ENVIRONMENTAL IMPACT ASSESSMENT

FOR

YANGON URBAN MASS RAPID TRANSIT (YUMRT)

CONSTRUCTION PROJECT

IN

THE REPUBLIC OF THE UNION OF MYANMAR

February, 2020

Myanma Railways

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Commitment to follow and compliance with Environmental Conservation Law, Rules, Environmental Impact Assessment Procedure, National Environmental Quality (Emission) Guidelines, Standards and Mitigation Measures stated in the Environmental Impact Assessment (EIA) Report

With Regard to the above matter, we, E Guard Environmental Services have prepared the Environmental Impact Assessment (EIA) Report for Yangon Urban Mass Rapid Transit (YUMRT) Construction Project. Our company strongly commits that this EIA report have been prepared by following Environmental Conservation Law (2012), Environmental Conservation Rules (2014), Environmental Impact Assessment Procedure (2015), National Environmental Quality (Emission) Guidelines (2015) and other relevant environmental standards through successful implementation of mitigation measures stated in this Environmental Impact Assessment (EIA) Report.

.....

Third Party

E Guard Environmental Services

Aye Thiha
Managing Director
E guard Environmental Services

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF TRANSPORT AND COMMUNICATIONS
MYANMA RAILWAYS
NAYPYITAW

TELEPHONE - 067 - 77000
FAX NO. - 067 - 77016

Ref No: Planning-2020(YUMRT) 521
Date: 20th February 2020

To

Director General
Environmental Conservation Department
Ministry of Natural Resources and Environmental Conservation

Subject: Endorsement of Environmental Impact Assessment (EIA) Report on Yangon Urban Mass Rapid Transit (YUMRT)

With regards to the above matter, we, Myanma Railways, strongly provides an endorsements as follows:

I, the undersigned Proponent (or representative of Myanma Railways), hereby ensures that:

a) information written in the EIA reports is complete and accurate to the best of our knowledge;
b) the EIA report has been prepared in strict compliance with applicable laws including the EIA Procedure Notification No. 616/2015 and with the TOR of the EIA Work; and
c) we will at all times comply with the commitments made in the EIA report including those stipulated in the EMP (i.e. environmental mitigation and monitoring)

With regards to environmental monitoring, air and water quality as well as noise and vibration level will be monitored during the construction and operation stages of the project as shown in the EIA report.

With best regards,

Feb 20, 2020

Phyo Htet Kyaw
Assistant General Manager (Technical and Admin)
Myanma Railways

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CHAPTER 1 EXECUTIVE SUMMARY

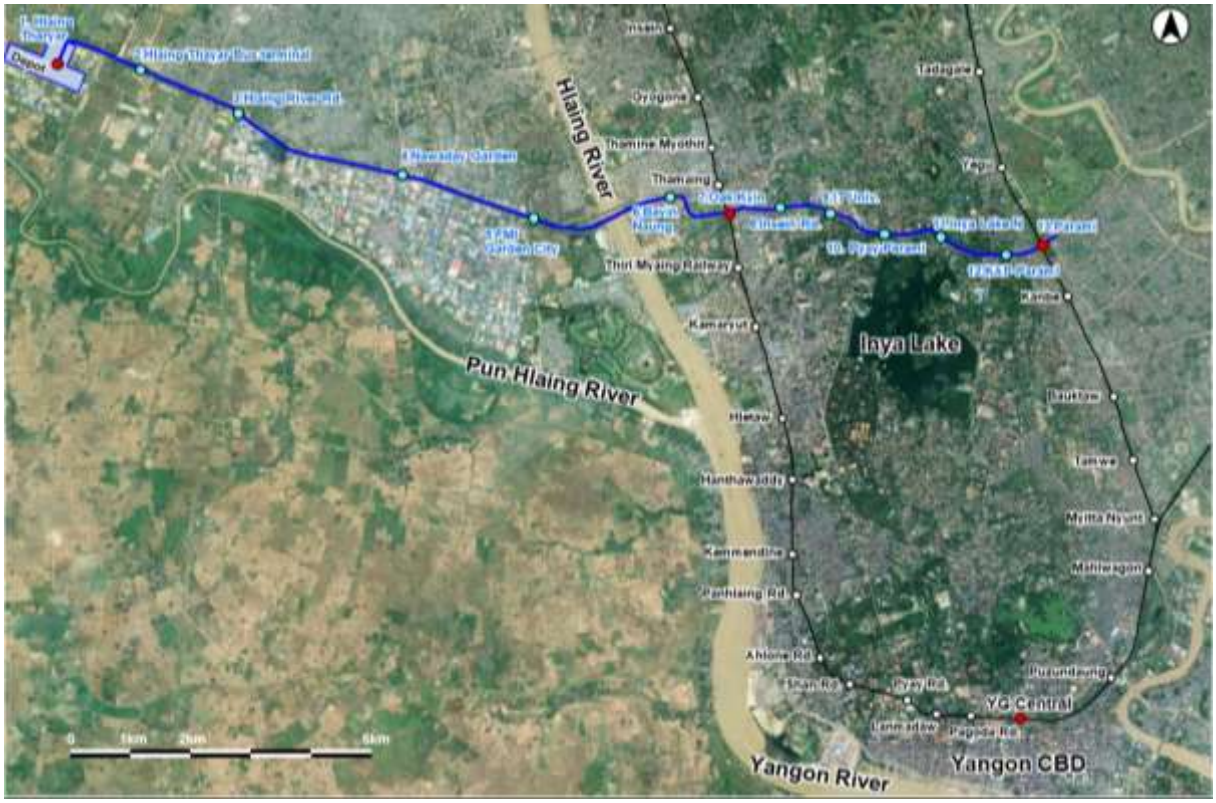
Section 1 Introduction

This environmental impact assessment (EIA) report for the Yangon Urban Mass Rapid Transit (YUMRT) has been prepared in accordance with the requirement set forth by the Environmental Impact Assessment Procedure (2015) in Myanmar. In line with the Environmental Conservation Law (2012) and Environmental Rules (2014) issued by the Ministry of Natural Resources and Environmental Conservation (MONREC), an EIA needs to be carried out and the EIA report approved by MONREC if the project was to be implemented in the country. This EIA study aims at assessing the environmental and social impacts that would be generated from the YUMRT and at putting forward ways to further enhance the positive impacts and to avoid, minimize, mitigate or compensate for the negative ones.

The objectives of this construction project are summarized as follows,

(1) Contribute to developing a comprehensive transit network for the sustainable social and economic development of Yangon;
(2) Contribute to Yangon becoming a world class city, and as the international gateway city of Myanmar;
(3) Contribute to the reduction of greenhouse gas emissions and the resultant climate change impacts;
(4) Contribute to increasing the quality of life of Yangon residents;
(5) Contribute to increasing the attractiveness and opportunities for visitors and investors;
(6) Contribute to increasing the economic value of the region;
(7) Contribute to reforming the spatial structure (guided by upstream policies);
(8) Contribute to improving the urban transport environment (air quality, noise, etc.);
(9) Provide quality urban public transport services in a sustainable manner; and
(10) Alleviate the existing and anticipated traffic congestion in the Greater Yangon area.

The location of the project is between Hlaing Tharyar and Parami of the EW Line, is shown in the Figure 1.1. The length of the project section is approximately 18 km starting from the existing Hlaing Tharyar MR station to the Parami MR station.



Source: JICA study team based on satellite image by Google Earth

Figure 1.1 Proposed Route of YUMRT E-W Line in Yangon Metropolitan Area

The project proponent is Myanma Railways (MR), which would carry out the project under the supervision of the Ministry of Transport and Communications (MOTC). Detail of the project proponent is shown below.

Table 1. 1 Contact Details of MR

Name of Organization	Myanmar Railway (MR)
Address	Nay Pyi Taw Station Compound, Nay Pyi Taw, Myanmar
TEL/FAX	+95-67-77164
Contact Person and Responsibility	- U Aung Thu Latt, General Manager, Lower Myanmar Administration, Address: Lower Myanmar Administration Office, Lower Block, Thein Phyu Road, Botahaung Tsp, Yangon Myanmar Tel: +95-1-298631 Fax: +95-1-298594 Email: gmlowermyanmar@gmail.com - U Phyo Htet Kyaw, Assistant General Manager (Planning), Planning and Administration Department Address: Naypyitaw Station Compound, Naypyitaw, Myanmar Tel: +95-67-77087 Fax: +95-67-77164 Email: kozin6893@gmail.com

Source: MR

This EIA study has been carried out by E Guard Environmental Services Company Limited under the supervision of JICA Study Team on approval of MONREC. A list of member of the EIA consultant is shown in the below Table along with their roles and responsibilities and academic qualifications. The table describes their work experiences in the past. Contact address of the EIA consultant is shown as below:

Name of Company: E Guard Environmental Services Company Limited
Address: No. 11, Airport Avenue Road, Yangon Airport Road, Saw Bwar Gyi Gone Quarter, Insein Township, Yangon 11011, Myanmar.
Tel/Fax: +951-667953
URL: *www.eguardservices.com*

Table 1. 2 Positions, Responsibility and Academic Qualification of EIA Consultant

No.	Name	Role	Responsibility	Academic Qualification
1	Daw Yu Wai Yan Thein Tan	Team Leader	Overall supervision and guidance of the study	M. Eng. (Environmental Engineering Management)
2	Daw Khine Mar Kyaw	Water Pollution Control	Environnemental quality survey and analysis	M. Eng. (Environmental Engineering Management)
3	U Kaung Htet Swan	Air Pollution Control	Environnemental quality survey and analysis	M. Eng. (Environmental Engineering Management)
4	U Naing Zaw Win	Social Environmental Expert	Socio-economic survey and analysis	B.Sc. (Forestry)
5	Daw Htet Shwe Sin Aung	Zoologist	Ecosystem Survey and Analysis	M.Sc. (Zoology)
6	Daw Hay Marn Hnin	Botanist	Ecosystem Survey and Analysis	M.Sc. (Botany)
7	U Kyaw Soe Moe	Transportation Engineer	Transportation survey and Analysis	B.E. (Civil Engineering)
8	U Si Thu Min Naing	GIS/CAD Field Surveyor,	GIS/CAD Field Surveyor,	B.E. (Mining Engineering)
9	Daw Thet Shwe Yee Aung	Geologist	Geological structural Survey	B.Sc. (Geology)
10	Daw May Thu Win	Lawyer	Provide Legislative advice	LL.B
11	Daw Shwe Sin Chue Lae	Surveyor and Enumerator	Collection of baseline data	B.E. (Electronic Communication Engineering)
12	U Thant Zin Aung	Surveyor and Enumerator	Collection of baseline data	B.E. (Mining Engineering)
13	Daw Khaing Yin Nyein	Surveyor and Enumerator	Collection of baseline data	B.Sc. (Industrial Chemistry)

Source: E Guard

Section 2 Policy, Legal and Institutional Framework

Table 2. 1 Applicable Laws and Legal Commitments for YUMRT Construction Project in Yangon

No.	Name of Laws and Regulations	Year
1	The Environmental Conservation Law	2012
2	The Environmental Conservation Rules	2014
3	Environmental Impact Assessment Procedure	2015
4	Emission Quality Standards Guideline	2015
5	The Myanmar Investment Law	2016
6	Myanmar Investment Rule	2017
7	The Rights of National Races Law	2015
8	The Public Health Law	1972
9	Prevention and Control of Communicable Disease Law	1995
10	The Control of Smoking and Consumption of Tobacco Product Law	2006
11	Myanmar Fire Force Law	2015
12	The Motor Vehicle Law (2015) and Rules (1987)	2015
13	The Myanmar Insurance Law	1993
14	Labor Organization Law	2011

No.	Name of Laws and Regulations	Year
15	The Second Amendment of the Settlement of Labor Disputes law	2019
16	The Development of Employment and Skill Law	2013
17	Minimum Wages Law	2013
18	Payment of Wages Law	2016
19	Law Amending The Workmen's Compensation Act (1923)	2005
20	Law Amending The Leaves and Holiday Act (1951)	2014
21	Social Security Law	2012
22	Petroleum and Petroleum and Product of petroleum law	2016
23	The Petroleum Rules	1937
24	Conservation of Water Resources and Rivers Law	2006
25	Freshwater Fisheries Law	1991
26	The Protection and Preservation of Cultural Heritage Regions Law	1998
27	The Protection and Preservation of Antique Objects Law	2015
28	The Protection and Preservation of Ancient Monument Law	2015
29	The Engineering Council Law	2013
30	Import and Export law	2012
31	Farm Land Law	2012
32	The Administration of Vacant, Fallow and Virgin Land Law	2012
33	Railway Transportation Service Law	2016
34	Forest Law	2018
35	Protection of Biodiversity and Protected Area Law	2018
36	Yangon City Development Council Law	2018
37	Land acquisition, Resettlement and Rehabilitation Law	2019

Section 3 Project Description and Alternative Selection

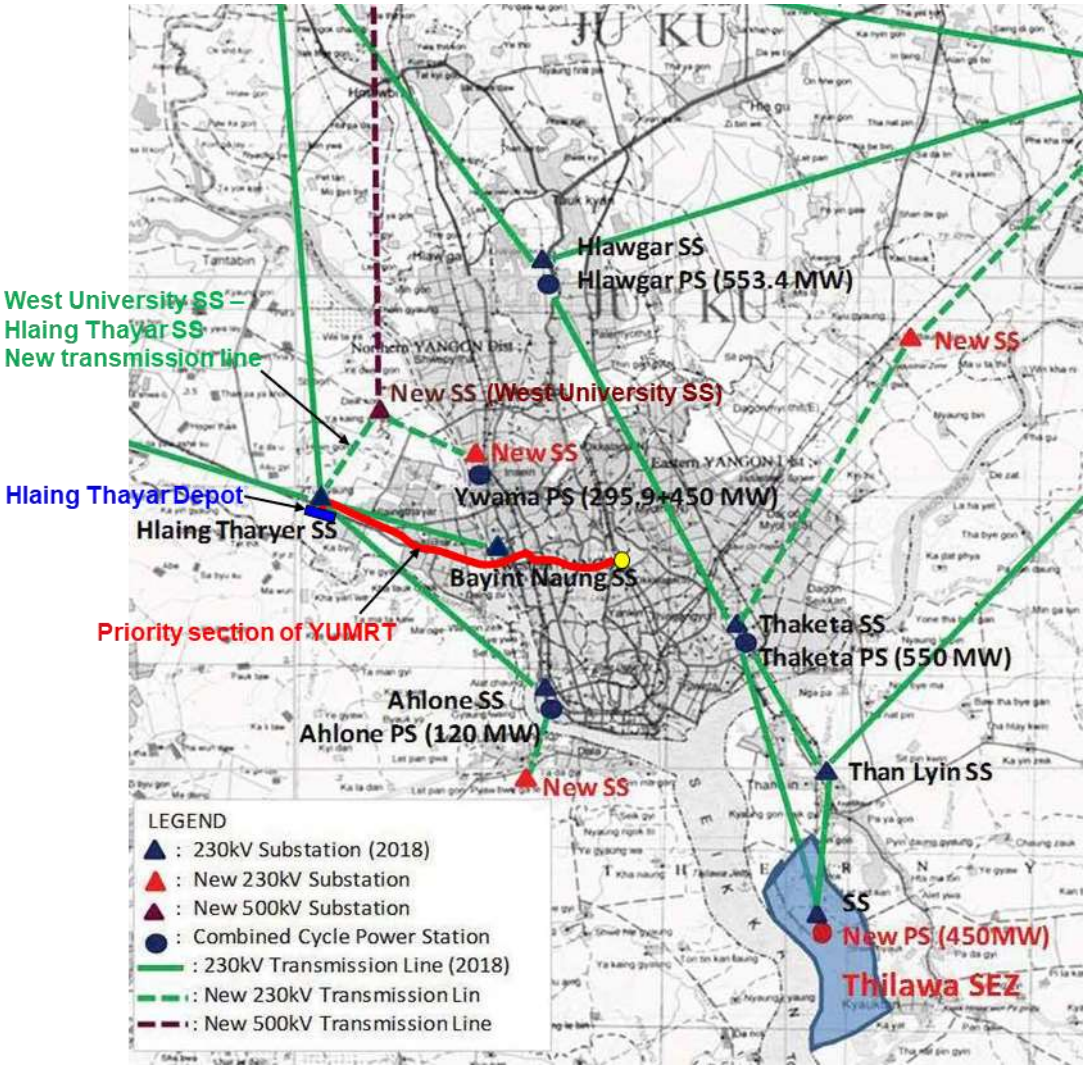
The project involves a construction of new elevated railway structure, which has the length approximately 18 km, with 13 elevated stations. A new railway depot construction including a receiving substation is also planned adjacent to the existing Haling Tharyar MR station, and a new Bayint Naung bridge construction to cross Hlaing River. The proposed design criteria of the project are shown in Table 3.1.

Table 3. 1 Proposed Design Criteria

Criteria			Description/ Value
1	Gauge		1,435mm (Standard Gauge)
2	Speed	Maximum	80km/h (Elevated)
		Schedule	30km/h
3	Minimum horizontal curvature	Main track	160m (Absolute minimum: 100m)
	Platform		400m
4	Gradient		35%
5	Traction power supply System	System	Overhead Catenary
		Voltage	1500V DC
6	Required Power Supply	Megawatts	37.1

In order to construct the stable power supply, location survey for Receiving Substation based on the below preconditions has been conducted.

(1) To secure approx. 2,000 m^2 to 3,000 m^2 land
(2) To be power grid nearby
(3) To connect with different two power grid



Reference: JICA Study Team

Figure 3. 1 Positional Relationship Between YUMRT and MOEE Power Grid in 2025

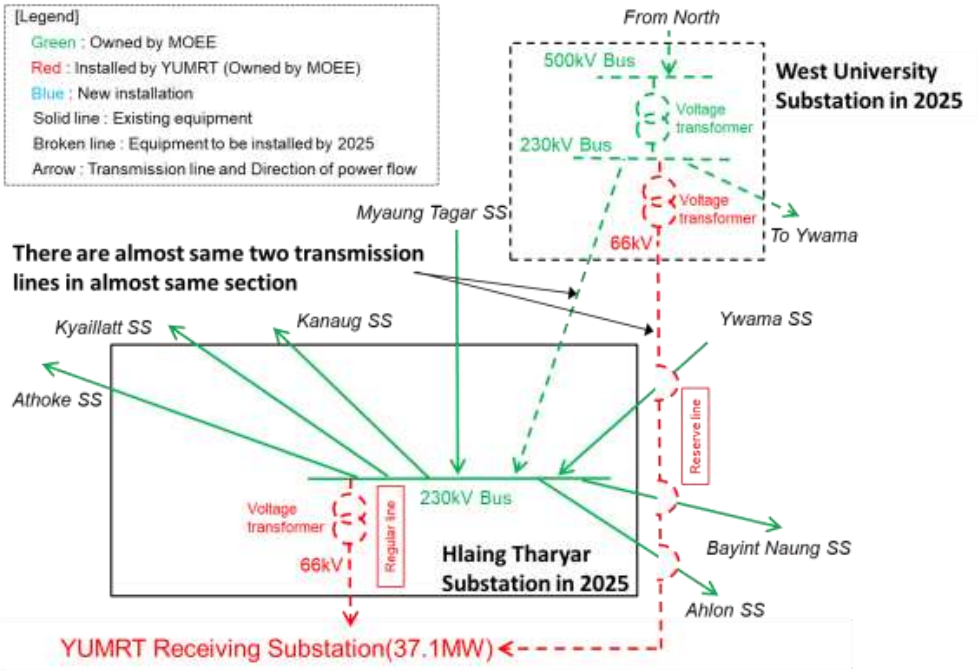
As a result of the study, it is found out that there is a high possibility with the place planned for Depot in Hlaing Tharyar as Figure 3.2.



Reference: JICA Study Team

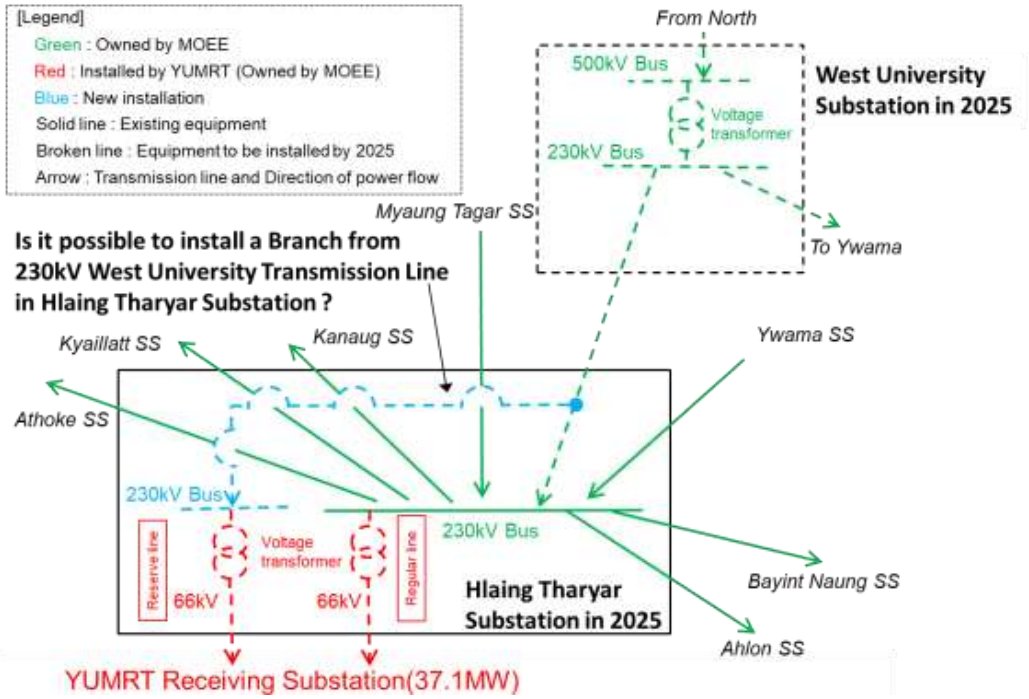
Figure 3. 2 Positional Relationship Between YUMRT Depot and MOEE Hlaing Tharyar Substation

A site survey with MOEE and MR has been conducted regarding two transmission lines connection between different two power grid and Receiving Substation. As the result, one of two transmission lines will be connected between the 230 [kV] bus in Hlaing Tharyar Substation and Receiving Substation. In the middle of this line, equipment to transform 230 [kV] to 66 [kV] will be installed in available space of Hlaing Tharyar Substation as shown in Figure 3.2. With regards to another transmission line, MOEE suggested the connection with length of 11.5km approximately from West University new Receiving Substation (RSS), planned to be constructed by other project, to Hlaing Tharyar by underground wire directly as shown in Figure 3.3 and 3.4, which was decided officially in the 3rd Steering Committee held on 28th August, 2019.



Reference: JICA Study Team

Figure 3. 3 Over View of Two Transmission Lines Connection Suggested by MOEE



Reference: JICA Study Team

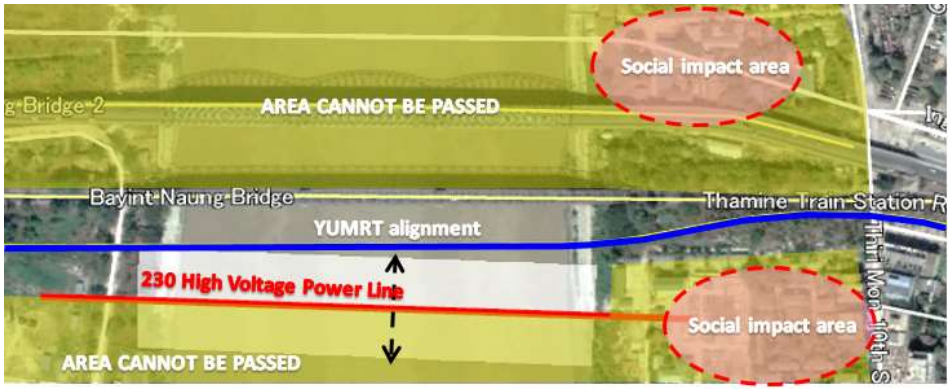
Figure 3. 4 Over View of Two Transmission Lines Connection Proposed by JST



Reference: JICA Study Team

Figure 3. 5 Proposed Route of Transmission Line for YUMRT

In the beginning stage of the study, the YUMRT alignment over Hlaing river was proposed to be on the southern side of the existing Bayint Naung Bridge (old) to secure enough distance (80m or more: same as the distance between the two road bridge) from the existing bridge to avoid scoured impact. However, it has been revealed that alignment must be closer to the road bridge due to the MOEE regulation – to keep 50m or more away from the high voltage power line. Therefore, there is the only one option, which means that YUMRT alignment should be located at the south side 40-50m away from Bayint Naung Bridge as below figure.

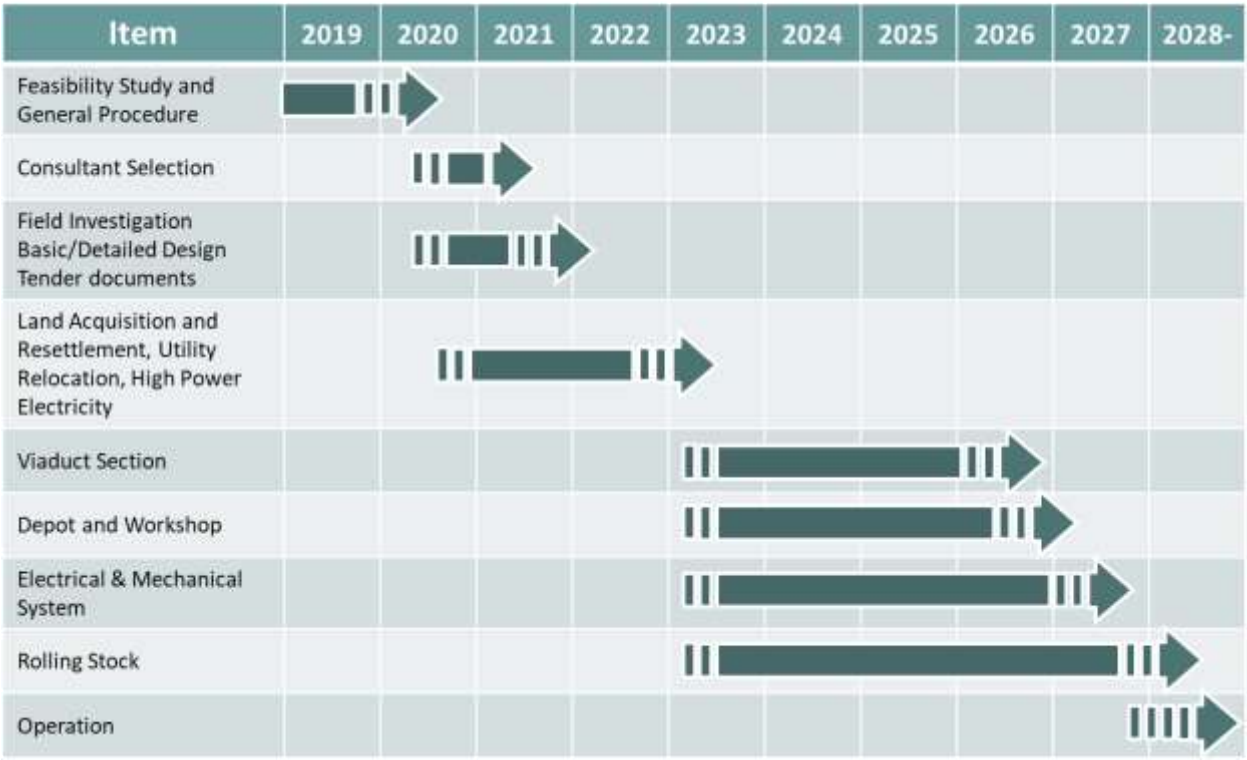


Reference: JICA Study Team

Figure 3. 6 YUMRT Alignment Passing Over Hlaing River

As of 2019, the project is positioned in Feasibility study and general procedure. From now onward, the construction will be commenced in early 2023 passing through the procedure of Consultant selection, Field investigation, Basic and Detailed design, Land acquisition and resettlement etc. After the construction period for approx.5 years, the operation period will start in 2027 or 2028 shown as below table.

Table 3. 2 Project Implementation Schedule as of 2019



Under this study, the following three alternative options were proposed and compared against each other having in mind this view. The proposed three alternative options are:

(1) No Project;
(2) Construction of YUMRT 1 (N-S line); and
(3) Construction of YUMRT 2 (E-W line).

In order to select the best-balanced and most suitable alternative, the comparison study was implemented with the following four evaluation items. However, since evaluation item for "demand" and "Environment & Society" has 2 detail items respectively, their average score is evaluated. Each evaluation index was assessed in the five stages A to E as shown below.

(1)Demand

Passenger (person/day)	Passenger (person/hour)
A：Over 2,000,001	A：Over 40,001
B：1,750,001 - 2,000,000	B：35,001 - 40,000
C：1,500,001 - 1,750,000	C：30,001 - 35,000
D：1,250,001 - 1,500,000	D：25,001 - 30,000
E：Less than 1,250,000	E：Less than 25,000

(2) Cost

Cost for construction, land acquisition and resettlement (billion USD)

A：Less than 2

B：2.1 - 2.5
C：2.6 - 3.0
D：3.1 - 3.5
E：Over 3.6

(3) Technic

Obstacle is existed or not
A：Nothing
B：Present but avoidable
C：Need additional survey
D：Difficult to avoid
E：Inevitable

(4) Environment and Society

No. of adjacent historical buildings	No. of Project Affected Household
A：0	A：0
B：1 - 3	B：1 - 500
C：4 - 6	C：501 - 1,000
D：7 - 9	D：1,001 - 1,500
E：Over 10	E：Over 1,501

Respective proposed alternative corridor was evaluated with A=20 points, B=15points, C=10 points, D=5 points and E= 0 point, and the alternate corridor with the highest score was selected as the optimum proposed option. A summary of an analysis on each option is described below followed by a table presenting an outcome of the evaluation.

Option 1: No Project

Analysis

In the case of no project implementation, land acquisition and resettlement are no longer necessary in the affected area. Currently, main transportation vehicle is a bus transit because most of Yangon citizen doesn't have income level that they can own their car. Modal shift will be promoted in case of developing YUMRT before increasing number of middle-income groups which own their car. However, in case of no developing YUMRT, future traffic congestion will be deteriorated due to insufficient road capacity affected by increasing traffic demand such as private vehicle, bus and taxi. The congestion will have negative impact on environmental aspect of air pollution, Noise and vibration, and aspect of traffic safety. All vehicles' velocity decreases by traffic jam aggravation may also increase volume of greenhouse gas emission. Although multiple positive impacts are predicted, the negative impact assumed from an economic and environmental point of view is significant. For this reason, it is evaluated that "No Project" option is undesirable in this case.

Option 2: Construction of YUMRT 1 (N-S line)

Analysis

The N-S line is a line passing from the vicinity of the Yangon international airport as the northern railhead to Twante District as the southern one via Yangon airport Rd, Pyay Rd., Kabar Aye Pagoda Rd. (hereinafter "KAP Rd.") passing through the east of Inya lake and crossing over Yangon River. Especially, the south section from Inya Lake is set as the underground alignment because there has been already density populated area of houses and commercial facilities and enough space for construction of elevated section cannot be secured. Additionally, the underground section is configured to be minimum required one because the construction cost for underground structure will be much higher than the elevated section cost.

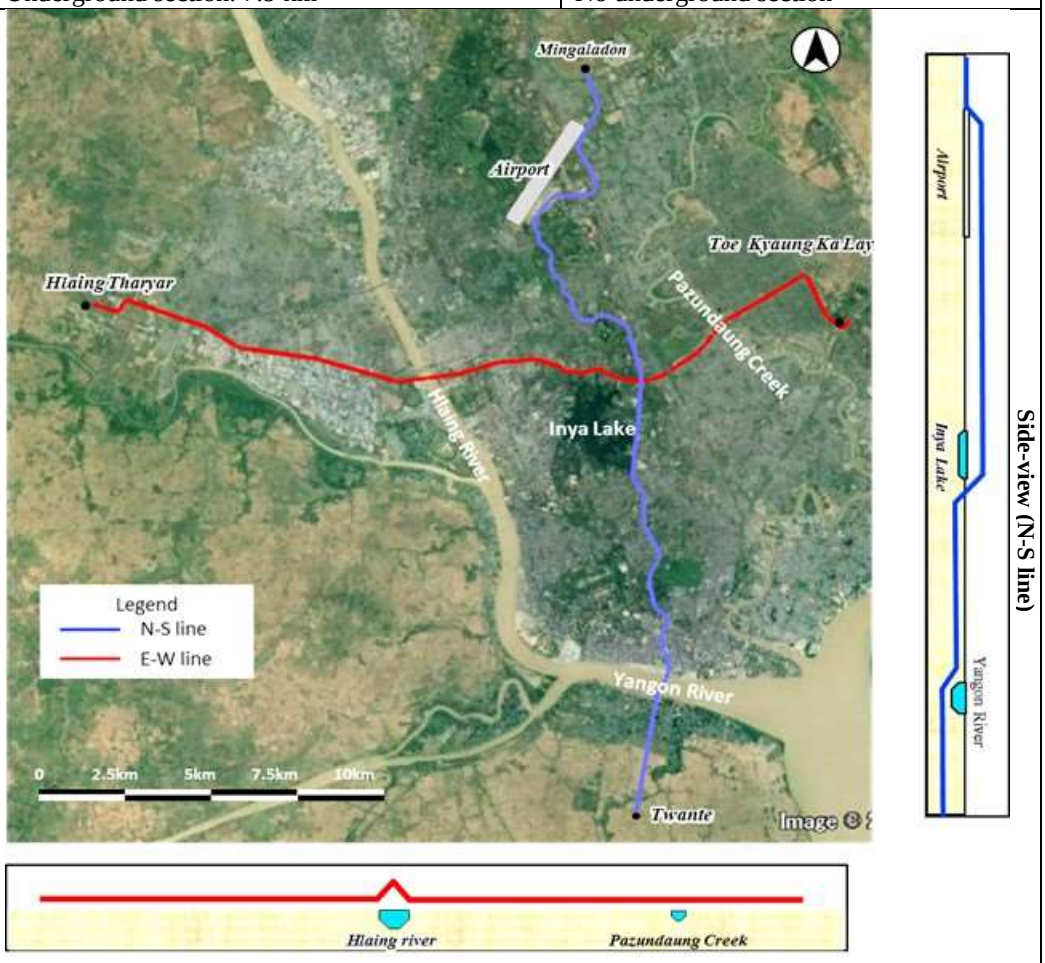
Option 3: Construction of YUMRT 2 (E-W line)

Analysis

The E-W line is a corridor passing from existing Hlaing Tharyar St. as the western railhead to existing Toe Kyaung Ka Lay St. as the eastern one via Yangon Pathein Rd., Parami Rd. after crossing over Hlaing River, Pinlon Rd. YUMRT 2 (E-W line) has the lowest construction cost due to shortest track length among the other alternatives. Higher passenger demand is also predicted for this track line due to the existence or construction plans of large-sized customer facilities such as university and hotel along the Parami Rd. Implementation of the E-W line will create better connectivity with YCR compared with other options (large-scale development plan around Parami St.: Inno City) and it is also easier to acquire construction space for YUMRT than other options because Parami Rd. is a 4-lane Rd. Meanwhile, for an area adjacent to Parami St. as the east end of priority development section, it is difficult to secure the area because a large-scale development project has already been commenced, and complaints about noise and vibration from YUMRT are also predicted due to overcrowded residential area. However, the benefit accrued from the construction of E-W line is considered to be profound largely outweighing the costs abovementioned.

In conclusion, after giving a rating to each of the above three options from a demand, cost, technic and environment and social point of view, E-W line had the first priority due to higher evaluation score from the view point of demand, cost and environment and society compared with N-S line whose score were same or lower for all evaluation items. In consultation with Myanmar government, the policy focusing on cost aspect and environmental social aspect was confirmed, and the E-W line was selected as the proposed option for YUMRT with higher evaluation from these aspects (57.5 out of 80).

Table 3. 3 Comparison of Project Alternatives (N-S line and E-W line)

Corridor	N-S line		E-W line	
Outline	Total length: 27.4 km Underground section: 7.9 km		Total length: 25.2km No underground section	
Corridor Map Side-view	 **Side-view (E-W line)**			
Demand	Passenger: 1,054,000 person/day 23,200 person/hour	E E (Average: 0)	Passenger: 1,770,000 person/day 44,300 person/hour	B A (Average: 17.5)
Cost	Construction cost: 3.3 billion USD	D	Construction cost: 2.5 billion USD	B
Technic	Obstacle: Need additional survey for Sule Pagoda	C	Obstacle: Need additional survey for transmission line	C
Environment and Social	No. of historical building: 9 No. of Project Affected Household: 700	D C (Average: 7.5)	No. of historical building: 1 No. of Project Affected Household: 450	B B (Average: 15)
Evaluation	Score = 22.5		**Proposed Alternative**	**Score = 57.5**

Section 4 Description of Surrounding Environment

The secondary data for surrounding proposed social environment such as population, economic status and health conditions and natural environment such as geology, hydrology and topography has been used from the General Administrative Department. See details in chapter 5.

Field measurements were carried out along the YUMRT at 18 locations for air quality, 21 locations for water quality (surface water), 12 locations for water quality (ground water), 35 points for noise and vibration level, 11 locations for soil and 4 locations for bottom sediment in dry and wet season.

It was observed that all air quality measurements except that of NO_2, CO, O_3 and SO_2 value of A-1 at dry season exceeded the National Environmental Quality (NEQ). At wet season, the level of PMs at some points did not exceed the guideline values. With regards to surface water quality, values of BOD, COD, Total Nitrogen and TSS at some points are found to be higher than guideline value. Especially, it was detected with extremely high concentration at survey points in Hlaing River. Regarding with ground water quality, the sampling result was compared against National Drinking Water Quality Standards specified by Ministry of Health Myanmar. It was not found arsenic value in all wells except GW12.Ground water quality measurements expect arsenic value of G12. At the point of GW2 and GW 10, iron concentration was much higher than the specified value.

According to the measured results, both day and night time noise levels at all road side (Type :A) points except NV-1, NV-26, NV-29 and NV32 exceeded the guideline values. Especially along Parami Rd., the value at some point exceeded 80d in day time. Regarding back point (Type: B), it can be see that average noise level values are below the guideline values in both day and night time except day time at NV-4,10,17 and all day time at NV-23. All the resultant values of vibration level measurements were found to be within the regulatory standards of vibration specified from Ministry of Environment, Government of Japan.

In comparing the results with Thailand environmental soil quality standard, it can be seen that soil values from each samples under the standard value except Arsenic. There is no guideline for bottom sediment and it can be seen that arsenic, chromium and lead value.

Table 4. 1 Result of Ambient Air Quality Measurement (unit: µg/m^3, ppm)

Point No.	Season	Standard Values (NEQ and WHO)					
		PM_{10} (24 Hr Average)	$PM_{2.5}$ (24 Hr Average)	NO_2 (1 Hr Average)	SO_2 (24 Hr Average)	CO (8 Hr Average)	O_3 (8 Hr Average)
		50 µg/m^3 (NEQ)	25 µg/m^3 (NEQ)	200 µg/m^3 (NEQ)	20 µg/m^3 (NEQ)	9 ppm (Air NEPM)	100 µg/m^3 (NEQ)
		Results					
A-1	Dry	**180**	**112**	89	2	0	67
	Wet	**51**	**33**	102	**45**	0	6
A-2	Dry	**199**	**134**	95	**208**	$2*10^{-8}$	41
	Wet	49	**32**	74	**39**	$2*10^{-5}$	10
A-3	Dry	**225**	**136**	93	**256**	$3*10^{-8}$	57
	Wet	**60**	**43**	41	**47**	$3.7*10^{-4}$	8
A-4	Dry	**188**	**133**	105	**426**	$3*10^{-7}$	61
	Wet	**58**	**41**	43	**45**	$3.8*10^{-4}$	12
A-5	Dry	**228**	**147**	92	**405**	$3*10^{-7}$	63
	Wet	**61**	**39**	102	**38**	$4.3*10^{-4}$	8
A-6	Dry	**211**	**141**	74	**477**	0	75
	Wet	**454**	**74**	5	**45**	$1.2*10^{-4}$	14
A-7	Dry	**190**	**110**	98	**348**	0	61

Point No.	Season	Standard Values (NEQ and WHO)					
		PM_{10} (24 Hr Average)	$PM_{2.5}$ (24 Hr Average)	NO_2 (1 Hr Average)	SO_2 (24 Hr Average)	CO (8 Hr Average)	O_3 (8 Hr Average)
		50 µg/m^3 (NEQ)	25 µg/m^3 (NEQ)	200 µg/m^3 (NEQ)	20 µg/m^3 (NEQ)	9 ppm (Air NEPM)	100 µg/m^3 (NEQ)
		Results					
	Wet	**154**	**61**	4	**43**	$4*10^{-4}$	2
A-8	Dry	**248**	**113**	99	**621**	$1*10^{-8}$	55
	Wet	33	**34**	18	**22**	$9*10^{-5}$	12
A-9	Dry	**158**	**86**	93	**514**	$1.2*10^{-6}$	51
	Wet	38	**25**	74	**75**	$3.5*10^{-4}$	10
A-10	Dry	**169**	**129**	127	**551**	$7*10^{-8}$	57
	Wet	39	16	4	**22**	$1.2*10^{-4}$	6
A-11	Dry	**169**	**131**	113	**514**	$1*10^{-7}$	69
	Wet	**53**	**32**	47	**39**	$1.5*10^{-4}$	14
A-12	Dry	**181**	**128**	140	**551**	$7*10^{-8}$	67
	Wet	**50**	**29**	37	**39**	$3.3*10^{-4}$	4
A-13	Dry	**313**	**104**	93	**524**	$1.5*10^{-7}$	65
	Wet	33	21	21	**27**	$3*10^{-4}$	14
A-14	Dry	**153**	**90**	177	**612**	$1.7*10^{-7}$	71
	Wet	43	18	19	**45**	$1.3*10^{-4}$	12
A-15	Wet	31	16	99	12	$2.9*10^{-7}$	23
A-16	Wet	**57**	**26**	93	**22**	$1.4*10^{-8}$	20
A-17	Wet	**69**	**30**	92	**24**	$4.4*10^{-8}$	26
A-18	Wet	**67**	**37**	84	**22**	$2.9*10^{-7}$	21

Source: E-guard study team

Table 4. 2 Result of Water Quality Measurements and Analyses (Surface Water)

Parameter	Season	Location										NEQG Value	Unit	Name of Lab
		SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10			
Temperature	Dry	29.1	30.3	27.5	29.3	29.3	29.5	30.4	31.0	30.8	30.6	-	°C	Onsite
	Wet	30.6	30.4	28.4	28.3	28.3	30.7	29.2	29.7	29.1	29.1			
pH	Dry	7.3	7.4	7.1	7.3	6.8	7.1	7.8	7.8	7.8	7.7	6.0-9.0		ISO
	Wet	7.1	6.9	6.8	7.1	7.2	7.8	7.6	7.5	7.4	7.3			
Turbidity	Dry	268	66	198	130	212	220	2200	2000	3400	3200	-	NTU	ISO
	Wet	46	29	22	68	55	89	122	136	144	140			
Total Organic Carbon (TOC)	Dry	14.00	11.94	26.60	39.82	42.33	33.74	3.67	3.29	3.27	3.32	-	mg/L	UAE
	Wet	5.10	4.05	11.95	4.98	8.93	6.02	4.60	2.71	5.24	4.85			
Biological Oxygen Demand (BOD)	Dry	**31**	30	**92**	**44**	**54**	**31**	20	25	12	**58**	30	mg/L	SGS
	Wet	5	6	5	12	13	8	15	7	14	11			
Chemical Oxygen Demand (COD)	Dry	57	58	167	175	236	**264**	95	164	188	152	250	mg/L	SGS
	Wet	26	28	40	69	68	20	25	12	19	21			
Total Nitrogen (T-N)	Dry	1.12	<1	14.00	**29.68**	**35.28**	<1	2.24	3.36	2.80	3.36	15	mg/L	SGS
	Wet	<1	<1	1.82	1.96	3.36	<1	5.60	6.16	6.16	7.00			
Total Phosphorous (T-P)	Dry	0.05	0.03	0.78	0.02	1.37	<0.01	0.29	0.96	0.58	0.46	5	mg/L	SGS
	Wet	0.05	0.03	1.07	1.49	1.21	0.10	0.63	0.15	0.57	0.75			
Oil and Grease	Dry	<5	7.9	<5	<5	5.8	<5	<5	<5	<5	<5	10	mg/L	SGS
	Wet	<5	<5	<5	<5	5.52	<5	<5	<5	<5	<5			
Total Suspended Solid (TSS)	Dry	<20	<20	**159**	**55**	**54**	**40**	**1,127**	**2,599**	**2,880**	**2,812**	25	mg/L	SGS
	Wet	**26**	23	**34**	21	24	15	**328**	**376**	**393**	**555**			
Dissolved Oxygen (DO)	Dry	3.6	4	Nil	Nil	Nil	Nil	5.8	6.2	5.6	5.6	-	mg/L	Supreme
	Wet	5.2	4.7	3.3	3.1	3	4.3	4.4	4	4.4	3.7			
Total Coliform Count	Dry	12	10	100	80	60	60	90	3	110	100	-	CFU/ 100ml	ISO
	Wet	5	4	6	20	12	10	14	16	12	14			
Water Level	Dry	2.5	2.5	2.0	2.0	1.0	0.8	23	23	23	23	-	m	Onsite
	Wet	3.0	3.0	3.0	4.5	2.5	1.5	40	40	40	42			

Parameter	Season	Location										NEQG Value	Unit	Name of Lab
		SW-11	SW-12	SW-13	SW-14	SW-15	SW-16	SW-17	SW-18	SW-19	SW-20	SW-21			
Temperature	Dry	29.8	30.3	31.2	30.0	28.4	28.8	29.2	28.8	27.5	27.5	-	-	ºC	Onsite
	Wet	29.9	29.8	29.9	29.9	27.5	26.4	26.0	29.9	27.0	26.0				
pH	Dry	7.7	7.7	7.8	7.8	7.6	7.4	7.1	7.1	7.1	6.9	6.9	6.0-9.0		ISO
	Wet	7.4	7.3	7.1	7.1	7.2	7.1	6.9	7	7.1	6.2				
Turbidity	Dry	2,000	2,800	3,600	3,400	110	128	290	142	1,300	400	146	-	NTU	ISO
	Wet	130	133	122	189	66	155	50	58	128	88				
Total Organic Carbon (TOC)	Dry	3.31	3.47	2.66	2.79	14.76	7.56	22.36	7.00	10.07	10.82	-	-	mg/L	
	Wet	2.68	4.08	3.29	2.51	3.96	4.37	4.23	2.28	3.44	2.07				
Biological Oxygen Demand (BOD)	Dry	**59**	**90**	**37**	**55**	**39**	9	9	9	5	9	<2	30	mg/L	SGS
	Wet	<2	<2	<2	<2	<2	<2	13	5	12	12				
Chemical Oxygen Demand (COD)	Dry	124	194	118	120	80	110	103	83	51	32	21.5	250	mg/L	SGS
	Wet	<10	<10	<10	<10	17	13	24	<10	18	21				
Total Nitrogen (T-N)	Dry	1.68	3.36	2.80	3.36	11.20	12.88	4.48	3.36	5.60	6.16	2.52	15	mg/L	SGS
	Wet	<1	<1	<1	<1	5.04	5.32	1.40	<1	3.92	3.36				
Total Phosphorous (T-P)	Dry	0.39	0.30	0.81	0.21	1.14	1.27	0.47	0.28	1.00	0.84	0.684	5	mg/L	SGS
	Wet	0.19	0.15	0.07	0.01	0.58	0.64	0.12	0.09	0.41	0.37				
Oil and Grease	Dry	<5	7.5	7.6	7.7	<5	6.19	<5	<5	<5	<5	<5	10	mg/L	SGS
	Wet	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5				
Total Suspended Solid (TSS)	Dry	**866**	**1,632**	**2,192**	**2,727**	22	**28**	**52**	15	**157**	**91**	24.50	25	mg/L	SGS
	Wet	**417**	**655**	**514**	**616**	**141**	**71**	**62**	20	**165**	**135**				
Dissolved Oxygen (DO)	Dry	6	5.8	6	5.6	2	3	1.6	2.2	0.6	0.6	-	-	mg/L	Supreme
	Wet	4.8	4.7	4.6	4.7	3	3	2.4	3.3	2.7	2.8				
Total Coliform Count	Dry	80	60	120	110	30	40	100	90	80	50	30	-	CFU/ 100ml	ISO
	Wet	16	12	20	20	10	14	18	20	20	16				
Water Level	Dry	23	23	23	23	1.0	1.5	1.5	2.0	2.0	2.0	-	-	m	Onsite
	Wet	38	38	38	38	1.5	1.8	2.0	2.6	3.4	3.1				

