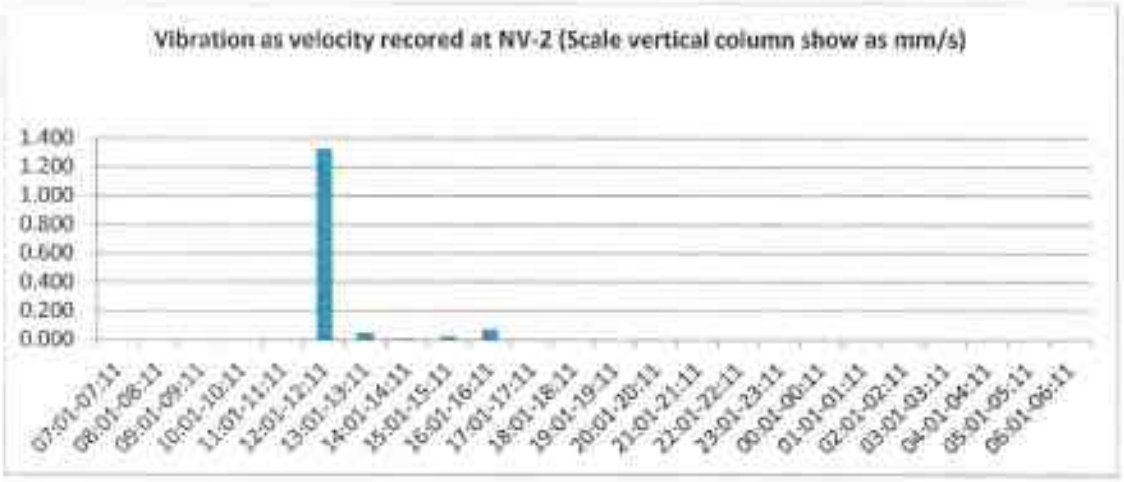

Figure 6. Vibration result of NV-2.

4. CONCLUSION

The noise level monitoring results are compared with target noise level proposed in this report (See Table 3). One noise receptor was designated in construction phase based on the baseline noise data.

All the noise level monitoring points are lower than the target noise level (See Table 8 to 11).

There is no standard relating to vibration during construction activities. Common practice in Myanmar has been to use guidance from internationally recognized standards. Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, the magnitude of vibration is expressed in terms of Peak Particle Velocity (PPV) in millimeters per second (mm/s).

In the case of nominally continuous sources of vibration such as traffic, vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short duration.

The observed noise and vibration in all monitoring points are lower than the target level.

During the same time monitoring condition, NV-1 & NV-2 were same ambient activities.

APPENDIX

Observed vibration level in 2 monitoring stations

Vibration as Velocity (mm/s)

Time	NV-1 (4-5 April)	NV-2 (5-6 April)
07:01-07:11	0.000	0.000
08:01-08:11	0.000	0.000
09:01-09:11	0.000	0.180
10:01-10:11	0.000	0.200
11:01-11:11	0.000	0.121
12:01-12:11	1.326	0.151
13:01-13:11	0.057	0.200
14:01-14:11	0.011	0.200
15:01-15:11	0.028	0.300
16:01-16:11	0.076	0.197
17:01-17:11	0.000	0.222
18:01-18:11	0.000	0.300
19:01-19:11	0.000	0.300
20:01-20:11	0.000	0.223
21:01-21:11	0.000	0.271
22:01-22:11	0.000	0.300
23:01-23:11	0.000	0.300
00:01-00:11	0.000	0.200
01:01-01:11	0.000	0.000
02:01-02:11	0.000	0.000
03:01-03:11	0.000	0.000
04:01-04:11	0.000	0.000
05:01-05:11	0.000	0.000
06:01-06:11	0.000	0.000

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