Source: E Guard Study Team

Table 4. 3 Result of Water Quality Measurements and Analyses (Ground Water)

Parameter	Season	Location												National Drinking Water Quality Standards	Unit	Name of Lab
		GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW 9	GW 10	GW 11	GW 12			
pH	Dry	7.2	6.8	6.7	6.5	6.9	6.5	6.6	**6.2**	7.1	6.5	6.7	6.9	6.5-8.5		ISO
	Wet	7.1	7.2	6.7	6.6	6.7	**6.2**	**6.4**	**6.4**							
Total Dissolved Solids (TDS)	Dry	**5,048**	**2,681**	**2,759**	**2,742**	357	347	819	38	614	91	**2,708**	100	1000	mg/l	SGS
	Wet	**4,567**	**2,706**	**2,731**	**2,922**	320	340	390	88							
Arsenic (As)	Dry	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.01	0.05	mg/l	
	Wet	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil							
Iron (Fe)	Dry	0.21	**50.17**	0.38	0.58	0.34	0.16	0.29	0.03	0.27	**7.31**	<0.01	<0.01	1	mg/l	SGS
	Wet	0.44	**9.59**	0.41	**1.07**	0.21	0.06	<0.01	<0.01							
Manganese (Mn)	Dry	**2.2**	**5.8**	**2.3**	**3.0**	**1.2**	**2.3**	**1.9**	-	0.04	**1.0**	0.01	**1.2**	0.4	mg/l	Supreme
	Wet	**0.6**	**2.5**	**2.5**	**1.1**	**0.7**	**1.8**	**1.3**	**0.9**							
Chloride	Dry	**2,591**	**1,425**	**1,453**	**1,578**	106	135	**337**	13	243	9	**1,393**	3.50	250	mg/l	SGS

Source: E Guard Study Team

Table 4. 4 Results of Noise Level Measurement

Point	Date	Location (A: Along the alignment, B:Backside)		Upper: Latitude Lower: Longitude	Period	LAeq (dB)	NEQG Value (dB)
NV-1	18.3.2019	Hlaing Tharyar St.	A	16°52'44.20"N	Day	50.6	70 (Day/Night)
				96°0'37.97"E	Night	52.9	
NV-2	18.3.2019	Hlaing Tharyar St.	B	16°52'45.02"N	Day	67.9	
				96°0'39.80"E	Night	57.4	
NV-3	19.3.2019	Dagon-Ayar Bus St.	A	16°52'42.16"N	Day	**76.9**	
				96°1'22.54"E	Night	**74.5**	
NV-4	19.3.2019	Dagon-Ayar Bus St.	B	16°52'40.22"N	Day	**86.3**	
				96°1'21.51"E	Night	64.9	
NV-5	20.3.2019	INTXN point of BOC and Twan Tay	A	16°52'16.40"N	Day	**70.2**	
				96°2'22.27"E	Night	**73.6**	
NV-6	20.3.2019	INTXN point of BOC and Twan Tay	B	16°52'14.86"N	Day	66.3	
				96°2'21.39"E	Night	48.1	
NV-7	21.3.2019	Mee Khwat Market	A	16°51'53.44"N	Day	**73.3**	
				96°3'7.67"E	Night	**71.9**	
NV-8	21.3.2019	Mee Khwat Market	B	16°51'54.41"N	Day	64.6	
				96°3'7.67"E	Night	65.5	
NV-9	22.3.2019	Na Wa Day INTXN point (Na Wa Day Housing)	A	16°51'43.99"N	Day	**71.4**	
				96°3'51.73"E	Night	**72.7**	
NV-10	22.3.2019	Na Wa Day INTXN point (Na Wa Day Housing)	B	16°51'43.08"N	Day	**73.6**	
				96°3'51.30"E	Night	61.8	
NV-11	23.3.2019	FMI	A	16°51'20.87"N	Day	**71.4**	
				96°5'8.25"E	Night	**74.6**	
NV-12	23.3.2019	FMI	B	16°51'22.06"N	Day	62.7	
				96°5'8.88"E	Night	65.3	
NV-13	24.3.2019	Under Ba Yint Naung Bridge	B	16°51'22.78"N	Day	59.9	
				96°6'0.63"E	Night	59.1	
NV-14	25.3.2019	Ba Yint Naung Pwel Yoan (Thiri Mon Pa Lar Zar)	A	16°51'31.64"N	Day	**73.0**	
				96°6'22.17"E	Night	**75.2**	
NV-15	25.3.2019	Ba Yint Naung Pwel Yoan (Thiri Mon Pa Lar Zar)	B	16°51'29.57"N	Day	66.2	
				96°6'22.84"E	Night	56.8	
NV-16	26.3.2019	INTXN of Parami Rd. and East 50' Rd.	A	16°51'26.73"N	Day	**82.8**	
				96°7'11.08"E	Night	**75.8**	
NV-17	26.3.2019	INTXN of Parami Rd. and East 50' Rd.	B	16°51'25.11"N	Day	**77.8**	
				96°7'11.38"E	Night	60.9	
NV-18	28.3.2019	INTXN of Parami Rd. and Inn Sein Rd.	A	16°51'27.62"N	Day	**80.1**	
				96°7'24.29"E	Night	**72.3**	
NV-19	28.3.2019	INTXN of Parami Rd. and Inn Sein Rd.	B	16°51'27.94"N	Day	61.9	70 (Day/Night)
				96°7'23.48"E	Night	69.2	
NV-20	2.4.2019	IT University	A	16°51'19.20"N	Day	**71.2**	
				96°8'7.62"E	Night	**70.3**	
NV-21	2.4.2019	IT University	B	16°51'17.80"N	Day	58.5	
				96°8'7.03"E	Night	57.6	
NV-22	29.3.2019	INTXN of Pyay Rd. and Parami Rd.	A	16°51'12.86"N	Day	**78.3**	
				96°8'25.89"E	Night	**75.5**	
NV-23	29.3.2019	INTXN of Pyay Rd. and Parami Rd.	B	16°51'14.34"N	Day	**73.2**	
				96°8'26.88"E	Night	**73.8**	
NV-24	30.3.2019	Inya Lake North-East St.	A	16°51'6.97"N	Day	**81.5**	
				96°8'58.42"E	Night	**83.2**	
NV-25	30.3.2019	Inya Lake North-East St.	B	16°51'5.24"N	Day	59.3	
				96°8'57.20"E	Night	58.5	
NV-26	24.3.2019	Parami General Hospital	A	16°50'59.68"N	Day	66.3	
				96°9'23.47"E	Night	67.2	

Point	Date	Location (A: Along the alignment, B:Backside)		Upper: Latitude Lower: Longitude	Period	LAeq (dB)	NEQG Value (dB)
NV-27	31.3.2019	INTXN of Parami Road and Ka Bar Aye Rd.	A	16°51'0.25"N	Day	**76.3**	
				96°9'29.01"E	Night	**73.5**	
NV-28	31.3.2019	INTXN of Parami Road and Ka Bar Aye Rd.	B	16°50'58.13"N	Day	57.2	
				96°9'29.13"E	Night	58.4	
NV-29	3.4.2019	In front of Kinder garden (Rainbow Pre-school)	A	16°51'5.98"N	Day	66.6	
				96°9'49.35"E	Night	63.2	
NV-30	10.5.2019	Parami St.	B	16°51'9.40"N	Day	61.4	
				96°9'55.09"E	Night	60.8	
NV-31	10.5.2019	Parami St.	B	16°51'10.04"N	Day	61.1	
				96°9'54.54"E	Night	61.4	
NV-32	14.8.2019	West Yangon University	A	16°56'20.15"N	Day	65.7	
				96° 2'27.62"E	Night	63.9	
NV-33	15.8.2019	Htan tapin Police Outpost	A	16°55'35.49"N	Day	**76.5**	
				96° 2'57.94"E	Night	**72.4**	
NV-34	16.8.2019	B.E.H.S No. (8), Hlaing Tharyar Township	A	16°53'59.89"N	Day	**74.7**	
				96° 2'46.10"E	Night	68.6	
NV-35	17.8.2019	Yadanar Thiri Myoe Oo Monastery	A	16°52'56.86"N	Day	**79.4**	
				96° 2'10.26"E	Night	**76.3**	

*Measurement values that exceed the NEQ Guideline values are shown in a red word.
Source: E Guard Study Team

Table 4. 5 Comparison of Vibration Monitoring Results and Regulatory Standards

Point	Date	Location (A: Along the alignment) (B: Backside)		Period	Vibration Level Lv	Standard MOE Japan (dB)
NV-1	18.3.2019	Hlaing Tharyar St.	A	Day	25.29	Day:70 Night:65
				Night	25.70	
NV-2	18.3.2019	Hlaing Tharyar St.	B	Day	30.67	
				Night	44.18	
NV-3	19.3.2019	Dagon-Ayar Bus St.	A	Day	28.78	
				Night	30.43	
NV-4	19.3.2019	Dagon-Ayar Bus St.	B	Day	24.57	
				Night	28.11	
NV-5	20.3.2019	INTXN point of BOC and Twan Tay	A	Day	51.12	
				Night	37.38	
NV-6	20.3.2019	INTXN point of BOC and Twan Tay	B	Day	27.34	
				Night	25.05	
NV-7	21.3.2019	Mee Khwat Market	A	Day	51.75	
				Night	49.69	
NV-8	21.3.2019	Mee Khwat Market	B	Day	37.87	
				Night	28.89	
NV-9	22.3.2019	Na Wa Day INTXN point (Na Wa Day Housing)	A	Day	45.37	Day:70 Night:65
				Night	40.72	
NV-10	22.3.2019	Na Wa Day INTXN point (Na Wa Day Housing)	B	Day	25.13	
				Night	29.64	
NV-11	23.3.2019	FMI	A	Day	43.20	
				Night	41.86	
NV-12	23.3.2019	FMI	B	Day	29.06	
				Night	38.4	
NV-13	24.3.2019	Under Ba Yint Naung Bridge	B	Day	39.80	
				Night	30.51	
NV-14	25.3.2019	Ba Yint Naung Pwel Yoan (Thiri Mon Pa Lar Zar)	A	Day	25.27	
				Night	34.63	
NV-15	25.3.2019	Ba Yint Naung Pwel Yoan (Thiri Mon Pa Lar Zar)	B	Day	49.96	
				Night	47.21	
NV-16	26.3.2019	INTXN of Parami Rd. and East 50'	A	Day	27.53	

Point	Date	Location (A: Along the alignment) (B: Backside)		Period	Vibration Level Lv	Standard MOE Japan (dB)
		Rd.		Night	27.75	
NV-17	26.3.2019	INTXN of Parami Rd. and East 50' Rd.	B	Day	39.40	
				Night	34.12	
NV-18	28.3.2019	INTXN of Parami Rd. and Inn Sein Rd.	A	Day	29.99	
				Night	20.82	
NV-19	28.3.2019	INTXN of Parami Rd. and Inn Sein Rd.	B	Day	42.24	
				Night	37.71	
NV-20	2.4.2019	IT University	A	Day	26.83	
				Night	24.65	
NV-21	2.4.2019	IT University	B	Day	36.31	
				Night	32.31	
NV-22	29.3.2019	INTXN of Pyay Rd. and Parami Rd.	A	Day	32.32	
				Night	26.33	
NV-23	29.3.2019	INTXN of Pyay Rd. and Parami Rd.	B	Day	42.78	
				Night	37.90	
NV-24	30.3.2019	Inya Lake North-East St.	A	Day	40.61	
				Night	46.02	
NV-25	30.3.2019	Inya Lake North-East St.	B	Day	34.35	
				Night	48.73	
NV-26	24.3.2019	Parami General Hospital	A	Day	29.83	
				Night	48.07	
NV-27	31.3.2019	INTXN of Parami Road and Ka Bar Aye Rd.	A	Day	31.10	
				Night	48.07	
NV-28	31.3.2019	INTXN of Parami Road and Ka Bar Aye Rd.	B	Day	43.89	
				Night	31.35	
NV-29	3.4.2019	In front of Kinder garden (Rainbow Pre-school)	A	Day	69.31	
				Night	56.54	
N-V30	10.5.2019	Parami St.	B	Day	30.09	
				Night	44.90	
NV-31	10.5.2019	Parami St.	B	Day	31.36	
				Night	40.85	Day:70 Night:65
N-V32	14.8.2019	West Yangon University	A	Day	42.52	
				Night	33.67	
NV-33	15.8.2019	Htan tapin Police Outpost	A	Day	45.54	
				Night	33.50	
NV-34	16.8.2019	B.E.H.S No. (8), Hlaing Tharyar Township	A	Day	37.25	
				Night	43.16	
NV-35	17.8.2019	Yadanar Thiri Myoe Oo Monastery	A	Day	62.46	
				Night	44.17	

Source: E Guard Study Team

Table 4. 6 Results of Soil Quality Analysis

Survey Point	Thailand Environmental Standard (mg/kg)				
	Arsenic	Cadmium	Chromium Hexavalent	Chromium	Lead
	3.9	37	300	-	400
	Result				
So-1	5.97	-	-	68.5	16.3
So-2	5.87	-	0.689	46.0	22.8
So-3	4.67	-	-	62.0	22.6
So-4	10.2	-	-	73.4	20.9
So-5	7.08	-	-	62.0	21.6
So-6	7.52	-	-	68.7	26.0

So-7	**5.26**	-	-	36.3	23.1
So-8	3.26	-	-	43.3	8.5
So-9	**4.07**	-	-	34.6	21.6
So-10	3.52	-	-	49.1	52.8
So-11	3.39	-	-	29.4	27.6

Table 4. 7 Results of Bottom Sediment Analysis

No.	Arsenic	Cadmium	Chromium Hexavalent	Chromium	Lead
BS-1	6.35	-	-	42.4	13.8
BS-2	4.52	-	-	47.2	15.4
BS-3	6.99	-	-	121	82.5
BS-4	9.40	-	-	57.6	36.3

A total number of 55 flora species were recorded along YUMRT line in both seasons. In the list, there is 2 species categorized as Endangered (EN) and Vulnerable (VU) on IUCN red list. Regarding Endangered species, Burmese rose wood whose scientific name is *Pterocarpus indicus* is the cultivated plant type which can grow and survive in most part of Myanmar. Regarding Vulnerable species, Mahogany, whose scientific name is *Swietenia macrophylla* and which is an exotic species, was observed at a public park which might not be directly affected. 49 fauna species were observed in total during the survey for both seasons. According to the IUCN status, there was only one threatened species (NT) which is River Tern.

A total number of 28 macroinvertebrates were recorded along the YUMRT line in dry and wet season. According to the survey results, 20 macroinvertebrates belonging to 18 families from 15 orders in dry season and 18 macroinvertebrates belonging to 17 families from 12 orders in wet season. Among them, 10 macroinvertebrates were found in both seasons. See more details in Chapter 5.

Section 5 Assessment of Environmental Impact

Impact assessment was conducted based on the results of scoping, analysis of the project components and the baseline data including field survey results. Most of the impacts expected to be generated from the project are considered to be limited in scale, confined to the project area, and hence manageable. This is due to the nature of the project, the social and natural environmental conditions in and around the project area and the policy adopted by MR and JICA Study Team to avoid land acquisition and minimize involuntary resettlement. As a result, no impact has been evaluated to be significantly detrimental (i.e. 'A-') in the impact assessment shown in below Tables.

Table 5. 1 Results of Assessment for Railway (Reason for the Evaluation)

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction/ Construction	Operation	
Pollution	1	Air pollution	**B-**	**B+**	**Construction:** Emission gas (NOx, SOx) and dust (PM) will have a temporary negative impact on the air quality by construction heavy machines, dump trucks and traffic congestion due to traffic control. **Operation:** Positive impact will be offered by reduction of traffic volume along YUMRT.
	2	Water pollution	**B-**	**B-**	**Construction:** - Turbid water will be generated at lakes and ponds along YUMRT alignment due to civil and excavation works.

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction/ Construction	Operation	
					- Turbid water will be generated at a proposed site for rolling stock yard due to soil filling works. - There is a possibility of being discharged organic waste water at an installed base camp site. - Negative impact for water quality will be occurred if construction waste is left for a long time illegally. **Operation:** There is a possibility of being discharged organic waste water from toilet installed every station and the rolling stock yard.
	3	Waste	**B-**	**B-**	**Construction:** - General waste and excreta will be generated from base camp site. - It is predicted that construction waste such as soil and deforestation trees are generated. **Operation:** General waste and excreta will be generated from every station, rolling stock yard and by increasing number of settlers.
	4	Soil contamination	**B-**	**B-**	**Construction:** - Excavated soil at the construction site may be contaminated due to oil leakage. - Negative impact for soil will be occurred if construction waste is left for a long time illegally. **Operation:** It is possible that soil contamination is generated at proposed rolling stock yard due to oil leaks of heavy machine and dump track, rolling stock coating, and waste dumping from residents.
	5	Noise and vibration	**B-**	**B±**	**Construction:** Noise and vibration will be generated by construction heavy machines, dump trucks, concrete placing work and traffic congestion due to traffic control. **Operation:** YUMRT can reduce traffic noise and vibration depending on traffic volume reduction, but YUMRT issues additional noise and vibration by itself.
	6	Ground subsidence	**B-**	**D**	**Construction:** Construction activities which have negative impact to underground water such as large-scale digging and water pumping are not scheduled in this project. But there is still a possibility of ground subsidence in case of soft foundation under elevated section. **Operation:** There is no significant impact.
	7	Offensive odor	**B-**	**B-**	**Construction:** Offensive odor may be issued depending on the volume of general waste etc. from basecamp sites. **Operation:** Offensive odor may be issued depending on the volume of general waste etc. from every station, rolling stock yard etc.
	8	Bottom sediment	D	D	**Construction:** Construction activities which have negative impact to bottom sediment are not scheduled in this project. **Operation:** Operation activities which have negative impact to bottom sediment are not scheduled in this project.
Natural Environment	9	Protected area	D	D	**Construction and Operation:** There is no protected area along E-W line's alignment.
Natural Environment	10	Ecosystem	**B-**	**B-**	**Construction:** - There is a negative impact for ecosystem through deforestation trees due to construction of viaduct and rolling stock yard. - It is a possible that turbid water will occur along and around E-W line's alignment. - Negative impact for ecosystem will be offered through construction of rolling stock yard. **Operation:** There is a negative impact on main species that have their feeding area around a bridge construction site due to YUMRT's running on the bridge with noise and vibration.
Natural Environment	11	Hydrology	**B-**	D	**Construction:** Negative impact for hydrology will be occurred depend on the amount and location of cutting and filling soil and digging. **Operation:** There is no activity which has negative impacts.
Natural Environment	12	Geology and Topography	**B-**	D	**Construction and Operation:** There is no specified and valuable geology and topography in and around the alignment. However, there is a possibility of soil erosion and slope collapse at a rolling stock yard constructed by filling soil.
Social Environment	13	Land acquisition/ Resettlement	**A-**	D	**Pre-construction:** It is predicted that there are large-sized land acquisition and resettlement along E-W's alignment. **Operation:** There is no land acquisition and resettlement on the operation phase.
Social Environment	14	Poverty	**A-**	**B+**	**Pre-construction:** The impact on poverty is evaluated based on characteristics of local society around the construction sites. **Operation:** There is no land acquisition and resettlement on the operation phase. -It may also have positive impacts on local economy because YUMRT can save time for travelling.
Social Environment	15	Indigenous and ethnic people	**B-**	D	**Pre-construction:** Existence of Indigenous and ethnic people including religious minority is confirmed by Census survey. Livelihood recovery support considering impact on them and their racial characteristic will be implemented provided that they exist. **Operation:** There is no impact on Indigenous and ethnic people due to no land acquisition or resettlement on the operation phase.
Social Environment	16	Local economy such as employment and livelihood, etc.	**B-**	**B+**	**Pre-construction:** - It is possible that a negative impact for livelihood of PAPs is generated depending on land acquisition and resettlement. - There is a positive impact on illegal dwellers living in Hlaing Tharyar economically as employment opportunity by YUMRT construction and as commercial opportunity for construction workers. **Operation:** -There is no land acquisition and resettlement on the operation phase. - A positive impact for local economy will be generated such as time saving for traveling to Central of Yangon and alleviation of traffic congestion.
Social Environment	17	Land use and	**B-**	**B-**	**Pre-construction and Construction:** There may be a negative impact as land acquisition for

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction/ Construction	Operation	
		utilization of local resources			agricultural land in proposed rolling stock area. **Operation:** There is no land acquisition and resettlement on the operation phase. But it is possible that a negative impact is generated as disordered development and rough-and-tumbled utilization of local resources around E-W alignment and stations.
	18	Water use and its rights	**B-**	D	**Construction:** A negative impact on well water quality for drinking may be issued depending on the construction activities and land acquisitions. **Operation:** - There is no impact on water use because of no land acquisition on the operation phase. - There is no additional impact on water use and its rights because Irrigation facilities and drinking water facilities such as waterworks and wells located in the project area including viaduct, station building and rolling stock yard can be transferred as necessary.
	19	Existing social infrastructure and services	**B-**	**B+**	**Pre-construction and Construction:** - A negative impact on sensitive facilities such as school, hospital and community center may be occurred depending on land acquisition and traffic control. - There may be a possibility of electrical power cut around the alignment when relocation and under installation of high –voltage line is conducted. **Operation:** Improvement of accessibility by installing YUMRT stations is expected, by which there is a possibility of positive impact on use of social infrastructure such as school, hospital etc.
	20	Social institutions such as social infrastructure and local decision - making institutions	**B-**	**B+**	**Construction:** It is possible that community severance is occurred depending on installing construction regulated area **Operation:** Positive impact will be offered by reduction of traffic volume along YUMRT
Social Environment	21	Maldistribution of benefit and damage	**B-**	**B-**	**Construction:** Depending on the construction area, there may be maldistribution of benefit and damage such as prohibition of road crossing and setting of detour route**.** **Operation:** Increasing number of settlers can be issued.
	22	Local conflict of interest	**B-**	**B-**	**Construction:** Local residents and municipalities may demand that construction contractor should supply employment opportunities equally as construction workers**.** -Some conflict may be occurred between locals and construction workers. -There may be some complains from nearby residents due to noise and vibration. **Operation:** There may be some complains from nearby residents due to noise and vibration.
	23	Cultural Heritage	D	D	**Pre-construction and Construction:** It is predicted that there is no impact on religious and historical buildings such as pagoda under the current proposed alignment. But confirm the existence of influence again at the time of linear determination. Existence of the impact should be confirmed to be sure after finalizing the alignment. **Operation:** There is no impact on religious and historical buildings because of non- additional land acquisition on the operation phase. But Existence of vibration impact by YUMRT operation should be confirmed.
	24	Landscape	**B-**	**B-**	**Construction and Operation:** - There is no landscape conservation area designated by law and regulation in the vicinity of the railway bridge and the elevated section. - The everyday landscape in the vicinity of the project area will change due to elevated structure, station buildings and relocation and under installation of high –voltage line.
	25	Gender	**B-**	**B-**	**Construction:** There may be a gender gap regarding wage, salary and treatment as construction workers. **Operation:** Employment opportunities for women will be limited with respect to YUMRT operation. In addition, It is possible that female passengers give up getting on a train because of being afraid of congestion in the train during commuting time.
	26	Children's right	**B-**	D	**Construction:** Children's compulsory education rights may be hindered because of customary child labor in the communities along the YUMRT alignment. **Operation:** There is no impact on children's right by YUMRT operation.
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	**B-**	**Construction:** Infectious diseases such as HIV/AIDS, etc. may be spread by inflow of construction workers. Additionally, land use changes by soil cutting and soil filling may create new habitats for mosquitoes that can mediate dengue fever. **Operation:** There is a possibility that STD and other infectious diseases spread by increasing of number of settlers and travelers after YUMRT operation.
	28	Labor environment including labor safety	**B-**	**B-**	**Construction:** It is necessary to improve labor environment for construction workers in accordance with related laws and regulations. **Operation:** - There is no big change in labor environment for local residents by YUMRT operation. - The appropriate labor environment for YUMRT staffs needs to be secured in accordance with related laws and regulations**.**
Others	29	Accidents	**B-**	**B-**	**Construction:** Since construction related vehicles use arterial roads on E-W line, there is a possibility of increasing traffic accidents. **Operation:** It is estimated that the risk of traffic accidents will increase due to speeding up of passing vehicles**.**
	30	Cross-border impact	**B-**	**B-**	**Construction:** Greenhouse gas emissions will increase by reducing the absorbed amount of

Category	No	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction/ Construction	Operation	
		and climate change			greenhouse gas by cutting street trees along the alignment, operation of construction heavy machinery and construction of structures.
					Operation: Since the traffic volume along E-W line will decrease due to YUMRT operation, reduction of greenhouse gases can be expected in the project area. On the other hand, it is also predicted that additional greenhouse gasses is generated depending on the quantity of consumed electricity by YUMRT operation.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 5. 2 Results of Assessment for Receiving Substation (Reason for the Evaluation)

Category	No	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
Pollution	1	Air pollution	**B-**	D	**Construction:** Air pollution such as exhaust fumes from earthmoving equipment as well as construction vehicle associated with Haling Tharyar substation and west university substation construction is anticipated
					Operation: No activity that will cause air pollution is expected.
	2	Water pollution	**B-**	D	**Construction:** - Temporary water pollution due to concrete mixing, aggregate collection and excavation is expected. In addition, temporally water pollution from contractor employ's camp/ office is expected. - Negative impact for water quality will be occurred if construction waste is left for a long time illegally.
					Operation: No activity that will cause water is expected.
	3	Waste	**B-**	D	**Construction:** Construction waste soil will be generated.
					Operation: No activity that will cause waste is expected
	4	Soil contamination	**B-**	**B-**	**Construction:** - Excavated soil at the construction site may be contaminated. - Negative impact for soil will be occurred if construction waste is left for a long time illegally.
					Operation: Inappropriate management of transformer will cause oil leakage. Consequently, it will contaminate soil.
	5	Noise and vibration	**B-**	**B-**	**Construction:** Noise and vibration resulting from construction activities is expected.
					Operation: Noise from the substation will affect residents around substation area.
	6	Ground subsidence	**B-**	D	**Construction and Operation:** Construction activities which have negative impact to underground water such as large-scale digging and water pumping are not scheduled in this project.
					Operation: No activity that will cause ground subsidence is expected.
	7	Offensive odor	**B-**	D	**Construction:** Offensive odor may be issued depending on the volume of general waste etc. from basecamp sites.
					Operation: No activity that will cause offensive odor is expected.
	8	Bottom sediment	**B-**	D	**Construction:** Excavated soil at the construction site may be contaminated.
					Operation: Operation activities which have negative impact to bottom sediment are not scheduled in this project.
Natural Environment	9	Protected area	D	D	**Construction and Operation:** There is no protected area within the project area.
	10	Ecosystem	**B-**	**B-**	**Construction:** There is a negative impact for ecosystem through deforestation trees due to construction of receiving substation.
					Operation: Some impacts on existing habitats will be expected due to substation operation with noise. It is necessary to confirm with the biodiversity survey team if the habitat of endangered species is located within the project area.
	11	Hydrology	D	D	**Construction and Operation:** No activity that will cause hydrology is expected.
	12	Geology and Topography	D	D	**Construction and Operation:** There is no specified and valuable geology and topography in and around the substation.
Social Environment	13	Land acquisition/ Resettlement	D	D	**Pre-construction and operation:** There is no land acquisition and resettlement on the pre-construction and operation phase because the palaces constructed substation are government land.
	14	Poverty	D	D	**Pre-construction:** There is no land acquisition and resettlement on the construction phase.
					Operation: There is no land acquisition and resettlement on the operation phase.
	15	Indigenous and ethnic people	D	D	**Pre-construction:** There is no impact on Indigenous and ethnic people due to no land acquisition or resettlement on the construction phase.
					Operation: There is no impact on Indigenous and ethnic people due to no land acquisition or resettlement on the operation phase.
	16	Local economy such as employment and livelihood, etc.	**B±**	D	**Pre-construction:** - It is possible that a negative impact for livelihood of PAPs is generated depending on land acquisition and resettlement. - Positive impact such as creation of local employment is predicted.
					Operation: No activity that will affect local economy such as employment and livelihood, etc.

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
	17	Land use and utilization of local resources	**B-**	D	**Pre-construction and Construction:** There may be a modification of land use and management. **Operation:** No activity that will affect land use and utilization of local resources.
	18	Water use and its rights	**B-**	D	**Construction:** A negative impact on well water quality for drinking may be issued depending on the construction activities and land acquisitions. **Operation:** There is no impact on water use and its rights.
	19	Existing social infrastructure and services	**B-**	D	**Pre-construction and Construction:** - A negative impact on sensitive facilities such as school, hospital and community center may be occurred depending on land acquisition and traffic control. - There may be a possibility of electrical power cut around the alignment when relocated. **Operation:** There is no impact on Existing social infrastructure and services.
	20	Social institutions such as social infrastructure and local decision - making institutions	D	D	**Construction:** There is no impact on Social institutions such as social infrastructure and local decision - making institutions. **Operation:** There is no community severance because E-W line is constructed by elevated structures for all sections.
Social Environment	21	Maldistribution of benefit and damage	**B-**	D	**Construction:** Depending on the construction area, there may be maldistribution of benefit and damage. **Operation:** It is predicted that there is no maldistribution of benefit and damage.
	22	Local conflict of interest	**B-**	D	**Construction:** There may be conflicts between local residences and construction workers. **Operation:** No activity that will affect local conflict of interest.
	23	Cultural Heritage	D	D	**Pre-construction, Construction and Operation:** It is predicted that there is no impact on religious and historical buildings such as pagoda under the current proposed area. There is no impact on religious and historical buildings because of non- additional land acquisition on the operation phase.
	24	Landscape	D	D	**Construction and Operation: -** The scenery will not be changed due to low rise facility. - No activity that will affect landscape is expected.
	25	Gender	**B-**	D	**Construction:** There may be a gender gap regarding wage, salary and treatment as construction workers. **Operation:** There is no impact in gender.
	26	Children's right	D	D	**Construction:** The project will not cause any adverse impact on children's rights. **Operation:** There is no impact on children's right by substation operation.
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	**Construction:** Infectious diseases such as HIV/AIDS, etc. may be spread by inflow of construction workers. **Operation:** No notable impact is expected.
	28	Labor environment including labor safety	**B-**	**B-**	**Construction:** Inappropriate management of working environment will rise the rick of accident and disease. **Operation:** The appropriate labor environment for substation staffs needs to be secured in accordance with related laws and regulations**.**
Others	29	Accidents	**B-**	D	**Construction:** There is a possibility of increasing traffic accidents because the effect of construction vehicles. **Operation:** Electric shock hazards will be expected due to improper management of ROW clearing or luck of information provided to public.
	30	Cross-border impact and climate change	D	D	**Construction and Operation:** Gas emission from construction vehicles is not significant. No activities that will affect global warming are expected.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 5. 3 Results of Assessment for Transmission line (Reason for the Evaluation)

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
Pollution	1	Air pollution	**B-**	D	**Construction:** Air pollution such as dust and exhaust fumes from earthmoving equipment and vehicles and dust emission from site clearance is anticipated. **Operation:** No notable impact is expected.
	2	Water pollution	**B-**	D	**Construction:** - Temporary water pollution due to excavation work near water bodies is expected. In addition, temporally water pollution from contractor employ's camp is expected. - Negative impact for water quality will be occurred if construction waste is left for a long time illegally. **Operation:** No notable impact is expected.
	3	Waste	**B-**	D	**Construction:** Generation of soil, sand and domestic waste will be generated. **Operation:** No activity that will cause waste is expected
	4	Soil contamination	**B-**	D	**Construction:** - Temporary soil contamination due to oil leakage that may be caused from using fuel for heavy machines and vehicles. However, the amount of oil use is limited and impact is considered to be insignificant. - Negative impact for soil will be occurred if construction waste is left for a long time illegally.

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
					Operation: No notable impact is expected.
	5	Noise and vibration	**B-**	D	**Construction:** Noise and vibration will be generated by construction heavy machines, dump trucks, and traffic congestion due to traffic control. **Operation:** No notable impact is expected.
	6	Ground subsidence	D	D	**Construction and Operation:** There is no significant impact.
	7	Offensive odor	**B-**	D	**Construction:** Offensive odor may be generated around the construction site due to excavation, drugging of mud in the drainage channels or from the camp sites during construction. **Operation:** No notable impact is expected.
	8	Bottom sediment	**B-**	D	**Construction**: There are some temporary impacts on bottom sediment of water bodies through the transmission line. **Operation:** operation activities which have negative impact to bottom sediment are not scheduled in this project.
Natural Environment	9	Protected area	D	D	**Construction and Operation:** There is no protected area within the project area.
	10	Ecosystem	D	D	**Construction and Operation:** No notable impact is expected.
	11	Hydrology	D	D	**Construction and Operation:** No activity that will cause hydrology is expected.
	12	Geology and Topography	D	D	**Construction and Operation:** There is no specified and valuable geology and topography in and around the substation.
Social Environment	13	Land acquisition/ Resettlement	D	D	**Pre-construction, Construction and Operation:** There is no land acquisition and resettlement on the pre- construction and operation phase because the palaces constructed substation are government land.
	14	Poverty	**B-**	D	**Pre-construction:** There will be some interruption to residents because of excavation and backfilling works the construction phase. **Operation:** There is no land acquisition and resettlement on the operation phase.
	15	Indigenous and ethnic people	D	D	**Pre-construction and Operation:** There is no impact on Indigenous and ethnic people due to no land acquisition or resettlement during the operation phase.
	16	Local economy such as employment and livelihood, etc.	**B+**	D	**Pre-construction:** - Positive impact such as creation of local employment is predicted. - Negative impact such as temporary closing of shops of local people along the construction of transmission line. **Operation:** No activity that will affect local economy such as employment and livelihood, etc.
	17	Land use and utilization of local resources	**B-**	D	**Pre-construction and Construction:** - There may be temporary land use because of excavation and backfilling works along the transmission line. **Operation:** No activity that will affect land use and utilization of local resources.
	18	Water use and its rights	**B-**	D	**Construction:** A negative impact on well water quality for domestic water may be issued depending on the construction activities. **Operation:** There is no impact on water use and its rights.
	19	Existing social infrastructure and services	**B-**	D	**Pre-construction and Construction:** - A negative impact on sensitive facilities such as existing roads, schools, hospital and community center will be temporarily affected due to excavation and earthmoving works. **Operation:** There is no significant impact.
	20	Social institutions such as social infrastructure and local decision - making institutions	D	D	**Construction and Operation:** There is no community severance because E-W line is constructed by elevated structures for all sections.
Social Environment	21	Maldistribution of benefit and damage	**B-**	D	**Construction:** Depending on the construction area, there may be maldistribution of benefit and damage such as prohibition of road crossing and shops closing temporarily. **Operation:** It is predicted that there is no maldistribution of benefit and damage after construction phase**.**
	22	Local conflict of interest	**B-**	D	**Construction:** Local residents and municipalities may complaint concerned with excavation and stockpiling temporarily. **Operation:** Existence of the impact should be confirmed.
	23	Cultural Heritage	D	D	**Pre-construction and Construction and Operation:** No cultural heritage has been identified along the transmission line.
	24	Landscape	**B-**	D	**Construction and Operation:** There is temporary landscape conservation in construction site along the transmission line.
	25	Gender	**B-**	D	**Construction:** There can be a gender gap regarding wage, salary and treatment among workers. **Operation:** It is predicted that there is no impact on gender.
	26	Children's right	**B-**	D	**Construction:** There is a possibility that children's compulsory education rights may be hindered because of customary child labor in the communities along the transmission line. **Operation:** No notable impact is expected.
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	**Construction:** Due to an inflow of construction workers Infectious diseases such as HIV/AIDS, etc. may spread although at a limited scale. **Operation:** No notable impact is expected.
	28	Labor environment	**B-**	D	**Construction:** It is necessary to implement safe labor environment for construction workers in

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
		including labor safety			accordance with related laws and regulations. **Operation:** There is no impact on labor environment including safety after construction phase.
Others	29	Accidents	**B-**	D	Construction: Accidents are expected to be relatively minor because construction is relatively small in scale construction machines and excavation is limited. **Operation:** There is no impact after construction phase.
	30	Cross-border impact and climate change	D	D	**Construction and Operation:** There is no impacts on cross- border impact and climate change due to the implementing the transmission line.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 5. 4 Results of Assessment for New Bayint Naung Bridge (Reason for the Evaluation)

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
Pollution	1	Air pollution	**B-**	**B+**	**Construction:** Emission gas (NOx, SOx) and dust (SPM) will have a temporary negative impact on the air quality by construction heavy machines, dump trucks and traffic congestion due to traffic control. **Operation:** Positive impact will be offered by reduction of traffic volume along YUMRT.
	2	Water pollution	**B-**	D	**Construction:** - Turbid water will be generated at a bridge construction site on the Hlaing River and at lakes due to civil and excavation works. -Turbid water will be generated at a proposed site for rolling stock yard due to soil filling works. - There is a possibility of being discharged organic waste water at an installed base camp site. - Negative impact for water quality will be occurred if construction waste is left for a long time illegally. **Operation:** No notable impact is expected.
	3	Waste	**B-**	D	**Construction:** - General waste and excreta will be generated from base camp site. - It is predicted that construction waste such as soil and deforestation trees are generated. **Operation:** No notable impact is expected.
	4	Soil contamination	**B-**	D	**Construction:** - Excavated soil at the construction site may be contaminated. - Leakage of oil from heavy machine and dump track may contaminate soil. - Negative impact for soil will be occurred if construction waste is left for a long time illegally. **Operation:** No notable impact is expected.
	5	Noise and vibration	**B-**	**B±**	**Construction:** Noise and vibration from excavation works, construction heavy machines, dump trucks, concrete placing work and traffic congestion due to traffic control may be generated. **Operation:** YUMRT can reduce traffic noise and vibration depending on traffic volume reduction, but YUMRT issues additional noise and vibration by itself.
	6	Ground subsidence	**B-**	**B-**	**Construction and Operation:** Construction activities which have negative impact to underground water such as large-scale digging and water pumping are not scheduled in this project. But there is still a possibility of ground subsidence in case of soft foundation under elevated section.
	7	Offensive odor	**B-**	D	**Construction:** Offensive odor may be issued depending on the volume of general waste etc. from basecamp sites. **Operation:** It is predicted that there is no impact on offensive odor
	8	Bottom sediment	**B-**	D	**Construction:** - Excavated soil at the construction site may be contaminated. - It is possible that bottom sediment in Hlaing River is contaminated under construction of bridge piers. **Operation:** Operation activities which have negative impact to bottom sediment are not scheduled in this project.
Natural Environment	9	Protected area	D	D	**Construction and Operation:** There is no protected area along proposed bridge area.
	10	Ecosystem	**B-**	**B-**	**Construction:** - There is a negative impact for ecosystem through deforestation trees due to construction of bridge. - There may be a negative impact on aquatic ecosystem due to excavation works and discharge of waste from railway bridge construction. **Operation:** There is a negative impact on main species that have their feeding area around a bridge construction site due to YUMRT's running on the bridge with noise and vibration.
	11	Hydrology	**B-**	**B-**	**Construction and Operation:** It is possible that river flow condition is modified due to construction and existence of railway bridge.
	12	Geology and Topography	**B-**	**B-**	**Construction and Operation:** There is no specified and valuable geology and topography in and around the alignment. However, There is a possibility of soil erosion and slope collapse at constructed by cutting and filling soil.
Enviro	13	Land acquisition/ Resettlement	**B-**	D	**Pre-construction:** It is predicted that there are some land acquisition and resettlement along the bridge area. **Operation:** There is no land acquisition and resettlement on the operation phase.

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
	14	Poverty	**B-**	D	**Pre-construction:** The impact on poverty is evaluated based on characteristics of local society around the construction sites. **Operation:** There is no land acquisition and resettlement on the operation phase.
	15	Indigenous and ethnic people	D	D	**Construction and Operation:** There is no impact on Indigenous and ethnic people due to no land acquisition or resettlement on the operation phase.
	16	Local economy such as employment and livelihood, etc.	**B±**	**B-**	**Pre-construction:** - It is possible that a negative impact for livelihood of PAPs is generated depending on land acquisition and resettlement. - There may be a negative impact on livelihood of fishery operators and other relevant person because of bridge construction in Hlaing River. - There is a positive impact on illegal dwellers living in Hlaing Tharyar economically as employment opportunity by YUMRT construction and as commercial opportunity for construction workers. **Operation:** -There is no land acquisition and resettlement on the operation phase. But a negative impact for livelihood of fishery operators and other relevant person may be issued because it is possible that their fishery area becomes narrow due to existence of constructed bridge.
	17	Land use and utilization of local resources	**B-**	D	**Pre-construction and Construction:** - There may be a negative impact as land acquisition for agricultural land in proposed railway bridge area. - A negative impact for utilization of local resources may be occurred due to a bridge construction in Hlaing River. **Operation:** There is no land acquisition and resettlement on the operation phase.
	18	Water use and its rights	**B-**	**B-**	**Construction:** A negative impact on well water quality for drinking may be issued depending on the construction activities and land acquisitions. Route of water vehicles (eg. fishery boats and ships) passing may change due to construction of bridge. **Operation:** - There may be a negative impact on fishery right due to the existence of bridge piers in Hlaing River.
	19	Existing social infrastructure and services	**B-**	**B+**	**Pre-construction and Construction:** - A negative impact on sensitive facilities such as school, hospital and community center may be occurred depending on traffic control. **Operation:** Positive impact on traffic volume reduction may occur by operation of YUMRT is expected.
	20	Social institutions such as social infrastructure and local decision - making institutions	D	D	**Construction and Operation:** There is no community severance along railway bridge area.
Social Environment	21	Maldistribution of benefit and damage	**B-**	**B-**	**Construction and Operation:** Depending on the construction area, there may be maldistribution of benefit and damage such as relocation of fishing area and hindering of their economy due to bridge construction.
	22	Local conflict of interest	**B-**	D	**Construction:** Local residents may complaint about entering construction workers and safety of their neighborhood. **Operation:** There is no possible impact on local conflict of interest by operation.
	23	Cultural Heritage	D	D	**Construction and Operation:** There is no impact on religious and historical buildings around proposed bridge area.
	24	Landscape	**B-**	D	**Construction and Operation:** - There is no landscape conservation area designated by law and regulation in the vicinity of the railway bridge. - The everyday landscape in the vicinity of the project area will change due to bridge construction.
	25	Gender	**B-**	D	**Construction: T**here can be a gender gap regarding wage, salary and treatment as construction workers. **Operation:** There is no possible impact on gender by operation.
	26	Children's right	**B-**	D	**Construction:** There is a possibility that children's compulsory education rights may be hindered because of customary child labor in the communities along the bridge. **Operation:** There is no impact on children's right by YUMRT operation.
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	**Construction:** Infectious diseases such as HIV/AIDS, etc. may be spread by inflow of construction workers. Additionally, Land use changes by soil cutting and soil filling may create new habitats for mosquitoes that can mediate dengue fever. **Operation:** There is a possibility that STD and other infectious diseases spread by increasing of number of settlers and travelers after YUMRT operation.
	28	Labor environment including labor safety	**B-**	D	**Construction:** It is necessary to improve labor environment for construction workers in accordance with related laws and regulations. **Operation:** - There is no big change in labor environment for local residents by YUMRT operation. -The appropriate labor environment for YUMRT staffs needs to be secured in accordance with related laws and regulations**.**
n	29	Accidents	**B-**	D	**Construction:** Since construction related vehicles use arterial roads, there is a possibility of

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction	Construction Operation	
					increasing traffic accidents.
					Operation: There is no accidents during operation of YUMRT.
	30	Cross-border impact and climate change	D	**B+**	**Construction:** Gas emission from construction vehicles is not significant. No activities that will affect global warming are expected.
					Operation: The traffic volume along YUMRT will decrease due to YUMRT operation.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Section 6 Environmental Management Plan Monitoring Plan

There are five main sections in this Environmental Management Plan (EMP):

(1) Environmental Mitigation Plan
(2) Environmental Monitoring Plan
(3) Emergency Preparedness and Response Plan
(4) Health and Safety Plan
(5) Grievance Redress Mechanism (GRM)
(6) Traffic Management Plan

Mitigation measures need to be put in place before, during and after the project against each of the negative impacts expected to take place. As important as such mitigation measures are activities to monitor and check if the entities responsible for taking such mitigation actions (i.e. contractor and MR) have indeed been carrying out the necessary activities and if such activities have led to the outcome they had been expected to deliver.

A summary of the environmental monitoring plan, are presented in Table 6.5, 6.6, 6.7.

Table 6. 1 Mitigation Measures against Project Impacts for Railway

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
Pollution					
1.	Air pollution	**B-**	**B+**	• Regular preventive maintenance service of construction equipment and machinery will strictly comply with and will require conducting daily routine equipment and machinery check-ups to ensure that there are in the optimum working conditions. • The proper work schedules should be considered not to concentrate the construction equipment at a certain point for long time. • To reduce the dust, the periodical water spray should be taken. • If the residents and pedestrians complain about the dust and gas, the consultant of the supervision and contractors should reconsider the construction technique. • When the air pollution levels exceeds significantly the environmental standards, the regulation on fuel quality, importing old cars and emission gas control should be prepared on necessity.	• No mitigation measure is required.
2.	Water pollution	**B-**	**B-**	• Concrete poring and road surfacing will be closely supervised to prevent spillage. • Temporary sanitation facilities such as portable (mobile) toilets and garbage bins will be provided by the contractors to ensure that the domestic wastes to be generated by the construction personals are properly handled and not thrown into the drainage to prevent further pollution. • Washing the construction tools along the waters will be prohibited to prevent water pollution • In construction works near water bodies, turbid waste water shall be disposed at designated sites.	• Promotion on awareness on water conservation and reducing water usage. • Promoting urinals and wash basins with automatic sensors.
3.	Waste	**B-**	**B-**	• Waste generated from the construction and camp sites should be disposed according to the instructions of YCDC. • Treatment is required if the soil contain poisonous substance prior to reuse and dumping. • Generated waste could be sold to others depending upon the suitability.	• YCDC should provide the proper numbers of garbage bins in every station for YUMRT users. • The waste in the operation stage should be properly collected and disposed or recycled in compliance with the respective rules.
4.	Soil contamination	**B-**	**B-**	• Spoil soil shall be disposed at designated dumping site. • Soil quality testing should be performed • Proper oil disposal measure should be implemented so that there will be no leakage occurs • Refueling place should be constructed with concrete floor to prevent leakage • Batteries containing liquid inside shall be kept on the impervious place.	• Soil pollution only may occur in the depot site due to the oil leakage so care should be taken so that the spillage will not be taken place. • Proper oil disposal measure should be implemented so that there will be no leakage occurs
5.	Noise and vibration	**B-**	**B±**	• Noise suppressors such as mufflers will be installed whenever deemed necessary to maintain the noise generated by various heavy equipment and other construction machinery within permissible limits. • Temporary noise barriers such as corrugated metal sheets will be installed around the construction sites to maintain noise level within permissible level if necessary. • High noise generating construction activities will be scheduled during daytime only (7:00 – 22:00) to avoid noise disturbance to adjust residential and commercial areas, and other noise-sensitive areas. • To identify impact on the surrounding buildings, the vibration level and condition of the buildings should be monitored. • If the local people complain about noise and vibration, the consultant of the supervision and contractors should reconsider the construction technique. • If the noise level reaches a significant level such as exceeding the environmental standards, the mitigation measures on noise control should be conducted.	• Installation of noise shield on the viaduct section. • At the station platform, paging and bell signaling volume shall be adjust to the lowest level where it will not detract from their function. • Noise monitoring shall continue during the operation phase to determine and install suitable noise reduction measures (e.g. unobtrusive noise barriers on the edge of the station) • Insulator/ anti-vibration devices will be installed under the rails thereby reducing noise and vibration. • The proper countermeasures to reduce noise and vibration such as slow speed in curve sections, installation of sound barrier and adoption of expansion and contraction

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
					joint should be included in the plan and design.
6.	Ground subsidence	**B-**	D	• In the detail design stage, the detailed geological surveys should be carried out. The proper structure design and construction technique should be considered on the basis of the survey results.	• The ground subsidence should be monitored regularly.
7.	Offensive odor	**B-**	**B-**	• Regular cleaning of the general waste from camp sites.	• Regular cleaning of the general waste from stations and rolling stock yard
8.	Bottom sediment	D	D	• Take care when working near the water body • Spoil soil shall be disposed at designated dumping site • Soil quality testing should be performed	• No mitigation measure is required
Natural Environment					
9.	Protected area	D	D	• No mitigation measure is required	• No mitigation measure is required
10.	Ecosystem	**B-**	**B-**	• Compensatory planting of shrubbery species to the limited area under the elevated structures should be considered as necessary. • Afforestation should be planted with collaboration of forest department. • In construction works at the excavation site, the turbid water should be monitored and controlled as necessary.	• Insulator/ anti-vibration devices will be installed along the bridge to reduce the impact on the aquatic ecosystem • The proper countermeasures to reduce noise and vibration such as slow speed in curve sections, installation of sound barrier and adoption of expansion and contraction joint should be included in the plan and design.
11.	Hydrology	**B-**	D	• In the detailed design stage, the detailed hydrological surveys should be conducted. The proper structure design and construction technique should be considered on the basis of the survey results.	• No mitigation measure is required.
12.	Geology and topography	**B-**	D	• In the detail design stage, the detailed geological and geotechnical surveys should be carried out. The proper structure design and construction technique should be considered on the basis of the survey results.	• The possibilities of soil erosion and slope collapse should be monitored regularly.
Social Environment					
13.	Land acquisition/ Resettlement	**A-**	D	• Conduct census survey and local stakeholder meeting • Prepare RAP involving the following measures o PAPs must be acknowledged as an eligible for compensation o Identify the eligibility of non-titled people at the census survey intended to PAPs and ensure the compensation and support o Refer the previous/on-going projects by other donors, determine the requirement for social vulnerability and compensate to them o Resettlement site must be prepared when PAPs need it • Livelihood recovery support should be provided considering impact on PAPs.	• No mitigation measure is required.
14.	Poverty	**A-**	**B+**	• Define the displaced persons and criteria for determining their eligibility for compensation • Record the detail list of property losses due to the project implementation for determining the compensation amount	• No mitigation measure is required.
15.	Indigenous and ethnic people	**B-**	D	• Conduct stakeholder meeting • Livelihood recovery support should be provided considering impact on their racial characteristic	• No mitigation measure is required.
16.	Local economy such as employment and livelihood, etc.	**B-**	**B+**	• Prepare RAP involving the following measure o Measure to restore PAPs livelihood must be secured	• No mitigation measure is required.
17.	Land use and utilization of local resources	**B-**	**B-**	• Proper design should be prepared to minimize the impact on land use • Restore the construction and labor camp to the previous land use condition after completion of the construction if possible, if not restore to the better land use condition • Prepare and plan to make sure there will be no misuse of local resources during the construction process.	• Prepare and plan to make sure there will be no disordered development and rough-and-tumbled utilization of local resources around E-W alignment and stations.
18.	Water use and its right	**B-**	D	• Water quality should be monitored especially ground water to ensure its quality for drinking and other usage. • If the water quality deems to be declined, appropriate water treatment measures should be implemented.	• No mitigation measure is required.
19.	Existing	**B-**	**B+**	• Make sure to provide easy access to sensitive facilities such as	• No mitigation measure is

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
	social infrastructure and services			hospital, school, etc. during the construction period and if required, measures such as detour route should be set up based on the traffic congestion condition • Social service utilities such as power, water, drainage and communication line will be diverted before starting the construction activity • Make sure that people will get the utility connection after the relocation of the facilities	required
20.	Local institutions such as social infrastructure and local decision-making institutions	**B-**	**B+**	• Make sure to provide easy access to sensitive facilities such as hospital, school, etc. during the construction period and if required, measures such as detour route should be set up based on the traffic congestion condition	• No mitigation measure is required
21.	Maldistribution of benefit and damage	**B-**	**B-**	• Establish external monitoring committee by the third party	• Establish external monitoring committee by the third party
22.	Local conflict of interest	**B-**	**B-**	• Give employment opportunities to local residents and municipalities on priority basis.	• Establish external monitoring committee by the third party
23.	Cultural heritage	D	D	• No impact on cultural and historical sites is predicted along the proposed alignment. However, existence of impact and its influence should be confirmed at the time of linear determination and after finalizing the alignment to ensure there will be no impact on religious and historical buildings	• Existence of vibration impact on the surrounding religious and historical buildings should be assessed • If the vibration exceeds the standard limit, vibration reduction measures should be implemented.
24.	Landscape	**B-**	**B-**	• Design on facilities which will harmonize with the surrounding landscape • All structure will be designed according to the National Building Code • Conduct construction works in a manner that there will be minimal disturbance to the original landscape.	• To reduce the visual impact caused by the changing of the original landscape, compensatory planting of shrubbery spices to the limited area under the elevated structures should be considered as necessary
25.	Gender	**B-**	**B-**	• Affected female headed household should include additional subsistence and relocation assistance, opportunity for skill training and income restoration, employment opportunity in civil work. • Feminine gender will be invited and join local stakeholder as well as male gender • Interview to feminine gender while in census survey will be considered	• Keep provision separate female ticket counter in the station • Keep provision of designated seat for female in the train
26.	Children's right	**B-**	D	• Secure the accessibility to go to school/hospital when select resettlement places • Child labor recruitment should be prohibited in the construction site	• No mitigation measure is required
27.	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	**B-**	• In order to prevent spreading of infectious diseases such as HIV/ AIDS, awareness training to workers shall be provided. • Local public health center will conduct health education to new settlers • Periodic health check-up program will conduct.	• Local public health center will conduct health education to new settlers • Periodic awareness program should be conducted • Periodic health check-up program will conduct.
28.	Labor environment including labor safety	**B-**	**B-**	• Construction personnel will be provided with the necessary safety gears such as protective hard hat and safety belt. • First aid stations supervised by the safety health officer of the contractor will be located within the construction site office. • Arrange safety training to the worker periodically.	• Proper safety instrument should keep in the station as well as office building • Arrange safety training to the worker periodically.
Others					
29.	Accidents	**B-**	**B-**	• A sound traffic management and detour plans duly approved by the concerned governmental agency will strictly implemented to minimize traffic congestions and accidents • Traffic enforcers will be designated along these areas to assist in directing traffic flow • Parking time of construction equipment such as dump track and agitator car along the major thorough fare will be limited, especially during peak hours to minimize traffic congestions	• A sound traffic management plan duly approved by the concerned governmental agency will strictly implemented to minimize traffic accidents • Appropriate vehicle speed detection system should be set up along the E-W alignment
30.	Cross-border impact and climate	**B-**	**B-**	• When the air pollution levels exceeds significantly the environmental standards, the regulation on fuel quality, importing old cars and emission gas control should be prepared on necessity.	• Planting of shrubbery spices to the limited area under the elevated structures should be

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
	change			• Planting of shrubbery spices to the limited area under the elevated structures should be considered as necessary to reduce the emission of greenhouse gases.	considered as necessary to reduce the emission of greenhouse gases.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 6. 2 Mitigation Measures against Project Impacts for Receiving Substation

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
Pollution					
1.	Air pollution	**B-**	D	• Apply preventive maintenance system, optimizing construction schedule to minimize time that vehicles are in construction time, apply dust control measures such as water spraying on the unpaved load, etc.	• No mitigation measure is required.
2.	Water pollution	**B-**	D	• Apply sediment traps, silt traps, develop fuel handling procedure, proper sewage system, etc.	• No mitigation measure is required.
3.	Waste	**B-**	D	• Waste generated from the construction should be disposed according to the instructions of YCDC. • Treatment is required if the soil contain poisonous substance prior to reuse and dumping. • Generated waste could be sold to others depending upon the suitability.	• No mitigation measure is required.
4.	Soil contamination	**B-**	**B-**	• Spoil soil shall be disposed at designated dumping site. • Proper oil disposal measure should be implemented so that there will be no leakage occurs	• Proper oil disposal measure should be implemented so that there will be no leakage occurs.
5.	Noise and vibration	**B-**	**B-**	• Kept distance from the residential area when operating noise emitting equipment, apply periodical inspection of the equipment, limit night work, etc.	• Noise monitoring shall continue during the operation phase to determine and install suitable noise reduction measures (e.g. unobtrusive noise barriers on the edge of the substation)
6.	Ground subsidence	**B-**	D	• In the detail design stage, the detailed geological surveys should be carried out. The proper structure design and construction technique should be considered on the basis of the survey results.	• No mitigation measure is required.
7.	Offensive odor	**B-**	D	• Regular cleaning of the general waste from camp sites.	• No mitigation measure is required
8.	Bottom sediment	**B-**	D	• Take care when working near the water body • Spoil soil shall be disposed at designated dumping site • Soil quality testing should be performed • Proper oil disposal measure should be implemented so that there will be no leakage occurs • Refueling place should be constructed with concrete floor to prevent leakage	• No mitigation measure is required
Natural Environment					
9.	Protected area	D	D	• No mitigation measure is required	• No mitigation measure is required
10.	Ecosystem	**B-**	**B-**	• Compensatory planting of shrubbery species to the limited area under construction should be considered as necessary. • In construction works at the excavation site, the turbid water should be monitored and controlled as necessary.	• Insulator/ anti-vibration devices will be installed around the substations to reduce the impact on the ecosystem
11.	Hydrology	D	D	• No mitigation measure is required.	• No mitigation measure is required.
12.	Geology and topography	D	D	• No mitigation measure is required.	• No mitigation measure is required.
Social Environment					
13.	Land acquisition/ Resettlement	D	D	• No mitigation measure is required.	• No mitigation measure is required.
14.	Poverty	D	D	• No mitigation measure is required.	• No mitigation measure is required.
15.	Indigenous and ethnic people	D	D	• No mitigation measure is required.	• No mitigation measure is required.

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
16.	Local economy such as employment and livelihood, etc.	**B±**	D	The project is expected to create a significant level of employment opportunities for local people and others	• No mitigation measure is required
17.	Land use and utilization of local resources	**B-**	D	• Prepare and plan to make sure there will be no misuse of local resources during the construction process.	• No mitigation measure is required
18.	Water use and its right	**B-**	D	• Water quality should be monitored especially ground water to ensure its quality for drinking and other usage. • If the water quality deems to be declined, appropriate water treatment measures should be implemented.	• No mitigation measure is required
19.	Existing social infrastructure and services	**B-**	D	• Apply appropriate logistics system for transportation with heavy load, establishing of road maintenance crews for immediate repair, provision of detours and road safety precaution.	• No mitigation measure is required
20.	Local institutions such as social infrastructure and local decision-making institutions	D	**D**	• No mitigation measure is required	• No mitigation measure is required
21.	Maldistribution of benefit and damage	**B-**	D	• Establish external monitoring committee by the third party	• No mitigation measure is required
22.	Local conflict of interest	**B-**	D	• Establish external monitoring committee by the third party	• No mitigation measure is required
23.	Cultural heritage	**D**	D	• No mitigation measure is required.	• No mitigation measure is required.
24.	Landscape	**D**	D	• No mitigation measure is required.	• No mitigation measure is required.
25.	Gender	**B-**	D	• Feminine gender will be invited and join local stakeholder as well as male gender	• No mitigation measure is required.
26.	Children's right	**D**	D	• Child labor recruitment should be prohibited in the construction site	• No mitigation measure is required
27.	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	In order to prevent spreading of infectious diseases such as HIV/AIDS, awareness training shall be provided to construction workers.	No mitigation measure is required
28.	Labor environment including labor safety	**B-**	**B-**	• Construction personnel will be provided with the necessary safety gears such as protective hard hat and safety belt. • First aid stations supervised by the safety health officer of the contractor will be located within the construction site office. • Arrange safety training to the worker periodically.	• Apply safe working practice.
Others					
29.	Accidents	**B-**	**D**	• A sound traffic management and detour plans duly approved by the concerned governmental agency will strictly implemented to minimize traffic congestions and accidents • Traffic enforcers will be designated along these areas to assist in directing traffic flow • Parking time of construction equipment such as dump track and agitator car along the major thorough fare will be limited, especially during peak hours to minimize traffic congestions	• No mitigation measure is required
30.	Cross-border impact and climate change	D	D	• No mitigation measure is required	No mitigation measure is required

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 6. 3 Mitigation Measures against Project Impacts for Transmission Line

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
Pollution					
1.	Air pollution	**B-**	D	• Regular preventive maintenance service of construction equipment and machinery will strictly comply with and will require conducting daily routine equipment and machinery check-ups to ensure that there are in the optimum working conditions. • The proper work schedules should be considered not to concentrate the construction equipment at a certain point for long time.	• No mitigation measure is required.

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
				• Water should be frequently sprayed on the ground at construction site, as appropriate, near residential areas.	
2.	Water pollution	**B-**	D	• Temporary sanitation facilities such as portable (mobile) toilets and garbage bins will be provided by the contractors to ensure that the domestic wastes to be generated by the construction personals are properly handled and not thrown into the drainage to prevent further pollution. • Washing the construction tools along the waters will be prohibited to prevent water pollution. • In construction works near water bodies, turbid waste water shall be disposed at designated sites.	• No mitigation measure is required.
3.	Waste	**B-**	D	• Waste generated from the construction must be disposed only after considering reducing, reusing and recycling in accordance with the instructions from YCDC. • Generated waste such as excavated soil could be reuse depending upon the suitability.	• No mitigation measure is required.
4.	Soil contaminatio n	**B-**	D	• All wastes including oil and grease shall be disposed at designated dumping site. • Proper fuel storage measure should be implemented so that there will be no leakage occurs. • To control temporary soil contamination, sanitation facilities and garbage bins must be provided in base camps.	• No mitigation measure is required.
5.	Noise and vibration	**B-**	D	• Temporary noise barriers such as corrugated metal sheets will be installed around the sites to keep within permissible noise level. • High noise generating earthmoving activities will be scheduled during daytime only (7:00 – 22:00) to avoid noise disturbance to adjust residential and commercial areas, and other noise-sensitive areas.	• No mitigation measure is required.
6.	Ground subsidence	D	D	• No mitigation measure is required.	• No mitigation measure is required.
7.	Offensive odor	**B-**	D	• The level of offensive odor should be monitored regularly. • Regular cleaning of the general waste from camp sites.	• No mitigation measure is required.
8.	Bottom sediment	**B-**	D	• Spoil soil shall be disposed at designated dumping site.	• No mitigation measure is required
Natural Environment					
9.	Protected area	D	D	• No mitigation measure is required	• No mitigation measure is required
10.	Ecosystem	D	D	• No mitigation measure is required.	• No mitigation measure is required.
11.	Hydrology	D	D	• No mitigation measure is required.	• No mitigation measure is required.
12.	Geology and topography	D	D	• No mitigation measure is required.	• No mitigation measure is required.
Social Environment					
13.	Land acquisition/ Resettlement	D	D	• No mitigation measure is required.	• No mitigation measure is required.
14.	Poverty	**B-**	D	• Provide temporary small bridges in regular way of local people when excavation works are conducted.	• No mitigation measure is required.
15.	Indigenous and ethnic people	D	D	• No mitigation measure is required.	• No mitigation measure is required.
16.	Local economy such as employment and livelihood, etc.	**B+/-**	D	• Provide temporary small bridges in regular way of local people when excavation works are conducted.	• No mitigation measure is required.
17.	Land use and utilization of local resources	**B-**	D	• Prepare and plan to make sure there will be no misuse of local resources during the construction phase.	• No mitigation measure is required.
18.	Water use and its right	**B-**	D	• Make sure not to damage the usual water supply system of local people. • Water quality should be monitored especially ground water to ensure its quality for drinking and other usage.	• No mitigation measure is required.
19.	Existing social infrastructure and services	**B-**	D	• Content and schedule of construction works shall be made public prior to construction. • Education shall be provided to construction workers and staff in charge of public complaints and communications should be designated.	• No mitigation measure is required
20.	Local institutions such as social infrastructure and local	D	D	• No mitigation measure is required	• No mitigation measure is required

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
	decision-making institutions				
21.	Maldistribution of benefit and damage	**B-**	D	• Establish external monitoring committee by the third party	• No mitigation measure is required.
22.	Local conflict of interest	**B-**	D	• Content and schedule of construction works shall be made public prior to construction. • Education shall be provided to construction workers and staff in charge of public complaints and communications should be designated.	• No mitigation measure is required.
23.	Cultural heritage	D	D	• No mitigation measure is required.	• No mitigation measure is required.
24.	Landscape	**B-**	D	• Construction safety net must be provided around the excavation and earthmoving works.	• No mitigation measure is required.
25.	Gender	**B-**	D	• Feminine gender will be invited and join local stakeholder as well as male gender	• No mitigation measure is required.
26.	Children's right	**B-**	D	• Child labor recruitment should be prohibited in the construction site	• No mitigation measure is required
27.	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	• In order to prevent spreading of infectious diseases such as HIV/ AIDS, awareness training to workers shall be provided.	• No mitigation measure is required.
28.	Labor environment including labor safety	**B-**	D	• Construction personnel will be provided with the necessary safety gears such as protective hard hat and safety belt. • First aid stations supervised by the safety health officer of the contractor will be located within the construction site office. • Emergency vehicles will be on stand-by within the construction site • Arrange safety training to the worker periodically.	• No mitigation measure is required.
Others					
29.	Accidents	**B-**	D	• A sound traffic management and detour plans duly approved by the concerned governmental agency will strictly implemented to minimize traffic congestions and accidents • Traffic enforcers will be designated along these areas to assist in directing traffic flow • Parking time of construction equipment such as dump track and agitator car along the major thorough fare will be limited, especially during peak hours to minimize traffic congestions	• No mitigation measure is required.
30.	Cross-border impact and climate change	D	D	• No mitigation measure is required.	• No mitigation measure is required.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 6. 4 Mitigation Measures against Project Impacts for New Bayint Naung Bridge

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
Pollution					
1.	Air pollution	**B-**	**B+**	• Regular preventive maintenance service of construction equipment and machinery will strictly comply with and will require conducting daily routine equipment and machinery check-ups to ensure that there are in the optimum working conditions. • The proper work schedules should be considered not to concentrate the construction equipment at a certain point for long time. • To reduce the dust, the periodical water spray should be taken. • If the residents and pedestrians complain about the dust and gas, the consultant of the supervision and contractors should reconsider the construction technique. • When the air pollution levels exceeds significantly the environmental standards, the regulation on fuel quality, importing old cars and emission gas control should be prepared on necessity.	• No mitigation measure is required.
2.	Water pollution	**B-**	**D**	• Concrete poring and road surfacing will be closely supervised to prevent spillage. • Temporary sanitation facilities such as portable (mobile) toilets and garbage bins will be provided by the contractors to ensure that the domestic wastes to be generated by the construction personals are properly handled and not thrown into the drainage to prevent further pollution. • Washing the construction tools along the waters will be prohibited to	• No mitigation measure is required.

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
				prevent water pollution. • In construction works near water bodies, turbid waste water shall be disposed at designated sites.	
3.	Waste	**B-**	D	• Waste generated from the construction should be disposed according to the instructions of YCDC. • Treatment is required if the soil contain poisonous substance prior to reuse and dumping. • Generated waste could be sold to others depending upon the suitability.	• No mitigation measure is required
4.	Soil contamination	**B-**	D	• Spoil soil shall be disposed at designated dumping site. • Soil quality testing should be performed • Proper oil disposal measure should be implemented so that there will be no leakage occurs • Refueling place should be constructed with concrete floor to prevent leakage • Batteries containing liquid inside shall be kept on the impervious place.	• Soil pollution only may occur in the depot site due to the oil leakage so care should be taken so that the spillage will not be taken place. • Proper oil disposal measure should be implemented so that there will be no leakage occurs
5.	Noise and vibration	**B-**	**B±**	• Noise suppressors such as mufflers will be installed whenever deemed necessary to maintain the noise generated by various heavy equipment and other construction machinery within permissible limits. • Temporary noise barriers such as corrugated metal sheets will be installed around the construction sites to maintain noise level within permissible level if necessary. • High noise generating construction activities will be scheduled during daytime only (7:00 – 22:00) to avoid noise disturbance to adjust residential and commercial areas, and other noise-sensitive areas. • To identify impact on the surrounding buildings, the vibration level and condition of the buildings should be monitored. • If the local people complain about noise and vibration, the consultant of the supervision and contractors should reconsider the construction technique. • If the noise level reaches a significant level such as exceeding the environmental standards, the mitigation measures on noise control should be conducted.	• Installation of noise shield on the viaduct section. • Noise monitoring shall continue during the operation phase to determine and install suitable noise reduction measures (e.g. unobtrusive noise barriers on the edge of the station) • Insulator/ anti-vibration devices will be installed under the rails thereby reducing noise and vibration.
6.	Ground subsidence	**B-**	**B-**	• In the detail design stage, the detailed geological surveys should be carried out. The proper structure design and construction technique should be considered on the basis of the survey results.	• The ground subsidence should be monitored regularly.
7.	Offensive odor	**B-**	D	• Regular cleaning of the general waste from camp sites.	• No mitigation measure is required
8.	Bottom sediment	**B-**	D	• Take care when working near the water body • Spoil soil shall be disposed at designated dumping site • Soil quality testing should be performed	• No mitigation measure is required
Natural Environment					
9.	Protected area	D	D	• No mitigation measure is required	• No mitigation measure is required
10.	Ecosystem	**B-**	**B-**	• Compensatory planting of shrubbery species to the limited area under the elevated structures should be considered as necessary. • Afforestation should be planted with collaboration of forest department. • In construction works at the excavation site, the turbid water should be monitored and controlled as necessary.	• Insulator/ anti-vibration devices will be installed along the bridge to reduce the impact on the aquatic ecosystem
11.	Hydrology	**B-**	**B-**	• In the detailed design stage, the detailed hydrological surveys should be conducted. The proper structure design and construction technique should be considered on the basis of the survey results. • Detail hydrological study is required to determine the effect of the construction of Railway Bridge and embankment on river flow pattern.	• Detail hydrological study is required to determine the effect on river flow condition due to the existence of Railway Bridge and embankment.
12.	Geology and topography	**B-**	**B-**	• In the detail design stage, the detailed geological and geotechnical surveys should be carried out. The proper structure design and construction technique should be considered on the basis of the survey results.	• The possibilities of soil erosion and slope collapse should be monitored regularly.
Social Environment					
13.	Land acquisition/ Resettlement	**B-**	D	• Conduct census survey and local stakeholder meeting • Prepare RAP involving the following measures • PAPs must be acknowledged as an eligible for compensation	• No mitigation measure is required.

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
				• Identify the eligibility of non-titled people at the census survey intended to PAPs and ensure the compensation and support • Refer the previous/on-going projects by other donors, determine the requirement for social vulnerability and compensate to them • Resettlement site must be prepared when PAPs need it • Livelihood recovery support should be provided considering impact on PAPs.	
14.	Poverty	**B-**	D	• Define the displaced persons and criteria for determining their eligibility for compensation • Record the detail list of property losses due to the project implementation for determining the compensation amount	• No mitigation measure is required.
15.	Indigenous and ethnic people	D	D	• No mitigation measure is required.	• No mitigation measure is required.
16.	Local economy such as employment and livelihood, etc.	**B±**	**B+**	• Prepare RAP involving the following measure • Measure to restore PAPs livelihood must be secured • Enhance the orderly development especially in Hlaing Tharyar area to create new employment and give such employment to PAPs on priority basis.	• Livelihood support should be provided to fishery operators and other relevant person considering impact on their livelihood.
17.	Land use and utilization of local resources	**B-**	D	• Proper design should be prepared to minimize the impact on land use • Restore the construction and labor camp to the previous land use condition after completion of the construction if possible, if not restore to the better land use condition • Prepare and plan to make sure there will be no misuse of local resources during the construction process.	• Prepare and plan to make sure there will be no disordered development and rough-and-tumbled utilization of local resources around E-W alignment and stations.
18.	Water use and its right	**B-**	**B-**	• Water quality should be monitored especially ground water to ensure its quality for drinking and other usage. • If the water quality deems to be declined, appropriate water treatment measures should be implemented.	• Consult with respective government authorities about the fishery right along the bridge piers in Hlaing river to ensure there will be no impact on the livelihood of fishery operators
19.	Existing social infrastructure and services	**B-**	**B+**	• Make sure to provide easy access to sensitive facilities such as hospital, school, etc. during the construction period and if required, measures such as detour route should be set up based on the traffic congestion condition • Social service utilities such as power, water, drainage and communication line will be diverted before starting the construction activity • Make sure that people will get the utility connection after the relocation of the facilities	• No mitigation measure is required
20.	Local institutions such as social infrastructure and local decision-making institutions	D	D	• No mitigation measure is required	• No mitigation measure is required
21.	Maldistribution of benefit and damage	**B-**	**B-**	• Establish external monitoring committee by the third party	• Establish external monitoring committee by the third party
22.	Local conflict of interest	**B-**	D	• Give employment opportunities to local residents and municipalities on priority basis.	• No mitigation measure is required
23.	Cultural heritage	D	D	• No impact on cultural and historical sites is predicted along the proposed alignment. However, existence of impact and its influence should be confirmed at the time of linear determination and after finalizing the alignment to ensure there will be no impact on religious and historical buildings	• Existence of vibration impact on the surrounding religious and historical buildings should be assessed • If the vibration exceeds the standard limit, vibration reduction measures should be implemented.
24.	Landscape	**B-**	D	• Design on facilities which will harmonize with the surrounding landscape • All structure will be designed according to the National Building Code • Conduct construction works in a manner that there will be minimal disturbance to the original landscape.	• To reduce the visual impact caused by the changing of the original landscape, compensatory planting of shrubbery spices to the limited area under the elevated structures should be considered as necessary
25.	Gender	**B-**	D	• Affected female headed household should include additional subsistence and relocation assistance, opportunity for skill training	• No mitigation measure is required

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
				and income restoration, employment opportunity in civil work. • Feminine gender will be invited and join local stakeholder as well as male gender • Interview to feminine gender while in census survey will be considered	
26.	Children's right	**B-**	D	• Secure the accessibility to go to school/hospital when select resettlement places • Child labor recruitment should be prohibited in the construction site	• No mitigation measure is required
27.	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	• In order to prevent spreading of infectious diseases such as HIV/ AIDS, awareness training to workers shall be provided. • Local public health center will conduct health education to new settlers • Periodic health check-up program will conduct.	• No mitigation measure is required
28.	Labor environment including labor safety	**B-**	D	• Construction personnel will be provided with the necessary safety gears such as protective hard hat and safety belt. • First aid stations supervised by the safety health officer of the contractor will be located within the construction site office. • Emergency vehicles will be on stand-by within the construction site • Arrange safety training to the worker periodically.	• No mitigation measure is required
Others					
29.	Accidents	**B-**	D	• A sound traffic management and detour plans duly approved by the concerned governmental agency will strictly implemented to minimize traffic congestions and accidents • Traffic enforcers will be designated along these areas to assist in directing traffic flow • Parking time of construction equipment such as dump track and agitator car along the major thorough fare will be limited, especially during peak hours to minimize traffic congestions	• A sound traffic management plan duly approved by the concerned governmental agency will strictly implemented to minimize traffic accidents • Appropriate vehicle speed detection system should be set up along the E-W alignment
30.	Cross-border impact and climate change	D	**B+**	• No mitigation measure is required	• No mitigation measure is required

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 6.5 Environmental Monitoring Plan for Railway

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
Planning Stage								
1	Involuntary Resettlement	- State/Progress of provision/payment of compensation and social assistance - Voices and complaints from the PAPs State of project site	- Consultation meeting and/or other means of communication with the PAPs - Confirmation of records of payment Site observation	Project-affected area (Along the project alignment pass through Hlaing Tharyar, Hlaing, Mayangone, Yankin, and South Okkalapa Townships)	Biannually	MR with support from MOTC and Yangon Region Government	Yangon Region Government	**MMK 500,000** (MMK 100,000 * 5 places)
2	Poverty	Voices and complaints from the local community	Consultation meeting and/or other means of communication with the PAPs	Project-affected area (Along the project alignment pass through Hlaing Tharyar, Hlaing, Mayangone, Yankin, and South Okkalapa Townships)	Biannually	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Included in '1. Involuntary Resettlement'.
Construction Stage								
1	Air Pollution	NO2, SO2, PM10, PM2.5, ozone and micro climate (i.e. temperature, humidity, wind speed and direction and so on for reference)	One weekday for 24 consecutive hours per location	Twelve locations along the project alignment	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 24,000** (USD 1,000 * 12 points * 2 times)
2	Water Pollution (Surface water)	BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform, total nitrogen, total phosphorus, total organic carbon and TSS	Sampling and measurement using field equipment and laboratory analyses	Twelve locations along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 12,000** (USD 500 * 12points * 2 times)
3	Water Pollution (Ground water)	pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	Sampling and measurement using field equipment and laboratory analyses	Six locations along the project alignment (*same places as baseline	Biannually (*once during dry season and once	Environmental consultant hired by MR	Yangon Region Government	**USD 48,000 (USD 400*6 points*2 times)**

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
				survey in principle)	during rainy season)			
4	Waste Disposal	- Volume of waste including soil, vegetation, existing railway structures and garbage - Voices and complaints from the local community	- Confirmation of records of waste generated - Confirmation of voices and complaints - Visual observation	Construction site and labor camps along the project alignment	Quarterly and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
5	Soil Contamination	- Soil condition - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Construction site and surrounding area of project alignment	Quarterly and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
6	Noise and Vibration	- LAeq (noise) - LV10 (vibration)	One weekday for 24 consecutive hours per location	Twelve locations along the project alignment	Biannually	Environmental consultant hired by MR	Yangon Region Government	**USD 12,000** (USD 500 * 12points * 2 times)
7	Offensive Odors	- Volume of waste and night soil including sludge, vegetation and garbage - Voices and complaints from the PAPs	- Confirmation of voices and complaints - Visual observation	Construction site and labor camps along the project alignment	monthly and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
8	Ecosystem	Habitat and estimated number of trees cut and other natural vegetation cleared	Biodiversity surveying using field equipment	Project-affected area	Whenever works that involve vegetation clearance take place	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
9	Hydrology	River water flow	Visual observation	Rivers and creeks where bridge construction work takes place	Whenever bridge construction works take place	Contractor under supervision of consultant	Yangon Region Government	Cost should be included in the construction cost.
10	Topography and Geology	Extent and necessity of cutting and filling	Visual observation	Project-affected area	Whenever works that involve cutting and filling take	Contractor under supervision of consultant	Yangon Region Government	Cost should be included in the construction cost.

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
					place			
11	Involuntary Resettlement	- State of provision/payment of compensation and social assistance and resettlement - Level of income and livelihood restoration of the PAPs - Voices and complaints from the PAPs State of project site	- Consultation meeting and/or other means of communication with the PAPs - Confirmation of records of payment Site observation	Project-affected area	Biannually and when complaints are heard in this regard	MR with support from MOTC and Yangon Region Government	Yangon Region Government	**MMK 600,000** (MMK 100,000 * 3 places * 2 times)
12	Water Usage	- Water saving efforts and activities - Voices and complaints from the local community	- Visual observation - Confirmation of voices and complaints	Construction site and labor camps	Whenever works that involve water use take place	Contractor under supervision of consultant	Yangon Region Government	Cost should be included in the construction cost.
13	Existing Social Infrastructure and Services	Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Project-affected area	When complaints are heard in this regard	Contractor under supervision of consultant	Yangon Region Government	Cost should be included in the construction cost.
14	Infectious Diseases such as HIV/AIDS	- Number of infected cases - Voices and complaints from the local community	- Confirmation of health check list of workers (and preferably of local community) - Confirmation of voices and complaints	Construction site and surrounding area	Monthly and when complaints are heard in this regard	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
15	Labour Environment	- Number of cases that suffered from heat strokes and other occupational health problems - Voices and complaints from the workers	- Confirmation of health check list of workers - Confirmation of voices and complaints	Construction site and labor camps	Monthly	Contractor under supervision of consultant	Yangon Region Government	Cost should be included in the construction cost.
16	Accidents	Number of accidents	Confirmation of records of accidents	Construction site	Monthly	Contractor under supervision of	Yangon Region Government	Cost should be included in the construction cost.

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
						consultant		
17	Cross Boundary Impacts, Cumulative Impacts and Climate Change	Air quality	Refer to '1. Air Pollution' above.				Yangon Region Government	
Operation Stage								
1	Air Pollution	- Air quality (e.g. dust level) - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Five locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the O&M cost.
2	Water Pollution (Surface water)	BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform, total nitrogen, total phosphorus, total organic carbon and TSS	Sampling and measurement using field equipment and laboratory analyses	Twelve locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years (*once during dry season and once during rainy season) and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	**USD 24,000** (USD 1,000 * 12 points * 2 times)
3	Water Pollution (Ground water)	pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	Sampling and measurement using field equipment and laboratory analyses	Six locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years (*once during dry season and once during rainy season) and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	**USD 4,800** (USD 400 * 6 points * 2 times)
4	Waste Disposal	- Volume of waste including existing railway structures, oil and garbage - Voices and complaints	- Confirmation of voices and complaints - Visual observation	Depot sites (i.e. Hlaing Thayar) and stations	Quarterly for the first two years and when complaints are	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the O&M cost.

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
		from the local community			heard in this regard			
5	Soil Contamination	- Soil condition - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Construction site and surrounding area	Quarterly for the first two years and when complaints are heard in this regard	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the O&M cost.
6	Noise and Vibration	- Noise and vibration level - Voices and complaints from the local community	- Confirmation of voices and complaints - Observation	Thirty one locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the O&M cost.
7	Water Usage	- Water saving efforts and activities - Voices and complaints from the local community	- Visual observation - Confirmation of voices and complaints	Depot sites (i.e. Hlaing Tharyar) and stations	Quarterly for the first two years and when complaints are heard in this regard	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the O&M cost.
8	Accidents	Number of accidents	Confirmation of records of accidents	Along the YUMRT alignment	Monthly	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Costs should be included in the O&M cost.
9	Cross Boundary Impacts, Cumulative Impacts and Climate Change	Water quality	Refer to '2. Water Pollution' above.					

Table 6.6 Environmental Monitoring Plan for Transmission Line and Substation

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
Planning Stage								
1	Involuntary Resettlement	- State/Progress of provision/payment of compensation and social	- Consultation meeting and/or other means of communication with the	Project-affected area (Along the project alignment	Biannually	MR with support from MOTC and	Yangon Region Government	Included in '1. Involuntary Resettlement for

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
		assistance - Voices and complaints from the PAPs State of project site	PAPs - Confirmation of records of payment Site observation	pass through Hlaing Tharyar, Hlaing, Mayangone, Yankin, and South Okkalapa Townships)		regional governments		Railway'.
2	Poverty	Voices and complaints from the local community	Consultation meeting and/or other means of communication with the PAPs	Project-affected area (Along the project alignment pass through Hlaing Tharyar, Hlaing, Mayangone, Yankin, and South Okkalapa Townships)	Biannually	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Included in '1. Involuntary Resettlement'.
Construction Stage								
1	Air Pollution	NO2, SO2, PM10, PM2.5, ozone and micro climate (i.e. temperature, humidity, wind speed and direction and so on for reference)	One weekday for 24 consecutive hours per location	Four locations along the transmission alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 8,000** (USD 1,000 * 4 points * 2 times)
2	Water Pollution (Surface water)	BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform, total nitrogen, total phosphorus, total organic carbon and TSS	Sampling and measurement using field equipment and laboratory analyses	One location along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 1,000** (USD 500 * 1points * 2 times)
3	Water Pollution (Ground water)	pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	Sampling and measurement using field equipment and laboratory analyses	Four locations along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 32,00 (USD 400*4 points*2 times)**
4	Noise and Vibration	- LAeq (noise) - LV10 (vibration)	- One weekday for 24 consecutive hours per	Four locations along the project	Biannually	Environmental consultant hired	Yangon Region Government	**USD 4,000** (USD 500 * 4 points *

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
			location	alignment		by MR		2 times)
5	Waste Disposal	- Volume of waste including excavated soil, oil and garbage - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Along the transmission line	During construction activities taking place	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost
6	Ecosystem	- Habitat and estimated number of trees cut and other natural vegetation cleared	- Biodiversity surveying using field equipment	Project-affected area	Whenever works that involve vegetation clearance take place	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
7	Hydrology	-Water flow	Visual observation	Rivers and creeks where bridge construction work takes place	Whenever transmission line construction works take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
8	Topography and Geology	Extent and necessity of cutting and filling	Visual observation	Project-affected area	Whenever works that involve cutting and filling take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
9	Water Usage	- Water saving efforts and activities Voices and complaints from the local community	- Visual observation Confirmation of voices and complaints	Construction site and labor camps	Whenever works that involve water use take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
10	Existing Social Infrastructure and Services	Voices and complaints from the local community	- Confirmation of voices and complaints Visual observation	Project-affected area	When complaints are heard in this regard	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
11	Infectious Diseases such as HIV/AIDS	- Number of infected cases - Voices and complaints	- Confirmation of health check list of workers	Construction site and surrounding	Monthly and when	Contractor with support from	Yangon Region	Cost should be included in the

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
		from the local community	(and preferably of local community) - Confirmation of voices and complaints	area	complaints are heard in this regard	consultant, MR, MOTC and Yangon Region Government	Government	construction cost.
12	Labour Environment	- Number of cases that suffered from heat strokes and other occupational health problems - Voices and complaints from the workers	- Confirmation of health check list of workers - Confirmation of voices and complaints	Construction site and labor camps	Monthly	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
13	Accidents	Number of accidents	- Confirmation of records of accidents	Construction site	Monthly	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
14	Cross Boundary Impacts, Cumulative Impacts and Climate Change	- Air quality	- Refer to '1. Air Pollution' above.				Yangon Region Government	
Operation Stage								
1	Air Pollution	- NO2, SO2, PM10, PM2.5, ozone and micro climate (i.e. temperature, humidity, wind speed and direction and so on for reference)	- One weekday for 24 consecutive hours per location	Four locations along the transmission alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 8,000** (USD 1,000 * 4 points * 2 times)
2	Water Pollution (Surface water)	- BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform, total nitrogen, total phosphorus, total organic carbon and TSS	- Sampling and measurement using field equipment and laboratory analyses	One location along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 1,000** (USD 500 * 1points * 2 times)
3	Water Pollution (Ground water)	- pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	- Sampling and measurement using field equipment and laboratory analyses	Four locations along the project alignment (*same places as baseline survey in	Biannually (*once during dry season and once during rainy	Environmental consultant hired by MR	Yangon Region Government	**USD 32,00 (USD 400*4 points*2 times)**

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
				principle)	season)			
4	Waste Disposal	- Volume of waste including existing railway structures, oil and garbage - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Depot sites (i.e. Hlaing Thayar) and stations	Quarterly for the first two years and when complaints are heard in this regard	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the O&M cost.
5	Noise and Vibration	- LAeq (noise) - LV10 (vibration)	- One weekday for 24 consecutive hours per location	Four locations along the project alignment	Biannually	Environmental consultant hired by MR	Yangon Region Government	**USD 4,000** (USD 500 * 4 points * 2 times)
6	Accidents	- Number of accidents	- Confirmation of records of accidents	Along the YUMRT alignment	Monthly	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Costs should be included in the O&M cost.
7	Local conflict of interests	- Voices and complaints from the local community	- Confirmation of voices and complaints	Along the transmission line (During maintenance)	During Maintenance	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
8	Cross Boundary Impacts, Cumulative Impacts and Climate Change	- Water quality	- Refer to '2. Water Pollution' above.					

Table 6.7 Environmental Monitoring Plan for Bridge

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
Planning Stage								
1	Involuntary Resettlement	- State/Progress of provision/payment of compensation and social assistance - Voices and complaints from the PAPs State of project site	- Consultation meeting and/or other means of communication with the PAPs - Confirmation of records of payment Site observation	Project-affected area (Along the project alignment pass through Hlaing Tharyar, Hlaing, Mayangone, Yankin, and South Okkalapa	Biannually	MR with support from MOTC and regional governments	Yangon Region Government	Included in '1. Involuntary Resettlement for Railway'.

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
				Townships)				
2	Poverty	Voices and complaints from the local community	Consultation meeting and/or other means of communication with the PAPs	Project-affected area (Along the project alignment pass through Hlaing Tharyar, Hlaing, Mayangone, Yankin, and South Okkalapa Townships)	Biannually	MR with support from MOTC and regional governments	Yangon Region Government	Included in '1. Involuntary Resettlement'.
Construction Stage								
1	Air Pollution	NO2, SO2, PM10, PM2.5, ozone and micro climate (i.e. temperature, humidity, wind speed and direction and so on for reference)	One weekday for 24 consecutive hours per location	Two locations along the project alignment	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 4,000** (USD 1,000 * 2 points * 2 times)
2	Water Pollution (Surface water)	BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform, total nitrogen, total phosphorus, total organic carbon and TSS	Sampling and measurement using field equipment and laboratory analyses	Eight locations along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 8,000** (USD 500 * 8points * 2 times)
3	Water Pollution (Ground water)	pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	Sampling and measurement using field equipment and laboratory analyses	Two locations along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 16,00 (USD 400*2 points*2 times)**
4	Waste Disposal	- Volume of waste including soil, vegetation, existing railway structures and garbage - Voices and complaints from the local community	- Confirmation of records of waste generated - Confirmation of voices and complaints - Visual observation	Construction site and labor camps along the project alignment	Quarterly and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
5	Soil Contamination	- Soil condition - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Construction site and surrounding area of project alignment	Quarterly and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
6	Noise and Vibration	- LAeq (noise) - LV10 (vibration)	One weekday for 24 consecutive hours per location	Two locations along the project alignment	Biannually	Environmental consultant hired by MR	Yangon Region Government	**USD 2,000** (USD 500 * 2points * 2 times)
7	Offensive Odors	- Volume of waste and night soil including sludge, vegetation and garbage - Voices and complaints from the PAPs	- Confirmation of voices and complaints - Visual observation	Construction site and labor camps along the project alignment	monthly and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
8	Ecosystem	Habitat and estimated number of trees cut and other natural vegetation cleared	Biodiversity surveying using field equipment	Project-affected area	Whenever works that involve vegetation clearance take place	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
9	Hydrology	River water flow	Visual observation	Rivers and creeks where bridge construction work takes place	Whenever bridge construction works take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
10	Topography and Geology	Extent and necessity of cutting and filling	Visual observation	Project-affected area	Whenever works that involve cutting and filling take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
11	Involuntary Resettlement	- State of provision/payment of compensation and social assistance and resettlement - Level of income and	- Consultation meeting and/or other means of communication with the PAPs - Confirmation of records of payment	Project-affected area	Biannually and when complaints are heard in this regard	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Included in '1. Involuntary Resettlement for Railway'.

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
		livelihood restoration of the PAPs - Voices and complaints from the PAPs State of project site	Site observation					
12	Water Usage	- Water saving efforts and activities - Voices and complaints from the local community	- Visual observation - Confirmation of voices and complaints	Construction site and labor camps	Whenever works that involve water use take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
13	Existing Social Infrastructure and Services	Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Project-affected area	When complaints are heard in this regard	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
14	Infectious Diseases such as HIV/AIDS	- Number of infected cases - Voices and complaints from the local community	- Confirmation of health check list of workers (and preferably of local community) - Confirmation of voices and complaints	Construction site and surrounding area	Monthly and when complaints are heard in this regard	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
15	Labour Environment	- Number of cases that suffered from heat strokes and other occupational health problems - Voices and complaints from the workers	- Confirmation of health check list of workers - Confirmation of voices and complaints	Construction site and labor camps	Monthly	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
16	Accidents	Number of accidents	Confirmation of records of accidents	Construction site	Monthly	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
17	Cross Boundary Impacts, Cumulative Impacts and	Air quality	Refer to '1. Air Pollution' above.				Yangon Region	

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
	Climate Change						Government	
Operation Stage								
1	Air Pollution	- Air quality (e.g. dust level) - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Two locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the O&M cost.
2	Water Pollution (Surface water)	BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform, total nitrogen, total phosphorus, total organic carbon and TSS	Sampling and measurement using field equipment and laboratory analyses	Eight locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years (*once during dry season and once during rainy season) and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	**USD 16,000** (USD 1,000 * 8 points * 2 times)
3	Water Pollution (Ground water)	pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	Sampling and measurement using field equipment and laboratory analyses	Two locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years (*once during dry season and once during rainy season) and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	**USD 1,600** (USD 400 * 2points * 2 times)
4	Waste Disposal	- Volume of waste including existing railway structures, oil and garbage - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Depot sites (i.e. Hlaing Tharyar) and stations	Quarterly for the first two years and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the O&M cost.

No	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
5	Soil Contamination	- Soil condition - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Construction site and surrounding area	Quarterly for the first two years and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the O&M cost.
6	Noise and Vibration	- Noise and vibration level - Voices and complaints from the local community	- Confirmation of voices and complaints - Observation	Thirty one locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the O&M cost.
7	Water Usage	- Water saving efforts and activities - Voices and complaints from the local community	- Visual observation - Confirmation of voices and complaints	Depot sites (i.e. Hlaing Tharyar) and stations	Quarterly for the first two years and when complaints are heard in this regard	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the O&M cost.
8	Accidents	Number of accidents	Confirmation of records of accidents	Along the YUMRT alignment	Monthly	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Costs should be included in the O&M cost.

Section 7 Public Consultation and Disclosure

It is important to disclose the information about the project during the preparation of draft EIA report and the opinion of PAPs and other stakeholders should be considered in the preparation of the draft EAI report. Stakeholder meetings were held in three places at the scoping stage in June, 2019 and at the draft EIA report preparation stage in January, 2020. The meetings attracted a wide range of stakeholders including the local people, relevant government organizations including ECD/MONREC, private companies and the media. An outline of the stakeholder meetings held at the scoping stage and draft EIA report preparation stage are presented below.

Table 7. 1 Summary of the Stakeholder Meetings at the Scoping Stage

No.	Date and Time	Township	Summary
1	9:00 to 12:00, June 1st, Saturday 2019	Hlaing Tharyar	Participants: a total of 1456 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
2	9:00 to 12:00, June 8th, Saturday 2019	Hlaing/ Mayangone	Participants: a total of 347 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
3	13:00 to 16:00, June 8th, Saturday 2019	Yankin/ South Okkalapa	Participants: a total of 183 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.

Source: JICA Study Team

Table 7. 2 Summary of the Stakeholder Meetings at the draft EIA Reporting Stage

No.	Date and Time	Township	Summary
1	8:00 to 11:00, January 12nd, Sunday 2020	Mayangone	Participants: a total of 77 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
2	14:00 to 17:00, January 12nd, Sunday 2020	Htantabin	Participants: a total of 137 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
3	14:00 to 17:00, January 13th, Monday 2020	Yankin/ South Okkalapa	Participants: a total of 134 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
4	8:00 to 11:00, January 14th, Tuesday 2020	Hlaing Tharyar	Participants: a total of 922 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
5	14:00 to 17:00, January 14th, Sunday 2020	Hlaing	Participants: a total of 113 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.

Source: JICA Study Team

The stakeholder meetings were held according to the following agenda:

1) Opening remarks;
2) Presentation on the proposed project;
3) Presentation on issues related to environmental and social considerations;
4) Question and answers; and
5) Closing remarks

According to the agenda above, MR introduced the project to the floor by explaining: the purpose of the stakeholder meeting; project objective and proponent; project location; project component; project schedule; and contact person using a power point presentation. Then the ESIA consultant explained: the EIA process; environmental type of the project; environmental baseline condition; terms of reference of the EIA survey; results of the EIA survey; environmental impact assessment; mitigation measures; and monitoring plan. In the question and answers session, MR and the EIA consultant gave an answer to each question raised from the floor which ranged from: environmental impact; project alternative; land acquisition and resettlement; mitigation measures; project period; and project components.MR and the EIA consultant received questions and opinions from the participants and gave answers to them.

Section 8 Conclusion and Recommendations

As described above, the adverse impact expected from the project is considered to be moderate in general. In order to maximize the benefits of the Project and to minimize its economic costs, it is crucial that the identified mitigation measures are implemented effectively and the construction process be monitored diligently. Practical mitigation measures and monitoring plan have been proposed by JICA Study Team and MR has agreed to put them in place to effectively reduce such impacts. In doing so, MR should continue working closely with organizations such as MOTC, MOEE and Yangon Region Government (YRG) and YCDC and steadily move forward together with the public and the PAPs.

အခန်း (၁) အစီရင်ခံစာအကျဉ်းချုပ်

အပိုင်း (၁) စီမံကိန်းမိတ်ဆက်

ရန်ကုန်မြို့ပြလူထုရထားပို့ဆောင်ရေးစီမံကိန်း Yangon Urban Mass Rapid Transit (YUMRT) Construction Project ၏ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်လေ့လာခြင်းအစီရင်ခံစာအား မြန်မာနိုင်ငံတွင် ပြဋ္ဌာန်းထားသော ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း (၂၀၁၅) အရ ရေးဆွဲထားပါသည်။ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင် ထိန်းသိမ်းရေးဝန်ကြီးဌာနမှ ပြဋ္ဌာန်းထားသည့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဥပဒေ (၂၀၁၂) နှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး နည်းဥပဒေ (၂၀၁၄) အရ နိုင်ငံအတွင်း အကောင်အထည်ဖော် ဆောင်ရွက်မည့် စီမံကိန်းသည် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်လေ့လာခြင်းလုပ်ငန်းအား လုပ်ဆောင်ရမည်ဖြစ်ပြီး ဝန်ကြီးဌာနမှ ခွင့်ပြုချက်ကို ရရှိရမည်ဖြစ်သည်။ ထိုပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်လေ့လာခြင်းအစီရင်ခံစာ၏ ရည်ရွယ်ချက်မှာ YUMRT မှ ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်အပေါ် သက်ရောက်မှုများကို ဆန်းစစ်ခြင်းနှင့် ဖြစ်ပေါ်လာနိုင်သော ကောင်းကျိုးများကို ပိုမိုတိုးတက်လာစေရန်နှင့် ဆိုးကျိုးများအား ရှောင်ကြဉ်ရန်၊ လျော့နည်းစေရန် ဖြစ်ပါသည်။

စီမံကိန်းအား အကောင်အထည်ဖော်ဆောင်ရွက်ရသည့် ရည်ရွယ်ချက်များမှာ

၁။ ရန်ကုန်တိုင်းဒေသကြီး၏ လူမှုစီးပွားရေးအခြေအနေများ စဉ်ဆက်မပြတ် ဖွံ့ဖြိုးတိုးတက်စေရန် ပြီးပြည့်စုံသည့် ဆက်သွယ်ရေးကွန်ယက်တစ်ခု ဖြစ်ပေါ်လာစေရန်၊

၂။ ရန်ကုန်တိုင်းဒေသကြီးအား မြန်မာနိုင်ငံ၏ ကမ္ဘာ့အဆင့်အတန်းမီမြို့အဖြစ်၊ နိုင်ငံတကာမှ ဝင်ထွက်သွားလာနိုင်သောမြို့အဖြစ် အကောင်အထည်ဖော်ဆောင်ရွက်ရာတွင် အထောက်အပံ့ ဖြစ်စေရန်၊

၃။ ဖန်လုံအိမ်ဓာတ်ငွေ့ထုတ်လွှတ်မှုနှင့် ရာသီဥတုပြောင်းလဲမှုကို လျော့ချစေရေးတွင် အထောက် အပံ့ဖြစ်စေရန်၊

၄။ ရန်ကုန်တိုင်းဒေသကြီးတွင် နေထိုင်ကြသော ပြည်သူများ လူနေမှုအဆင့်အတန်း မြင့်တက်စေရန်၊

၅။ လာရောက်လည်ပတ်သူများနှင့် ရင်းနှီးမြုပ်နှံသူများအား ဆွဲဆောင်မှုရှိစေရန်နှင့် အခွင့်အလမ်း များတိုးပွားစေရန်၊

၆။ ဒေသတွင်း စီးပွားရေးအခြေအနေများ မြင့်တက်လာစေရန်၊

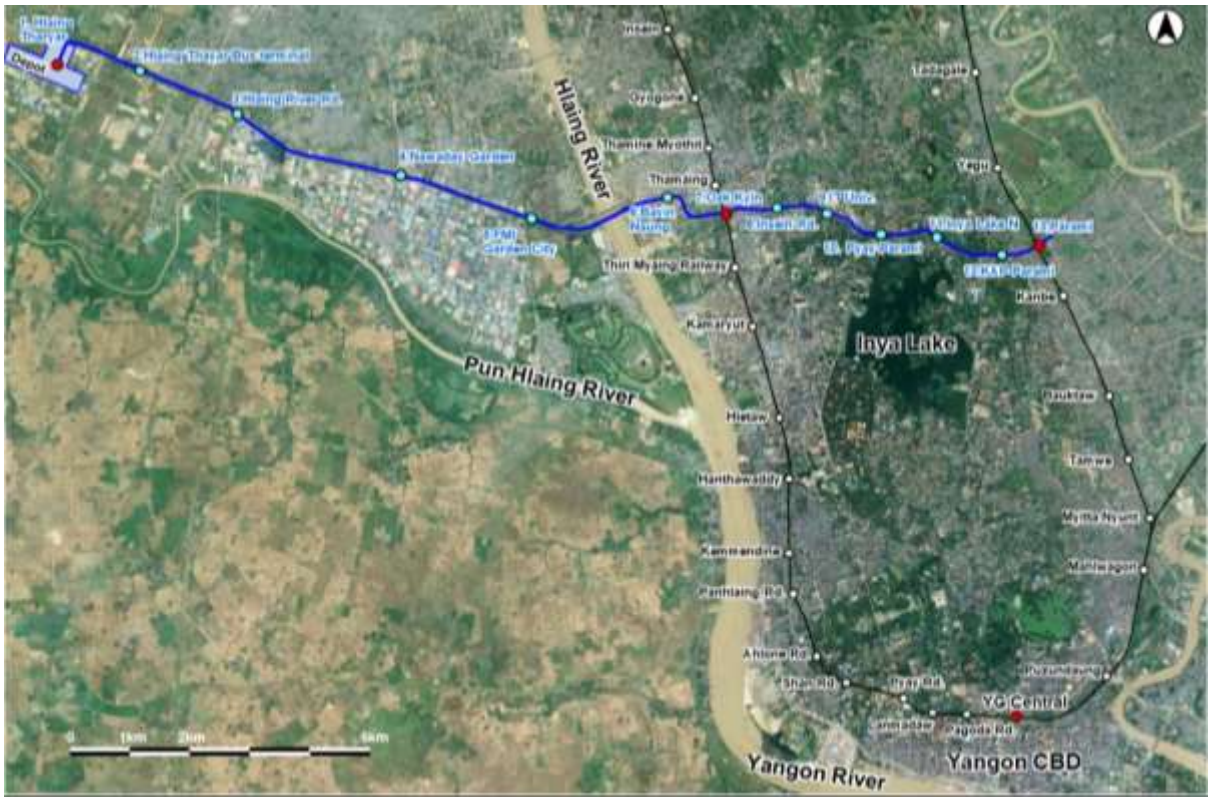
၇။ Spatial Structure ကို ပြုပြင်ပြောင်းလဲရာတွင် အထောက်အပံ့ဖြစ်စေရန်

၈။ မြို့ပြ၏ လမ်းပန်းဆက်သွယ်ရေးနှင့် ဆက်စပ်နေသော ပတ်ဝန်းကျင်အရည်အသွေးများ ပိုမို ကောင်းမွန်လာစေရန် (လေအရည်အသွေး၊ ဆူညံသံ)

၉။ မြို့ပြ၏ အများပြည်သူလမ်းပန်းဆက်သွယ်ရေးဝန်ဆောင်မှုကို စဉ်ဆက်မပြတ် ဖွံ့ဖြိုးတိုးတက်မှု ရှိစေရန်၊

၁၀။ ရန်ကုန်မြို့တွင်းတွင် ကြုံတွေ့နေရသော ကားလမ်းပိတ်သည့် ကိစ္စများကို သက်သာစေရန်၊

စီမံကိန်းတည်နေရာမှာ အရှေ့အနောက်ဆက်သွယ်နေသည့် လှိုင်သာယာနှင့် ပါရမီကြားဖြစ်ပြီး ပုံ (၂.၁) တွင် ဖော်ပြထားပါသည်။ စီမံကိန်း၏ အရှည်မှာ လှိုင်သာယာဘူတာမှ ပါရမီဘူတာအထိ ခန့်မှန်းချေ (၁၈) ကီလိုမီတာ ရှိပါသည်။



ပုံ ၁.၁ ရန်ကုန်မြို့တော်ဧရိယာအတွင်း လျာထားသော အရှေ့အနောက် မိုးပျံရထားလမ်းကြောင်း

စီမံကိန်းအဆိုပြုသူမှာ ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန လက်အောက်ရှိ မြန်မာ့မီးရထား ဖြစ်ပါသည်။ စီမံကိန်းအဆိုပြုသူ၏ အသေးစိတ်အချက်အလက်များကို အောက်ပါဇယားတွင် ဖော်ပြထားပါသည်။

ဇယား ၁.၁ မြန်မာ့မီးရထား၏ ဆက်သွယ်ရေးဆိုင်ရာ အချက်အလက်များ

အဖွဲ့အစည်းနာမည်	မြန်မာ့မီးရထား
လိပ်စာ	နေပြည်တော်ဘူတာ၊ နေပြည်တော်၊ မြန်မာ
တယ်လီဖုန်း/ ဖတ်စ်	+၉၅-၆၇-၇၇၁၆၄
စီမံကိန်းတာဝန်ရှိသူ	➢ ဦးအောင်သူလတ်၊ အထွေထွေမန်နေဂျာ၊ အောက်မြန်မာပြည် လိပ်စာ–အောက်မြန်မာပြည်ရုံး၊ အောက်ဘလောက်၊ သိမ်ဖြူလမ်း၊ ဗိုလ်တထောင်မြို့နယ်၊ ရန်ကုန်တိုင်းဒေသကြီး၊ မြန်မာ။ တယ်လီဖုန်း– +၉၅-၁-၂၉၈၆၃၊ ဖတ်စ်– +၉၅-၁-၂၉၈၅၉၄ အီးမေးလ်– gmlowermyanmar@gmail.com – ဦးဖြိုးထက်ကျော်၊ လက်ထောက်အထွေထွေမန်နေဂျာ (စီမံခန့်ခွဲမှု)၊ စီမံကိန်းနှင့် အုပ်ချုပ်ရေးဌာန လိပ်စာ– နေပြည်တော်ဘူတာ၊ နေပြည်တော်၊ မြန်မာ။ တယ်လီဖုန်း– +၉၅-၆၇-၇၇၀၈၈၇၊ ဖတ်စ်– +၉၅-၆၇-၇၇၁၆၄ အီးမေးလ်– kozin6893@gmail.com

အဆိုပါ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းအစီရင်ခံစာအား JICA Study Team ၏ ကြီးကြပ်မှုနှင့်အတူ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင် ထိန်းသိမ်းရေးဝန်ကြီးဌာန၏ ထောက်ခံချက်လိုင်စင်ရရှိထားသော E Guard Environmental Services ကုမ္ပဏီလီမိတက်မှ ရေးသားထားပါသည်။ အစီရင်ခံစာရေးသားရာတွင် ပါဝင်ဆောင်ရွက်ထားသော ပတ်ဝန်းကျင်ဆိုင်ရာ အတိုင်ပင်ခံများ၏ တာဝန်များနှင့် ပညာအရည်အချင်းများ ကိုအောက်ပါဇယားတွင် ဖော်ပြထားပါသည်။ ယင်းဇယားတွင် အလုပ်အတွေ့အကြုံများကိုပါ ထည့်သွင်းဖော်ပြထားပါသည်။ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ အတိုင်ပင်ခံအဖွဲ့အစည်း၏ ဆက်သွယ်ရန် လိပ်စာနှင့် ဖုန်းနံပါတ်များမှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်။

Company အမည် – အီးဂတ်ပတ်ဝန်းကျင်ဆိုင်ရာဝန်ဆောင်မှု ကုမ္ပဏီလီမိတက်

လိပ်စာ – အမှတ် (၁၄၅– A2–A3)၊ သီရိမင်္ဂလာလမ်းသွယ်၊ (၄) ရပ်ကွက်၊ ၈ မိုင်၊ မရမ်းကုန်းမြို့နယ်၊ ရန်ကုန် ၁၁၀၆၂၊ မြန်မာ။

တယ်လီဖုန်း၊ ဖတ်စ် – +၉၅၁-၆၆၇၉၅၃

URL – www.eguardservices.com

ဇယား ၁.၂ ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာ အတိုင်ပင်ခံအဖွဲ့ဝင်များ၏ တာဝန်များနှင့် ပညာအရည်အချင်းများ

စဉ်	အမည်	အခန်းကဏ္ဍ	တာဝန်	ပညာအရည်အချင်း
၁။	ဒေါ်ယုဝေယံသိန်းတန်	Team Leader	ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ငန်းများ ကြီးကြပ်ခြင်းနှင့် ဆန်းစစ်လေ့လာခြင်း	M. Eng. (Environmental Engineering Management)
၂။	ဒေါ်ခိုင်မာကျော်	Water Pollution Control	ပတ်ဝန်းကျင်အရည်အသွေးဆိုင်ရာအချက်အလက်များ ကောက်ယူခြင်းနှင့် ဆန်းစစ်လေ့လာခြင်း	M. Eng. (Environmental Engineering Management)
၃။	ဦးကောင်းထက်စွမ်း	Air Pollution Control	ပတ်ဝန်းကျင်အရည်အသွေးဆိုင်ရာအချက်အလက်များ ကောက်ယူခြင်းနှင့် ဆန်းစစ်လေ့လာခြင်း	M. Eng. (Environmental Engineering Management)
၄။	ဦးနိုင်ဇော်ဝင်း	Social Environmental Expert	လူမှုစီးပွားဆိုင်ရာ အချက်အလက်များကောက်ယူခြင်းနှင့် ဆန်းစစ်ခြင်း	B.Sc. (Forestry)
၅။	ဒေါ်ထက်ရွှေဇင်အောင်	Zoologist	ဇီဝမျိုးစုံမျိုးကွဲဆိုင်ရာ အချက်အလက်များကောက်ယူခြင်းနှင့် ဆန်းစစ်ခြင်း	M.Sc. (Zoology)
၆။	ဒေါ်ဟေမာန်နှင်း	Botanist	ဇီဝမျိုးစုံမျိုးကွဲဆိုင်ရာ အချက်အလက်များကောက်ယူခြင်းနှင့် ဆန်းစစ်ခြင်း	M.Sc. (Botany)
၇။	ဦးကျော်စိုးမိုး	Transportation Engineer	ဆက်သွယ်သွားလာရေးကွန်ယက်နှင့် ပတ်သက်၍ ကွင်းဆင်းလေ့လာခြင်းနှင့် ဆန်းစစ်ခြင်း	B.E. (Civil Engineering)
၈။	ဦးစည်သူမင်းနိုင်	GIS/CAD Field Surveyor	ပထဝီဝင်ဆိုင်ရာသတင်းအချက်အလက်စနစ်ဆိုင်ရာလုပ်ငန်းများလုပ်ဆောင်ခြင်း	B.E. (Mining Engineering)
၉။	ဒေါ်သက်ရွှေရည်အောင်	Geologist	ဘူမိဗေဒဆိုင်ရာအချက်အလက်များကောက်ယူခြင်း	B.Sc. (Geology)
၁၀။	ဒေါ်မေသူဝင်း	Lawyer	ဥပဒေဆိုင်ရာအကြံပေးခြင်း	LL.B
၁၁။	ဒေါ်ရွှေစင်ခြူးလွဲ	Surveyor and Enumerator	အချက်အလက်များကောက်ယူခြင်း	B.E. (Electronic Communication Engineering)
၁၂။	ဦးသန့်စင်အောင်	Surveyor and Enumerator	အချက်အလက်များကောက်ယူခြင်း	B.E. (Mining Engineering)
၁၃။	ဒေါ်ခိုင်ယဉ်ငြိမ်း	Surveyor and Enumerator	အချက်အလက်များကောက်ယူခြင်း	B.Sc. (Industrial Chemistry)

အပိုင်း (၂) မူဝါဒ၊ ဥပဒေနှင့် မူဘောင်များ

စဉ်	ဥပဒေနှင့် စည်းမျဉ်းစည်းကမ်းများ၏အမည်များ	ခုနှစ်
၁။	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ	၂၀၁၂
၂။	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေ	၂၀၁၄
၃။	ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်း	၂၀၁၅
၄။	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေးထုတ်လွှတ်မှုလမ်းညွှန်ချက်	၂၀၁၅
၅။	မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုဥပဒေ	၂၀၁၆
၆။	ရင်းနှီးမြှုပ်နှံမှုနည်းဥပဒေများ	၂၀၁၇
၇။	တိုင်းရင်းသားလူမျိုးများအကျိုးစီးပွားကာကွယ်စောင့်ရှောက်ရေးဥပဒေ	၂၀၁၅
၈။	ပြည်သူ့ကျန်းမာရေးဥပဒေ	၁၉၇၂
၉။	ကူးစက်ရောဂါများကာကွယ်နှိမ်နှင်းရေးဥပဒေ	၁၉၉၅
၁၀။	ဆေးလိပ်နှင့်ဆေးရွက်ကြီးထွက်ပစ္စည်းသောက်သုံးမှုထိန်းချုပ်ရေးဥပဒေ	၂၀၀၆
၁၁။	မြန်မာနိုင်ငံမီးသတ်တပ်ဖွဲ့ဥပဒေ	၂၀၁၅
၁၂။	မော်တော်ယာဉ်ဥပဒေ	၂၀၁၅
၁၃။	မြန်မာ့အာမခံလုပ်ငန်းဥပဒေ	၁၉၉၃
၁၄။	အလုပ်သမားအဖွဲ့အစည်းဥပဒေ	၂၀၁၁
၁၅။	အလုပ်သမားရေးရာအငြင်းပွားမှုဖြေရှင်းရေးဥပဒေကို ဒုတိယအကြိမ်ပြင်ဆင်သည့် ဥပဒေ	၂၀၁၉
၁၆။	အလုပ်အကိုင်နှင့်ကျွမ်းကျင်မှုဖွံ့ဖြိုးတိုးတက်ရေးဥပဒေ	၂၀၁၃
၁၇။	အနည်းဆုံးအခကြေးငွေဥပဒေ	၂၀၁၃
၁၈။	အခကြေးငွေပေးချေရေးဥပဒေ	၂၀၁၆
၁၉။	အလုပ်သမားလျော်ကြေးအက်ဥပဒေကို ပြင်ဆင်သည့် ဥပဒေ (၁၉၂၃)	၁၉၂၃
၂၀။	ခွင့်နှင့်အလုပ်ပိတ်ရက်များအက်ဥပဒေကို ပြင်ဆင်သည့် ဥပဒေ (၁၉၅၁)	၂၀၁၄
၂၁။	လူမှုဖူလုံရေးဥပဒေ	၂၀၁၂
၂၂။	ရေနံနှင့်ရေနံထွက်ပစ္စည်းဥပဒေ	၂၀၁၆
၂၃။	ရေနံနည်းဥပဒေများ	၁၉၃၀

၂၄။	ရေအရင်းအမြစ်နှင့်မြစ်၊ ချောင်းများထိန်းသိမ်းရေးဥပဒေ	၂၀၀၆
၂၅။	ရေချိုငါးလုပ်ငန်းဥပဒေ	၁၉၉၁
၂၆။	ယဉ်ကျေးမှုအမွေအနှစ်ဒေသများကာကွယ်ထိန်းသိမ်းရေးဥပဒေ	၂၀၁၉
၂၇။	ရှေးဟောင်းဝတ္ထုပစ္စည်းများကာကွယ်ထိန်းသိမ်းရေးဥပဒေ	၂၀၁၅
၂၈။	ရှေးဟောင်းအဆောက်အအုံများကာကွယ်ထိန်းသိမ်းရေးဥပဒေ	၂၀၁၅
၂၉။	မြန်မာနိုင်ငံအင်ဂျင်နီယာကောင်စီဥပဒေ	၂၀၁၃
၃၀။	ပို့ကုန်သွင်းကုန်ဥပဒေ	၂၀၁၂
၃၁။	လယ်ယာမြေဥပဒေ	၂၀၁၂
၃၂။	မြေလွတ်၊ မြေလပ်နှင့် မြေရိုင်းများ စီမံခန့်ခွဲရေးဥပဒေ	၂၀၁၂
၃၃။	ရထားလမ်းပို့ဆောင်ရေးဥပဒေ	၂၀၁၆
၃၄။	သစ်တောဥပဒေ	၂၀၁၈
၃၅။	ဇီဝမျိုးစုံမျိုးကွဲနှင့် သဘာဝထိန်းသိမ်းရေးနယ်မြေများ ကာကွယ်ရေးဥပဒေ	၂၀၁၈
၃၆။	ရန်ကုန်တိုင်းဒေသကြီး စည်ပင်သာယာရေးဥပဒေ	၂၀၁၈
၃၇။	မြေသိမ်းဆည်းခြင်း၊ ပြန်လည်နေရာချထားခြင်းနှင့် ပြန်လည်ထူထောင်ခြင်းဆိုင်ရာဥပဒေ	၂၀၁၉

အပိုင်း (၃) စီမံကိန်းအကြောင်းအရာဖော်ပြချက်နှင့် အခြားဆောင်ရွက်နိုင်သော နည်းလမ်းများ ရွေးချယ်ခြင်း

စီမံကိန်းတွင် ဘူတာရုံ (၁၃) ခုပါရှိမည့် (၁၈) ကီလိုမီတာခန့်ရှည်လျားသော အထပ်မြင့်မိုးပျံ ရထားလမ်းဆောက်လုပ်ရေးလုပ်ငန်းစဉ် ပါဝင်ပါသည်။ ဓာတ်အားခွဲရုံပါဝင်သည့် ဘူတာရုပ်ဝန်း ကို လက်ရှိလှိုင်သာယာ ဘူတာအနီးနှင့် လှိုင်မြစ်ကိုဖြတ်၍ ဘုရင့်နောင်တံတားအသစ်ဆောက်လုပ်ရေး လုပ်ငန်းအနီးတွင် အကောင်ထည်ဖော်ဆောင်ရွက်မည်ဖြစ်သည်။ အဆိုပြုတင်သွင်းထားသော စီမံကိန်းဒီဇိုင်းကို ဇယား ၄.၁ တွင် ဖော်ပြထားပါသည်။

ဇယား ၃.၁ အဆိုပြု စီမံကိန်းဒီဇိုင်း

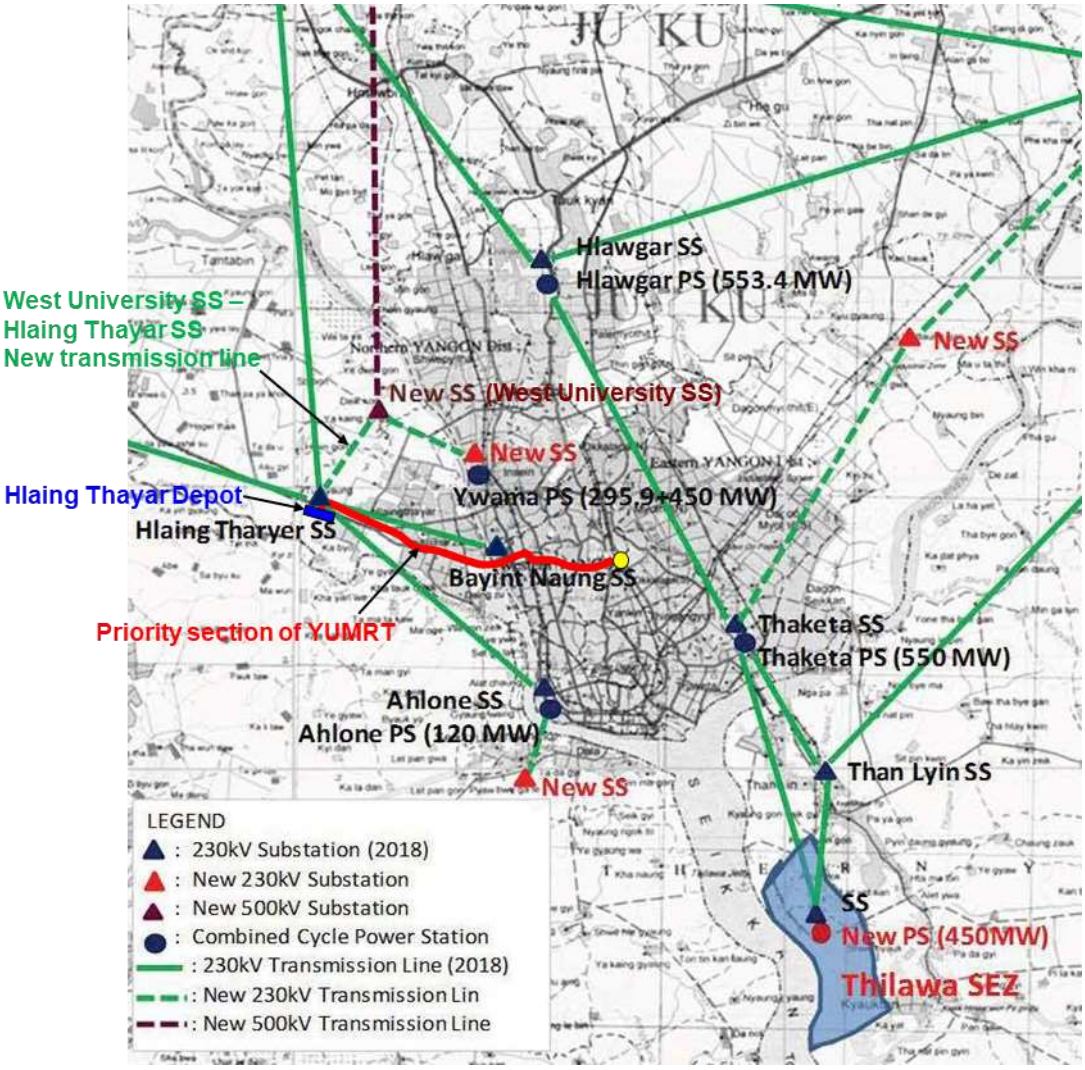
အမျိုးအစား			တန်ဖိုးဖော်ပြချက်
၁။	မီးရထားလမ်းနှစ်ခုကြား အကွာအဝေး		၁၄၃၅ mm (စံသတ်မှတ်ချက်)
၂။	အလျင်နှုန်း	အမြန်ဆုံး	၈၀ km/h

		အချိန်စာရင်း	၃၀ km/h
၃။	Minimum Horizontal Curvature	Main Track	၁၆၀ m (minimum: ၁၀၀ m
	Platform		၄၀၀ m
၄။	လျှောစောက်		၃၅ %
၅။	လျှပ်စစ်ဓာတ်အား ထောက်ပံ့ရေးစနစ်	စနစ်	Overhead Catenary
		Voltage	၁၅၀၀ V DC
၆။	လိုအပ်သော လျှပ်စစ်ဓာတ်အား	မဂ္ဂါဝပ်	၃၇.၁

ကိုးကား; JICA လေ့လာရေးအဖွဲ့

ကောင်းမွန်တည်ငြိမ်သော လျှပ်စစ်ဓာတ်အား ဆောက်လုပ်ရန်, ဓာတ်အားခွဲရုံအတွက် အောက်ပါအချက် အလက်များအပေါ် အခြေခံ၍ နေရာဆန်းစစ်လေ့လာမှုကို ပြုလုပ်ခဲ့ပါသည်။

- ၂၀၁၀ မှ ၃၀၁၀ စတုရန်းမိတာရှိသော မြေကေဖြစ်ရန်
- အနီးပတ်ဝန်းကျင်တွင် Power Grid ရှိရန်
- Power Grid နှစ်ခုအားဆက်သွယ်ရန်



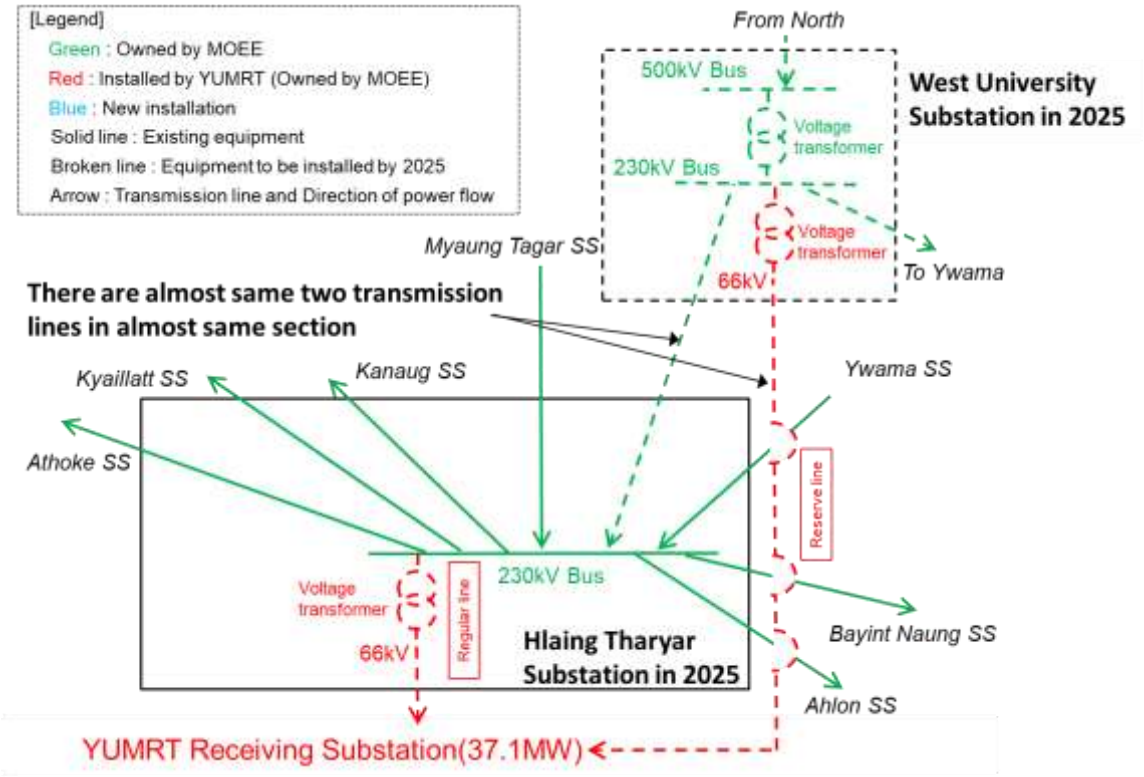
ပုံ ၃.၁ ၂၀၂၅ တွင် တွေ့ရမည့် လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၏ လှိုင်သာယာ ဓာတ်အားခွဲရုံနှင့် YUMRT ဆက်စပ်မှုအနေအထား

လေ့လာတွေ့ရှိချက်များအရ ပုံ (၄.၂၈) တွင် ဖော်ပြထားသည့်အတိုင်း လှိုင်သာယာမြို့နယ်တွင် ဘူတာရုပ်ဝန်းအား တည်ဆောက်နိုင်ချေ များပါသည်။

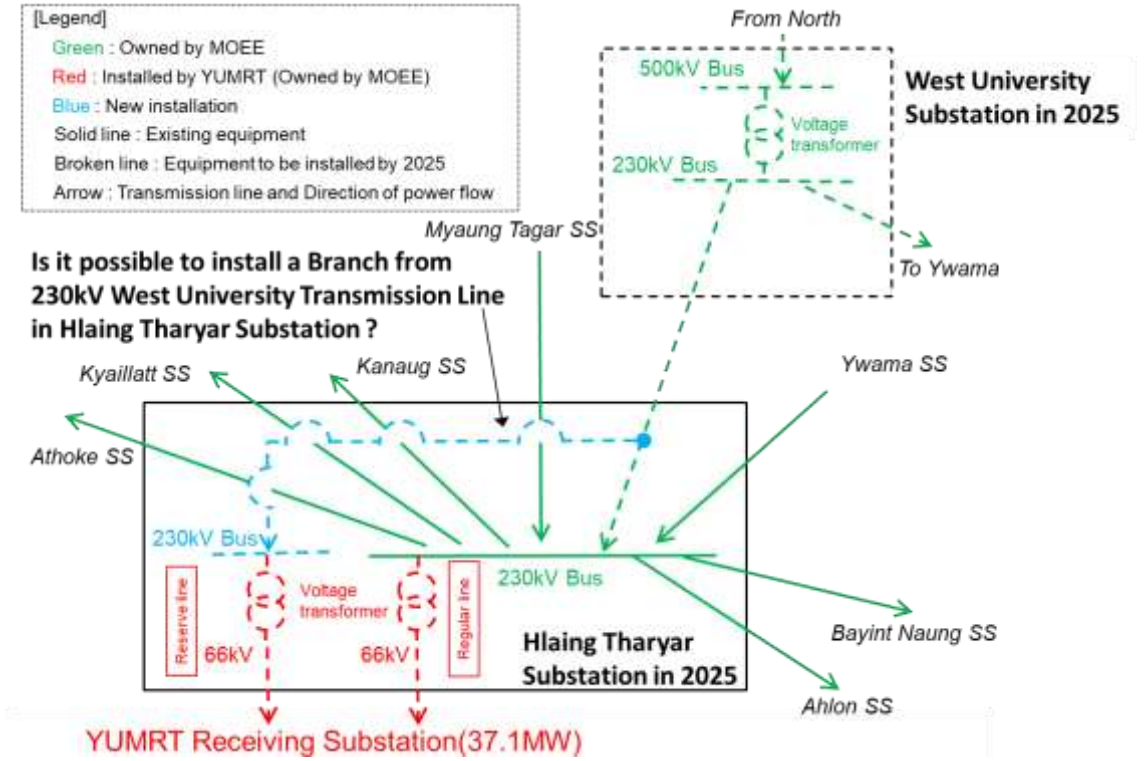


ပုံ ၃.၂ လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၏ လှိုင်သာယာ ဓာတ်အားခွဲရုံနှင့် YUMRT ဆက်စပ်မှုအနေအထား

ဓာတ်အားလိုင်း (၂) ခုနှင့် ဓာတ်အားခွဲရုံအကြား ဓာတ်အားသွယ်တန်းကြိုး (၂) ကြိုးအား တပ်ဆင်ရန်အတွက် လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာနနှင့် မြန်မာ့မီးရထားမှ ကွင်းဆင်းလေ့လာမှု ပြုလုပ်ထားပါသည်။ ရလာဒ်အားဖြင့် ဓာတ်အားသွယ်တန်းကြိုးနှစ်ခုထဲမှ တစ်ခုကို (၂၃၀) ကီလိုဗို့ဘတ်စ်ရှိသော လှိုင်သာယာ ဓာတ်အားခွဲရုံနှင့် လက်ခံရရှိမည့် ဓာတ်အားခွဲရုံအား ဆက်သွယ်ရန်ဖြစ်သည်။ ပုံ (၄.၈) တွင် ဖော်ပြထားသည့်အတိုင်း ဓာတ်အားသွယ်တန်းကြိုး အလယ်တွင် (၂၃၀) kV မှ (၆၆) kV အားပြောင်းလဲရန် စက်ပစ္စည်းကို လှိုင်သာယာ ဓာတ်အားခွဲရုံ၏ နေရာလွတ်တွင် တပ်ဆင်ပါမည်။ ပုံ (၄.၉) နှင့် (၄.၃၀) တွင် ဖော်ပြထားသည့်အတိုင်း အခြားကျန်ရှိသည့် ဓာတ်အားသွယ်တန်းကြိုးတစ်ခုမှာ (၁၁.၅) ကီလိုမီတာရှိပြီး အနောက်ပိုင်း တက္ကသိုလ်တွင် တည်ဆောက်မည့် ဓာတ်အားခွဲရုံမှ လှိုင်သာယာဓာတ်အားခွဲရုံအား မြေအောက်မှ တိုက်ရိုက်ဆက်သွယ်သွားမည်ဟု ၂၈ရက် သြဂုတ်လ၊ ၂၀၁၉ ခုနှစ်တွင် ကျင်းပခဲ့သည့် တတိယအကြိမ်မြောက် Steering ကော်မတီတွင် အတည်ပြုဆုံးဖြတ်ခဲ့ပါသည်။



ပုံ ၃.၃ MOEE မှ အကြံပြုခဲ့သော ဓာတ်အားသွယ်တန်းကြိုး ၂ ကြိုး၏ လမ်းကြောင်း

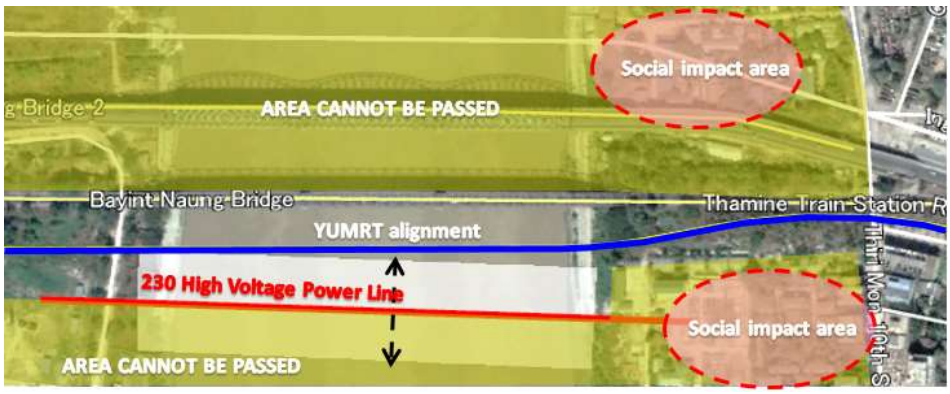


ပုံ ၃.၄ JST မှ အကြံပြုခဲ့သော ဓာတ်အားသွယ်တန်းကြိုး ၂ ကြိုး၏ လမ်းကြောင်း



ပုံ ၃.၅ YUMRT ၏ လျာထားသော ဓာတ်အားသွယ်တန်းကြိုးလမ်းကြောင်း

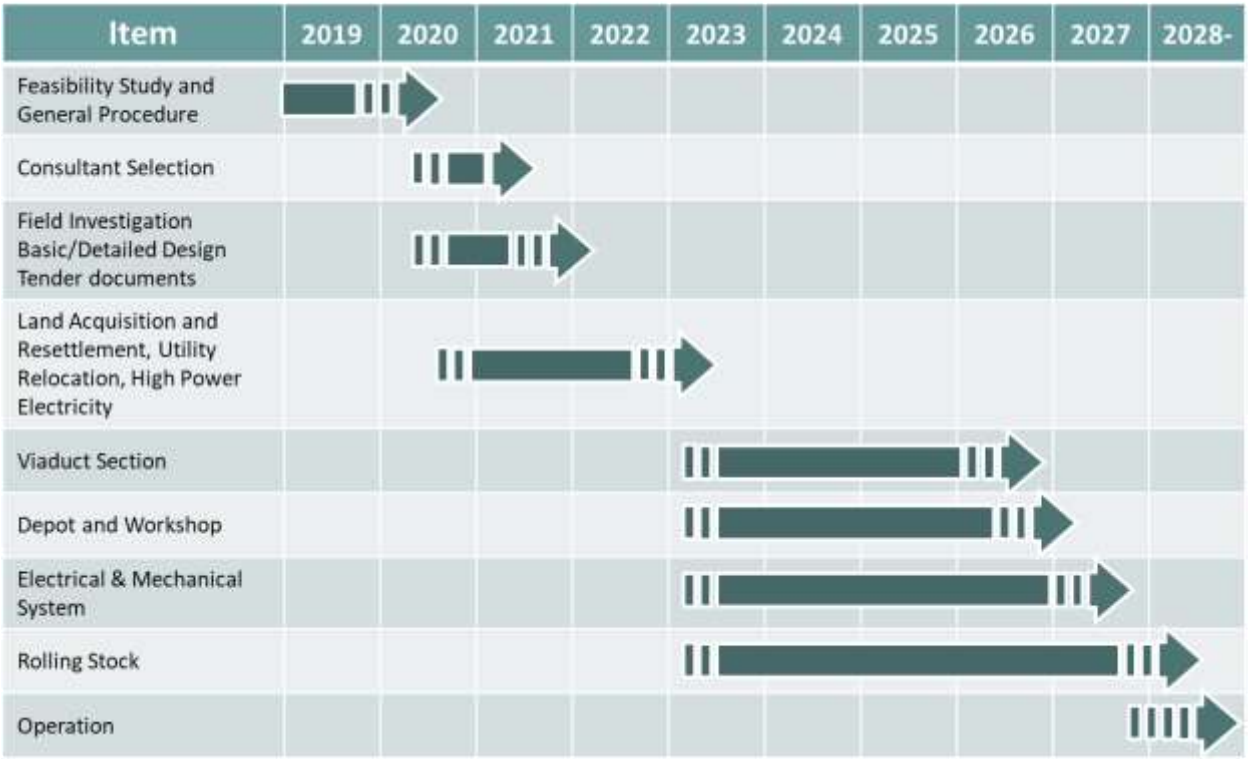
လေ့လာမှုအစတွင် လှိုင်မြစ်ကိုဖြတ်၍ တည်ဆောက်မည့် YUMRT လမ်းကြောင်းအား လက်ရှိ တည်ရှိနေသော ဘုရင့်နောင်တံတား (အဟောင်း) ၏ တောင်ဘက်တွင် သက်ရောက်မှုများကို လျော့နည်းစေရန် လုံလောက်သည့်အကွာအဝေး (လက်ရှိ တံတားအသစ်နှင့် တံတားအဟောင်းကြား အကွာအဝေးနီးတူ-၈၀ မီတာနှင့်အထက်) တွင် တည်ဆောက်ရန် လျာထားပါသည်။ သို့သော် MOEE ၏ လုပ်ထုံးလုပ်နည်းများအရ ပြင်းအားများသော လျှပ်စစ်လိုင်းနှင့် နီးကပ်မှုမရှိစေရန် လမ်းကြောင်းမှာ လက်ရှိ ကားသွားသော တံတားမှ ၅၀ မီတာနှင့်အထက်ရှိသော အကွာဝေးတွင် ဆောက်လုပ်ရမည်ဖြစ်ပါသည်။ သို့ဖြစ်ပါ၍ YUMRT လမ်းကြောင်းမှာ အောက်ဖော်ပြပါပုံတွင် ပါရှိသည့်အတိုင်း ဘုရင့်နောင်တံတား၏ တောင်ဘက် ၄၀-၅၀ မီတာရှိသော အကွာအဝေးတွင် ဆောက်လုပ်ပါမည်။



ပုံ ၃.၆ လှိုင်မြစ်ကို ဖြတ်သွားသော YUMRT လမ်းကြောင်း

၂၀၁၉ ခုနှစ်တွင် စီမံကိန်းမှာ ကနဦးလေ့လာခြင်းအဆင့်ကို ပြုလုပ်ရန် လျာထားခဲ့ပါသည်။ ထိုမှစ၍ အတိုင်ပင်ခံအဖွဲ့အစည်းရွေးချယ်ခြင်း၊ မြေပြင်ကွင်းဆင်းလေ့လာခြင်း၊ အခြေခံ အသေးစိတ်ဒီဇိုင်း ရေးဆွဲခြင်း၊ မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချထားခြင်းလုပ်ငန်းများကို ပြုလုပ်သွား မည်ဖြစ်ပြီး ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်များမှာ ၂၀၂၃ ခုနှစ်အစောပိုင်းတွင် စတင်အကောင်အထည် ဖော်မည်ဖြစ်ပါသည်။ ဆောက်လုပ်ရေးမှာ ၅ နှစ်ခန့်ကြာမြင့်မည်ဖြစ်၍ လုပ်ငန်းစတင်လည်ပတ်ချိန် မှာ ၂၀၂၇ သို့မဟုတ် ၂၀၂၈ ခုနှစ်တွင် စတင်ပါမည်။

ဇယား ၃.၂ ၂၀၁၉ မှစတင်၍ စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်မည့် အချိန်ဇယား



လေ့လာချက်များအရ အဆိုပြုတင်သွင်းခဲ့သည် အခြားဆောင်ရွက်နိုင်သောနည်းလမ်း (၃) ခုကို အောက်တွင် ဖော်ပြထားပါသည်။ ထိုနည်းလမ်းများအား တစ်ခုနှင့်တစ်ခု နှိုင်းယှဉ်၍ စဉ်းစားခဲ့ ပါသည်။

၁။ စီမံကိန်းအား အကောင်အထည်မဖော်ခြင်း

၂။ YUMRT စီမံကိန်း ၁ ဖြစ်သော တောင်-မြောက် လမ်းကြောင်းအား ဆောက်လုပ်ခြင်း

၃။ YUMRT စီမံကိန်း ၂ ဖြစ်သော ရှေ့-နောက် လမ်းကြောင်းအား ဆောက်လုပ်ခြင်း

အကောင်းဆုံးနှင့် အသင့်တော်ဆုံးဖြစ်သည့် ဆောင်ရွက်နိုင်သောနည်းလမ်းကို ရွေးချယ်ရာတွင် အချက်အလက် ၄ ခုပေါ်မူတည်၍ ဆုံးဖြတ်ပါသည်။ အချက်အလက်များဖြစ်သည့်

“ခရီးသည်စီးနင်းမှု”နှင့် “ပတ်ဝန်းကျင်နှင့်လူမှုစီးပွား” တွင် ပါဝင်သောအသေးစိတ် အချက်အလက်များအပေါ် မူတည်၍ ဆုံးဖြတ်ပါသည်။ ထိုသို့ ဆုံးဖြတ်ရာတွင် A မှ E အထိ အဆင့် ၅ ဆင့်ဖြင့် အောက်တွင်ဖော်ပြထားသည့်အတိုင်း ပြုလုပ်ဆောင်ရွက်ပါသည်။

(၁) ခရီးသည်စီးနင်းမှု

ခရီးသည် (တစ်ရက်အသုံးပြုနှုန်း)	ခရီးသည် (တစ်နာရီအတွင်းအသုံးပြုနှုန်း)
A: ၂၀၀၀၀၁ အထက်	A: ၄၀၀၁ အထက်
B: ၁၇၅၀၀၁ မှ ၂၀၀၀၀၀	B: ၃၅၀၁ မှ ၄၀၀၀
C: ၁၅၀၀၀၁ မှ ၁၇၅၀၀၀	C: ၃၀၀၁ မှ ၃၅၀၀
D: ၁၂၅၀၀၁ မှ ၁၅၀၀၀၀	D: ၂၅၀၁ မှ ၃၀၀၀
E: ၁၂၅၀၀၀ အောက်	E: ၂၅၀၀ အောက်

(၂) ကုန်ကျစရိတ်

ဆောက်လုပ်ရေး၊ မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချထားခြင်း အတွက် ကုန်ကျစရိတ် (ဘီလီယမ် – USD)

A: ၂ အောက်

B: ၂.၁–၂.၅

C: ၂.၆–၃.၀

D: ၃.၁–၃.၅

E: ၃.၆ အထက်

(၃) နည်းပညာ

အတားအဆီးများရှိခြင်း၊ မရှိခြင်း

A: မရှိ

B: အတားအဆီးအား ရှောင်လွှဲ၍ရသော

C: ထပ်ဆောင်းလေ့လာရန် လိုအပ်သော

D: ရှောင်လွှဲရန် ခက်ခဲသော

E: ရှောင်လွှဲ၍ မရသော

(၄) ပတ်ဝန်းကျင်နှင့် လူမှုစီးပွား

စီမံကိန်းအနီးတစ်ပိုက်ရှိ သမိုင်းဝင်အဆောက်အအုံ	စီမံကိန်းကြောင့် သက်ရောက်ခံအိမ်ထောင်စု
A: ၀	A: ၀
B: ၁-၃	B: ၁-၅၀၀
C: ၄-၆	C: ၅၀၁-၁၀၀၀
D: ၇-၉	D: ၁၀၀၁-၁၅၀၀
E: ၁၀ အထက်	E: ၁၅၀၁ အထက်

အခြားဆောင်ရွက်နိုင်သော နည်းလမ်းများအား ချင့်ချိန်တွက်ချက်ရာတွင် A=20 points, B=15 points, C=10 points, D=5 points နှင့် E=0 points ဖြင့်တွက်ဆ၍ ဆုံးဖြတ်ပါသည်။ အမှတ်အများဆုံးရသော နည်းလမ်းအား အသင့်တော်ဆုံးနည်းလမ်းအဖြစ် ရွေးချယ်ပါသည်။ နည်းလမ်းတစ်ခုခြင်းစီအတွက် ချင့်ချိန်တွက်ချက်မှု အကျဉ်းချုပ်အား အောက်ပါဇယားတွင် ဖော်ပြထားပါသည်။

နည်းလမ်း ၁: စီမံကိန်းအား အကောင်အထည်မဖော်ခြင်း

<u>လေ့လာတွက်ချက်မှု</u>

စီမံကိန်းအား အကောင်အထည်ဖော်ဆောင်ခြင်းမရှိပါက စီမံကိန်းကြောင့် သက်ရောက်သော နယ်မြေများတွင် မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချထားခြင်းလုပ်ငန်းစဉ်အား လုပ်ဆောင်ရန် မလိုအပ်ပါ။ လက်ရှိ ရန်ကုန်မြို့ပြနေပြည်သူများ၏ ဝင်ငွေမှာ ကိုယ်ပိုင်ကား ဝယ်စီးရန်အတွက်မလုံလောက်သောကြောင့် အဓိက လမ်းပန်းဆက်သွယ်ရေးမှာ ဘတ်စ်ကားလိုင်းများ ဖြစ်ပါသည်။ လစဉ်ဝင်ငွေ အလယ်အလတ်ရှိသော ကိုယ်ပိုင်ကား ဝယ်ယူနိုင်သော လူတန်းစားပမာဏ ပိုမိုတိုးပွားလာခြင်းမတိုင်မီ YUMRT စီမံကိန်းအား ပိုမိုဖွံဖြိုးလားစေရန် အကောင်အထည်ဖော်ဆောင်ဆောင်ရွက်ရပါမည်။ သို့သော် YUMRT စီမံကိန်းကို မဆောင်ရွက်ပါက များပြားလာသော ကိုယ်ပိုင်ယာဉ်များ၊ ဘတ်စ်ကားများနှင့် အငှားယာဉ်များကြောင့် လမ်းအသုံးပြုမှုများပြားလာကာ ကားလမ်းကြောင်း ပိတ်မှုများ ပိုမိုများပြား

လာနိုင်စေပါသည်။ ယာဉ်ကြောပိတ်ဆို့မှုများသည် ပတ်ဝန်းကျင်အပေါ် လေထုညစ်ညမ်းမှု၊ ဆူညံသံနှင့် တုန်ခါမှုများဖြစ်ပေါ် စေနိုင်သည့်အပြင် ယာဉ်အန္တရာယ် ကင်းရှင်းမှုကိုပါ ထိခိုက်စေပါသည်။ ထို့အပြင် အရှိန်ဖြင့်သွားလာနေသော ယာဉ်များ၏ ပိတ်ဆို့မှုများကြောင့် Greenhouse Gas ထွက်ရှိမှုနှုန်းကိုလည်း မြင့်တက်စေပါသည်။ ကောင်းကျိုးများရှိသော်လည်း တစ်ဖက်တွင် စီးပွားရေးနှင့် ပတ်ဝန်းကျင်ကို ထည့်သွင်းစဉ်းစားပါက သက်ရောက်မှုများရှိသည်ကို တွေ့ရပါသည်။ ထိုအတွက်ကြောင့် စီမံကိန်းအား အကောင်အထည်မဖော်ခြင်း နည်းလမ်းအား လိုလားရန် နည်းပါးပါသည်။

နည်းလမ်း ၂: YUMRT စီမံကိန်း ၁ ဖြစ်သော တောင်-မြောက် လမ်းကြောင်းအား ဆောက်လုပ်ခြင်း

<u>လေ့လာတွက်ချက်မှု</u>

တောင်-မြောက်လမ်းကြောင်းမှာ ရန်ကုန်မြို့၏မြောက်ဘက်တွင်ရှိသော နိုင်ငံတကာလေဆိပ်မှ စ၍ လေဆိပ်လမ်းမ၊ ပြည်လမ်း၊ ကမ္ဘာအေးဘုရားလမ်း၊ အင်းယားကန်အရှေ့ဘက်ခြမ်းနှင့် ရန်ကုန်မြစ်ကို ဖြတ်ကာ တောင်ဘက်ရှိ တွံတေးမြို့နယ်သို့ ဆက်သွယ်မည့် လမ်းကြောင်းဖြစ်ပါသည်။ အင်းယားကန်၏ တောင်ဘက်ခြမ်းမှာ လူနေမှုထူထပ်ပြီး စီးပွားရေးလုပ်ငန်းများ များပြားသော ဇုံဧရိယာဖြစ်၍ လုံခြုံစိတ်ချရသည့် ရထားလမ်းကြောင်းအား ဆောက်လုပ်ရန် နေရာအခက်အခဲရှိသည့်အတွက် ဆောက်လုပ်မည့် လမ်းကြောင်းအား မြေအောက်မှသွားရန် လျာထားပါသည်။ ထို့အပြင် မြေအောက်ရထားလမ်းမှာ မိုးပျံရထားဆောက်လုပ်မှုထက် အကုန်အကျပိုမိုများပြားသောကြောင့် ယခုနည်းလမ်းအား လိုလားရန် နည်းပါးပါသည်။

နည်းလမ်း ၃: YUMRT စီမံကိန်း ၂ ဖြစ်သော ရှေ့-နောက် လမ်းကြောင်းအား ဆောက်လုပ်ခြင်း

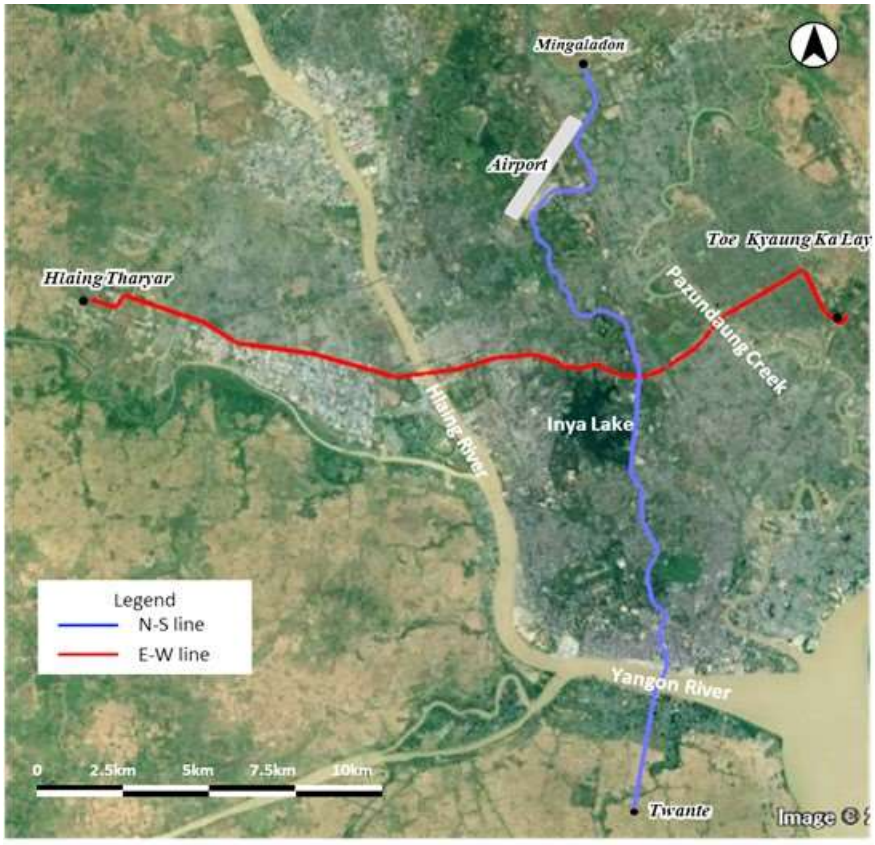
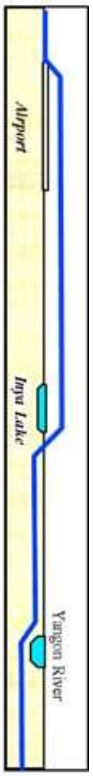
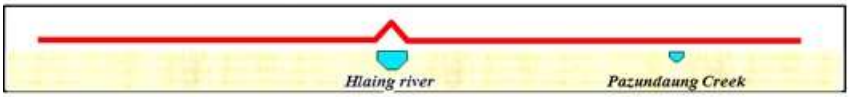
<u>လေ့လာတွက်ချက်မှု</u>

ရှေ့-နောက်လမ်းကြောင်းမှာ ရန်ကုန်မြို့၏အနောက်ဘက်တွင်ရှိသော လှိုင်သာယာဘူတာမှ စထွက်၍ ရန်ကုန်-ပုသိမ်ကားလမ်းမ၊ ထိုမှတစ်ဆင့် လှိုင်မြစ်ကိုဖြတ်၍ ပါရမီလမ်းနှင့် ပင်လုံလမ်းတို့ကို ဖြတ်သန်းဆောက်လုပ်ကာ အရှေ့ဘက်ခြမ်းရှိ တိုးကြောင်ကလေးဘူတာတွင် အဆုံးသတ်ပါသည်။ အရှေ့-အနောက်လမ်းကြောင်းမှာ အခြားသော နည်းလမ်းများနှင့် နှိုင်းယှဉ်ပါက ကုန်ကျစရိတ်မှာ အနည်းပါးဆုံးဖြစ်ပါသည်။ ထို့အပြင် တက္ကသိုလ်များ၊ ဟိုတယ်များရှိသော ပါရမီလမ်းကို ဖြတ်သွားမည်ဖြစ်၍ စီးနင်းလိုက်ပါမည့် ခရီးသည်မှာ ပိုမိုများပြားပါသည်။ အထက်ဖော်ပြပါနည်းလမ်းများနှင့် နှိုင်းယှဉ်ပါက ပါရမီလမ်းနားရှိ Inno City ကဲ့သို့သော ရန်ကုန်မြို့ပြ လူနေမှုအဆင့်အတန်းအား တိုးတက်စေသော စီမံကိန်းများနှင့်လည်း ချိတ်ဆက်သွားလာရန်ပိုမိုလွယ်ကူစေပြီး ပါရမီလမ်းမှာ (၄) လမ်းသွားဖြစ်၍ ဆောက်လုပ်ရေးအတွက် လုံလောက်သော အကျယ်အဝန်းရှိပါသည်။ ပါရမီလမ်းနှင့် နီးသော အရှေ့ဘက်ခြမ်းတွင်

တိုးတက်ရေးစီမံကိန်း စတင်နေပြီဖြစ်သည့်အပြင် လူနေမှုထူထပ်သော နေရာဖြစ်၍ YUMRT ကြောင့် ဖြစ်ပေါ်လာနိုင်သော ဆူညံသံနှင့်တုန်ခါမှုများအပေါ် မကျေနပ်မှုများ ရှိလာနိုင်ပါသည်။ သို့သော်လည်း အရှေ့-အနောက်လမ်းကြောင်းအကြောင့် ဖြစ်ပေါ်လာနိုင်ချေရှိသော ကောင်းကျိုးများမှာ သက်ရောက်နိုင်ချေရှိသော ဆိုးကျိုးများထက် များပြားပါသည်။

အချုပ်အားဖြင့်ဆိုရသော် အထက်ဖော်ပြပါ နည်းလမ်းများအား ခရီးသည်စီးနင်းမှု၊ ကုန်ကျစရိတ်၊ နည်းပညာနှင့် ပတ်ဝန်းကျင်နှင့် လူမှုစီးပွားများအရ တွက်ချက်ကြည့်ပါက ရမှတ်တူညီလုနီးပါး သို့မဟုတ် နည်းသော တောင်-မြောက်လမ်းကြောင်းနှင့် ယှဉ်ကြည့်ပါက အရှေ့-အနောက်လမ်းကြောင်းမှာ ပထမဦးစားပေးအဖြစ် သတ်မှတ်ပါသည်။ ကုန်ကျစရိတ်နှင့် ပတ်ဝန်းကျင်နှင့် လူမှုစီးပွားကို ဦးတည်ထားသော မူဝါဒကို မြန်မာနိုင်ငံ အစိုးရနှင့် တိုင်ပင်ဆွေးနွေးပြီးနောက် အရှေ့-အနောက် လမ်းကြောင်းကို အတည်ပြုခြင်းဖြစ်ပါသည်။

ဇယား ၃.၃ အခြားဆောင်ရွက်နိုင်သောနည်းလမ်းများအား နှိုင်းယှဉ်ဖော်ပြချက် (တောင်-မြောက် နှင့် အရှေ့-အနောက် လမ်းကြောင်း)

လမ်းကြောင်း	N–S line		E–W line	
Outline	လမ်းကြောင်းအရှည်: ၂၇.၄ ကီလိုမီတာ မြေအောက်လမ်းကြောင်းအရှည်: ၇.၉ ကီလိုမီတာ		လမ်းကြောင်းအရှည်: ၂၅.၂ ကီလိုမီတာ မြေအောက်လမ်းကြောင်းမရှိပါ။	
လမ်းကြောင်းပြဓြေပုံ Side-view				
				
	Side-view (အရှေ့-အနောက်လမ်းကြောင်း)			
ခရီးသည်စီးနင်းမှု	ခရီးသည်: တစ်ရက်လျှင် လူဦးရေ ၁၀၅၄၀၀၀ တစ်နာရီလျှင် လူဦးရေ ၂၃၂၀၀	E E (ပျမ်းမျှ: 0)	ခရီးသည်: တစ်ရက်လျှင် လူဦးရေ ၁၇၇၀၀၀၀ တစ်နာရီလျှင် လူဦးရေ ၄၄၃၀၀	B A (ပျမ်းမျှ: 17.5)
ကုန်ကျစရိတ်	ဆောက်လုပ်ရေးကုန်ကျစရိတ်: အမေရိကန် ဒေါ်လာ ၃.၃ ဘီလီယံ	D	ဆောက်လုပ်ရေးကုန်ကျစရိတ်: အမေရိကန် ဒေါ်လာ ၂.၅ ဘီလီယံ	B
နည်းပညာ	အတားအဆီး : ဆူးလေဘုရားအတွက် ထပ်ဆောင်း ကွင်းဆင်းလေ့လာမှု လိုအပ်	C	အတားအဆီး : လျှပ်စစ်သွယ်တန်းကြိုးအတွက် ထပ်ဆောင်း ကွင်းဆင်းလေ့လာမှု လိုအပ်	C

ပတ်ဝန်းကျင်နှင့် လူမှုစီးပွား	ရှေးဟောင်းအဆောက်အအုံ: ၉ စီမံကိန်းကြောင့် သက်ရောက်မည့် အိမ်ထောင်စု: ၇၀၀	D C (ပျမ်းမျှ: 7.5)	ရှေးဟောင်းအဆောက်အအုံ: ၁ စီမံကိန်းကြောင့် သက်ရောက်မည့် အိမ်ထောင်စု: ၄၅၀	B B (ပျမ်းမျှ: 15)
အကဲဖြတ်မှု	ရမှတ် = ၂၂.၅		**အခြားဆောင်ရွက်နိုင်သောနည်းလမ်း** ရမှတ်= **၅၇.၅**	

အပိုင်း (၄) အနီးအနားပတ်ဝန်းကျင်ဆိုင်ရာ ဖော်ပြချက်

စီမံကိန်း၏ အနီးအနားပတ်ဝန်းကျင်ရှိ လူမှုရေးဆိုင်ရာ အချက်အလက်များဖြစ်သော လူဦးရေ၊ စီးပွားရေးအခြေအနေနှင့် ကျန်းမာရေးအခြေအနေများ၊ ပတ်ဝန်းကျင်ဆိုင်ရာ အချက်အလက်များဖြစ်သော ဘူမိဗေဒ၊ ဧလဗေဒနှင့် မြေမျက်နှာသွင်ပြင်အနေအထားများကို သက်ဆိုင်ရာ မြို့နယ်များရှိ အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာနများမှ ရယူထားပါသည်။ (အသေးစိတ်အချက်အလက်များကို အခန်း (၅) တွင် ကြည့်ရှုပါရန်။)

လက်တွေ့မြေပြင်ကွင်းဆင်းလေ့လာမှုများမှာ ခြောက်သွေ့ရာသီနှင့် စိုစွတ်ရာသီတွင် စီမံကိန်းလမ်းကြောင်း တစ်လျှောက်ရှိ လေထုအရည်အသွေးကို တိုင်းတာခြင်း (၁၈) နေရာ၊ မြေပေါ်ရေ အရည်အသွေးကို (၂၁) နေရာ၊ မြေအောက်ရေ အရည်အသွေးကို (၁၂) နေရာ၊ ဆူညံသံနှင့်တုန်ခါမှုကို (၃၅) နေရာ၊ မြေဆီလွှာ အရည်အသွေးကို (၁၁) နေရာနှင့် နုန်းအနည်အနှစ်အရည်အသွေးကို (၄) နေရာအသီးသီး တိုင်းတာမှုများ ပြုလုပ်ခဲ့ပါသည်။

ခြောက်သွေ့ရာသီတွင် တိုင်းတာထားသော ရလဒ်များအရ A–1 တွင် နိုက်ထရိုဂျင် ဒိုင်အောက်ဆိုဒ်၊ ကာဗွန်မိုနောက်ဆိုဒ်၊ အိုဇုန်း နှင့် ဆာလဖာဒိုင်အောက်ဆိုဒ်မှာ သတ်မှတ်ထားသော အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်ထက် ကျော်လွန်နေပါသည်။ စိုစွတ်ရာသီတွင် အချို့သော နေရာများရှိ PM တန်ဖိုးမှာ လမ်းညွှန်ချက်အောက် ရောက်ရှိနေသည်ကိုတွေ့ရှိရ ပါသည်။ မြေပေါ်ရေ အရည်အသွေးအား တိုင်းတာရာတွင် အချို့သော နေရာများ၌ BOD၊ COD၊ Total Nitrogen နှင့် TSS တန်ဖိုးများမှာ သတ်မှတ်ထားသော အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်ထက် ကျော်လွန်နေပါသည်။ အထူးသဖြင့် လှိုင်မြစ်ကဲ့သို့ ပျော်ဝင်မှုနှုန်းများ သော နေရာများတွင် တွေ့ရပါသည်။ မြေအောက်ရေ အရည်အသွေးကို မြန်မာနိုင်ငံ ကျန်းမာရေးဝန်ကြီးဌာနမှ ထုတ်ပြန်ထားသော အမျိုးသားသောက်သုံးရေစံချိန်စံညွှန်းနှင့် နှိုင်းယှဉ်ပါသည်။ GW 12 မှလွဲ၍ ရေတွင်းများတွင် Arsenic ပါဝင်မှုကို မတွေ့ရှိပါ။ GW 2 နှင့် GW 10 များတွင် သံဓာတ်ပါဝင်မှုနှုန်းမှာ သတ်မှတ်စံနှုန်းထက် များပြားနေသည်ကို တွေ့ရပါသည်။

တိုင်းတာရရှိသော ရလဒ်များအရ နေ့အချိန်နှင့် ညအချိန် ဆူညံသံနှင့် တုန်ခါမှု တိုင်းတာမှုတွင် NV–1၊ NV–26၊ NV–29 နှင့် NV–32 များမှ လွဲ၍ လမ်းကြောင်းတစ်လျှောက် (Type–A) ရှိ ဆူညံမှုများမှာ သတ်မှတ်ထားသော လမ်းညွှန်ချက်ထက် ပိုနေသည်ပါသည်။ အထူးသဖြင့် ပါရမီလမ်းတစ်လျှောက်ရှိ အချို့နေရာများတွင် နေ့အချိန်ရှိသင့်သော ဆူညံသံအဆင့်ထက် 80d ပိုနေသည်ပါသည်။ Type–B ကဲ့သို့ လမ်းကြောင်းတွင် တစ်နေ့လုံးတိုင်းတာသော NV–23 နှင့် နေ့အချိန်တိုင်းတာသော NV–4၊ NV–10 နှင့် NV–17 များမှ လွဲ၍ ကျန်သည့်နေရာများမှာ နေ့နှင့်ညအချိန်များတွင် သတ်မှတ်ထားသော

ဆူညံသံအဆင့်အောက် ရောက်ရှိပါသည်။ တုန်ခါမှုနှုန်းများမှာ ဂျပန်နိုင်ငံ ပတ်ဝန်းကျင်ဝန်ကြီးဌာန မှသတ်မှတ်ထားသော တုန်ခါမှုစံနှုန်းအတွင်းတွင် ရှိပါသည်။

မြေဆီလွှာအရည်အသွေးကို စစ်ဆေးရာတွင် ထိုင်းနိုင်ငံမှ သတ်မှတ်ထားသော လမ်းညွှန်ချက်များ ဖြင့်နှိုင်းယှဉ်ကြည့်ရာ Arsenic မှလွဲ၍ အခြားပါဝင်မှုများမှာ စံသတ်မှတ်ချက်အတွင်းရှိပါသည်။ နုန်းအနယ်အနှစ် အရည်အသွေးကို နှိုင်းယှဉ်လေ့လာရန် လမ်းညွှန်ချက်မရှိပါ။

ဇယား ၄.၁ ပတ်ဝန်းကျင်လေထု အရည်အသွေးကို တိုင်းတာရရှိသော ရလဒ် (ယူနစ်- µg/m^3, ppm)

တည်နေရာ	ရာသီ	စံနှုန်းများ (အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက် NEQ နှင့် Australian Ambient Air Quality Standards, NEPM)					
		PM_{10} (ပျမ်းမျှ ၂၄ နာရီ)	$PM_{2.5}$ (ပျမ်းမျှ ၂၄ နာရီ)	NO_2 (ပျမ်းမျှ ၁ နာရီ)	SO_2 (ပျမ်းမျှ ၂၄ နာရီ)	CO (ပျမ်းမျှ ၈ နာရီ)	O_3 (ပျမ်းမျှ ၈ နာရီ)
		၅၀ µg/m^3 (NEQ)	၂၅ µg/m^3 (NEQ)	၂၀၀ µg/m^3 (NEQ)	၂၀ µg/m^3 (NEQ)	၉ ppm (Air NEPM)	၁၀၀ µg/m^3 (NEQ)
		ရလဒ်များ					
A-1	ခြောက်သွေ့ရာသီ	၁၈၀	၁၁၂	၈၉	၂	၀	၆၇
	စိုစွတ်ရာသီ	၅၁	၃၃	၁၀၂	၄၅	၀	၆
A-2	ခြောက်သွေ့ရာသီ	၁၉၉	၁၃၄	၉၅	၂၀၈	၂*၁၀$^{-၈}$	၄၁
	စိုစွတ်ရာသီ	၄၉	၃၂	၇၄	၃၉	၂*၁၀$^{-၅}$	၁၀
A-3	ခြောက်သွေ့ရာသီ	၂၂၅	၁၃၆	၉၃	၂၅၆	၃*၁၀$^{-၈}$	၅၇
	စိုစွတ်ရာသီ	၆၀	၄၃	၄၁	၄၇	၃.၇*၁၀$^{-၄}$	၈
A-4	ခြောက်သွေ့ရာသီ	၁၈၈	၁၃၃	၁၀၅	၄၂၆	၃ *၁၀$^{-၇}$	၆၁
	စိုစွတ်ရာသီ	၅၈	၄၁	၄၃	၄၅	၃.၈*၁၀$^{-၄}$	၁၂
A-5	ခြောက်သွေ့ရာသီ	၂၂၈	၁၄၇	၉၂	၄၀၅	၃ *၁၀$^{-၇}$	၆၃

တည်နေရာ	ရာသီ	စံနှုန်းများ (အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက် NEQ နှင့် Australian Ambient Air Quality Standards, NEPM)					
		PM_{10} (ပျမ်းမျှ ၂၄ နာရီ)	$PM_{2.5}$ (ပျမ်းမျှ ၂၄ နာရီ)	NO_2 (ပျမ်းမျှ ၁ နာရီ)	SO_2 (ပျမ်းမျှ ၂၄ နာရီ)	CO (ပျမ်းမျှ ၈ နာရီ)	O_3 (ပျမ်းမျှ ၈ နာရီ)
		၅၀ µg/m³ (NEQ)	၂၅ µg/m³ (NEQ)	၂၀၀ µg/m³ (NEQ)	၂၀ µg/m³ (NEQ)	၉ ppm (Air NEPM)	၁၀၀ µg/m³ (NEQ)
		ရလဒ်များ					
	စိုစွတ်ရာသီ	၆၁	၃၉	၁၀၂	၃၈	၄.၃*၁၀⁻⁶	၈
A-6	ခြောက်သွေ့ ရာသီ	၂၁၁	၁၄၁	၇၄	၄၇၇	၀	၇၅
	စိုစွတ်ရာသီ	၄၅၄	၇၄	၅	၄၅	၁.၂*၁၀⁻⁶	၁၄
A-7	ခြောက်သွေ့ ရာသီ	၁၉၀	၁၁၀	၉၈	၃၄၈	၀	၆၁
	စိုစွတ်ရာသီ	၁၅၄	၆၁	၄	၄၃	၄*၁၀⁻⁶	၂
A-8	ခြောက်သွေ့ ရာသီ	၂၄၈	၁၁၃	၉၉	၆၂၁	၁*၁၀⁻⁵	၅၅
	စိုစွတ်ရာသီ	၃၃	၃၄	၁၈	၂၂	၉*၁၀⁻⁵	၁၂
A-9	ခြောက်သွေ့ ရာသီ	၁၅၈	၈၆	၉၃	၅၁၄	၁.၂*၁၀⁻⁶	၅၁
	စိုစွတ်ရာသီ	၃၈	၂၅	၇၄	၇၅	၃.၅*၁၀⁻⁶	၁၀
A-10	ခြောက်သွေ့ ရာသီ	၁၆၉	၁၂၉	၁၂၇	၅၅၁	၇*၁၀⁻⁵	၅၇
	စိုစွတ်ရာသီ	၃၉	၁၆	၄	၂၂	၁.၂*၁၀⁻⁶	၆
A-11	ခြောက်သွေ့ ရာသီ	၁၆၉	၁၃၁	၁၁၃	၅၁၄	၁*၁၀⁻⁵	၆၉
	စိုစွတ်ရာသီ	၅၃	၃၂	၄၇	၃၉	၁.၅*၁၀⁻⁶	၁၄
A-12	ခြောက်သွေ့	၁၈၁	၁၂၈	၁၄၀	၅၅၁	၇*၁၀⁻⁵	၆၇

တည်နေရာ	ရာသီ	စံနှုန်းများ (အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက် NEQ နှင့် Australian Ambient Air Quality Standards, NEPM)					
		PM_{10} (ပျမ်းမျှ ၂၄ နာရီ)	$PM_{2.5}$ (ပျမ်းမျှ ၂၄ နာရီ)	NO_2 (ပျမ်းမျှ ၁ နာရီ)	SO_2 (ပျမ်းမျှ ၂၄ နာရီ)	CO (ပျမ်းမျှ ၈ နာရီ)	O_3 (ပျမ်းမျှ ၈ နာရီ)
		၅၀ µg/m^3 (NEQ)	၂၅ µg/m^3 (NEQ)	၂၀၀ µg/m^3 (NEQ)	၂၀ µg/m^3 (NEQ)	၉ ppm (Air NEPM)	၁၀၀ µg/m^3 (NEQ)
		ရလဒ်များ					
	ရာသီ						
	စိုစွတ်ရာသီ	၅၀	၂၉	၃၇	၃၉	၃.၃*၁၀$^{-၄}$	၄
A-13	ခြောက်သွေ့ ရာသီ	၃၁၃	၁၀၄	၉၃	၅၂၄	၁.၅*၁၀$^{-၇}$	၆၅
	စိုစွတ်ရာသီ	၃၃	၂၁	၂၁	၂၇	၃*၁၀$^{-၄}$	၁၄
A-14	ခြောက်သွေ့ ရာသီ	၁၅၃	၉၀	၁၇၇	၆၁၂	၁.၇*၁၀$^{-၇}$	၇၁
	စိုစွတ်ရာသီ	၄၃	၁၈	၁၉	၄၅	၁.၃*၁၀$^{-၄}$	၁၂
A-15	စိုစွတ်ရာသီ	၃၁	၁၆	၉၉	၁၂	၂.၉*၁၀$^{-၇}$	၂၃
A-16	စိုစွတ်ရာသီ	၅၇	၂၆	၉၃	၂၂	၁.၄*၁၀$^{-၅}$	၂၀
A-17	စိုစွတ်ရာသီ	၆၉	၃၀	၉၂	၂၄	၄.၄*၁၀$^{-၅}$	၂၆
A-18	စိုစွတ်ရာသီ	၆၇	၃၇	၈၄	၂၂	၂.၉*၁၀$^{-၇}$	၂၁

Source: E Guard Study Team

ဇယား ၄.၂ မြေပေါ်ရေ အရည်အသွေးကို တိုင်းတာရရှိသော ရလဒ်

အတိုင်းအတာ	ရာသီ	တည်နေရာ										အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်	ယူနစ်	ဓာတ်ခွဲခန်းအမည်
		SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10			
Temperature	ခြောက်သွေ့ ရာသီ	၂၉.၁	၃၀.၃	၂၇.၅	၂၉.၃	၂၉.၃	၂၉.၅	၃၀.၄	၃၁	၃၀.၈	30.6	–	°C	Onsite
	စိုစွတ်ရာသီ	၃၀.၆	၃၀.၄	၂၈.၄	၂၈.၃	၂၈.၃	၃၀.၇	၂၉.၂	၂၉.၇	၂၉.၁	၂၉.၁			
pH	ခြောက်သွေ့ ရာသီ	၇.၃	၇.၄	၇.၁	၇.၃	၆.၈	၇.၁	၇.၈	၇.၈	၇.၈	၇.၇	၆.၀–၉.၀၁		ISO
	စိုစွတ်ရာသီ	၇.၁	၆.၉	၆.၈	၇.၁	၇.၂	၇.၈	၇.၆	၇.၅	၇.၄	၇.၃			
Turbidity	ခြောက်သွေ့ ရာသီ	၂၆၈	၆၆	၁၉၈	၁၃၀	၂၁၂	၂၂၀	၂၂၀၀	၂၀၀၀	၃၄၀၀	၃၂၀၀	–	NTU	ISO
	စိုစွတ်ရာသီ	၄၆	၂၉	၂၂	၆၈	၅၅	၈၉	၁၂၂	၁၃၆	၁၄၄	၁၄၀			
Total Organic Carbon (TOC)	ခြောက်သွေ့ ရာသီ	၁၄	၁၁.၉၄	၂၆.၆	၃၉.၈၂	၄၂.၃၃	၃၃.၇၄	၃.၆၇	၃.၂၉	၃.၂၇	၃.၃၂	–	mg/L	UAE
	စိုစွတ်ရာသီ	၅.၁	၄.၀၅	၁၁.၉၅	၄.၉၈	၈.၉၃	၆.၀၂	၄.၆	၂.၇၁	၅.၂၄	၄.၈၅			
Biological Oxygen Demand	ခြောက်သွေ့	၃၁	၃၀	၉၂	၄၄	၅၄	၃၁	၂၀	၂၅	၁၂	၅၈	၃၀	mg/L	SGS

အတိုင်းအတာ	ရာသီ	တည်နေရာ										အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်	ယူနစ်	ဓာတ်ခွဲခန်းအမည်
		SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10			
(BOD)	ရာသီ													
	စိုစွတ်ရာသီ	၅	၆	၅	၁၂	၁၃	၈	၁၅	၇	၁၄	၁၁			
Chemical Oxygen Demand (COD)	ခြောက်သွေ့ ရာသီ	၅၇	၅၈	၁၆၇	၁၇၅	၂၃၆	၂၆၄	၉၅	၁၆၄	၁၈၈	၁၅၂	၂၅၀	mg/L	SGS
	စိုစွတ်ရာသီ	၂၆	၂၈	၄၀	၆၉	၆၈	၂၀	၂၅	၁၂	၁၉	၂၁			
Total Nitrogen (T-N)	ခြောက်သွေ့ ရာသီ	၁.၁၂	<၁	၁၄	၂၉.၆၈	၃၅.၂၈	<၁	၂.၂၄	၃.၃၆	၂.၈၀	၃.၃၆	၁၅	mg/L	SGS
	စိုစွတ်ရာသီ	<၁	<၁	၁.၈၂	၁.၉၆	၃.၃၆	<၁	၅.၆	၆.၁၆	၆.၁၆	၇			
Total Phosphorous (T-P)	ခြောက်သွေ့ ရာသီ	၀.၀၅	၀.၀၃	၀.၇၈	၀.၀၂	၁.၃၇	<၀.၀၁	၀.၂၉	၀.၉၆	၀.၅၈	၀.၄၆	၅	mg/L	SGS
	စိုစွတ်ရာသီ	၀.၀၅	၀.၀၃	၁.၀၇	၁.၄၉	၁.၂၁	၀.၁၀	၀.၆၃	၀.၁၅	၀.၅၇	၀.၇၅			
Oil and Grease	ခြောက်သွေ့ ရာသီ	<၅	၇.၉	<၅	<၅	၅.၈	<၅	<၅	<၅	<၅	<၅	၁၀	mg/L	SGS
	စိုစွတ်ရာသီ	<၅	<၅	<၅	<၅	၅.၅၂	<၅	<၅	<၅	<၅	<၅			

အတိုင်းအတာ	ရာသီ	တည်နေရာ										အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်	ယူနစ်	ဓာတ်ခွဲခန်းအမည်
		SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10			
Total Suspended Solid (TSS)	ခြောက်သွေ့ရာသီ	<၂၀	<၂၀	၁၅၉	၅၅	၅၄	၄၀	၁၁၂၇	၂၅၉၉	၂၈၈၀	၂၈၁၂	၂၅	mg/L	SGS
	စိုစွတ်ရာသီ	၂၆	၂၃	၃၄	၂၁	၂၄	၁၅	၃၂၈	၃၇၆	၃၉၃	၅၅၅			
Dissolved Oxygen (DO)	ခြောက်သွေ့ရာသီ	၃.၆	၄	Nil	Nil	Nil	Nil	၅.၈	၆.၂	၅.၆	၅.၆	-	mg/L	Supreme
	စိုစွတ်ရာသီ	၅.၂	၄.၇	၃.၃	၃.၁	၃	၄.၃	၄.၄	၄	၄.၄	၃.၇			
Total Coliform Count	ခြောက်သွေ့ရာသီ	၁၂	၁၀	၁၀၀	၈၀	၆၀	၆၀	၉၀	၃	၁၁၀	၁၀၀	-	CFU/ 100ml	ISO
	စိုစွတ်ရာသီ	၅	၄	၆	၂၀	၁၂	၁၀	၁၄	၁၆	၁၂	၁၄			
Water Level	ခြောက်သွေ့ရာသီ	၂.၅	၂.၅	၂	၂	၁	၀.၈	၂၃	၂၃	၂၃	၂၃	-	m	Onsite
	စိုစွတ်ရာသီ	၃	၃	၃	၄.၅	၂.၅	၁.၅	၄၀	၄၀	၄၀	၄၂			

Source: E Guard Study Team

ဇယား ၄.၃ မြေအောက်ရေ အရည်အသွေးကို တိုင်းတာရရှိသော ရလဒ်

အတိုင်းအတာ	ရာသီ	တည်နေရာ												အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်	ယူနစ်	ဓာတ်ခွဲခန်းအမည်
		GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW 9	GW 10	GW 11	GW 12			
pH	ခြောက်သွေ့ရာသီ	၇.၂	၆.၈	၆.၇	၆.၅	၆.၉	၆.၅	၆.၆	၆.၂	၇.၁	၆.၅	၆.၇	၆.၉	၆.၅–၈.၅		ISO
	စိုစွတ်ရာသီ	၇.၁	၇.၂	၆.၇	၆.၆	၆.၇	၆.၂	၆.၄	၆.၄							
Total Dissolved Solids (TDS)	ခြောက်သွေ့ရာသီ	၅၀၄၈	၂၆၈၁	၂၇၅၉	၂၇၄၂	၃၅၇	၃၄၇	၈၁၉	၃၈	၆၁၄	၉၁	၂၇၀၈	၁၀၀	၁၀၀၀	mg/l	SGS
	စိုစွတ်ရာသီ	၄၅၆၇	၂၇၀၆	၂၇၃၁	၂၉၂၂	၃၂၀	၃၄၀	၃၉၀	၈၈							
Arsenic (As)	ခြောက်သွေ့ရာသီ	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	၀.၀၁	၀.၀၅	mg/l	
	စိုစွတ်ရာသီ	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil							
Iron (Fe)	ခြောက်သွေ့ရာသီ	၀.၂၁	၅၀.၁၇	၀.၃၈	၀.၅၈	၀.၃၄	၀.၁၆	၀.၂၉	၀.၀၃	၀.၂၇	၇.၃၁	<၀.၀၁	<၀.၀၁	၁	mg/l	SGS
	စိုစွတ်ရာသီ	၀.၄၄	၉.၅၉	၀.၄၁	၁.၀၇	၀.၂၁	၀.၀၆	<၀.၀၁	<၀.၀၁							
Manganese	ခြောက်သွေ့	၂.၂	၅.၈	၂.၃	၃	၁.၂	၂.၃	၁.၉	-	၀.၀၄	၁	၀.၀၂	၁.၂	၀.၄	mg/l	Supreme

(Mn)	ရာသီ															
	စိုစွတ်ရာသီ	၀.၆	၂.၅	၂.၅	၁.၁	၀.၇	၁.၈	၁.၃	၀.၉							
Chloride	ခြောက်သွေ့ ရာသီ	၂၅၉၁	၁၄၂၅	၁၄၅၃	၁၅၇၈	၁၀၆	၁၃၅	၃၃၇	၁၃	၂၄၃	၉	၁၃၉၃	၃.၅	၂၅၀	mg/l	SGS

ဇယား ၄.၄ ဆူညံမှုအဆင့် တိုင်းတာရရှိသော ရလဒ်

အမှတ်	ရက်စွဲ	တည်နေရာ (A:လမ်းကြောင်းတစ်လျှောက်, B:receptor)		Upper: Latitude Lower: Longitude	အချိန်	LAeq (dB)	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်)
NV-1	၁၈.၃.၂၀၁၉	လှိုင်သာယာလမ်း	A	16°52'44.20"N	နေ့	၅၀.၆	၇၀ (နေ့ / ည)
				96°0'37.97"E	ည	၅၂.၉	
NV-2	၁၈.၃.၂၀၁၉	လှိုင်သာယာလမ်း	B	16°52'45.02"N	နေ့	၆၇.၉	
				96°0'39.80"E	ည	၅၇.၄	
NV-3	၁၉.၃.၂၀၁၉	ဒဂုံ-ဧရာ ကားမှတ်တိုင်	A	16°52'42.16"N	နေ့	၇၆.၉	
				96°1'22.54"E	ည	၇၄.၅	
NV-4	၁၉.၃.၂၀၁၉	ဒဂုံ-ဧရာ ကားမှတ်တိုင်	B	16°52'40.22"N	နေ့	၈၆.၃	
				96°1'21.51"E	ည	၆၄.၉	
NV-5	၂၀.၃.၂၀၁၉	BOC နှင့်တွဲ့တေးကြား ဆုံမှတ်	A	16°52'16.40"N	နေ့	၇၀.၂	
				96°2'22.27"E	ည	၇၃.၆	
NV-6	၂၀.၃.၂၀၁၉	BOC နှင့်တွဲ့တေးကြား ဆုံမှတ်	B	16°52'14.86"N	နေ့	၆၆.၃	
				96°2'21.39"E	ည	၄၈.၁	
NV-7	၂၁.၃.၂၀၁၉	မီးခွက်ဈေး	A	16°51'53.44"N	နေ့	၇၃.၃	
				96°3'7.67"E	ည	၇၁.၉	
NV-8	၂၁.၃.၂၀၁၉	မီးခွက်ဈေး	B	16°51'54.41"N	နေ့	၆၄.၆	
				96°3'7.67"E	ည	၆၅.၅	
NV-9	၂၂.၃.၂၀၁၉	နဝဒေးအိမ်ရာ	A	16°51'43.99"N	နေ့	၇၁.၄	
				96°3'51.73"E	ည	၇၂.၇	
NV-10	၂၂.၃.၂၀၁၉	နဝဒေးအိမ်ရာ	B	16°51'43.08"N	နေ့	၇၃.၆	
				96°3'51.30"E	ည	၆၁.၈	
NV-11	၂၃.၃.၂၀၁၉	FMI	A	16°51'20.87"N	နေ့	၇၁.၄	
				96°5'8.25"E	ည	၇၄.၆	
NV-12	၂၃.၃.၂၀၁၉	FMI	B	16°51'22.06"N	နေ့	၆၂.၇	

အမှတ်	ရက်စွဲ	တည်နေရာ (A:လမ်းကြောင်းတစ်လျှောက်, B:receptor)		Upper: Latitude Lower: Longitude	အချိန်	LAeq (dB)	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်)
				96°5'8.88"E	ည	၆၅.၃	
NV-13	၂၄.၃.၂၀၁၉	ဘုရင့်နောင်တံတားအောက်	B	16°51'22.78"N	နေ့	၅၉.၉	
				96°6'0.63"E	ည	၅၉.၁	
NV-14	၂၅.၃.၂၀၁၉	ဘုရင့်နောင်ပွဲရုံ (သီရိမွန် ပလာဇာ)	A	16°51'31.64"N	နေ့	၇၃	
				96°6'22.17"E	ည	၇၅.၂	
NV-15	၂၅.၃.၂၀၁၉	ဘုရင့်နောင်ပွဲရုံ (သီရိမွန် ပလာဇာ)	B	16°51'29.57"N	နေ့	၆၆.၂	
				96°6'22.84"E	ည	၅၆.၈	
NV-16	၂၆.၃.၂၀၁၉	ပါရမီလမ်းနှင့် လမ်း ၅၀ အရှေ့ဘက် ဆုံမှတ်	A	16°51'26.73"N	နေ့	၈၂.၈	
				96°7'11.08"E	ည	၇၅.၈	
NV-17	၂၆.၃.၂၀၁၉	ပါရမီလမ်းနှင့် လမ်း ၅၀ အရှေ့ဘက် ဆုံမှတ်	B	16°51'25.11"N	နေ့	၇၇.၈	
				96°7'11.38"E	ည	၆၀.၉	
NV-18	၂၈.၃.၂၀၁၉	ပါရမီလမ်းနှင့် အင်းစိန်လမ်း ဆုံမှတ်	A	16°51'27.62"N	နေ့	၈၀.၁	
				96°7'24.29"E	ည	၇၂.၃	
NV-19	၂၈.၃.၂၀၁၉	ပါရမီလမ်းနှင့် လမ်း ၅၀ အရှေ့ဘက် ဆုံမှတ်	B	16°51'27.94"N	နေ့	၆၁.၉	၇၀ (နေ့ / ည)
				96°7'23.48"E	ည	၆၉.၂	
NV-20	၂.၄.၂၀၁၉	IT တက္ကသိုလ်	A	16°51'19.20"N	နေ့	၇၁.၂	
				96°8'7.62"E	ည	၇၀.၃	
NV-21	၂.၄.၂၀၁၉	IT တက္ကသိုလ်	B	16°51'17.80"N	နေ့	၅၈.၅	
				96°8'7.03"E	ည	၅၇.၆	
NV-22	၂၉.၃.၂၀၁၉	ပြည်လမ်းနှင့် ပါရမီလမ်းဆုံမှတ်	A	16°51'12.86"N	နေ့	၇၈.၃	
				96°8'25.89"E	ည	၇၅.၅	
NV-23	၂၉.၃.၂၀၁၉	ပြည်လမ်းနှင့် ပါရမီလမ်းဆုံမှတ်	B	16°51'14.34"N	နေ့	၇၃.၂	
				96°8'26.88"E	ည	၇၃.၈	
NV-24	၃၀.၃.၂၀၁၉	အင်းယားကန် အရှေ့မြောက်လမ်း	A	16°51'6.97"N	နေ့	၈၁.၅	

အမှတ်	ရက်စွဲ	တည်နေရာ (A:လမ်းကြောင်းတစ်လျှောက်, B:receptor)		Upper: Latitude Lower: Longitude	အချိန်	LAeq (dB)	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်)
				96°8'58.42"E	ည	၈၃.၂	
NV-25	၃၀.၃.၂၀၁၉	အင်းယားကန် အရှေ့မြောက်လမ်း	B	16°51'5.24"N	နေ့	၅၉.၃	
				96°8'57.20"E	ည	၅၈.၅	
NV-26	၂၄.၃.၂၀၁၉	ပါရမီဆေးရုံ	A	16°50'59.68"N	နေ့	၆၆.၃	
				96°9'23.47"E	ည	၆၇.၂	
NV-27	၃၁.၃.၂၀၁၉	ပါရမီလမ်းနှင့် ကမ္ဘာအေးလမ်းဆုံမှတ်	A	16°51'0.25"N	နေ့	၇၆.၃	
				96°9'29.01"E	ည	၇၃.၅	
NV-28	၃၁.၃.၂၀၁၉	ပါရမီလမ်းနှင့် ကမ္ဘာအေးလမ်းဆုံမှတ်	B	16°50'58.13"N	နေ့	၅၇.၂	
				96°9'29.13"E	ည	၅၈.၄	
NV-29	၃.၄.၂၀၁၉	Rainbow မူကြိုကျောင်းရှေ့	A	16°51'5.98"N	နေ့	၆၆.၆	
				96°9'49.35"E	ည	၆၃.၂	
NV-30	၁၀.၅.၂၀၁၉	ပါရမီလမ်း	B	16°51'9.40"N	နေ့	၆၁.၄	
				96°9'55.09"E	ည	၆၀.၈	
NV-31	၁၀.၅.၂၀၁၉	ပါရမီလမ်း	B	16°51'10.04"N	နေ့	၆၁.၁	
				96°9'54.54"E	ည	၆၁.၄	
NV-32	၁၄.၈.၂၀၁၉	အနောက်ပိုင်းတက္ကသိုလ်	A	16°56'20.15"N	နေ့	၆၅.၇	
				96° 2'27.62"E	ည	၆၃.၉	
NV-33	၁၅.၈.၂၀၁၉	ထန်းတပင်မြို့နယ် ရဲစခန်း	A	16°55'35.49"N	နေ့	၇၆.၅	
				96° 2'57.94"E	ည	၇၂.၄	
NV-34	၁၆.၈.၂၀၁၉	အ.ထ.က (၈) လှိုင်သာမြို့နယ်	A	16°53'59.89"N	နေ့	၇၄.၇	
				96° 2'46.10"E	ည	၆၈.၆	
NV-35	၁၇.၈.၂၀၁၉	ရတနာသီရိမြို့ဦး ဘုန်းကြီးကျောင်း	A	16°52'56.86"N	နေ့	၇၉.၄	
				96° 2'10.26"E	ည	၇၆.၃	

ဇယား ၄.၅ တုန်ခါမှုတိုင်းတာရရှိသော ရလဒ်နှင့် စံနှုန်းနှိုင်းယှဉ်ချက်

အမှတ်	ရက်စွဲ	တည်နေရာ (A:လမ်းကြောင်းတစ်လျှောက်, B:receptor)		အချိန်	တုန်ခါမှုအဆင့် Lv	Standard MOE Japan (dB)
NV-1	၁၈.၃.၂၀၁၉	လှိုင်သာယာလမ်း	A	နေ့	၂၅.၂၉	နေ့ :၇၀ ည :၆၅
				ည	၂၅.၇	
NV-2	၁၈.၃.၂၀၁၉	လှိုင်သာယာလမ်း	B	နေ့	၃၀.၆၇	
				ည	၄၄.၁၈	
NV-3	၁၉.၃.၂၀၁၉	ဒဂုံ-ဇရာ ကားမှတ်တိုင်	A	နေ့	၂၈.၇၈	
				ည	၃၀.၄၃	
NV-4	၁၉.၃.၂၀၁၉	ဒဂုံ-ဇရာ ကားမှတ်တိုင်	B	နေ့	၂၄.၅၇	
				ည	၂၈.၁၁	
NV-5	၂၀.၃.၂၀၁၉	BOC နှင့်တွဲ့တေးကြား ဆုံမှတ်	A	နေ့	၅၁.၁၂	
				ည	၃၇.၃၈	
NV-6	၂၀.၃.၂၀၁၉	BOC နှင့်တွဲ့တေးကြား ဆုံမှတ်	B	နေ့	၂၇.၃၄	
				ည	၂၅.၀၅	
NV-7	၂၁.၃.၂၀၁၉	မီးခွက်ဈေး	A	နေ့	၅၁.၇၅	
				ည	၄၉.၆၉	
NV-8	၂၁.၃.၂၀၁၉	မီးခွက်ဈေး	B	နေ့	၃၇.၈၇	
				ည	၂၈.၈၉	
NV-9	၂၂.၃.၂၀၁၉	နဝဒေးအိမ်ရာ	A	နေ့	၄၅.၃၇	နေ့ :၇၀ ည :၆၅
				ည	၄၀.၇၂	
NV-10	၂၂.၃.၂၀၁၉	နဝဒေးအိမ်ရာ	B	နေ့	၂၅.၁၃	
				ည	၂၉.၆၄	
NV-11	၂၃.၃.၂၀၁၉	FMI	A	နေ့	၄၃.၂	
				ည	၄၁.၈၆	
NV-12	၂၃.၃.၂၀၁၉	FMI	B	နေ့	၂၉.၀၆	

အမှတ်	ရက်စွဲ	တည်နေရာ (A:လမ်းကြောင်းတစ်လျှောက်, B:receptor)		အချိန်	တုန်ခါမှုအဆင့် Lv	Standard MOE Japan (dB)
				ည	၃၈.၄	
NV-13	၂၄.၃.၂၀၁၉	ဘုရင့်နောင်တံတားအောက်	B	နေ့	၃၉.၈	
				ည	၃၀.၅၁	
NV-14	၂၅.၃.၂၀၁၉	ဘုရင့်နောင်ပွဲရုံ (သီရိမွန် ပလာဇာ)	A	နေ့	၂၅.၂၇	
				ည	၃၄.၆၃	
NV-15	၂၅.၃.၂၀၁၉	ဘုရင့်နောင်ပွဲရုံ (သီရိမွန် ပလာဇာ)	B	နေ့	၄၉.၉၆	
				ည	၄၇.၂၁	
NV-16	၂၆.၃.၂၀၁၉	ပါရမီလမ်းနှင့် လမ်း ၅၀ အရှေ့ဘက် ဆုံမှတ်	A	နေ့	၂၇.၅၃	
				ည	၂၇.၇၅	
NV-17	၂၆.၃.၂၀၁၉	ပါရမီလမ်းနှင့် လမ်း ၅၀ အရှေ့ဘက် ဆုံမှတ်	B	နေ့	၃၉.၄	
				ည	၃၄.၁၂	
NV-18	၂၈.၃.၂၀၁၉	ပါရမီလမ်းနှင့် အင်းစိန်လမ်း ဆုံမှတ်	A	နေ့	၂၉.၉၉	
				ည	၂၀.၈၂	
NV-19	၂၈.၃.၂၀၁၉	ပါရမီလမ်းနှင့် လမ်း ၅၀ အရှေ့ဘက် ဆုံမှတ်	B	နေ့	၄၂.၂၄	
				ည	၃၇.၇၁	
NV-20	၂.၄.၂၀၁၉	IT တက္ကသိုလ်	A	နေ့	၂၆.၈၃	
				ည	၂၄.၆၅	
NV-21	၂.၄.၂၀၁၉	IT တက္ကသိုလ်	B	နေ့	၃၆.၃၁	
				ည	၃၂.၃၁	
NV-22	၂၉.၃.၂၀၁၉	ပြည်လမ်းနှင့် ပါရမီလမ်းဆုံမှတ်	A	နေ့	၃၂.၃၂	
				ည	၂၆.၃၃	
NV-23	၂၉.၃.၂၀၁၉	ပြည်လမ်းနှင့် ပါရမီလမ်းဆုံမှတ်	B	နေ့	၄၂.၇၈	
				ည	၃၇.၉	
NV-24	၃၀.၃.၂၀၁၉	အင်းယားကန် အရှေ့မြောက်လမ်း	A	နေ့	၄၀.၆၁	

အမှတ်	ရက်စွဲ	တည်နေရာ (A:လမ်းကြောင်းတစ်လျှောက်, B:receptor)		အချိန်	တုန်ခါမှုအဆင့် Lv	Standard MOE Japan (dB)
				ည	၄၆.၀၂	
NV-25	၃၀.၃.၂၀၁၉	အင်းယားကန် အရှေ့မြောက်လမ်း	B	နေ့	၃၄.၃၅	
				ည	၄၈.၇၃	
NV-26	၂၄.၃.၂၀၁၉	ပါရမီဆေးရုံ	A	နေ့	၂၉.၈၃	
				ည	၄၈.၀၇	
NV-27	၃၁.၃.၂၀၁၉	ပါရမီလမ်းနှင့် ကမ္ဘာအေးလမ်းဆုံမှတ်	A	နေ့	၃၁.၁	
				ည	၄၈.၀၇	
NV-28	၃၁.၃.၂၀၁၉	ပါရမီလမ်းနှင့် ကမ္ဘာအေးလမ်းဆုံမှတ်	B	နေ့	၄၃.၈၉	
				ည	၃၁.၃၅	
NV-29	၃.၄.၂၀၁၉	Rainbow မူကြိုကျောင်းရှေ့	A	နေ့	၆၉.၃၁	
				ည	၅၆.၅၄	
N-V30	၁၀.၅.၂၀၁၉	ပါရမီလမ်း	B	နေ့	၃၀.၀၉	
				ည	၄၄.၉	
NV-31	၁၀.၅.၂၀၁၉	ပါရမီလမ်း	B	နေ့	၃၁.၃၆	
				ည	၄၀.၈၅	နေ့ :၇၀ ည :၆၅
N-V32	၁၄.၈.၂၀၁၉	အနောက်ပိုင်းတက္ကသိုလ်	A	နေ့	၄၂.၅၂	
				ည	၃၃.၆၇	
NV-33	၁၅.၈.၂၀၁၉	ထန်းတပင်မြို့နယ် ရဲစခန်း	A	နေ့	၄၅.၅၄	
				ည	၃၃.၅	
NV-34	၁၆.၈.၂၀၁၉	အ.ထ.က (၈) လှိုင်သာမြို့နယ်	A	နေ့	၃၇.၂၅	
				ည	၄၃.၁၆	
NV-35	၁၇.၈.၂၀၁၉	ရတနာသီရိမြို့ဦး ဘုန်းကြီးကျောင်း	A	နေ့	၆၂.၄၆	
				ည	၄၄.၁၇	

*Measurement values that exceed MOE Japan Standards are shown in a red word.

Source: E Guard Study Team

ဇယား ၄.၆ မြေဆီလွှာအရည်အသွေး တိုင်းတာရရှိသော ရလဒ်

အမှတ်	ထိုင်းနိုင်ငံမှ သတ်မှတ်ထားသော လမ်းညွှန်ချက်များ (mg/kg)				
	Arsenic	Cadmium	Chromium Hexavalent	Chromium	Lead
	၃.၉	၃၇	၃၀၀	-	၄၀၀
	ရလဒ်				
So-1	၅.၉၇	-	-	၆၈.၅	၁၆.၃
So-2	၅.၈၇	-	၀.၆၈၉	၄၆	၂၂.၈
So-3	၄.၆၇	-	-	၆၂	၂၂.၆
So-4	၁၀.၂	-	-	၇၃.၄	၂၀.၉
So-5	၇.၀၈	-	-	၆၂	၂၁.၆
So-6	၇.၅၂	-	-	၆၈.၇	၂၆
So-7	၅.၂၆	-	-	၃၆.၃	၂၃.၁
So-8	၃.၂၆	-	-	၄၃.၃	၈.၅
So-9	၄.၀၇	-	-	၃၄.၆	၂၁.၆
So-10	၃.၅၂	-	-	၄၉.၁	၅၂.၈
So-11	၃.၃၉	-	-	၂၉.၄	၂၇.၆

ဇယား ၄.၇ အနည်ကျအရည်အသွေး တိုင်းတာရရှိသော ရလဒ်

အမှတ်	Arsenic	Cadmium	Chromium Hexavalent	Chromium	Lead
BS-1	၆.၃၅	-	-	၄၂.၄	၁၃.၈
BS-2	၄.၅၂	-	-	၄၇.၂	၁၅.၄
BS-3	၆.၉၉	-	-	၁၂၁	၈၂.၅
BS-4	၉.၄၀	-	-	၅၇.၆	၃၆.၃

စီမံကိန်းလမ်းကြောင်းတစ်လျှောက်တွင် ခြောက်သွေ့ရာသီနှင့် စိုစွတ်ရာသီများ၌ အပင်မျိုးစိတ်ပေါင်း (၅၅) မျိုးကို တွေ့ရှိရပါသည်။ ထိုမျိုးစိတ်များအနက် ကမ္ဘာလုံးဆိုင်ရာ မျိုးသုဉ်းရန်နှင့် အန္တရာယ်ရှိသော မျိုးစိတ်များအဆင့်သတ်မှတ်ခြင်းဆိုင်ရာ IUCN Red List တွင်ပါဝင်သော မျိုးသုဉ်းရန်အန္တရာယ်ရှိသောမျိုးစိတ် (EN) နှင့် မျိုးသုဉ်းရန်အန္တရာယ်ကျရောက်နိုင်သော မျိုးစိတ် (VU) အဖြစ်သတ်မှတ်ထားသော မျိုးစိတ် (၂)ခုကို တွေ့ရပါသည်။ မျိုးသုဉ်းရန်အန္တရာယ်ရှိသောမျိုးစိတ် (EN) အဖြစ် သိပ္ပံနာမည် *Pterocarpus indicus* ရှိသော မြန်မာနိုင်ငံအနှံ့အပြားတွင် ပေါက်ရောက်ရှင်သန်နိုင်သော စိုက်ပျိုးပင်အမျိုးအစားဖြစ်သည့် ပန်းပိတောက်ပင်ကို တွေ့ရပါသည်။ မျိုးသုဉ်းရန် အန္တရာယ်ကျရောက်နိုင် သော မျိုးစိတ် (VU) အဖြစ် တိုက်ရိုက်သက်ရောက်မှုမရှိနိုင်သော ပန်းခြံများတွင် တွေ့ရသည့် ဒေသဖြစ်ပင်မဟုတ်သော သိပ္ပံနာမည် *Swietenia macrophylla* မဟောဂနီပင်ကို တွေ့ရပါသည်။ ခြောက်သွေ့ရာသီနှင့် စိုစွတ်ရာသီများ၌ သတ္တဝါမျိုးစိတ်ပေါင်း (၄၇) မျိုးကို တွေ့ရှိရပါသည်။ IUCN စာရင်းအရ မျိုးသုဉ်းရန်အန္တရာယ်ကျရောက်လုနီးပါးမျိုးစိတ် (NT) အဖြစ် မြစ်မြစ်တွေးငှက်ကို တွေ့ရပါသည်။

အပိုင်း (၅) ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းကို နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်းရလဒ်၊ စီမံကိန်းအကြောင်း အရာပေါ်ဆန်းစစ်ချက်များ၊ ကွင်းဆင်းလေ့လာရရှိသော အခြေခံအချက် အလက်များအပေါ်မူတည်၍ ဆောင်ရွက်ပါသည်။ စီမံကိန်းကြောင့် ဖြစ်ပေါ်လာနိုင်ချေရှိသော သက်ရောက်မှုအများစုမှာ ပမာဏနှင့် စီမံကိန်းဧရိယာအရ ထိန်းသိမ်းနိုင်ပါသည်။ စီမံကိန်းအနီးတစ်ဝိုက်ရှိ လူမှုစီးပွားနှင့် ပတ်ဝန်းကျင် အခြေအနေများနှင့် JICA Study Team နှင့် မြန်မာ့မီးရထား၏ မူဝါဒများကို ကျင့်သုံးကာ စီမံကိန်း၏ သဘောသဘာဝကြောင့် မြေယာသိမ်းဆည်းမှုနှင့်ဆန္ဒမပါဘဲ နေရာပြောင်းရွှေ့ရမှုများကို လျော့ချစေနိုင်ရန် ရည်ရွယ်ပါသည်။ ရလဒ်အားဖြင့် စီမံကိန်းကြောင့် ဖြစ်ပေါ်နိုင်သော သိသာထင်ရှားသည့် ထိခိုက်မှု (A–) ကို မတွေ့ရပါ။

ဇယား ၅.၁ ရထားလမ်းကြောင့် ဖြစ်ပေါ်စေနိုင်သော သက်ရောက်မှုများကို ဆန်းစစ်ခြင်း

အခန်းကဏ္ဍ	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေးမစတင်မီအဆင့်	ဆောက်လုပ်ရေးအဆင့်	
ဂုဏ်ရည်ပမ်း	၁။	လေထုညစ်ညမ်းမှု	B-	B+	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်ငန်းသုံး စက်ပစ္စည်းများ၊ ဝန်ချီစက်များနှင့် ကားလမ်းပိတ်ဆို့မှုများကြောင့် NOx, SOx နှင့် ဖုန်မှုန့်များထုတ်လွှတ်မှုစေပြီး လေထုအပေါ် ယာယီသက်ရောက်မှုဖြစ်ပေါ်စေပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** စီမံကိန်းတစ်လျှောက် ကားလမ်းပိတ်ဆို့မှုလျော့ပါးသွားစေမှုကြောင့် ကောင်းကျိုးရှိပါသည်။
	၂။	ရေထုညစ်ညမ်းမှု	B-	B-	**ဆောက်လုပ်ရေးအဆင့်:** - မြေတူးခြင်းများ၊ အလုပ်သမားများအသုံးပြုခြင်းကြောင့် YUMRT တစ်လျှောက်ရှိ ကန်နှင့် ရေအိုင်များတွင် ရေများနောက်ကျိစေနိုင်ပါသည်။ - ရထားတွဲများအသုံးပြုသည့်နေရာများမှ မြေပြန်ဖို့ခြင်းလုပ်ငန်းများကြောင့် ရေထုညစ်ညမ်းစေနိုင်သည်။ - အလုပ်သမားတန်းလျားများမှ ထွက်ရှိလာသော စွန့်ပစ်ရေများကြောင့် ညစ်ညမ်းစေနိုင်သည်။ - ဆောက်လုပ်ရေးစွန့်ပစ်ပစ္စည်းများကို တာရှည်ထားရှိမှုကြောင့်လည်း ရေထုအပေါ် သက်ရောက်မှုရှိစေပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ရထားတွဲများထားရှိသော ရပ်ဝန်းနှင့် ဘူတာများတွင် ထားရှိသော အိမ်သာများကြောင့် ရေထုညစ်ညမ်းမှုဖြစ်နိုင်သည်။
	၃။	အမှိုက်စွန့်ပစ်မှု	B-	B-	**ဆောက်လုပ်ရေးအဆင့်:** အလုပ်သမားတန်းလျားများမှ အမှိုက်စွန့်ပစ်မှုများရှိမည်။ ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်များမှလည်း မြေကြီးနှင့် သစ်ပင်ခုတ်ထစ်မှုကြောင့် အမှိုက်များထွက်ရှိမည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** မီးရထားဘူတာရုံများ၊ ရထားတွဲထားရှိသော ရပ်ဝန်းများနှင့် အခြေချနေထိုင်သူများတိုးပွားလာမှုကြောင့် အမှိုက်များထွက်ရှိမည်။
	၄။	မြေဆီလွှာ ညစ်ညမ်းမှု	B-	B-	**ဆောက်လုပ်ရေးအဆင့်:** - ဆီဖိတ်ယိုမှုကြောင့် လုပ်ငန်းခွင်အတွင်း မြေကြီးများ ညစ်ညမ်းနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** မီးရထားစက်ခေါင်းများ၊ စက်သုံးဆီဖြည့်တင်းခြင်း/ပြင်ဆင်ခြင်းနှင့် ချောဆီများ ယိုဖိတ်ခြင်းကြောင့်လည်း မြေဆီလွှာညစ်ညမ်းမှုကို ဖြစ်ပေါ်စေနိုင်ပါသည်။ ပြည်သူများမှ အမှိုက်စွန့်ပစ်စုပုံခြင်းကြောင့်လည်း ဖြစ်ပေါ်နိုင်ပါသည်။
	၅။	ဆူညံသံနှင့် တုန်ခါမှု	B-	B±	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးသုံး စက်ပစ္စည်းများ၊ ယာဉ်ကြီးများအသုံးပြုမှု၊ ဆောက်လုပ်ရေး လုပ်ငန်းစဉ် (concrete works) များနှင့် ကားလမ်းပိတ်ဆို့မှုများကြောင့် ဆူညံသံနှင့် တုန်ခါမှုများ ဖြစ်နိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ယာဉ်ကြောပိတ်ဆို့မှုကို လျော့ချနိုင်မှုကြောင့် ဆူညံသံနှင့် တုန်ခါမှုကို လျော့ချနိုင်သော်လည်း စီမံကိန်းကြောင့် ဆူညံသံနှင့် တုန်ခါမှု သက်ရောက်ခြင်းများ ရှိနိုင်ပါသည်။
	၆။	မြေကျွံကျမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** မြေနက်ပိုင်းထိ တူးဖော်မှုနှင့် ရေစုတ်ထုတ်ရေး လုပ်ငန်းစဉ်များ မပါဝင်သည့်အတွက်ကြောင့် ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်ကြောင့် မြေအောက်ရေအပေါ်ဆိုးကျိုးများ မရှိပါ။ သို့သော် အောက်ခံမြေသားပျော့မှုကြောင့် မြေကျွံကျမှုဖြစ်နိုင်ချေရှိပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၇။	အနံ့အသက်	B-	B-	**ဆောက်လုပ်ရေးအဆင့်:** အလုပ်သမားတန်းလျားမှ အမှိုက်စွန့်ပစ်မှုများကြောင့် အနံ့အသက်ဆိုးရွားမှုရှိစေနိုင်ပါသည်။

အခန်းဘောင်	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေး မစတင်မီအဆင့်	ဆောက်လုပ် ရေးအဆင့်	
		ဆိုးရွားမှု			**စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ဘူတာရုံခွဲများ၊ ရထားတွဲများထားသော ရုပ်ဝန်းများမှ အမှိုက်စွန့်ပစ်မှုအပေါ်မူတည်ပြီး သက်ရောက်မှု ရှိနိုင်ပါသည်။
	၈။	နုန်းအနယ်အနှစ် အရည်အသွေး	D	D	**ဆောက်လုပ်ရေးအဆင့်:** အနည်ကျမှုအရည်အသွေးအပေါ် သက်ရောက်မှုရှိစေနိုင်သော လုပ်ငန်းစဉ်များ မပါဝင်ပါ။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** အနည်ကျမှုအရည်အသွေးအပေါ် သက်ရောက်မှုရှိစေနိုင်သော လုပ်ငန်းစဉ်များ မပါဝင်ပါ။
လူမှုပတ်ဝန်းကျင်	၉။	ထိန်းသိမ်းကာကွယ်ထားသော ဧရိယာများ	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** အရှေ့-အနောက်လမ်းကြောင်းတစ်လျှောက် ထိန်းသိမ်းကာကွယ်ထားသော ဧရိယာများမရှိပါ။
	၁၀။	ဂေဟစနစ်	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်:** - ရထားလမ်းနှင့် ရထားတွဲများ ထားရှိမည့်နေရာများအတွက် သစ်ပင်များခုတ်ထစ်မှုကြောင့် ဂေဟစနစ်အပေါ်တွင် ထိခိုက်မှုရှိနိုင်ပါသည်။ - အရှေ့-အနောက်လမ်းကြောင်းတစ်လျှောက်ရှိ မြစ်ချောင်းများတွင် ရေညစ်ညမ်းများဖြစ်ပေါ်နိုင်ခြင်းကြောင့် ဂေဟစနစ်အပေါ်တွင် ထိခိုက်မှုရှိနိုင်ပါသည်။ - ရထားတွဲများထားရှိမည့် ရုပ်ဝန်းကို တည်ဆောက်ခြင်းကြောင့် ဂေဟစနစ်အပေါ် သက်ရောက်မှုရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ဆူညံသံနှင့် တုန်ခါမှုကို ဖြစ်ပေါ်စေသော ရထားလမ်းရှိရာ တံတားနှင့် အနီးတွင် ကျက်စားသော မျိုးစိတ်များအပေါ်တွင် ထိခိုက်မှုရှိနိုင်ပါသည်။
	၁၁။	ဧလဗေဒ	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** မြေကြီးတူးယူခြင်းနှင့် မြေပြန်ဖို့ခြင်းတို့၏ နေရာနှင့် ပမာဏအပေါ်မူတည်၍ ဧလဗေဒအပေါ် ထိခိုက်မှုရှိစေပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၁၂။	မြေမျက်နှာသွင်ပြင်နှင့် ဘူမိဗေဒ	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** လမ်းကြောင်းတစ်လျှောက်တွင် ထူခြားတန်ဖိုးရှိသော ဘူမိဗေဒနှင့် မြေမျက်နှာသွင်ပြင်အနေအထားမရှိပါ။ သို့သော် ရထားတွဲများ ထားရှိသည့် ရုပ်ဝန်းကို တည်ဆောက်ရန် မြေသား ပြန်ဖို့ခြင်းများကြောင့် မြေဆီလွှာတိုက်စားခြင်းနှင့် မြေပြိုကျခြင်းများ ဖြစ်ပေါ်နိုင်ပါသည်။
လူမှုပတ်ဝန်းကျင်	၁၃။	မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချထားခြင်း	**A-**	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်:** အရှေ့-အနောက်လမ်းကြောင်းတစ်လျှောက်တွင် မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများ အမြောက်အများ ပြုလုပ်ရပါမည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၁၄။	ဆင်းရဲမွဲ	**A-**	**B+**	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်:** ဆောက်လုပ်ရေးနှင့် အနီးဝန်းကျင်ရှိ လူအဖွဲ့အစည်းအခြေအနေပေါ် မူတည်၍ ဆင်းရဲမွဲကို သတ်မှတ်ရပါမည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** မြေယာသိမ်းဆည်းခြင်းနှင့် ဆန္ဒမပါဝဲ နေရာ ရွှေ့ပြောင်းရခြင်းများ မရှိပါ။ စီမံကိန်းကြောင့် လမ်းပန်းဆက်သွယ်ရေးပိုမို မြန်ဆန်စေပြီး စီးပွားရေးတွင် တိုးတက်မှုများ ရှိလာနိုင်ပါသည်။
	၁၅။	ဒေသခံတိုင်းရင်းသားများအပေါ် သက်ရောက်မှု	**B-**	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်:** ဒေသခံတိုင်းရင်းသားများ နေထိုင်မှုရှိမရှိကို အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာနမှ မှတ်တမ်းရယူပါသည်။ တိုင်းရင်းသားလူမျိုးများ၏ အခြေအနေများအပေါ် မူတည်၍ ပြန်လည်ထူထောင်ရေးလုပ်ငန်းများကို ထည့်သွင်းစဉ်းစားပါမည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။

အခန်းဘောင်	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေး မစတင်မီအဆင့်	ဆောက်လုပ်ရေးအဆင့်	
	၁၆။	အလုပ်အကိုင်အခွင့်အလမ်းများနှင့် ဒေသတွင်း စီးပွားရေးအခြေအနေ	B-	B+	**ဆောက်လုပ်ရေး မစတင်မီအဆင့် :** - မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများကြောင့် စီမံကိန်းသက်ရောက်ခံရသည့် အိမ်ထောင်စုတို့၏ စီးပွားရေးအခြေအနေပေါ်တွင် ထိခိုက်မှုရှိနိုင်ပါသည်။ - စီမံကိန်းကြောင့် လိုင်သာယာတွင် နေထိုင်သော ကျူးကျော်များအတွက် ဆောက်လုပ်ရေးတွင် ဝင်ရောက်လုပ်ကိုင်နိုင်သည့် အလုပ်အကိုင်အခွင့်အလမ်းများ ရှိလာနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများမရှိပါ။ - စီမံကိန်းကြောင့် လမ်းပန်းဆက်သွယ်ရေးပိုမို မြန်ဆန်စေပြီး စီးပွားရေးတွင် တိုးတက်မှုများ ရှိလာနိုင်ပါသည်။
	၁၇။	မြေအသုံးချမှုနှင့်ဒေသတွင်း သယံဇာတ အရင်းအမြစ်များ	B-	B-	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့်:** ရထားတွဲများထားရှိရာ ရပ်ဝန်းဆောက်လုပ်မှုအတွက် မြေအသုံးချမှုနှင့် ဒေသတွင်း သယံဇာတအရင်းအမြစ်များ အပေါ် သက်ရောက်မှုများရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများမရှိပါ။
	၁၈။	ရေအသုံးချမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်နှင့် မြေယာသိမ်းဆည်းမှုအပေါ်မူတည်၍ ရေတွင်းများရှိသောက်ရေရေအရည်အသွေးကို ထိခိုက်မှုရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - မြေယာသိမ်းဆည်းခြင်းမရှိသည့်အတွက်ကြောင့် ထိခိုက်မှုမရှိပါ။ - ရထားလမ်း၊ ရထားတွဲများထားရှိရာ ရပ်ဝန်းနှင့် ဘူတာများတွင် ရေအသုံးပြုချမှုနှင့် ရေတွင်းများ ရှိသောကြောင့် ထိခိုက်မှုမရှိပါ။
	၁၉။	လူမှုအဆောက်အအုံနှင့် ဝန်ဆောင်မှုကဏ္ဍ	B-	B+	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့် :** - အခြေခံအဆောက်အအုံများဖြစ်သည့် ကျောင်း၊ ဆေးရုံနှင့် လူမှုစင်တာများတွင် မြေယာသိမ်းဆည်းခြင်း သို့မဟုတ် ကားလမ်းပိတ်ဆို့မှုများကြောင့် သက်ရောက်မှုများရှိနိုင်ပါသည်။ - ပြင်းအားများသော လျှပ်စစ်သွယ်တန်းကြိုးများ တပ်ဆင်ခြင်းနှင့် ပြန်လည်နေရာချထားရေး အစီအစဉ်များကြောင့် လျှပ်စစ်ဓာတ်အားပြတ်တောက်မှုများ ဖြစ်နိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - စီမံကိန်းကြောင့် အခြေခံအဆောက်အအုံများတွင် ကောင်းကျိုးများ ဖြစ်ပေါ်စေနိုင်ပါသည်။
	၂၀။	ဒေသတွင်း လူမှုအဖွဲ့အစည်းများ	B-	B+	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်များကြောင့် အခြေခံအဆောက်အအုံနှင့် လူမှုအထောက်အပံ့များ ပြတ်တောက်ခြင်း ဖြစ်စေနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ကားလမ်းပိတ်ဆို့မှုများလျော့ကျစေသည့်အတွက်ကြောင့် ကောင်းကျိုးများ ဖြစ်ပေါ်စေနိုင်ပါသည်။
Social Environment	၂၁။	လွဲမှားသော အကျိုးခံစားမှုနှင့် ထိခိုက်မှုများ	B-	B-	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်ငန်းနေရာအပေါ်မူတည်၍ လမ်းအသုံးပြုမှုနှင့် လမ်းလွဲများထားရှိမှုတို့ ဖြစ်ပေါ်နိုင်ခြင်းကြောင့် အကျိုးခံစားမှု မညီမျှခြင်းများ ရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** အခြေချနေထိုင်သူဦးရေများပြားလာနိုင်ပါသည်။
	၂၂။	ဒေသတွင်းဆိုင်ရာ ပဋိပက္ခ	B-	B-	**ဆောက်လုပ်ရေးအဆင့်:** - ဆောက်လုပ်ရေးလုပ်သားများနှင့် အလုပ်အကိုင် တန်းတူ အခွင့်အရေးရရှိမှုနှင့် ပတ်သက်၍ ဒေသခံများနှင့် စည်ပင်သာယာရေးအဖွဲ့အစည်းများမှ စီမံကိန်းပိုင်ရှင်ကို တောင်းဆိုလာနိုင်ပါသည်။

အခန်းကဏ္ဍ	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေး မစတင်မီအဆင့်	ဆောက်လုပ်ရေးအဆင့်	
					- ဒေသခံများနှင့် ဆောက်လုပ်ရေးလုပ်သားများကြားတွင် ပဋိပက္ခများ ဖြစ်ပွားနိုင်ပါသည်။ - ဆူညံသံနှင့် တုန်ခါမှုများကြောင့် ဒေသခံများမှ မကျေနပ်မှုများဖြစ်နိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: ဆူညံသံနှင့် တုန်ခါမှုများကြောင့် ဒေသခံများမှ မကျေနပ်မှုများ ဖြစ်နိုင်ပါသည်။
	၂၃။	ယာဉ်ကျေးမှုအမွေအနှစ်များ	D	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့် :** လက်ရှိလျာထားသည့် လမ်းကြောင်းတစ်လျှောက်တွင် ဘာသာရေးဆိုင်ရာ အဆောက်အအုံများနှင့် သမိုင်းဝင် အဆောက်အအုံများမရှိပါ။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: စီမံကိန်းလည်ပတ်သည့်အဆင့်တွင် မြေနေရာသိမ်းဆည်းခြင်းများ မရှိတော့သည့်အတွက် ထိခိုက်မှုမရှိနိုင်ပါ။ သို့သော် စီမံကိန်းကြောင့်ဖြစ်ပေါ်လာနိုင်သော တုန်ခါမှုကို ဆန်းစစ်ရမည်။
	၂၄။	မြေယာရှုခင်း	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - စီမံကိန်းနှင့် အနီးပတ်ဝန်းကျင်တွင် ဥပဒေ၊ စည်းမျဉ်းစည်းကမ်းများအရ ဆောက်လုပ်ထားသော မြေယာရှုခင်းများ မရှိပါ။ - စီမံကိန်းကြောင့် နေ့စဉ်မြင်တွေ့နေရသော မြင်ကွင်းပဒါသမှာ ပြောင်းလဲသွားမည်။
	၂၅။	ကျား/မ တန်းတူညီမျှမှု	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်သားအနေဖြင့် လုပ်အားခ/ အရေးယူမှုများတွင် မတူညီမှုများရှိနိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: အမျိုးသမီးများ အလုပ်အကိုင်အခွင့်အရေးရရှိမှုတွင် ကန့်သတ်ချက်ရှိနိုင်သည်။ ထို့အပြင် အမျိုးသမီးများ ရထားစီးနင်းသည့်အခါ လိုက်ပါစီးနင်းသူပမာဏများသည့်အခါ လိုက်ပါမစီးနင်းနိုင်သည်များ ဖြစ်နိုင်ပါသည်။
	၂၆။	ကလေးသူငယ်အခွင့်အရေး	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** စီမံကိန်းလမ်းကြောင်းတစ်လျှောက် ဆောက်လုပ်ရေးလုပ်ငန်းများဆောင်ရွက်စဉ် ကလေးအလုပ်သမားခန့်အပ်မှုများကြောင့် ပညာရေးတွင် အနှောက်အယှက်ဖြစ်စေနိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၂၇။	ကျန်းမာရေး (HIV/AIDS ကဲ့သို့ ကူးစက်နိုင်သည့် ရောဂါများ)	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးအလုပ်သမားများအကြား ကူးစက်ရောဂါများ ဖြစ်ပေါ်နိုင်ပါသည်။ မြေတူးဖော်ခြင်းနှင့် ပြန်ဖို့ခြင်းများမှလည်း ခြင်ပေါက်ဖွားမှုဖြစ်စေနိုင်ပြီး ရောဂါဖြစ်စေနိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: အခြေချနေထိုင်သူများတိုးပွားလာခြင်းနှင့် ရထားအသုံးပြုသူများမှတဆင့် ကာလသားရောဂါကဲ့သို့သော ကူးစက်ရောဂါများဖြစ်ပွားနိုင်ပါသည်။
	၂၈။	အလုပ်သမားများ၏ ပတ်ဝန်းကျင်	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်:** ပြဋ္ဌာန်းထားသော ဥပဒေ၊ စည်းမျဉ်းများနှင့်အညီ အလုပ်သမားများအတွက် ကောင်းမွန်သော ပတ်ဝန်းကျင်ဖြစ်ရန် လိုအပ်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: - အလုပ်သမားများ၏ ပတ်ဝန်းကျင်တွင် ကြီးမားသည့် ပြောင်းလဲမှုမရှိပါ။ - ပြဋ္ဌာန်းထားသော ဥပဒေ၊ စည်းမျဉ်းများနှင့်အညီ အလုပ်သမားများအတွက် ကောင်းမွန်သော ပတ်ဝန်းကျင်ဖြစ်ရန် လိုအပ်ပါသည်။
သဘာဝပတ်ဝန်းကျင်	၂၉။	မတော်တဆမှုများ	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးသုံး ယာဉ်များအသုံးပြုမှုကြောင့် ယာဉ်မတော်တဆမှုများ ဖြစ်ပွားနိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: ဖြတ်သန်းသွားလာသော ယာဉ်များ၏ အရှိန်တင်မောင်းနှင်မှုများကြောင့် မတော်တဆမှုများ ဖြစ်ပေါ်နိုင်ပါသည်။
	၃၀။	နေရာဒေသကျော်လွန်၍	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်:** စီမံကိန်းတစ်လျှောက် သစ်ပင်များခုတ်ထစ်မှု၊ ဆောက်လုပ်ရေးယာဉ်များ အသုံးပြုမှုများကြောင့် ဖန်လုံအိမ်ဓာတ်ငွေ့ထုတ်လွှတ်မှု မြင့်မားနိုင်ပါသည်။

အမျိုးအစား	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေးမစတင်မီအဆင့်	ဆောက်လုပ်ရေးအဆင့်	
		ထိခိုက်သက်ရောက်မှုများနှင့် ရာသီဥတုပြောင်းလဲမှု			**စီမံကိန်းလည်ပတ်သည့် အဆင့်:** စီမံကိန်းတစ်လျှောက်တွင် ယာဉ်ကြောပိတ်ဆို့မှုများ လျော့နည်းသွားမှုကြောင့် ဖန်လုံအိမ်ခေတ်ငွေ့ထုတ်လွှတ်မှု လျော့နိုင်ပါသည်။ စီမံကိန်းမှ အသုံးပြုသည့် လျှပ်စစ်ပမာဏပေါ်မူတည်၍လည်း ဖန်လုံအိမ်ခေတ်ငွေ့ထုတ်လွှတ်မှုများ ရှိပါသည်။

ဇယား ၅.၂ လျှပ်စစ်ဓာတ်အားခွဲရုံကြောင့် ဖြစ်ပေါ်စေနိုင်သော သက်ရောက်မှုများကို ဆန်းစစ်ခြင်း

အမျိုးအစား	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေးမစတင်မီအဆင့်	ဆောက်လုပ်ရေးအဆင့်	
သဘာဝပတ်ဝန်းကျင်	၁။	လေထုညစ်ညမ်းမှု	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** လှိုင်သာယာနှင့် အနောက်ပိုင်းတက္ကသိုလ်ရှိ လျှပ်စစ်ဓာတ်အားပေးရုံတည်ဆောက်မှုကြောင့် ဆောက်လုပ်ရေးလုပ်ငန်းသုံး စက်ပစ္စည်းများ၊ ဝန်ချီစက်များနှင့် ကားလမ်းပိတ်ဆို့မှုများကြောင့် ဖုန်မှုန့်များထုတ်လွှတ်မှုစေပြီး လေထုအပေါ် သက်ရောက်မှုရှိစေပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၂။	ရေထုညစ်ညမ်းမှု	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** - မြေတူးခြင်းများ၊ အလုပ်သမားများအသုံးပြုခြင်းကြောင့် YUMRT တစ်လျှောက်ရှိ ကန်နှင့် ရေအိုင်များတွင် ရေများနောက်ကျိစေနိုင်ပါသည်။ - ရထားတွဲများအသုံးပြုသည့်နေရာများမှ မြေပြန်ဖို့ခြင်းလုပ်ငန်းများကြောင့် ရေထုညစ်ညမ်းစေနိုင်သည်။ - အလုပ်သမားတန်းလျားများမှ ထွက်ရှိလာသော ရေများကြောင့် ညစ်ညမ်းစေနိုင်သည်။ - ဆောက်လုပ်ရေးစွန့်ပစ်ပစ္စည်းများကို တာရှည်ထားရှိမှုကြောင့်လည်း ရေထုအပေါ် သက်ရောက်မှုရှိစေပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ရထားတွဲများထားရှိသော ရပ်ဝန်းနှင့် ဘူတာများတွင် ထားရှိသော အိမ်သာများကြောင့် ရေထုညစ်ညမ်းမှုဖြစ်နိုင်သည်။
	၃။	အမှိုက်စွန့်ပစ်မှု	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** အလုပ်သမားတန်းလျားများမှ အမှိုက်စွန့်ပစ်မှုများရှိမည်။ ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်များမှလည်း မြေကြီးနှင့် သစ်ပင်ခုတ်ထစ်မှုကြောင့် အမှိုက်များထွက်ရှိမည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** မီးရထားဘူတာရုံများ၊ ရထားတွဲထားရှိသော ရပ်ဝန်းများနှင့် အခြေချနေထိုင်သူများတိုးပွားလာမှုကြောင့် အမှိုက်များထွက်ရှိမည်။
	၄။	မြေဆီလွှာညစ်ညမ်းမှု	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်:** - ဆီဖိတ်ယိုမှုကြောင့် လုပ်ငန်းခွင်တွင် တူးဖော်ထားသော မြေကြီးများ ညစ်ညမ်းနိုင်ပါသည်။ - ဆောက်လုပ်ရေးလုပ်ငန်းမှ ထွက်ရှိသော စွန့်ပစ်ပစ္စည်းများကို အချိန်ကြာမြင့်စွာ စုပုံထားရှိခြင်းကြောင့် ညစ်ညမ်းမှုဖြစ်နိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ထရန်စဖော်မာများအား ကောင်မွန်စွာ မစီမံခြင်းကြောင့် ဆီယိုဖိတ်မှုများဖြစ်ပေါ်နိုင်ပါသည်။
	၅။	ဆူညံသံနှင့် တုန်ခါမှု	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးသုံး စက်ပစ္စည်းများ၊ ယာဉ်များအသုံးပြုမှု၊ အုတ်အသယ်အချလုပ်ငန်းစဉ်များနှင့် ကားလမ်းပိတ်ဆို့မှုများကြောင့် ဆူညံသံနှင့် တုန်ခါမှုများ ဖြစ်နိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** လျှပ်စစ်ဓာတ်အားပေးစက်ရုံလည်ပတ်ခြင်းကြောင့် အနီးပတ်ဝန်းကျင်ရှိ နေထိုင်သူများအပေါ်တွင် ဆူညံသံ သက်ရောက်မှုရှိနိုင်ပါသည်။
	၆။	မြေကျဆုံးမှု	**B-**	**D**	**ဆောက်လုပ်ရေးအဆင့်:** မြေနက်ပိုင်းထိ တူးဖော်မှုနှင့် ရေစုတ်ထုတ်ရေး လုပ်ငန်းစဉ်များ မပါဝင်သည့်အတွက်ကြောင့် ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်ကြောင့် မြေအောက်ရေအပေါ်ဆိုးကျိုးများ မရှိပါ။

အမျိုးအစား	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေး မစတင်မီအဆင့်	ဆောက်လုပ် ရေးအဆင့်	
					သို့သော် အောက်ခံမြေသားပျော့မှုကြောင့် မြေကျဉ်ကျမှုဖြစ်နိုင်ချေရှိပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၇။	အနှံ့အသက်ဆိုးရွားမှု	**B-**	**D**	**ဆောက်လုပ်ရေးအဆင့်:** အလုပ်သမားတန်းလျားမှ အမှိုက်စွန့်ပစ်မှုများကြောင့် အနှံ့အသက်ဆိုးရွားမှုရှိစေနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၈။	နုန်းအနယ်အနှစ် အရည်အသွေး	**B-**	**D**	**ဆောက်လုပ်ရေးအဆင့်:** မြေတူးဖော်ခြင်းလုပ်ငန်းများမှ အနှီးနှာရှိမြစ်ချောင်းများကို ညစ်ညမ်းနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** အနည်ကျမှုအရည်အသွေးအပေါ် သက်ရောက်မှုရှိစေနိုင်သော လုပ်ငန်းစဉ်များ မပါဝင်ပါ။
သဘာဝပတ်ဝန်းကျင်	၉။	ထိန်းသိမ်းကာကွယ်ထားသော ဇရိယာများ	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** အရှေ့-အနောက်လမ်းကြောင်းတစ်လျှောက် ထိန်းသိမ်းကာကွယ်ထားသော ဇရိယာများမရှိပါ။
	၁၀။	ဂေဟစနစ်	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်:** - ရထားလမ်းနှင့် ရထားတွဲများ ထားရှိမည့်နေရာများအတွက် သစ်ပင်များခုတ်ထစ်မှုကြောင့် ဂေဟစနစ်အပေါ်တွင် ထိခိုက်မှုမရှိပါ။ - အရှေ့-အနောက်လမ်းကြောင်းတစ်လျှောက်ရှိ မြစ်ချောင်းများတွင် ရေညစ်ညမ်းများဖြစ်ပေါ်နိုင်ခြင်းကြောင့် ဂေဟစနစ်အပေါ်တွင် ထိခိုက်မှုရှိနိုင်ပါသည်။ - ရထားတွဲများထားရှိမည့် ရပ်ဝန်းကို တည်ဆောက်ခြင်းကြောင့် ဂေဟစနစ်အပေါ် သက်ရောက်မှုရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ဆူညံသံနှင့် တုန်ခါမှုကို ဖြစ်ပေါ်စေသော ရထားလမ်းရှိရာ တံတားနှင့် အနီးတွင် ကျက်စားသော မျိုးစိတ်များအပေါ်တွင် ထိခိုက်မှုရှိနိုင်ပါသည်။
	၁၁။	ဇလဗေဒ	D	D	**ဆောက်လုပ်ရေးအဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၁၂။	မြေမျက်နှာသွင်ပြင်နှင့် ဘူမိဗေဒ	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** လမ်းကြောင်းတစ်လျှောက်တွင် ထူးခြားတန်ဖိုးရှိသော ဘူမိဗေဒနှင့် မြေမျက်နှာသွင်ပြင်အနေအထားမရှိပါ။
လူမှုပတ်ဝန်းကျင်	၁၃။	မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချထားခြင်းများ	D	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်:** မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများမရှိပါ။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများမရှိပါ။
	၁၄။	ဆင်းရဲမှု	D	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်:** မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများမရှိပါ။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများမရှိပါ။
	၁၅။	ဒေသခံတိုင်းရင်းသားများအပေါ် သက်ရောက်မှု	D	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်:** : သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၁၆။	အလုပ်အကိုင်အခွင့်	**B+/-**	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်:**

အခန်းဘောင်	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု: ဆောက်လုပ်ရေး မစတင်မီအဆင့်	အကဲဖြတ်မှု: ဆောက်လုပ်ရေးအဆင့်	Reason for evaluation
		အလမ်းများနှင့် ဒေသတွင်း စီးပွားရေးအခြေ အနေ			- တည်ဆောက်စဉ်ကာလအတွင်း အလုပ်အကိုင်အခွင့်အလမ်းများ ရရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၁၇။	မြေအသုံးချမှုနှင့်ဒေသတွင်း သယံဇာတ အရင်းအမြစ်များ	**B-**	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့်:** ဓာတ်အားခွဲရုံတည်ဆောက်ခြင်းကြောင့် လယ်မြေအား မြေယာပြောင်းလဲအသုံးချခြင်းများဖြစ်ပေါ်နိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၁၈။	ရေအသုံးချမှု	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်နှင့် မြေယာသိမ်းဆည်းမှုအပေါ်မူတည်၍ သောက်ရေအတွက် ရေတွင်းများရှိ ရေအရည်အသွေးကို ထိခိုက်မှုရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - မြေယာသိမ်းဆည်းခြင်းမရှိသည့်အတွက်ကြောင့် ထိခိုက်မှုမရှိပါ။ - ရထားလမ်း၊ ရထားတွဲများထားရှိရာ ရုပ်ဝန်းနှင့် ဘူတာများတွင် ရေအသုံးပြုချမှုနှင့် ရေတွင်းများ ရှိသောကြောင့် ထိခိုက်မှုမရှိပါ။
	၁၉။	လူမှုအဆောက်အအုံနှင့် ဝန်ဆောင်မှုကဏ္ဍ	**B-**	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့် :** - အခြေခံအဆောက်အအုံများဖြစ်သည့် ကျောင်း၊ ဆေးရုံနှင့် လူမှုစင်တာများတွင် မြေယာသိမ်းဆည်းခြင်း သို့မဟုတ် ကားလမ်းပိတ်ဆို့မှုများကြောင့် သက်ရောက်မှုများရှိနိုင်ပါသည်။ - ပြင်းအားများသော လျှပ်စစ်သွယ်တန်းကြိုးများ တပ်ဆင်ခြင်းနှင့် ပြန်လည်နေရာချထားရေး အစီအစဉ်များကြောင့် လျှပ်စစ်ဓာတ်အားပြတ်တောက်မှုများ ဖြစ်နိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၂၀။	ဒေသတွင်း လူမှုအဖွဲ့အစည်းများ	D	D	**ဆောက်လုပ်ရေးအဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
Social Environment	၂၁။	လွဲမှားသော အကျိုးခံစားမှုနှင့် ထိခိုက်မှုများ	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်ငန်းနေရာအပေါ်မူတည်၍ လမ်းအသုံးပြုမှုနှင့် လမ်းလွဲများထားရှိမှုတို့ ဖြစ်ပေါ်နိုင်ခြင်းကြောင့် အကျိုးခံစားမှု မညီမျှခြင်းများ ရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၂၂။	ဒေသတွင်းဆိုင်ရာ ပဋိပက္ခ	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** - ဒေသခံများနှင့် ဆောက်လုပ်ရေးလုပ်သားများကြားတွင် ပဋိပက္ခများ ဖြစ်ပွားနိုင်ပါသည်။ - ဆူညံသံနှင့် တုန်ခါမှုများကြောင့် ဒေသခံများမှ မကျေနပ်မှုများဖြစ်နိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၂၃။	ယာဉ်ကျေးမှုအမွေအနှစ်များ	D	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့် :** လက်ရှိလျာထားသည့် လမ်းကြောင်းတစ်လျှောက်တွင် ဘာသာရေးဆိုင်ရာ အဆောက်အအုံများနှင့် သမိုင်းဝင် အဆောက်အအုံများမရှိပါ။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** စီမံကိန်းလည်ပတ်သည့်အဆင့်တွင် မြေနေရာသိမ်းဆည်းခြင်းများ မရှိတော့သည့်အတွက် ထိခိုက်မှုမရှိနိုင်ပါ။ သို့သော် စီမံကိန်းကြောင့်ဖြစ်ပေါ်လာနိုင်သော တုန်ခါမှုကို ဆန်းစစ်ရမည်။

အန်းတရ	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေးမစတင်မီအဆင့်	ဆောက်လုပ်ရေးအဆင့်	
	၂၄။	မြေယာရှုခင်း	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** : သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု မရှိပါ။
	၂၅။	ကျား/မ တန်းတူညီမျှမှု	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်သားအနေဖြင့် လုပ်အား၁/ အရေးယူမှုများတွင် မတူညီမှုများရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု မရှိပါ။
	၂၆။	ကလေးသူငယ်အခွင့် အရေး	D	D	**ဆောက်လုပ်ရေးအဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု မရှိပါ။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု မရှိပါ။
	၂၇။	ကျန်းမာရေး (HIV/AIDS ကဲ့သို့ ကူးစက်နိုင်သည့် ရောဂါများ)	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးအလုပ်သမားများအကြား ကူးစက်ရောဂါများ ဖြစ်ပေါ်နိုင်ပါသည်။ မြေတူးဖော်ခြင်းနှင့် ပြန်ဖို့ခြင်းများမှလည်း ခြင်ပေါက်ဖွားမှုဖြစ်စေနိုင်ပြီး ရောဂါဖြစ်စေနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု မရှိပါ။
	၂၈။	အလုပ်သမားများ၏ ပတ်ဝန်းကျင်	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်:** ပြဋ္ဌာန်းထားသော ဥပဒေ၊ စည်းမျဉ်းများနှင့်အညီ အလုပ်သမားများအတွက် ကောင်းမွန်သော ပတ်ဝန်းကျင်ဖြစ်ရန် လိုအပ်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - ပြဋ္ဌာန်းထားသော ဥပဒေ၊ စည်းမျဉ်းများနှင့်အညီ အလုပ်သမားများအတွက် ကောင်းမွန်သော ပတ်ဝန်းကျင်ဖြစ်ရန် လိုအပ်ပါသည်။
အခြား	၂၉။	မတော်တဆမှုများ	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးသုံး ယာဉ်များအသုံးပြုမှုကြောင့် ယာဉ်မတော်တဆမှုများ ဖြစ်ပွားနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု မရှိပါ။
	၃၀။	နေရာဒေသကျော် လွှန်၍ ထိခိုက်သက်ရောက်မှုများနှင့် ရာသီဥတုပြောင်းလဲမှု	D	D	**ဆောက်လုပ်ရေးအဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု မရှိပါ။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု မရှိပါ။

ဇယား ၅.၃ လျှပ်စစ်ဓာတ်အားသွယ်တန်းကြိုးကြောင့် ဖြစ်ပေါ်စေနိုင်သော သက်ရောက်မှုများကို ဆန်းစစ်ခြင်း

အန်းတရ	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေးမစတင်မီအဆင့်	ဆောက်လုပ်ရေး အဆင့်	
သဘာဝပတ်ဝန်းကျင်	၁။	လေထုညစ်ညမ်းမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** ဝန်ချီစက်များနှင့် ကားလမ်းပိတ်ဆို့မှုများကြောင့် ဖုန်မှုန့်များနှင့် အခိုးအငွေ့များ ထုတ်လွှတ်စေပြီး လေထုအပေါ် သက်ရောက်မှုရှိစေသည့်အပြင် ဆောက်လုပ်ရေးလုပ်ငန်းခွင်

အမျိုးအစား	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေးမစတင်မီ အဆင့်	ဆောက်လုပ်ရေး အဆင့်	
					ရှင်းလင်းခြင်းမှလည်း ဖုန်မှုန့်များ ထွက်ရှိနိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၂။	ရေထုညစ်ညမ်းမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** - မြစ်ချောင်းများအနီး မြေတူးဖော်ခြင်းကြောင့် ယာယီ ရေထုညစ်ညမ်းမှု ဖြစ်ပေါ်နိုင်ပါသည်။ ထို့အပြင် အလုပ်သမား အခြေစိုက်စခန်းမှ လည်း ယာယီ ရေထုညစ်ညမ်းမှု ဖြစ်ပေါ်နိုင်ပါသည်။ - ဆောက်လုပ်ရေးဆိုင်ရာစွန့်ပစ်ပစ္စည်းများအား အချိန်အတော်ကြာ တရားမဝင် ထားရှိပါက ရေအရည်အသွေးအပေါ် ဆိုးကျိုးသက်ရောက်မှု ဖြစ်ပေါ်နိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၃။	အမှိုက်စွန့်ပစ်မှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** မြေ၊ သဲနှင့် အထွေထွေစွန့်ပစ်ပစ္စည်းများ ထွက်ရှိနိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: စွန့်ပစ်ပစ္စည်းထွက်ရှိနိုင်သော လုပ်ငန်းများမရှိပါ။
	၄။	မြေဆီလွှာညစ်ညမ်းမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** - စက်ယန္တရားကြီးများနှင့်ယာဉ်များအတွက် လောင်စာဆီအသုံးပြုခြင်းမှ ဆီယိုဖိတ်ခြင်းကြောင့် မြေဆီလွှာညစ်ညမ်းမှု ဖြစ်ပေါ်နိုင်ပါသည်။ သို့ရာတွင် ဆီအသုံးပြုမှု ပမာဏအား ကန့်သတ်ထားပြီး ထိခိုက်သက်ရောက်မှုမှာ သိသာထင်ရှားမှုမရှိဟု ယူဆပါသည်။ - ဆောက်လုပ်ရေးဆိုင်ရာစွန့်ပစ်ပစ္စည်းများအား အချိန်အတော်ကြာ တရားမဝင် ထားရှိပါက မြေအရည်အသွေးအပေါ် ဆိုးကျိုးသက်ရောက်မှု ဖြစ်ပေါ်နိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၅။	ဆူညံသံနှင့် တုန်ခါမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်ငန်းသုံး စက်ယန္တရားကြီးများ၊ မြေသယ်ယာဉ်များနှင့် ယာဉ်ကြောပိတ်ဆို့မှုများမှ ဆူညံသံနှင့် တုန်ခါမှုများ ဖြစ်ပေါ်နိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၆။	မြေကျဆင်းမှု	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၇။	အန့်အသက်ဆိုးရွားမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** မြေတူးခြင်း၊ ဆောက်လုပ်ရေးလုပ်ငန်းခွင်အတွင်း ရွံ့များ ရေနုတ်မြောင်းများအတွင်း စီးဝင်ခြင် တို့ကြောင့် အန့်အသက်ဆိုးရွားမှု ဖြစ်ပေါ်နိုင်သည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၈။	နုန်းအနယ်အနှစ်အရည်အသွေး	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** ဓာတ်အားသွယ်တန်းကြိုးကြောင့် မြစ်ချောင်းများ၏ နုန်းအနယ်အနှစ်အရည်အသွေးကို သက်ရောက်မှုအချို့ရှိသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: အနည်ကျမှုအရည်အသွေးအပေါ် သက်ရောက်မှုရှိစေနိုင်သော လုပ်ဆောင်ချက်များမပါရှိပါ။
ပူးပေါင်းပတ်ဝန်းကျင်	၉။	ထိန်းသိမ်းကာကွယ်ထားသော ဧရိယာများ	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ဆောက်လုပ်ရေးဧရိယာအတွင်း ထိန်းသိမ်းကာကွယ်ထားသော ဧရိယာမရှိပါ။
	၁၀။	ဂေဟစနစ်	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၁၁။	ဇလဗေဒ	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။

အမှတ်စဉ်	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ခြင်းမစတင်မီအဆင့်	ဆောက်လုပ်ရေးအဆင့်	
	၁၂။	မြေမျက်နှာသွင်ပြင်နှင့် ဘူမိဗေဒ	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၁၃။	မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချထားခြင်းများ	D	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်၊ ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ဓာတ်အားခွဲရုံအား အစိုးရပိုင်မြေအတွင်း တည်ဆောက်ထားခြင်းကြောင့် ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့်အဆင့်တွင် မြေယာသိမ်းယူခြင်းနှင့် ပြန်လည်နေရာချထားခြင်းများမရှိပါ။
	၁၄။	ဆင်းရဲမှု	B–	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်: ဆောက်လုပ်ရေးအဆင့်တွင်** မြေတူးခြင်းနှင့် မြေဖို့ခြင်းလုပ်ငန်းများကြောင့် ဒေသခံများအား ယာယီအနှောင့်အယှက်ဖြစ်စေနိုင်သည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** စီမံကိန်းလည်ပတ်သည့်အဆင့်တွင် မြေယာသိမ်းယူခြင်းနှင့် ပြန်လည်နေရာချထားခြင်းများမရှိပါ။
	၁၅။	ဒေသခံတိုင်းရင်းသားများအပေါ် သက်ရောက်မှု	D	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့်:** စီမံကိန်းလည်ပတ်သည့်အဆင့်တွင် ဒေသခံတိုင်းရင်းသားများအပေါ် မြေယာသိမ်းယူခြင်းနှင့် ပြန်လည်နေရာချထားခြင်းများမရှိပါ။
	၁၆။	အလုပ်အကိုင်အခွင့်အလမ်းများနှင့် ဒေသတွင်းစီးပွားရေးအခြေအနေ	B±	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်:** - ဒေသတွင်းအလုပ်အကိုင်အခွင့်အလမ်းများပေါ်ပေါက်လာခြင်းကဲ့သို့ ကောင်းကျိုးသက်ရောက်မှုများ ဖြစ်ပေါ်နိုင်သည်။ - ဓာတ်အားသွယ်တန်းကြိုးတည်ဆောက်သည့် လမ်းကြောင်းတစ်လျှောက် ဒေသခံများ၏ စျေးဆိုင်များ ယာယီပိတ်ရခြင်းကဲ့သို့ ဆိုးကျိုးသက်ရောက်မှု ဖြစ်ပေါ်နိုင်သည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ဒေသတွင်းစီးပွားရေးအခြေအနေအား ထိခိုက်နိုင်သော လုပ်ဆောင်ချက်များမရှိပါ။
	၁၇။	မြေအသုံးချမှုနှင့်ဒေသတွင်း သယံဇာတ အရင်းအမြစ်များ	B–	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့်:** - ဓာတ်အားလိုင်းသွယ်တန်းကြိုးတစ်လျှောက် ယာယီမြေအသုံးချမှုရှိနိုင်သည်။ အဆိုပြု စီမံကိန်းအတွက် မြေအသုံးချမှု သတင်းအချက်အလက်အား အတည်ပြုရန်လိုအပ်သည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** မြေအသုံးချမှုနှင့်ဒေသတွင်း သယံဇာတ အရင်းအမြစ်များ ထိခိုက်နိုင်သော လုပ်ဆောင်ချက်များ မပါရှိပါ။
	၁၈။	ရေအသုံးချမှု	B–	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေး လုပ်ငန်းများအပေါ်မူတည်၍ တွင်းရေအရည်အသွေးအား ဆိုးကျိုးသက်ရောက်မှု ရှိနိုင်သည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ရေအသုံးချမှုအပေါ် သက်ရောက်မှုမရှိပါ။
	၁၉။	လူမှုအဆောက်အအုံ နှင့် ဝန်ဆောင်မှုကဏ္ဍ	B–	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့်:** - မြေတူးဖော်ခြင်းနှင့် မြေတူးဖော်ခြင်း လုပ်ငန်းများကြောင့် တည်ရှိပြီးလမ်းများ၊ ကျောင်းများ၊ ဆေးရုံများနှင့် ဆက်သွယ်ရေးစင်တာများအား ယာယီထိခိုက်မှုများ ဖြစ်ပေါ်နိုင်သည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော သက်ရောက်မှု မဖြစ်နိုင်ပါ။
	၂၀။	ဒေသတွင်း လူမှုအဖွဲ့အစည်းများ	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** အရေ့- အနောက်လမ်းကြောင်းကို မြင့်မားသောပုံစံတည်ဆောက်ထားခြင်းကြောင့် ရပ်ရွာလူထုအား ထိခိုက်မှုမရှိပါ။

အမျိုးအစား	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေးမစတင်မီအဆင့်	ဆောက်လုပ်ရေး အဆင့်	
	၂၁။	လွဲမှားသော အကျိုးခံစားမှုနှင့် ထိခိုက်မှုများ	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးဧရိယာအပေါ်မူတည်၍ လမ်းဖြတ်ကူးမှုတားဖြစ်ခြင်းနှင့် ဈေးဆိုင်များယာယီပိတ်သိမ်းခြင်းကဲ့သို့ လွဲမှားသော အကျိုးခံစားမှုနှင့် ထိခိုက်မှုများရှိနိုင်သည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** စီမံကိန်းလည်ပတ်သည့်အဆင့်တွင် လွဲမှားသော အကျိုးခံစားမှုနှင့် ထိခိုက်မှုများမရှိနိုင်ပါ။
	၂၂။	ဒေသတွင်းဆိုင်ရာ ပဋိပက္ခ	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** မြေတူးဖော်ခြင်းနှင့် ပစ္စည်းများစုပုံထားရှိခြင်းကြောင့် ဒေသခံပြည်သူနှင့် ရပ်ရွာအဖွဲ့အစည်းများမှ မကျေနပ်မှုများ ဖြစ်နိုင်သည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော သက်ရောက်မှု မဖြစ်နိုင်ပါ။
	၂၃။	ယာဉ်ကျေးမှုအမွေအနှစ်များ	D	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်၊ ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ဓာတ်အားသွယ်တန်းကြိုးတစ်လျှောက် ယာဉ်ကျေးမှုအမွေအနှစ်များ မရှိပါ။
	၂၄။	မြေယာရှုခင်း	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** ဓာတ်အားသွယ်တန်းကြိုးတစ်လျှောက် ယာယီ မြင်ကွင်းပသာဒထိခိုက်မှု ရှိနိုင်သည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော သက်ရောက်မှု မဖြစ်နိုင်ပါ။
	၂၅။	ကျား/မ တန်းတူညီမျှမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** လုပ်ခ၊ လစာနှင့် အလုပ်သမားများအပေါ် ဆက်ဆံမှုများနှင့် ပက်သက်၍ ကျား/မ ကွဲပြားမှုများရှိနိုင်သည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ကျား/ မ တန်းတူညီမျှမှုအပေါ် သက်ရောက်မှုမရှိနိုင်ပါ။
	၂၆။	ကလေးသူငယ်အခွင့်အရေး	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** ဓာတ်အားသွယ်တန်းကြိုးတစ်လျှောက်ရှိ ကလေးလုပ်သား ခန့်ထားခြင်းကြောင့် ကလေးများပညာမသင်မနေရ ပညာရေးစနစ်အား အနှောင့်အယှက်ဖြစ်စေနိုင်သည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော သက်ရောက်မှုမရှိပါ။
	၂၇။	ကျန်းမာရေး (HIV/AIDS ကဲ့သို့ ကူးစက်နိုင်သည့် ရောဂါများ)	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်သားများဝင်ရောက်လာမှုကြောင့် HIV/ AIDS ကဲ့သို့ ကူးစက်ရောဂါများပြန့်ပွားနိုင်သည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော သက်ရောက်မှုမရှိပါ။
	၂၈။	အလုပ်သမားပတ်ဝန်းကျင်	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** ပြဋ္ဌာန်းထားသော ဥပဒေ၊ စည်းမျဉ်းများနှင့်အညီ အလုပ်သမားများအတွက် ကောင်းမွန်သော ပတ်ဝန်းကျင်ဖြစ်ရန် လိုအပ်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ဆောက်လုပ်ရေးလုပ်ငန်းများ ပြီးစီးသည့်အခါ ဘေးအန္တရာယ်ကင်းရှင်းရေးအပါအဝင် အလုပ်သမားပတ်ဝန်းကျင်အား ထိခိုက်မှုမရှိပါ။
ပြည်သူ	၂၉။	မတော်တဆမှုများ	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်ငန်းမှာအသေးစားလုပ်ငန်းမျှသာဖြစ်ပြီး မြေတူးဖော်မှုများကိုလည်းကန့်သတ်ထားသောကြောင့် မတော်တဆမှုများ အနည်းငယ်သာဖြစ်မည်ဟု မျှော်မှန်းထားသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော သက်ရောက်မှုမရှိပါ
	၃၀။	နေရာဒေသကျော်လွန်၍ ထိခိုက်သက်ရောက်မှုများနှင့် ရာသီဥတုပြောင်းလဲမှု	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ဓာတ်အားလိုင်းသွယ်တန်းမှုကြောင့်ဘေးနေရာဒေသကျော်လွန်၍ ထိခိုက်သက်ရောက်မှုများနှင့် ရာသီဥတု ပြောင်းလဲမှုများမရှိပါ။

ဇယား ၅.၄ ဘုရင့်နောင်တံတားသစ်ကြောင့် ဖြစ်ပေါ်စေနိုင်သော သက်ရောက်မှုများကို ဆန်းစစ်ခြင်း

အခန်းကဏ္ဍ	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေးမစတင်မီအဆင့်	ဆောက်လုပ်ရေးအဆင့်	
သဘာဝပတ်ဝန်းကျင်	၁။	လေထုညစ်ညမ်းမှု	B-	B+	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်ငန်းသုံး စက်ပစ္စည်းများ၊ ဝန်ချီစက်များနှင့် ကားလမ်းပိတ်ဆို့မှုများကြောင့် NOx, SOx နှင့် ဖုန်မှုန့်များထုတ်လွှတ်မှုစေပြီး လေထုအပေါ် ခဏတာ သက်ရောက်မှုရှိစေပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** စီမံကိန်းတစ်လျှောက် ကားလမ်းပိတ်ဆို့မှုလျော့ပါးသွားစေမှုကြောင့် ကောင်းကျိုးရှိပါသည်။
	၂။	ရေထုညစ်ညမ်းမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** - တံတားဆောက်လုပ်ရေးအတွက် မြေကြီးများ တူးယူခြင်းစသည့် လုပ်ငန်းစဉ်များကြောင့် လျှိုဝှက်မြစ်တွင် ရေနောက်ကျိမှုများ ဖြစ်ပေါ်နိုင်ပါသည်။ - အလုပ်သမားတန်းလျားများမှ ထွက်ရှိလာသော ရေများကြောင့် ညစ်ညမ်းစေနိုင်သည်။ - ဆောက်လုပ်ရေးစွန့်ပစ်ပစ္စည်းများကို တာရှည်ထားရှိမှုကြောင့်လည်း ရေထုအပေါ် သက်ရောက်မှုရှိစေပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၃။	အမှိုက်စွန့်ပစ်မှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** အလုပ်သမားတန်းလျားများမှ အမှိုက်စွန့်ပစ်မှုများရှိမည်။ ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်များမှလည်း မြေကြီးနှင့် သစ်ပင်ခုတ်ထစ်မှုကြောင့် အမှိုက်များထွက်ရှိမည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၄။	မြေဆီလွှာညစ်ညမ်းမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** - ဆီဖိတ်ယိုမှုကြောင့် လုပ်ငန်းခွင်တွင် တူးဖော်ထားသော မြေကြီးများ ညစ်ညမ်းနိုင်ပါသည်။ - စက်ပစ္စည်းများမှ ဆီဖိတ်ယိုမှုကြောင့်လည်း မြေဆီလွှာအပေါ် သက်ရောက်မှုရှိနိုင်ပါသည်။ - ဆောက်လုပ်ရေးစွန့်ပစ်ပစ္စည်းများကို တာရှည်ထားရှိမှုကြောင့်လည်း မြေဆီလွှာအပေါ် သက်ရောက်မှုရှိစေပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၅။	ဆူညံသံနှင့် တုန်ခါမှု	B-	B±	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးသုံး စက်ပစ္စည်းများ၊ ယာဉ်များအသုံးပြုမှု၊ အုတ်အသယ်အချလုပ်ငန်းစဉ်များနှင့် ကားလမ်းပိတ်ဆို့မှုများကြောင့် ဆူညံသံနှင့် တုန်ခါမှုများ ဖြစ်နိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ယာဉ်ကြောပိတ်ဆို့မှုကို လျော့ချနိုင်မှုကြောင့် ဆူညံသံနှင့် တုန်ခါမှုကို လျော့ချနိုင်သော်လည်း စီမံကိန်းကြောင့် သက်ရောက်မှုများ ရှိပါသည်။
	၆။	မြေကျွံကျမှု	B-	B-	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** မြေနက်ပိုင်းထိ တူးဖော်မှုနှင့် ရေစုတ်ထုတ်ရေး လုပ်ငန်းစဉ်များ မပါဝင်သည့်အတွက်ကြောင့် ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်ကြောင့် မြေအောက်ရေအပေါ်ဆိုးကျိုးများ မရှိပါ။ သို့သော် အောက်ခံမြေသားပျော့မှုကြောင့် မြေကျွံကျမှုဖြစ်နိုင်ချေရှိပါသည်။
	၇။	အနုံအသက်ဆိုးရွားမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** အလုပ်သမားတန်းလျားမှ အမှိုက်စွန့်ပစ်မှုများကြောင့် အနုံအသက်ဆိုးရွားမှုရှိစေနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၈။	နုန်းအနယ်အနှစ်	B-	D	**ဆောက်လုပ်ရေးအဆင့်:**

အခန်းကဏ္ဍ	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု: ဆောက်လုပ်ရေး မစတင်မီအဆင့်	အကဲဖြတ်မှု: ဆောက်လုပ်ရေးအဆင့်	Reason for evaluation
		အရည်အသွေး			- လုပ်ငန်းခွင်တွင် တူးဖော်ထားသော မြေကြီးများ ညစ်ညမ်းနိုင်ပါသည်။ - တံတားဆောက်လုပ်ရေး လုပ်ငန်းစဉ်များကြောင့် လှိုင်မြစ်အတွင်းရှိ အနည်ကျမှုအရည်အသွေးအပေါ် သက်ရောက်မှုရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** အနည်ကျမှုအရည်အသွေးအပေါ် သက်ရောက်မှုရှိစေနိုင်သော လုပ်ငန်းစဉ်များ မပါဝင်ပါ။
သဘာဝပတ်ဝန်းကျင်	၉။	ထိန်းသိမ်းကာကွယ်ထားသော ဧရိယာများ	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** အရှေ့-အနောက်လမ်းကြောင်းတစ်လျှောက် ထိန်းသိမ်းကာကွယ်ထားသော ဧရိယာများရှိပါ။
	၁၀။	ဂေဟစနစ်	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်:** - တံတားဆောက်လုပ်ရေးအတွက် သစ်ပင်များခုတ်ထစ်မှုကြောင့် ဂေဟစနစ်အပေါ်တွင် သက်ရောက်မှုရှိနိုင်ပါသည်။ - တံတားဆောက်လုပ်ရေးအတွက် မြေတူးခြင်းများနှင့် စွန့်ပစ်ပစ္စည်းများအကြောင့် မြစ်ထဲတွင် နေထိုင်သော ရေနေသတ္တဝါများအပေါ် သက်ရောက်မှုရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** ဆူညံသံနှင့် တုန်ခါမှုကို ဖြစ်ပေါ်စေသော ရထားလမ်းရှိရာ တံတားနှင့် အနီးတွင် ကျက်စားသော မျိုးစိတ်များအပေါ်တွင် ထိခိုက်မှုရှိနိုင်ပါသည်။
	၁၁။	ဧလေဗေဒ	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** တံတားဆောက်လုပ်ခြင်းကြောင့် မြစ်ကြောင်းစီးဆင်းမှုတွင် သက်ရောက်မှုရှိနိုင်ပါသည်။
	၁၂။	မြေမျက်နှာသွင်ပြင်နှင့် ဘူမိဗေဒ	**B-**	**B-**	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** လမ်းကြောင်းတစ်လျှောက်တွင် ထူခြားတန်ဖိုးရှိသော ဘူမိဗေဒနှင့် မြေမျက်နှာသွင်ပြင်အနေအထားမရှိပါ။ သို့သော် ရထားတွဲများ ထားရှိသည့် ရုပ်ဝန်းကို တည်ဆောက်ရန် မြေသား ပြန်ဖို့ခြင်းများကြောင့် မြေဆီလွှာတိုက်စားခြင်းနှင့် မြေပြိုကျခြင်းများ ဖြစ်ပေါ်နိုင်ပါသည်။
လူမှုဘဝ	၁၃။	မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချထားခြင်းများ	**B-**	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်:** တံတားလမ်းကြောင်းတစ်လျှောက်တွင် မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများ ပြုလုပ်ရပါမည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၁၄။	ဆင်းရဲမှု	**B-**	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်:** ဆောက်လုပ်ရေးနှင့် အနီးဝန်းကျင်ရှိ လူ့အဖွဲ့အစည်းပေါ်မူတည်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများ မရှိပါ။
	၁၅။	ဒေသခံတိုင်းရင်းသားများအပေါ် သက်ရောက်မှု	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၁၆။	အလုပ်အကိုင်အခွင့်အလမ်းများနှင့် ဒေသတွင်း စီးပွားရေးအခြေအေ	**B±**	**B-**	**ဆောက်လုပ်ရေး မစတင်မီအဆင့် :** - မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများ များကြောင့် စီးပွားရေးအခြေအနေပေါ်တွင် ထိခိုက်မှုရှိနိုင်ပါသည်။ - လှိုင်မြစ်ကို မှီခိုရသော တံငါသည်များနှင့် သက်ဆိုင်ရာ လုပ်ငန်းရှင်များအပေါ်တွင် ထိခိုက်မှုရှိနိုင်ပါသည်။ - စီမံကိန်းကြောင့် လှိုင်သာယာတွင် နေထိုင်သော ကျူးကျော်များအတွက် ဆောက်လုပ်ရေးတွင် ဝင်ရောက်လုပ်ကိုင်နိုင်သည့် အလုပ်အကိုင်အခွင့်အလမ်းများ ရှိလာနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:**

အခန်းကဏ္ဍ	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေး မစတင်မီအဆင့်	ဆောက်လုပ်ရေးအဆင့်	
					- မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများရခြင်းများမရှိပါ။ - စီမံကိန်းကြောင့် ငါးဖမ်းရန် နေရာအခက်အခဲရှိလာနိုင်သည့်အတွက် တံငါသည်များနှင့် သက်ဆိုင်ရာ လုပ်ငန်းရှင်များအပေါ်တွင် ထိခိုက်မှုရှိနိုင်ပါသည်။
	၁၇။	မြေအသုံးချမှုနှင့်ဒေသတွင်း သယံဇာတ အရင်းအမြစ်များ	B-	D	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့်:** - မြေယာသိမ်းဆည်းခြင်းနှင့် ပြန်လည်နေရာချ ထားခြင်းများပြုလုပ်ရပါမည်။ - ဆောက်လုပ်ရေးကြောင့် သယံဇာတများကို သုံးစွဲခြင်းမှ သက်ရောက်မှုရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - မြေယာသိမ်းဆည်းခြင်းနှင့် ဆန္ဒမပါဝဲ နေရာ ရွှေ့ပြောင်းရခြင်းများမရှိပါ။
	၁၈။	ရေအသုံးချမှု	B-	B-	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်နှင့် မြေယာသိမ်းဆည်းမှုအပေါ်မူတည်၍ သောက်ရေအတွက် ရေတွင်းများရှိ ရေအရည်အသွေးကို ထိခိုက်မှုရှိနိုင်ပါသည်။ ရေလမ်းသုံး ယာဉ်များ (ငါးဖမ်းလှေနှင့် သမ္ဘာနံများ) အသုံးပြုမည့် ရေလမ်းကြောင်း အပြောင်းအလဲရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - တံတားတည်ရှိမှုကြောင့် ငါးဖမ်းရာတွင် ထိခိုက်မှုရှိနိုင်ပါသည်။
	၁၉။	လူမှုအဆောက်အအုံနှင့် ဝန်ဆောင်မှုကဏ္ဍ	B-	B+	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့် :** - အခြေခံအဆောက်အအုံများဖြစ်သည့် ကျောင်း၊ ဆေးရုံနှင့် လူမှုစင်တာများတွင် မြေယာသိမ်းဆည်းခြင်း သို့မဟုတ် ကားလမ်းပိတ်ဆို့မှုများကြောင့် သက်ရောက်မှုများရှိနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - စီမံကိန်းကြောင့် အခြေခံအဆောက်အအုံများတွင် ကောင်းကျိုးများ ဖြစ်ပေါ်စေနိုင်ပါသည်။
	၂၀။	ဒေသတွင်း လူမှုအဖွဲ့အစည်းများ	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့် :** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
Social Environment	၂၁။	လွဲမှားသော အကျိုးခံစားမှုနှင့် ထိခိုက်မှုများ	B-	B-	**ဆောက်လုပ်ရေး မစတင်မီအဆင့်နှင့် ဆောက်လုပ်ရေးအဆင့် :** ဆောက်လုပ်ရေးလုပ်ငန်းနေရာအပေါ်မူတည်၍ ငါးဖမ်းရန်နေရာများတွင် အပြောင်းအလဲများ ဖြစ်ပေါ်နိုင်ခြင်းကြောင့် အကျိုးခံစားမှု မညီမျှခြင်းများနှင့် လူမှုစီးပွားအပေါ် အဟန့်အတားရှိနိုင်ပါသည်။
	၂၂။	ဒေသတွင်းဆိုင်ရာ ပဋိပက္ခ	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** - ဆောက်လုပ်ရေးလုပ်သားများအကြောင့် ပတ်ဝန်းကျင်တွင် လုံခြုံစိတ်ချမှုနှင့် ပတ်သက်၍ မကျေနပ်မှုများရှိလာနိုင်ပါသည်။ **စီမံကိန်းလည်ပတ်သည့် အဆင့်:** သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၂၃။	ယာဉ်ကျေးမှုအမွေအနှစ်များ	D	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** လက်ရှိလျာထားသည့် လမ်းကြောင်းတစ်လျှောက်တွင် ဘာသာရေးဆိုင်ရာ အဆောက်အအုံများနှင့် သမိုင်းဝင် အဆောက်အအုံများမရှိပါ။
	၂၄။	မြေယာရှုခင်း	B-	D	**ဆောက်လုပ်ရေးအဆင့်နှင့် စီမံကိန်းလည်ပတ်သည့် အဆင့်:** - စီမံကိန်းနှင့် အနီးပတ်ဝန်းကျင်တွင် ဥပဒေ၊ စည်းမျဉ်းစည်းကမ်းများအရ ဆောက်လုပ်ထားသော မြေယာရှုခင်းများ မရှိပါ။ - စီမံကိန်းကြောင့် နေ့စဉ်မြင်တွေ့နေရသော မြင်ကွင်းပဒါသမှာ ပြောင်းလဲသွားမည်။
	၂၅။	ကျား/မ တန်းတူညီမျှမှု	B-	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးလုပ်သားအနေဖြင့် လုပ်အားခ/ အရေးယူမှုများတွင် မတူညီမှုများရှိနိုင်ပါသည်။

အခန်းဘွဲ့	စဉ်	သက်ရောက်မှု (JICA Item)	အကဲဖြတ်မှု		Reason for evaluation
			ဆောက်လုပ်ရေးမစတင်မီအဆင့်	ဆောက်လုပ်ရေးအဆင့်	
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၂၆။	ကလေးသူငယ်အခွင့်အရေး	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** စီမံကိန်းလမ်းကြောင်းတစ်လျှောက် ဆောက်လုပ်ရေးလုပ်ငန်းများဆောင်ရွက်စဉ် ကလေးအလုပ်သမားခန့်အပ်မှုများကြောင့် ပညာရေးတွင် အနှောက်အယှက်ဖြစ်စေနိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၂၇။	ကျန်းမာရေး (HIV/AIDS ကဲ့သို့ ကူးစက်နိုင်သည့် ရောဂါများ)	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးအလုပ်သမားများအကြား ကူးစက်ရောဂါများ ဖြစ်ပေါ်နိုင်ပါသည်။ မြေတူးဖော်ခြင်းနှင့် ပြန်ဖို့ခြင်းများမှလည်း ခြင်ပေါက်ဖွားမှုဖြစ်စေနိုင်ပြီး ရောဂါဖြစ်စေနိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: အခြေချနေထိုင်သူများတိုးပွားလာခြင်းနှင့် ရထားအသုံးပြုသူများမှတဆင့် ကာလသားရောဂါကဲ့သို့သော ကူးစက်ရောဂါများဖြစ်ပွားနိုင်ပါသည်။
	၂၈။	အလုပ်သမားများ၏ ပတ်ဝန်းကျင်	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** ပြဋ္ဌာန်းထားသော ဥပဒေ၊ စည်းမျဉ်းများနှင့်အညီ အလုပ်သမားများအတွက် ကောင်းမွန်သော ပတ်ဝန်းကျင်ဖြစ်ရန် လိုအပ်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: - အလုပ်သမားများ၏ ပတ်ဝန်းကျင်တွင် ကြီးမားသည့် ပြောင်းလဲမှုမရှိပါ။ - ပြဋ္ဌာန်းထားသော ဥပဒေ၊ စည်းမျဉ်းများနှင့်အညီ အလုပ်သမားများအတွက် ကောင်းမွန်သော ပတ်ဝန်းကျင်ဖြစ်ရန် လိုအပ်ပါသည်။
အခြားသုံး	၂၉။	မတော်တဆမှုများ	**B-**	D	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးသုံး ယာဉ်များအသုံးပြုမှုကြောင့် ယာဉ်မတော်တဆမှုများ ဖြစ်ပွားနိုင်ပါသည်။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှုမရှိပါ။
	၃၀။	နေရာဒေသကျော်လွန်၍ ထိခိုက်သက်ရောက်မှုများနှင့် ရာသီဥတုပြောင်းလဲမှု	D	**B+**	**ဆောက်လုပ်ရေးအဆင့်:** ဆောက်လုပ်ရေးသုံးယာဉ်များမှ ထွက်ရှိသော ဓာတ်ငွေ့များမှာ ကမ္ဘာပူနွေးမှုအပေါ်တွင် သက်ရောက်မှု မရှိနိုင်ပါ။
					စီမံကိန်းလည်ပတ်သည့် အဆင့်: စီမံကိန်းတစ်လျှောက်တွင် ယာဉ်ကြောပိတ်ဆို့မှုများ လျော့နည်းသွားမှုကြောင့် ဖန်လုံအိမ်ဓာတ်ငွေ့ထုတ်လွှတ်မှု လျော့နိုင်ပါသည်။

အပိုင်း (၆) ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ် လျှော့ချမှု အစီအစဉ်

ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှု အစီအစဉ်တွင်-

(၁) ပတ်ဝန်းကျင်ဆိုင်ရာ လျှော့ချမှု အစီအစဉ်

(၂) ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ်

(၃) အရေးပေါ်အခြေအနေအတွက် ကြိုတင်ပြင်ဆင်ခြင်းနှင့် ဖြစ်လာပါက တုံ့ပြန်ဆောင်ရွက်ခြင်းအစီအစဉ်

(၄) ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေးအစီအစဉ်

(၅) မကျေလည်မှုများကို ဖြေရှင်းသည့် အစီအစဉ်

(၆) ယာဉ်သွားလာမှု စီမံခန့်ခွဲခြင်း အစီအစဉ်ဟူ၍ အဓိက အပိုင်း (၆) ပိုင်း ပါရှိပါသည်။

စီမံကိန်း မစတင်မီ၊ စီမံကိန်းကာလ အတောအတွင်းနှင့် စီမံကိန်းနောက်ပိုင်း ဖြစ်ပေါ်နိုင်သည်ဟု မျှော်မှန်းထားသော ဆိုးကျိုးသက်ရောက်မှု တစ်ခုချင်းစီအတွက် လျော့ပါးစေရေး နည်းလမ်းများအား ထည့်သွင်းရန် လိုအပ်ပါသည်။ လျော့ပါးမှုလုပ်ငန်းစဉ်များအား ဆောင်ရွက်ရန် တာဝန်ရှိသော အဖွဲ့အစည်းများ(ကန်ထရိုက်တာနှင့် မြန်မာ့မီးရထား)မှ ယင်းလုပ်ငန်းများအား အမှန်တကယ် လိုက်နာဆောင်ရွက်ခြင်းရှိ၊မရှိ နှင့် ယင်းလုပ်ငန်းများမှ မျှော်မှန်းထားသော ရလဒ်များ ရရှိနိုင်မှု ရှိ၊မရှိကို စစ်ဆေးခြင်းနှင့် စောင့်ကြည့်လေ့လာခြင်းတို့သည်လည်း လျော့ပါးသက်သာရေး နည်းလမ်းများကဲ့သို့ပင် အရေးပါလှပါသည်။

ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ်၊ ကုန်ကျစားရိတ်နှင့် အကောင်အထည်ဖော်ဆောင်ရွက်မည့် အစီအစဉ်များ အကျဉ်းချုပ်ကို ဇယား ၇.၅၊ ၇.၆ နှင့် ၇.၇ တွင် ဖော်ပြထားပါသည်။

ဇယား ၆.၁ ရထားလမ်းအတွက် စီမံကိန်းကြောင့် သက်ရောက်မှုများအား လျော့ပါးစေရေးနည်းလမ်းများ

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
ညစ်ညမ်းမှုထိန်းချုပ်ခြင်း					
၁	လေထုညစ်ညမ်းမှု	B-	B+	• ဆောက်လုပ်ရေးလုပ်ငန်းသုံး ကိရိယာများနှင့် စက်ယန္တယားများအား ပုံမှန်ထိန်းသိမ်းကာကွယ်မှုများအား တိကျစွာ လုပ်ဆောင်ရန်နှင့် ယင်းကိရိယာနှင့် စက်ယန္တယားများ အကောင်းဆုံးလည်ပတ်မှု အခြေအနေတွင် ရှိစေရန် ပုံမှန် စစ်ဆေးမှုများ လိုအပ်သည်။ • လုပ်ငန်းခွင်အချိန်ဇယားတွင် ဆောက်လုပ်ရေးလုပ်ငန်းသုံးကိရိယာများအား အချိန်တစ်ခုအထိ ကြာရှည်စွာအသုံးပြုခြင်းမရှိစေရန် သင့်လျော်စွာ ထည့်သွင်းစဉ်းစားသင့်သည်။ • ဖုန်မှုန့်ထွက်ရှိမှုအားလျှော့ချရန် အချိန်မှန်ရေဖြန်းခြင်းအား လုပ်ဆောင်သင့်သည်။ • ဒေသခံများနှင့် လမ်းသွားလမ်းလာများမှ ဖုန်မှုန့်နှင့် အငွေ့များနှင့် ပက်သက်၍ မကျေနပ်မှုများရှိလာပါက ကြီးကြပ်မှုနှင့် ကန်ထရိုက်တာတို့၏ အတိုင်ပင်ခံမှ ဆောက်လုပ်ရေး နည်းလမ်းများအား ပြန်လည်စဉ်းစားသင့်သည်။ • လေထုညစ်ညမ်းမှုအဆင့်သည် ပတ်ဝန်းကျင်ဆိုင်ရာ စံနှုန်းများထက် သိသိသာသာ ကျော်လွန်လာပါက လောင်စာအရည်အသွေး၊ ကားအကောင်းများတင်သွင်းခြင်းနှင့် ဓာတ်ငွေ့ထုတ်လွှတ်မှု ထိန်းချုပ်ခြင်း ဆိုင်ရာ စည်းမျဉ်းများကို လိုအပ်ချက်အရ ပြန်လည်ပြင်ဆင် သင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ
၂	ရေထုညစ်ညမ်းမှု	B-	B-	• ကွန်ကရစ်လောင်းခြင်းနှင့် လမ်းခင်းခြင်းမှ ယိုဖိတ်ခြင်းများအား ကာကွယ်ရန် အနီးကပ် ကြီးကြပ်ကွပ်ကဲရမည်။ • ဆောက်လုပ်ရေးလုပ်သားများမှ ထွက်ရှိသော အညစ်အကြေးများအား စနစ်တကျ စီမံခန့်ခွဲနိုင်ရန်နှင့် ရေနုတ်မြောင်းများထဲသို့ စွန့်ပစ်ခြင်းကြောင့် နောက်ထပ် ညစ်ညမ်းမှုများမှ ကာကွယ်ရန် ရွှေ့လျားအိမ်သာကဲ့သို့ ယာယီ အညစ်အကြေးစွန့်ပစ်ရေး ပစ္စည်းများကို ကန်ထရိုက်တာများမှ	• ရေထိန်းသိမ်းမှုနှင့် ရေအသုံးချမှု လျော့ချ ရေးအသိပေးမှုဆိုင်ရာ လုပ်ငန်းများ တိုးမြှင့်ဆောင်ရွက်ခြင်း • အပေါ်စွန့်အင်တုံနှင့်

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
				ထောက်ပံ့ပေးရမည်။ • ရေထုညစ်ညမ်းမှုမှ ကာကွယ်ရန် ရေကြောင်းတစ်လျှောက် ဆောက်လုပ်ရေးလုပ်ငန်းသုံး ကိရိယာများအား ဆေးကြောခြင်းအား တားမြစ်ရမည်။ • မြစ်ချောင်းများအနီးရှိ ဆောက်လုပ်ရေးလုပ်ငန်းခွင်တွင် နောက်ကျိစော စွန့်ပစ်ရေများအား သတ်မှတ်နေရာ၌သာ စွန့်ပစ်ရမည်။	လက်ဆေးဘောစင်များအား အလိုအလျောက် အာရုံခံကိရိယာများဖြင့် အဆင့် မြှင့်တင်ခြင်း
၃	စွန့်ပစ်ပစ္စည်း	B–	B–	• ဆောက်လုပ်ရေးနှင့် ယာယီစခန်းများမှ ထွက်ရှိသော စွန့်ပစ်ပစ္စည်းများအား ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ၏ လမ်းညွှန်ချက်အရ စွန့်ပစ်ရမည်။ • မြေဆီလွှာတွင် အဆိပ်အတောက်ဖြစ်စေသော အရာများ ပါဝင်ပါက ပြန်လည်အသုံးပြုခြင်းနှင့် စွန့်ပစ်ခြင်းများ မလုပ်မီ ပြုပြင်ရန် လိုအပ်သည်။ • ထွက်ရှိလာသောအမှိုက်များအား သင့်လျော်သည့် အခြေအနေပေါ်မူတည်၍ အခြားသို့ ပြန်လည်ရောင်းချခြင်း ပြုလုပ်နိုင်သည်။	• YUMRT အသုံးပြုသူများအတွက် ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီမှ ဘူတာရုံတိုင်းတွင် လုံလောက်သော အမှိုက်ပုံးအရေအတွက် ထားရှိသင့်သည်။ • စီမံကိန်းလည်ပတ်စဉ်အဆင့်တွင် အမှိုက်များကို သက်ဆိုင်ရာ စည်းကမ်းများနှင့်အညီ စနစ်တကျ စုဆောင်းပြီး စွန့်ပစ်ခြင်း (သို့မဟုတ်) ပြန်လည်အသုံးပြုသင့်သည်။
၄	မြေဆီလွှာ ညစ်ညမ်းမှု	B–	B–	• ညစ်ညမ်းသော မြေများအား သတ်မှတ်စွန့်ပစ်နေရာတွင် စွန့်ပစ်ရမည်။ • မြေဆီလွှာအရည်အသွေး စစ်ဆေးမှု လုပ်ဆောင်သင့်သည်။ • ယိုဖိတ်မှုများ မဖြစ်ပေါ်စေရန် သင့်လျော်သော ဆီစွန့်ပစ်မှုနည်းလမ်းကို ဆောင်ရွက်သင့်သည်။ • ဆီယိုစိမ့်ခြင်းမှ ကာကွယ်ရန် ဆီဖြည့် သည့်နေရာအား ကွန်ကရစ်ကြမ်းခင်းဖြင့် တည်ဆောက်သင့်သည်။ • အရည်ပါသော ဘက်ထရီအိုးများအား အရည်၊ ဓာတ်ငွေ့များ မစိမ့်ဝင်နိုင့်သည့် နေရာမျိုး၌ ထားရှိရမည်။	• မြေဆီလွှာ ညစ်ညမ်းခြင်းသည် ဘူတာရုပ်ဝန်း၌သာ ဖြစ်ပေါ်နိုင်သဖြင့် ယိုဖိတ်ခြင်း မဖြစ်စေရန် ဆီယိုစိမ့်ခြင်းကို ဂရုပြုရမည်။ • ယိုဖိတ်မှုများ မဖြစ်ပေါ်စေရန် သင့်လျော်သော ဆီစွန့်ပစ်မှုနည်းလမ်းကို ဆောင်ရွက်သင့်သည်။
၅	ဆူညံသံနှင့် တုန်ခါမှု	B–	B±	• ကြီးမားသော ကိရိယာ အမျိုးမျိုးနှင့် အခြားဆောက်လုပ်ရေး စက်ယန္တရားများမှ ထွက်ရှိသော ဆူညံသံများအား ခွင့်ပြုထားသော ပမာဏအတွင်း ရှိစေရန် ဆူညံသံ လျှော့ချသည့်ကိရိယာများကို လိုအပ်သည်ဟု ယူဆပါက တပ်ဆင်ရမည်။ • ဆူညံသံပမာဏအား ခွင့်ပြုထားသော ပမာဏအတွင်းရှိစေရန် သတ္တုပြားနံရံများကဲ့သို့ ယာယီဆူညံသံ အကာအကွယ်များအား ဆောက်လုပ်ရေးလုပ်ငန်းခွင်တစ်ဝိုက်တွင် လိုအပ်ပါက တပ်ဆင်ရမည်။ • လူနေအိမ်၊ စီးပွားရေး ဇရိယာများနှင့် အခြား ဆူညံသံကြောင့် ထိခိုက်လွယ်သော ဇရိယာများတွင် အနှောင့်အယှက်ဖြစ်စေခြင်းမှ ရှောင်ရှားရန် ဆူညံသံမြင့်မားစွာထွက်ရှိသော ဆောက်လုပ်ရေး လုပ်ငန်းများကို နေ့ဘက် (၇:၀၀ နာရီမှ ၂၂:၀၀ နာရီ) အတွင်းသာ စီစဉ်ဆောင်ရွက်ရမည်။ • အနီးဝန်းကျင်ရှိ အဆောက်အဦများအပေါ် သက်ရောက်မှုများအား သိရှိရန် အဆောက်အဦများ၏ တုန်ခါမှု အဆင့်နှင့် အခြေအနေတို့ကို စောင့်ကြည့် လေ့လာသင့်သည်။ • ဒေသခံများမှ ဆူညံသံနှင့် တုန်ခါမှုနှင့် ပက်သက်၍ မကျေနပ်မှုများ ရှိလာပါက ကြိုးကြပ်မှုနှင့် ကန်ထရိုက်တာ တို့၏ အတိုင်ပင်ခံမှ ဆောက်လုပ်ရေး နည်းလမ်းများအား ပြန်လည် စဉ်းစားသင့်သည်။ • ဆူညံသံပမာဏသည် ပတ်ဝန်းကျင်ဆိုင်ရာ စံနှုန်းများထက် သိသိသာသာ ကျော်လွန်လာပါက လောင်စာအရည်အသွေး၊	• ရထားလမ်းတွင် ဆူညံသံအကာအကွယ် တပ်ဆင်ခြင်း • ဘူတာရုံ ပလက်ဖောင်း၌ အချက်ပေးစနစ်သံနှင့် ဘဲလ်မြည်သံတို့ကို ယင်းတို့ ၏ လုပ်ဆောင်မှု မလျော့ကျနိုင်သည့် အနိမ့်ဆုံး အဆင့်အထိ ချိန်ညှိရမည်။ • သင့်လျော်သော ဆူညံသံလျှော့ချရေး နည်းလမ်းများ (ဥပမာ- ဘူတာရုံ၏ ဘေးတစ်လျှောက် ဆူညံသံ အကာအကွယ်များ) တပ်ဆင်ရန်နှင့် တွက်ချက်နိုင်ရန် ဆူညံသံ စောင့်ကြပ် ကြည့်ရှုမှုအား စီမံကိန်းလည်ပတ်သည့် ကာလတွင်လည်း ဆက်လက်လုပ်ဆောင်ရမည်။

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
				ကားအကောင်းများတင်သွင်းခြင်းနှင့် ခတ်ငွေ့ထုတ်လွှတ်မှု ထိန်းချုပ်ခြင်းဆိုင်ရာ စည်းမျဉ်းများကို လိုအပ်ချက်အရ ပြန်လည်ပြင်ဆင် သင့်သည်။	• လျှပ်ကာ / တုန်ခါမှု ကာကွယ်ပစ္စည်းများကို ရထားလမ်းအောက်ခြေတွင် တပ်ဆင်ပြီး ဆူညံသံနှင့် တုန်ခါမှုကို လျှော့ချရမည်။ • ဆူညံသံနှင့်တုန်ခါမှု လျှော့ချရန် လမ်းကွေ့အပိုင်းများတွင် သွားလာသည့် အရှိန်နှုန်းလျှော့ မောင်းနှင်ခြင်း၊ အသံ အကာအကွယ်တပ်ဆင်ခြင်းနှင့် ချုံနိုင်ဆန့်နိုင်သောအဆက်များ ထားရှိခြင်းကဲ့သို့ သင့်လျော်သော တန်ပြန်အစီအစဉ်များ ပါဝင်ရမည်။
၆	မြေကျွံခြင်း	B–	D	• အသေးစိတ်ဒီဇိုင်းအဆင့်တွင် အသေးစိတ် ဘူမိဗေဒဆိုင်ရာ ကွင်းဆင်းစစ်တမ်းများ လုပ်ဆောင်ရမည်။ သင့်လျော်သော အဆောက်အဦဒီဇိုင်းနှင့် ဆောက်လုပ်မှု နည်းစနစ်များကို ကွင်းဆင်းလေ့လာမှုစစ်တမ်းရလဒ်ပေါ်မူတည်၍ ဆုံးဖြတ်ရမည်။	• မြေကျွံမှုကို ပုံမှန်စောင့်ကြည့်စစ်ဆေးသင့်သည်။
၇	အနှံအသက်ဆိုးရွားမှု	B–	B–	• ယာယီစခန်းမှ အထွေထွေစွန့်ပစ်ပစ္စည်းများအား ပုံမှန် သန့်ရှင်းခြင်း	• ဘူတာရုံနှင့် ရထားတွဲရပ်ဝန်းမှ အထွေထွေစွန့်ပစ်ပစ္စည်းများအား ပုံမှန် သန့်ရှင်းခြင်း
၈	အနည်ကျမှုအရည်အသွေး	D	D	• မြစ်ချောင်းများအနီးတွင်အလုပ်လုပ်ပါက ဂရုပြုပါ။ • ညစ်ညမ်းသော မြေများအား သတ်မှတ်စွန့်ပစ်နေရာတွင် စွန့်ပစ်ရမည်။ • မြေဆီလွှာအရည်အသွေး စစ်ဆေးမှု လုပ်ဆောင်သင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
သဘာဝပတ်ဝန်းကျင်					
၉	ထိန်းသိမ်းကာကွယ်ထားသော ဇရီယာများ	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၀	ဂေဟစနစ်	B–	B–	• အဆောက်အဦအမြင့်များအောက်ရှိ ကန့်သတ်ဇရီယာများတွင် ချုံနွယ်မျိုးစိတ် အပင်များ အစားထိုးစိုက်ပျိုးခြင်းကို လိုအပ်သည့်အလျောက် ထည့်သွင်းစဉ်းစားရမည်။ • သစ်တောဦးစီးဌာနနှင့် ပူးပေါင်း၍ သစ်တောပျိုးထောင်မှု ပြုလုပ်သင့်သည်။ • ဆောက်လုပ်ရေးလုပ်ငန်းများရှိ မြေတူးဖော်သည့်လုပ်ငန်းများတွင် ညစ်ညမ်းရေများအား လိုအပ်သလို စောင့်ကြပ်ကြည့်ရှုခြင်းနှင့် ထိန်းချုပ်ခြင်းတို့ ပြုလုပ်ရမည်။	• လျှပ်ကာ / တုန်ခါမှု ကာကွယ်ပစ္စည်းများကို ရေနေဂေဟစနစ်အား သက်ရောက်မှုများမှလျော့ချရန် တပ်ဆင်ရမည်။ • ဆူညံသံနှင့်တုန်ခါမှု လျှော့ချရန် လမ်းကွေ့အပိုင်းများတွင် သွားလာသည့် အရှိန်နှုန်းလျှော့ မောင်းနှင်ခြင်း၊ အသံ အကာအကွယ်တပ်ဆင်ခြင်းနှင့် ကျုံနိုင် ဆန့်နိုင်သော အဆက်များ ထားရှိခြင်းကဲ့သို့ သင့်လျော်သော တန်ပြန်အစီအစဉ်များ ပါဝင်ရမည်။
၁၁	ဧလဗေဒ	B–	D	•အသေးစိတ်ဒီဇိုင်းအဆင့်တွင် အသေးစိတ် ဧလဗေဒဆိုင်ရာ ကွင်းဆင်းစစ်တမ်းများ လုပ်ဆောင်ရမည်။ သင့်လျော်သော အဆောက်အဦဒီဇိုင်းနှင့် ဆောက်လုပ်မှု နည်းစနစ်များကို ကွင်းဆင်းလေ့လာမှုစစ်တမ်းရလဒ်ပေါ်မူတည်၍ ဆုံးဖြတ်ရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
၁၂	မြေမျက်နှာသွင်ပြင်နှင့် ဘူမိဗေဒ	B–	D	• အသေးစိတ်ဒီဇိုင်းအဆင့်တွင် အသေးစိတ် ဘူမိဗေဒဆိုင်ရာ နှင့် ဘူမိနည်းပညာဆိုင်ရာ ကွင်းဆင်းစစ်တမ်းများ လုပ်ဆောင်ရမည်။ သင့်လျော်သော အဆောက်အဦဒီဇိုင်းနှင့် ဆောက်လုပ်မှု နည်းစနစ်များကို ကွင်းဆင်းလေ့လာမှုစစ်တမ်းရလဒ်ပေါ်မူတည်၍ ဆုံးဖြတ်ရမည်။	• မြေဆီလွှာတိုက်စားမှုနှင့် မြေပြိုမှု ဖြစ်နိုင်ခြေများအား ပုံမှန် စောင့်ကြပ်ကြည့်ရှုရမည်။
လူမှုပတ်ဝန်းကျင်					
၁၃	မြေယာရယူခြင်း/ ပြန်လည်နေရာချထားခြင်း	A–	D	• သန်းခေါင်စာရင်းကောက်ယူခြင်းနှင့် လူထုတွေ့ဆုံပွဲများ ပြုလုပ်ခြင်း • အောက်ပါနည်းလမ်းများပါဝင်သော ပြန်လည်နေရာချထားခြင်း အစီအစဉ်များ ပြင်ဆင်ခြင်း ○ စီမံကိန်းသက်ရောက်ခံပြည်သူများကို လျော်ကြေးရပိုင်ခွင့်ရှိသူများအဖြစ် သတ်မှတ်ရမည်။ ○ စီမံကိန်းသက်ရောက်ခံ ပြည်သူများအတွက် ရည်ရွယ်သည့် သန်းခေါင်စာရင်းစစ်တမ်းတွင် အမည်မပါသောသူများ၏ ရပိုင်ခွင့်ကို ဖော်ထုတ်ရန်နှင့် လျော်ကြေးနှင့် အထောက်အပံ့များရရှိစေရန် ○ ယခင်/ လုပ်ဆောင်ဆဲ စီမံကိန်းများမှ အလျှုရှင်များကို ကိုးကားပြီး လူမှုရေးဆိုင်ရာအားနည်းထိခိုက်မှု အတွက် လိုအပ်ချက်များကို စဉ်းစားဆုံးဖြတ်ပြီး လျော်ကြေးငွေပေးခြင်း။ စီမံကိန်းသက်ရောက်ခံပြည်သူများလိုအပ်သည့်အခါ ပြန်လည်နေရာချထားမည့် နေရာများအား ပြင်ဆင်ထားရမည်။ • သက်မွေးဝမ်းကျောင်းမှု ပြန်လည်ထူထောင်ရေး အထောက်အပံ့များအား စီမံကိန်းသက်ရောက်ခံပြည်သူ၏ ထိခိုက်မှုအပေါ် စဉ်းစားကာ ထောက်ပံ့ပေးသင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ
၁၄	ဆင်းရဲနွမ်းပါးမှု	A–	B+	• နေရပ်မှစွန့်ခွာသွားသူများအား ယင်းတို့၏လျော်ကြေးရပိုင်ခွင့်ကို ဆုံးဖြတ်ပေးနိုင်ရန် စံနှုန်း သတ်မှတ်ပေးခြင်း ။ • လျော်ကြေးပမာဏကိုဆုံးဖြတ်ရန်အတွက်စီမံကိန်းအကောင်အထည်ဖော်မှု ကြောင့်ပိုင်ဆိုင်မှုဆုံးရှုံးမှုအသေးစိတ်စာရင်းကိုမှတ်တမ်းတင်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၁၅	ဒေသခံတိုင်းရင်းသားများအပေါ် သက်ရောက်မှု	B–	D	• သန်းခေါင်စာရင်းကောက်ယူခြင်းနှင့် လူထုတွေ့ဆုံပွဲများ ပြုလုပ်ခြင်း • သက်မွေးဝမ်းကျောင်းမှု ပြန်လည်ထူထောင်ရေး အထောက်အပံ့များအား ယင်းတို့၏ လူမျိုးရေးဆိုင်ရာ လက္ခဏာအား ထိခိုက်မှုအပေါ် စဉ်းစားကာ ထောက်ပံ့ပေးသင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၁၆	အလုပ်အကိုင်အခွင့်အလမ်းများနှင့် ဒေသတွင်းစီးပွားရေးအခြေအနေ	B–	B+	• ပြန်လည်နေရာချထားခြင်း အစီအစဉ်များ ပြင်ဆင်ခြင်း။ ○ စီမံကိန်းသက်ရောက်ခံပြည်သူများ၏ သက်မွေးဝမ်းကျောင်းမှု ပြန်လည်ထူထောင်ရန် နည်းလမ်းများ ထားရှိရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၁၇	မြေအသုံးချမှုနှင့် ဒေသတွင်းသယံဇာတ အရင်းအမြစ်များ	B–	B–	• မြေအသုံးချမှုအပေါ် သက်ရောက်မှုအား လျော့နည်းစေရန် သင့်တော်သော ဒီဇိုင်းပုံစံအား ပြင်ဆင်သင့်သည်။ • ဆောက်လုပ်ရေးပြီးဆုံးပါက ဆောက်လုပ်ရေးစခန်းနှင့် လုပ်သားစခန်းအား ယခင်မြေအသုံးချမှုအခြေအနေအတိုင်း ဖြစ်နိုင်သရွေ့ ပြန်လည်ထားရှိပါ။ မထားရှိနိုင်ပါက ပိုမိုကောင်းမွန်သော မြေအသုံးချမှုပုံစံအဖြစ် ထားရှိပါ။ • ဆောက်လုပ်ရေးကာလအတွင်း ဒေသဆိုင်ရာအရင်းအမြစ်များအား လွဲမှားစွာ အသုံးပြုမှု မဖြစ်စေရန် စီစဉ်ဆောင်ရွက်ပါ။	• အရှေ့-အနောက်လမ်းကြောင်းနှင့် ဘူတာရုံတစ်လျှောက်တွင် အစီအစဉ်မကျသော ဖွံ့ဖြိုးတိုးတက်မှုလုပ်ငန်း နှင့် ဒေသဆိုင်ရာ အရင်းအမြစ်များအား အလွန်အကျွံ သုံးစွဲမှုများ မရှိစေရန် စီစဉ် ပြင်ဆင်ပါ။
၁၈	ရေအသုံးချမှု	B–	D	• သောက်သုံးရန်နှင့် အခြား အသုံးပြုမှုများအတွက် မြေအောက်ရေအရည်အသွေး ကို အထူးစောင့်ကြပ်စစ်ဆေးသင့်သည်။ • ရေအရည်အသွေး မပြည့်မှီပါဟု ယူဆပါက သင့်လျော်သော ရေသန့်စင်မှု	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
				နည်းလမ်းများကို ထည့်သွင်းဆောင်ရွက်သင့်သည်။	
၁၉	လူမှုအဆောက်အဦနှင့် ဝန်ဆောင်မှု ကဏ္ဍ	B–	B+	• စီမံကိန်းတည်ဆောက်ရေးကာလအတွင်း ဆေရုံ၊ ကျောင်း စသည့် ထိခိုက်လွယ်သော အဆောက်အဦများအား လွယ်ကူစွာသွားလာနိုင်စေရန် ဆောင်ရွက်ပါ။ ယာဉ်ကြောပိတ်ဆို့မှု အခြေအနေအပေါ်မူတည်၍ လိုအပ်ပါက လမ်းလွှဲများထားရှိပါ။ • ဆောက်လုပ်ရေးလုပ်ငန်းများ မစတင်မီ လျှပ်စစ်ဓာတ်အား၊ ရေအား၊ ရေနုတ်မြောင်းနှင့် ဆက်သွယ်ရေးလိုင်းကဲ့သို့ လူမှုဝန်ဆောင်မှု လုပ်ငန်းများအားများအား လမ်းကြောင်းပြောင်းမည်။ • အဆောက်အဦများ နေရာချထားပြီးပါက အသုံးချဝန်ဆောင်မှုများ ဆက်လက်ရရှိအောင် ဆောင်ရွက်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၀	ဒေသတွင်း လူမှုအဖွဲ့အစည်းများ	B–	B+	• စီမံကိန်းတည်ဆောက်ရေးကာလအတွင်း ဆေရုံ၊ ကျောင်း စသည့် ထိခိုက်လွယ်သော အဆောက်အဦများအား လွယ်ကူစွာသွားလာနိုင်စေရန် ဆောင်ရွက်ပါ။ ယာဉ်ကြောပိတ်ဆို့မှု အခြေအနေအပေါ်မူတည်၍ လိုအပ်ပါက လမ်းလွှဲများထားရှိပါ။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၁	လွှမ်းသော အကျိုးခံစားမှုနှင့် ထိခိုက်မှုများ	B–	B–	• တတိယအဖွဲ့.အစည်းမှ ပြင်ပ စောင့်ကြည့်စစ်ဆေးရေးကော်မတီ ဖွဲ့စည်းခြင်း။	• တတိယအဖွဲ့.အစည်းမှ ပြင်ပ စောင့်ကြည့်စစ်ဆေးရေးကော်မတီ ဖွဲ့စည်းခြင်း။
၂၂	ဒေသတွင်း အကျိုးစီးပွားဆိုင်ရာ ပဋိပက္ခများ	B–	B–	• ဒေသခံပြည်သူများနှင့် ၄င်းမြို့နယ်များတွင်နေထိုင်သူများအား ဦးစားပေး၍ အလုပ်အကိုင် အခွင့်အလမ်းများပေးခြင်း။	• တတိယအဖွဲ့.အစည်းမှ ပြင်ပ စောင့်ကြည့်စစ်ဆေးရေးကော်မတီ ဖွဲ့စည်းခြင်း ။
၂၃	ယဉ်ကျေးမှုအမွေအနှစ်များ	D	D	• စီမံကိန်းလမ်းကြောင်းတစ်လျှောက်တွင် သမိုင်းဝင် ယဉ်ကျေးမှုဆိုင်ရာ နေရာများအားသက်ရောက်နိုင်မှုကို မမျှော်မှန်းထားပါ။ သို့သော် ဘာသာရေးနှင့် သမိုင်းဝင် အဆောက်အဦများအပေါ် သက်ရောက်မှု မရှိနိုင်ကြောင်း သေချာစေရန် အစဉ်လိုက်စိစစ်သတ်မှတ်နေစဉ်နှင့် စီမံကိန်းလမ်းကြောင်းအား အပြီးသတ်ပြီးနောက်တွင် သက်ရောက်မှုရှိခြင်းနှင့် ၎င်း၏ လွှမ်းမိုးနိုင်မှုတို့ကို အတည်ပြုရမည်။	• အနီးဝန်းကျင်ရှိ ဘာသာရေးနှင့် သမိုင်းဝင်အဆောက်အဦများအပေါ် တုန်ခါမှု သက်ရောက်မှုရှိခြင်းကို စစ်ဆေးရမည်။ • တုန်ခါမှုသည် သတ်မှတ်စံနှုန်းထက် ကျော်လွန်နေပါက တုန်ခါမှုလျှော့ချရေးနည်းလမ်းများအား အကောင်အထည်ဖော်ဆောင်ရွက်သင့်သည်။
၂၄	မြေယာရှုခင်း	B–	B–	• အဆောက်အဦများအား ၎င်း၏ပတ်ဝန်းကျင်ရှိ မြင်ကွင်းနှင့် သဟဇာတဖြစ်အောင် ဒီဇိုင်းရေးဆွဲပါ။ • အဆောက်အဦအားလုံးအား မြန်မာနိုင်ငံအဆောက်အဦဆိုင်ရာ စည်းမျဉ်းများအရ ဒီဇိုင်းရေးဆွဲမည်။ • ဆောက်လုပ်ရေးလုပ်ငန်းများအား မူလမြင်ကွင်းပသာဒကို အနှောင့်အယှက်အနည်းဆုံးရှိစေရန် စီစဉ်ဆောင်ရွက်မည်။	• မူလရှုခင်းအား ပြောင်းလဲမှုကြောင့် မြင်းကွင်းအပေါ် သက်ရောက်မှုများအား လျှော့ချရန်။ • အဆောက်အဦအမြင့်များအောက်ရှိ ကန့်သတ်ဧရိယာများတွင် ချုံနွယ်မျိုးစိတ် အပင်များ အစားထိုးစိုက်ပျိုးခြင်းကို လိုအပ်သည့် အလျောက် ထည့်သွင်းစဉ်းစားရမည်။
၂၅	ကျား/ မတန်းတူညီမျှမှု	B–	B–	• စီမံကိန်းသက်ရောက်ခံ အမျိုးသမီးအိမ်ထောင်ဦးစီး ဦးဆောင်သော အိမ်ထောင်စုများအတွက် ထပ်ဆောင်း ဝမ်းရေးဖူလုံမှုနှင့် ပြောင်းရွှေ့နေထိုင်မှု အထောက်အပံ့များ၊ ကျွမ်းကျင်မှုသင်တန်းများနှင့် ဝင်ငွေပြန်လည်ထူထောင်ရေး အစီအစဉ်များ၊ မြို့ပြလုပ်ငန်းများတွင်	• ဘူတာရုံတွင် အမျိုးသမီးသီးသန့် လက်မှတ်အရောင်းကောင်တာများထားရှိပါ။

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
				အလုပ်အကိုင်အခွင့်အလမ်းများ ပါဝင်သင့်သည်။ • အမျိုးသမီးများသည် ဒေသတွင်း လူထုတွေ့ဆုံဆွေးနွေးပွဲများ၌လည်း အမျိုးသားများကဲ့သို့ ဖိတ်ကြားခံရခြင်း၊ တက်ရောက်ခွင့်ရှိခြင်းတို့ ရရှိရမည်။ • သန်းခေါင်စာရင်းစစ်တမ်းကောက်ယူခြင်းတွင် အမျိုးသမီးများအား မေးမြန်းခြင်းကိုလည်း ထည့်သွင်းစဉ်းစားရမည်။	• ရထားပေါ်တွင် အမျိုးသမီးများထိုင်ရန် သတ်မှတ်ထိုင်ခုံများ ထားရှိပါ။
၂၆	ကလေးသူငယ် အခွင့်အရေး	B–	D	• ပြန်လည်နေရာချထားမည့် တည်နေရာအား ရွေးချယ်ရာတွင် ကျောင်း/ဆေးရုံ များသို့ သွားလာရလွယ်ကူစေရန် ဆောင်ရွက်ပါ။ • ဆောက်လုပ်ရေးလုပ်ငန်းခွင်တွင် ကလေးလုပ်သားစုဆောင်းမှုအား တားမြစ်သင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ
၂၇	ကျန်းမာရေး (HIV/AIDS ကဲ့သို့ကူးစက်ရောဂါများ)	B–	B–	• HIV/ AIDS ကဲ့သို့ ကူးစက်ရောဂါများပြန့်ပွားခြင်းမှ ကာကွယ်ရန် အလုပ်သမားများအား အသိပညာပေးသင်တန်းများ ပြုလုပ်ပေးသင့်သည်။ • အသစ်ခြေချနေထိုင်သူများအား ဒေသဆိုင်ရာပြည်သူ့ကျန်းမာရေးစင်တာများမှ ကျန်းမာရေးအသိပညာပေးခြင်းတို့ စီစဉ်ဆောင်ရွက်ပေးရမည်။ • အပတ်စဉ်/ လစဉ် ကျန်းမာရေးစစ်ဆေးခြင်းအစီအစဉ် ပြုလုပ်ရမည်။	• အသစ်ခြေချနေထိုင်သူများအား ဒေသဆိုင်ရာပြည်သူ့ကျန်းမာရေးစင်တာများမှ ကျန်းမာရေးအသိပညာပေးခြင်းတို့ စီစဉ်ဆောင်ရွက်ပေးရမည်။ • အသိပညာပေးအစီအစဉ်များ ပုံမှန် ပြုလုပ်ပေးသင့်သည်။ • အပတ်စဉ်/ လစဉ် ကျန်းမာရေးစစ်ဆေးခြင်းအစီအစဉ် ပြုလုပ်ရမည်။
၂၈	အလုပ်သမားများ၏ ပတ်ဝန်းကျင်	B–	B–	• ဆောက်လုပ်ရေးလုပ်သားများအား အကာအကွယ်ဦးထုပ်နှင့် လုံခြုံရေးခါးပတ်ကဲ့သို့ လိုအပ်သော ဘေးအန္တရာယ်ကင်းရှင်းရေး အသုံးအဆောင်များအား ထောက်ပံ့ပေးရမည်။ • ကန်ထရိုက်တာ၏ ကျန်းမာရေးအရာရှိမှ ဦးဆောင်သော ရှေးဦးသူနာပြုစုရေးရုံများအား ဆောက်လုပ်ရေးလုပ်ငန်းခွင်ရုံးခန်းအတွင်း ထားရှိရမည်။ • အလုပ်သမားများအား ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ သင်တန်းများ ပုံမှန်ပြုလုပ်ပေးရမည်။	• သင့်လျော်သော ဘေးအန္တရာယ်ကင်းရှင်းရေး ကိရိယာများအား ဘူတာရုံနှင့် ရုံးခန်းများတွင် ထားရှိသင့်သည်။ • အလုပ်သမားများအား ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ သင်တန်းများ ပုံမှန်ပြုလုပ်ပေးရမည်။
အခြား					
၂၉	မတော်တဆမှုများ	B–	B–	• ယာဉ်ကြောပိတ်ဆို့မှုနှင့် ယာဉ်မတော်တဆဖြစ်မှုများအား လျော့နည်းစေရန် သက်ဆိုင်ရာအစိုးရအဖွဲ့အစည်းမှ အတည်ပြုထားသော ယာဉ်ကြောစီမံခန့်ခွဲမှုနှင့် လမ်းကြောင်းလွှဲပြောင်းမှု အစီအစဉ်များအား တိကျစွာ အကောင်အထည်ဖော်ဆောင်ရွက်ရမည်။ • ယာဉ်သွားလာမှုအား လမ်းညွှန်ဆောင်ရွက်ပေးနိုင်ရန် ဒုံးဇရိယာတစ်လျှောက်တွင် ယာဉ်ထိန်းရဲများ သတ်မှတ်ထားရှိရမည်။ • ယာဉ်သွားလာမှုများပြားချိန်၌ ယာဉ်ကြောပိတ်ဆို့မှုအား လျှော့ချရန် လမ်းတစ်လျှောက်ရှိ မြေသယ်ယာဉ်နှင့် ကွန်ကရစ်ဖျော်ယာဉ်များကဲ့သို့ ဆောက်လုပ်ရေးယာဉ်များ ရပ်နားချိန်ကို ကန့်သတ်ရမည်။	• ယာဉ်ကြောပိတ်ဆို့မှုနှင့် ယာဉ်မတော်တဆဖြစ်မှုများအား လျော့နည်းစေရန် သက်ဆိုင်ရာအစိုးရအဖွဲ့အစည်းမှ အတည်ပြုထားသော ယာဉ်ကြောစီမံခန့်ခွဲမှုနှင့် လမ်းကြောင်းလွှဲပြောင်းမှု အစီအစဉ်များအား တိကျစွာ အကောင်အထည်ဖော်ဆောင်ရွက်ရမည်။ • အရှေ့-အနောက် လမ်းကြောင်းတစ်လျှောက် သင့်လျော်သော မော်တော်ယာဉ်အမြန်နှုန်း ထောက်လှမ်းသည့်စနစ်ကို ထားရှိရမည်။
၃၀	နေရာဒေသ	B–	B–	• လေထုညစ်ညမ်းမှုအဆင့်သည် ပတ်ဝန်းကျင်ဆိုင်ရာ စံနှုန်းများထက် သိသိသာသာ ကျော်လွန်လာပါက လောင်စာအရည်အသွေး၊	• ဖန်လုံအိမ်ဓာတ်ငွေ့ထုတ်လွှတ်မှုလျော့ချရန်။

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
	ကျော်လွန်၍ ထိခိုက်သက်ရောက်မှုများနှင့် ရာသီဥတုပြောင်းလဲမှု			ကားအကောင်းများတင်သွင်းခြင်းနှင့် ဓာတ်ငွေ့ထုတ်လွှတ်မှု ထိန်းချုပ်ခြင်းဆိုင်ရာ စည်းမျဉ်းများကို လိုအပ်ချက်အရ ပြန်လည်ပြင်ဆင် သင့်သည်။ • ဖန်လုံအိမ်ဓာတ်ငွေ့ထုတ်လွှတ်မှု လျော့ချရန် အဆောက်အဦအမြင့်များ အောက်ရှိ ကန့်သတ်ဧရိယာများတွင် ချုံနွယ်မျိုးစိတ် အပင်များ အစားထိုးစိုက်ပျိုးခြင်းကို လိုအပ်သည့်အလျောက် ထည့်သွင်းစဉ်းစားရမည်။	အဆောက်အဦအမြင့်များ အောက်ရှိ ကန့်သတ်ဧရိယာများတွင် ချုံနွယ်မျိုးစိတ် အပင်များ အစားထိုးစိုက်ပျိုးခြင်းကို လိုအပ်သည့်အလျောက် ထည့်သွင်းစဉ်းစားရမည်။

A+/–: သိသာထင်ရှားသော ကောင်းကျိုး (+) ဆိုးကျိုး (–) ဖြစ်ပေါ်နိုင်ပါသည်။

B+/–: သက်ရောက်မှုအနည်းငယ်မျှသာရှိသော ကောင်းကျိုး (+) ဆိုးကျိုး (–) ဖြစ်ပေါ်နိုင်ပါသည်။

C+/–: ကောင်းကျိုး/ ဆိုးကျိုးများ၏ သက်ရောက်မှုပမာဏကို ယခုအဆင့်တွင် မသိရှိနိုင်သေးပါ။

D: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု တစ်စုံတစ်ရာ မဖြစ်ပေါ်နိုင်ပါ။

ဇယား ၆.၂ ဓာတ်အားခွဲရုံကြောင့်သက်ရောက်မှုများအား လျော့ပါးစေရေးနည်းလမ်းများ

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
ည်စည်မ်းမှုထိန်းချုပ်ခြင်း					
၁	လေထုညစ်ညမ်းမှု	B–	D	• စက်ပစ္စည်းများ ပြုပြင်ထိန်းသိမ်းမှုစနစ်ထားရှိခြင်း၊ မော်တော်ယာဉ်များ ဆောက်လုပ်ရေးလုပ်ငန်းများလုပ်ဆောင်နေချိန်အတွင်း ရှိနေချိန်အား လျှော့ချရန် လုပ်ငန်းချိန်ဇယားကိုချိန်ညှိခြင်း၊ မခင်းရသေးသောလမ်းများအား ရေဖြန်းပေးခြင်းကဲ့သို့ ဖုန်မှုန့်ထိန်းချုပ်မှုနည်းလမ်းများထားရှိခြင်းတို့ ပြုလုပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂	ရေထုညစ်ညမ်းမှု	B–	D	• အနည်စစ်ဇကာ၊ ကျောက်စစ်ဇကာများ၊ ပိုမိုကောင်းမွန်သော လောင်စာဆီကိုင်တွယ်အသုံးပြုနည်းလမ်းများ၊ သင့်လျော်သော မိလ္လာစနစ်အား အသုံးပြုပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၃	စွန့်ပစ်ပစ္စည်း	B–	D	• ဆောက်လုပ်ရေးနှင့် ယာယီစခန်းများမှ ထွက်ရှိသော စွန့်ပစ်ပစ္စည်းများအား ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ၏ လမ်းညွှန်ချက်အရ စွန့်ပစ်ရမည်။ • မြေဆီလွှာတွင် အဆိပ်အတောက်ဖြစ်စေသော အရာများ ပါဝင်ပါက ပြန်လည်အသုံးပြုခြင်းနှင့် စွန့်ပစ်ခြင်းများ မလုပ်မီ ပြုပြင်ရန် လိုအပ်သည်။ • ထွက်ရှိလာသောအမှိုက်များအား သင့်လျော်သည့် အခြေအနေပေါ်မူတည်၍ အခြားသို့ ပြန်လည်ရောင်းချခြင်း ပြုလုပ်နိုင်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၄	မြေဆီလွှာညစ်ညမ်းမှု	B–	B–	• ညစ်ညမ်းသော မြေများအား သတ်မှတ်စွန့်ပစ်နေရာတွင် စွန့်ပစ်ရမည်။ • ယိုဖိတ်မှုများ မဖြစ်ပေါ်စေရန် သင့်လျော်သော ဆီစွန့်ပစ်မှုနည်းလမ်းကို ဆောင်ရွက်သင့်သည်။	• ယိုဖိတ်မှုများ မဖြစ်ပေါ်စေရန် သင့်လျော်သော ဆီစွန့်ပစ်မှုနည်းလမ်းကို ဆောင်ရွက်သင့်သည်။
၅	ဆူညံသံနှင့် တုန်ခါမှု	B–	B–	• ဆူညံသံထုတ်လွှတ်သော စက်ကိရိယာများလည်ပတ်ခြင်းအား လူနေဇရိယာနှင့်ကွာဝေးအောင်ထားပါ။ အပတ်စဉ်/ လစဉ် စက်ကရိယာများအား စစ်ဆေးမှုပြုလုပ်ပါ။ ညဘက် အလုပ်လုပ်ခြင်းအား ကန့်သတ်ပါ။	• သင့်လျော်သော ဆူညံသံလျှော့ချရေးနည်းလမ်းများ (ဥပမာ– ဘူတာရုံ၏ ဘေးတစ်လျှောက် ဆူညံသံ အကာအကွယ်များ) တပ်ဆင်ရန်နှင့် တွက်ချက်နိုင်ရန် ဆူညံသံစောင့်ကြပ် ကြည့်ရှုမှုအား စီမံကိန်းလည်ပတ်သည့် ကာလတွင်လည်း ဆက်လက်လုပ်ဆောင်ရမည်။
၆	မြေကျွံကျမှု	B–	D	• အသေးစိတ်ဒီဇိုင်းအဆင့်တွင် အသေးစိတ် ဘူမိဗေဒဆိုင်ရာ ကွင်းဆင်းစစ်တမ်းများ လုပ်ဆောင်ရမည်။ သင့်လျော်သော အဆောက်အဦဒီဇိုင်းနှင့် ဆောက်လုပ်မှု နည်းစနစ်များကို ကွင်းဆင်းလေ့လာမှုစစ်တမ်းရလဒ်ပေါ်မူတည်၍ ဆုံးဖြတ်ရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းမျာ မလိုအပ်ပါ
၇	အနုံအသက်ဆိုးရွားမှု	B–	D	• ယာယီစခန်းမှ အထွေထွေစွန့်ပစ်ပစ္စည်းများအား ပုံမှန် သန့်ရှင်းခြင်း။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းမျာ မလိုအပ်ပါ။
၈	အနည်ကျမှုအရည်အသွေး	B–	D	• မြစ်ချောင်းများအနီးတွင်အလုပ်လုပ်ပါက ဂရုပြုပါ။ • ညစ်ညမ်းသော မြေများအား သတ်မှတ်စွန့်ပစ်နေရာတွင် စွန့်ပစ်ရမည်။ • မြေဆီလွှာအရည်အသွေး စစ်ဆေးမှု လုပ်ဆောင်သင့်သည်။ • ယိုဖိတ်မှုများ မဖြစ်ပေါ်စေရန် သင့်လျော်သော ဆီစွန့်ပစ်မှုနည်းလမ်းကို ဆောင်ရွက်သင့်သည်။ • ဆီယိုစိမ့်ခြင်းမှ ကာကွယ်ရန် လောင်စာပြန်လည်ဖြည့်သည့် နေရာအား ကွန်ကရစ်ကြမ်းခင်းဖြင့် ဆောက်လုပ်သင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းမျာ မလိုအပ်ပါ။
သဘာဝပတ်ဝန်းကျင်					

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
၉	ထိန်းသိမ်းကာကွယ်ထားသော ဇရိယာများ	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၀	ဂေဟစနစ်	B–	B–	• အဆောက်အဦအမြင့်များအောက်ရှိ ကန့်သတ်ဇရိယာများတွင် ချုံနွယ်မျိုးစိတ် အပင်များ အစားထိုးစိုက်ပျိုးခြင်းကို လိုအပ်သည့်အလျောက် ထည့်သွင်းစဉ်းစားရမည်။ • ဆောက်လုပ်ရေးလုပ်ငန်းများရှိ မြေတူးဖော်သည့်လုပ်ငန်းများတွင် ညစ်ညမ်းရေများအား လိုအပ်သလို စောင့်ကြပ်ကြည့်ရှုခြင်းနှင့် ထိန်းချုပ်ခြင်းတို့ ပြုလုပ်ရမည်။	• လျှပ်ကာ / တုန်ခါမှု ကာကွယ်ပစ္စည်းများကို ဂေဟစနစ်အား သက်ရောက်မှုများမှလျှော့ချရန် တပ်ဆင်ရမည်။
၁၁	ဇလဗေဒ	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ?
၁၂	ဘူမိဗေဒနှင့် မြေမျက်နှာသွင်ပြင်	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
လူမှုပတ်ဝန်းကျင်					
၁၃	မြေယာရယူခြင်း/ပြန်လည်နေရာချထားခြင်း	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၄	ဆင်းရဲနွမ်းပါးမှု	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၅	ဒေသခံတိုင်းရင်းသားများအပေါ် သက်ရောက်မှု	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၆	အလုပ်အကိုင်အခွင့်အလမ်းများနှင့် ဒေသတွင်းစီးပွားရေး အခြေအနေ	B±	D	• စီမံကိန်းသည် ဒေသခံပြည်သူများနှင့် အခြားသူများအတွက် အလုပ်အကိုင်အခွင့်အလမ်းများအား သိသိသာသာ ပေးနိုင်ရန် မျှော်မှန်းထားပါသည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၇	မြေအသုံးချမှုနှင့် ဒေသတွင်းသယံဇာတ အရင်းအမြစ်များ	B–	D	• ဆောက်လုပ်ရေးကာလအတွင်း ဒေသဆိုင်ရာအရင်းအမြစ်များအား လွဲမှားစွာ အသုံးပြုမှု မဖြစ်စေရန် စီစဉ်ဆောင်ရွက်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၈	ရေအသုံးချမှု	B–	D	• သောက်သုံးရန်နှင့် အခြား အသုံးပြုမှုများအတွက် အထူးသဖြင့် မြေအောက်ရေအရည်အသွေး ကို စောင့်ကြပ်စစ်ဆေးသင့်သည်။ • ရေအရည်အသွေး မပြည့်မှီပါဟု ယူဆပါက သင့်လျော်သော ရေသန့်စင်မှု နည်းလမ်းများကို ထည့်သွင်းဆောင်ရွက်သင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၉	လူမှုအဆောက်အဦနှင့် ဝန်ဆောင်မှုကဏ္ဍ	B–	D	• လေးလံသောဝန်များဖြင့်သယ်ယူပို့ဆောင်ရေးအတွက်သင့်လျော်သော ထောက်ပံ့ပို့ဆောင်ရေးစနစ်၊ လမ်းပြုပြင်ထိန်းသိမ်းရေးအဖွဲ့များကို ချက်ချင်းပြင်ဆင်ခြင်း၊ လမ်းလွှဲပေးခြင်းနှင့် လမ်းအန္တရာယ်ကင်းရှင်းရေး ကြိုတင်ကာကွယ်ခြင်းများပြုလုပ်ရန်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၀	ဒေသတွင်းလူမှုအဖွဲ့အစည်းများ	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
၂၁	လွဲမှားသော အကျိုးခံစားမှုနှင့် ထိခိုက်မှုများ	B–	D	• တတိယအဖွဲ့အစည်းမှ ပြင်ပ စောင့်ကြည့်စစ်ဆေးရေးကော်မတီဖွဲ့စည်းခြင်း။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၂	ဒေသတွင်း အကျိုးစီးပွားဆိုင်ရာ ပဋိပက္ခများ	B–	D	• ဒေသခံပြည်သူများနှင့် ၄င်းဖြို့နယ်များတွင်နေထိုင်သူများအား ဦးစားပေး၍ အလုပ်အကိုင် အခွင့်အလမ်းများပေးခြင်း။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၃	ယဉ်ကျေးမှု အမွေအနှစ်များ	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၄	မြေယာရှုခင်း	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၅	ကျား/ မ တန်းတူညီမျှမှု	B–	D	• အမျိုးသမီးများသည် ဒေသတွင်း လူထုတွေ့ဆုံဆွေးနွေးပွဲများ၌လည်း အမျိုးသားများကဲ့သို့ ဖိတ်ကြားခံရခြင်း၊ တက်ရောက်ခွင့်ရှိခြင်းတို့ ရရှိရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၆	ကလေးသူငယ် အခွင့်အရေး	D	D	• ဆောက်လုပ်ရေးလုပ်ငန်းခွင်တွင် ကလေးလုပ်သားစုဆောင်းမှုအား တားမြစ်သင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၇	ကျန်းမာရေး (HIV/AIDS ကဲ့သို့ ကူးစက်ရောဂါများ)	B–	D	• HIV/ AIDS ကဲ့သို့ ကူးစက်ရောဂါများပြန့်ပွားခြင်းမှ ကာကွယ်ရန် အလုပ်သမားများအား အသိပညာပေးသင်တန်းများ ပြုလုပ်ပေးသင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၈	အလုပ်သမားများ၏ ပတ်ဝန်းကျင်	B–	B–	• ဆောက်လုပ်ရေးလုပ်သားများမား အကာအကွယ်ဦးထုပ်နှင့် လုံခြုံရေးခါးပတ်ကဲ့သို့ လိုအပ်သော ဘေးအန္တရာယ်ကင်းရှင်းရေး အသုံးအဆောင်များအား ထောက်ပံ့ပေးရမည်။ • ကန်ထရိုက်တာ၏ ကျန်းမာရေးအရာရှိမှ ဦးဆောင်သော ရှေးဦးသူနာပြုစုရေးရုံများအား ဆောက်လုပ်ရေးလုပ်ငန်းခွင်ရုံးခန်းအတွင်း ထားရှိရမည်။ • အလုပ်သမားများအား ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ သင်တန်းများ ပုံမှန်ပြုလုပ်ပေးရမည်။	• လုံခြုံစိတ်ချရသော အလုပ်လုပ်ကိုင်မှု အလေ့အကျင့်ကို ကျင့်သုံးပါ။
အခြား					
၂၉	မတော်တဆမှုများ	B–	D	• ယာဉ်ကြောပိတ်ဆို့မှုနှင့် ယာဉ်မတော်တဆဖြစ်မှုများအား လျော့နည်းစေရန် သက်ဆိုင်ရာအစိုးရအဖွဲ့အစည်းမှ အတည်ပြုထားသော ယာဉ်ကြောစီမံခန့်ခွဲမှုနှင့် လမ်းကြောင်းလွှဲပြောင်းမှု အစီအစဉ်များအား တိကျစွာ အကောင်အထည်ဖော်ဆောင်ရွက်ရမည်။ • ယာဉ်သွားလာမှုအား လမ်းညွှန်ဆောင်ရွက်ပေးနိုင်ရန် ၄င်းဇရိယာတစ်လျှောက်တွင် ယာဉ်ထိန်းရဲများ သတ်မှတ်ထားရှိရမည်။ • ယာဉ်သွားလာမှုများပြားချိန်၌ ယာဉ်ကြောပိတ်ဆို့မှုအား လျှော့ချရန် လမ်းတစ်လျှောက်ရှိ မြေသယ်ယာဉ်နှင့် ကွန်ကရစ်ဖျော်ယာဉ်များကဲ့သို့ ဆောက်လုပ်ရေးယာဉ်များ ရပ်နားချိန်ကို ကန့်သတ်ရမည်။	• စီမံကိန်းလမ်ကြောင်းအား သင့်လျော်အောင် စီမံပါ။ သတိပေးဆိုင်းဘုတ် များကို ဓာတ်အားခွဲရုံ အတွင်းရှိ နေရာတစ်ခုချင်းစီ၌ တပ်ဆင်ခြင်းနှင့် လုံခြုံရေးစည်းရုံးများ ဓာတ်အားခွဲရုံ ၌ တပ်ဆင်ပါ။
၃၀	နေရာဒေသကျော်လွန်၍ ထိခိုက်သက်ရောက်မှုများနှင့် ရာသီဥတုပြောင်းလဲမှု	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။

A+/–: သိသာထင်ရှားသော ကောင်းကျိုး (+) ဆိုးကျိုး (–) ဖြစ်ပေါ်နိုင်ပါသည်။

B+/–: သက်ရောက်မှုအနည်းငယ်မျှသာရှိသော ကောင်းကျိုး (+) ဆိုးကျိုး (–) ဖြစ်ပေါ်နိုင်ပါသည်။

C+/–: ကောင်းကျိုး/ ဆိုးကျိုးများ၏ သက်ရောက်မှုပမာဏကို ယခုအဆင့်တွင် မသိရှိနိုင်သေးပါ။

D: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု တစ်စုံတစ်ရာ မဖြစ်ပေါ်နိုင်ပါ။

ဇယား ၆.၃ လျှပ်စစ်ဓာတ်အားသွယ်တန်းကြိုး ကြောင့်သက်ရောက်မှုများအား လျော့ပါးစေရေးနည်းလမ်းများ

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
ညစ်ညမ်းမှုထိန်းချုပ်ခြင်း					
၁	လေထုညစ်ညမ်းမှု	B–	D	• ဆောက်လုပ်ရေးလုပ်ငန်းသုံး ကိရိယာများနှင့် စက်ယန္တယားများအား ပုံမှန်ထိန်းသိမ်းကာကွယ်မှုများအား တိကျစွာ လုပ်ဆောင်ရန်နှင့် ယင်းကိရိယာနှင့် စက်ယန္တယားများ အကောင်းဆုံးလည်ပတ်မှု အခြေအနေတွင် ရှိစေရန် ပုံမှန် စစ်ဆေးမှုများ လိုအပ်သည်။ • လုပ်ငန်းခွင်အချိန်ဇယားတွင် ဆောက်လုပ်ရေးလုပ်ငန်းသုံးကိရိယာများအား အချိန်တစ်ခုအထိ ကြာရှည်စွာစွဲမြဲအသုံးပြုခြင်း မရှိစေရန်သင့်လျော်စွာ ထည့်သွင်းစဉ်းစားသင့်သည်။ • ဖုန်မှုန့်ထွက်ရှိမှုအားလျှော့ချရန် အချိန်မှန်ရေဖြန်းခြင်းအား လုပ်ဆောင်သင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂	ရေထုညစ်ညမ်းမှု	B–	D	• ဆောက်လုပ်ရေးလုပ်သားများမှ ထွက်ရှိသော အညစ်အကြေးများအား စနစ်တကျ စီမံခန့်ခွဲနိုင်ရန်နှင့် ရေနုတ်မြောင်းများထဲသို့ စွန့်ပစ်ခြင်းကြောင့် နောက်ထပ် ညစ်ညမ်းမှုများမှ ကာကွယ်ရန် ရွှေ့လျားအိမ်သာကဲ့သို့ ယာယီအညစ်အကြေးစွန့်ပစ်ရေး ပစ္စည်းများကို ကန်ထရိုက်တာများမှ ထောက်ပံ့ပေးရမည်။ • ရေထုညစ်ညမ်းမှုမှ ကာကွယ်ရန် ရေကြောင်းတစ်လျှောက် ဆောက်လုပ်ရေးလုပ်ငန်းသုံး ကိရိယားများအား ဆေးကြောခြင်းအား တားမြစ်ရမည်။ • မြစ်ချောင်းများအနီးရှိ ဆောက်လုပ်ရေးလုပ်ငန်းခွင်တွင် နောက်ကျိစော စွန့်ပစ်ရေများအား သတ်မှတ်နေရာ၌သာ စွန့်ပစ်ရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၃	စွန့်ပစ်ပစ္စည်း	B–	D	• ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ၏ လမ်းညွှန်ချက်အရ ဆောက်လုပ်ရေးနှင့် ယာယီစခန်းများမှ ထွက်ရှိသော စွန့်ပစ်ပစ္စည်းများကို လျှော့ချအသုံးပြုခြင်း၊ ပြန်လည်သုံးစွဲခြင်း၊ ပြန်လည်အသုံးပြုခြင်းတို့အား စဉ်းစားဆုံးဖြတ်ပြီးမှသာ စွန့်ပစ်ရမည်။ • တူးဖော်ပြီးမြေများကဲ့သို့ စွန့်ပစ်ပစ္စည်းများအား အခြအနေပေါ်မူတည်၍ ပြန်လည်အသုံးပြုနိုင်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၄	မြေဆီလွှာညစ်ညမ်းမှု	B–	D	• ဆီနှင့် ချောဆီအပါအဝင် စွန့်ပစ်ပစ္စည်းများအား သတ်မှတ်အမှိုက်စွန့်ပစ်နေရာ၌တွင်သာ စွန့်ပစ်ရမည်။ • ယိုဖိတ်မှုများ မဖြစ်ပေါ်စေရန် သင့်လျော်သော ဆီစွန့်ပစ်မှုနည်းလမ်းကို ဆောင်ရွက်သင့်သည်။ • ယာယီမြေဆီလွှာညစ်ညမ်းမှုမှ ကာကွယ်ရန် အခြေစိုက်စခန်းများ၌ သန့်ရှင်းမှုအသုံးအဆောင်ပစ္စည်းများနှင့် အမှိုက်ပုံးများအား ထားရှိပေးရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၅	ဆူညံသံနှင့် တုန်ခါမှု	B–	D	• ဆူညံသံပမာဏအား ခွင့်ပြုထားသော ပမာဏအတွင်းရှိစေရန် သတ္တုပြားနံရံများကဲ့သို့ ယာယီဆူညံသံ အကာအကွယ်များအား ဆောက်လုပ်ရေးလုပ်ငန်းခွင်တစ်ဝိုက်တွင် လိုအပ်ပါက တပ်ဆင်ရမည်။ • လူနေအိမ်၊ စီးပွားရေး ဧရိယာများနှင့် အခြား ဆူညံသံကြောင့်	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
				ထိခိုက်လွယ်သော ဇရိယာများတွင် အနှောင့်အယှက်ဖြစ်စေခြင်းမှ ရှောင်ရှားရန် ဆူညံသံမြင့်မားစွာထွက်ရှိသော လုပ်ငန်းများကို နေ့ဘက် (၇:၀၀ နာရီမှ ၂၂:၀၀ နာရီ) အတွင်းသာ စီစဉ်ဆောင်ရွက်ရမည်။	
၆	မြေကျွံကျမှု	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၇	အနုံအသက်ဆိုးရွားမှု	B–	D	• အနုံအသက်ဆိုးရွားမှု အခြေအနေအား ပုံမှန် စောင့်ကြည့်စစ်ဆေးရမည်။ • ယာယီစခန်းမှ အထွေထွေစွန့်ပစ်ပစ္စည်းများအား ပုံမှန် သန့်ရှင်းခြင်း။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၈	အနည်ကျမှုအရည်အသွေး	B–	D	• ညစ်ညမ်းသော မြေများအား သတ်မှတ်စွန့်ပစ်နေရာတွင် စွန့်ပစ်ရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
သဘာဝပတ်ဝန်းကျင်					
၉	ထိန်းသိမ်းကာကွယ်ထားသော ဇရိယာများ	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၀	ဂေဟစနစ်	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၁	ဇလဗေဒ	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၂	ဘူမိဗေဒနှင့် မြေမျက်နှာသွင်ပြင်	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
လူမှုပတ်ဝန်းကျင်					
၁၃	မြေယာရယူခြင်း/ပြန်လည်နေရာချထားခြင်း	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၄	ဆင်းရဲနွမ်းပါးမှု	B–	D	• မြေတူးဖော်ခြင်းလုပ်ငန်းများပြုလုပ်သောအခါ ဒေသခံများ ပုံမှန်သွားလာနေကျ နေရာများ၌ ယာယီတံတားငယ်များ ထိုးပေးပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၅	ဒေသခံတိုင်းရင်းသားများအပေါ် သက်ရောက်မှု	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၆	အလုပ်အကိုင်အခွင့်အလမ်းများနှင့် ဒေသတွင်းစီးပွားရေး အခြေအနေ	B±	D	• မြေတူးဖော်ခြင်းလုပ်ငန်းများပြုလုပ်သောအခါ ဒေသခံများ ပုံမှန်သွားလာနေကျ နေရာများ၌ ယာယီတံတားငယ်များ ထိုးပေးပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၇	မြေအသုံးချမှုနှင့် ဒေသတွင်းသယံဇာတ အရင်းအမြစ်များ	B–	D	• ဆောက်လုပ်ရေးကာလအတွင်း ဒေသဆိုင်ရာအရင်းအမြစ်များအား လွဲမှားစွာ အသုံးပြုမှု မဖြစ်စေရန် စီစဉ်ဆောင်ရွက်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၈	ရေအသုံးချမှု	B–	D	• ဒေသခံပြည်သူများ၏ ပုံမှန်ရေပေးဝေရေးစနစ်ကို မပျက်စီးစေရန် ဆောင်ရွက်ပါ။ • သောက်သုံးရန်နှင့် အခြား အသုံးပြုမှုများအတွက်	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
				မြေအောက်ရေအရည်အသွေးကို အထူးစောင့်ကြပ်စစ်ဆေးသင့်သည်။	
၁၉	လူမှုအဆောက်အဦနှင့် ဝန်ဆောင်မှုကဏ္ဍ	B–	D	• ဆောက်လုပ်ရေးမစတင်မီ ဆောက်လုပ်ရေး၏ အကြောင်းအရာအပြည့်အစုံနှင့် အချိန်ဇယားအား ပြည်သူအများသို့ ချပြသင့်သည်။ • ဆောက်လုပ်ရေးလုပ်သားနှင့် အများပြည်သူတိုင်ကြားချက်နှင့် ဆက်သွယ်ရေးတာဝန်ကျ အလုပ်သမားများအား အသိပညာပေးခြင်းတို့ ပြုလုပ်ပေးသင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၀	ဒေသတွင်းလူမှုအဖွဲ့အစည်းများ	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၁	လွဲမှားသောအကျိုးခံစားမှုနှင့် ထိခိုက်မှုများ	B–	D	• တတိယအဖွဲ့အစည်းမှ ပြင်ပ စောင့်ကြည့်စစ်ဆေးရေးကော်မတီဖွဲ့စည်းခြင်း?	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၂	ဒေသတွင်းအကျိုးစီးပွားဆိုင်ရာ ပဋိပက္ခများ	B–	D	• ဆောက်လုပ်ရေးမစတင်မီ ဆောက်လုပ်ရေး၏ အကြောင်းအရာအပြည့်အစုံနှင့် အချိန်ဇယားအား ပြည်သူအများသို့ ချပြသင့်သည်။ • ဆောက်လုပ်ရေးလုပ်သားနှင့် အများပြည်သူတိုင်ကြားချက်နှင့် ဆက်သွယ်ရေးတာဝန်ကျ အလုပ်သမားများအား အသိပညာပေးခြင်းတို့ ပြုလုပ်ပေးသင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၃	ယဉ်ကျေးမှုအမွေအနှစ်များ	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၄	မြေယာရှုခင်း	B–	D	• ဆောက်လုပ်ရေးလုပ်ငန်းခွင်သုံး ဘေးအန္တရာယ်ကင်းရှင်းရေး ပိုက်ကွန်အားမြေတူးဖော်ခြင်းနှင့် မြေသယ်ခြင်းလုပ်ငန်းများတစ်ပိုက်တွင် ထားရှိပေးရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၅	ကျား/ မတန်းတူညီမျှမှု	B–	D	• အမျိုးသမီးများသည် ဒေသတွင်း လူထုတွေ့ဆုံဆွေးနွေးပွဲများ၌လည်း အမျိုးသားများကဲ့သို့ ဖိတ်ကြားခံရခြင်း၊ တက်ရောက်ခွင့်ရှိခြင်းတို့ ရရှိရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၆	ကလေးသူငယ်အခွင့်အရေး	B–	D	• ဆောက်လုပ်ရေးလုပ်ငန်းခွင်တွင် ကလေးလုပ်သားစုဆောင်းမှုအား တားမြစ်သင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၇	ကျန်းမာရေး (HIV/AIDS ကဲ့သို့ ကူးစက်ရောဂါများ)	B–	D	• HIV/ AIDS ကဲ့သို့ ကူးစက်ရောဂါများပြန့်ပွားခြင်းမှ ကာကွယ်ရန် အလုပ်သမားများအား အသိပညာပေးသင်တန်းများ ပြုလုပ်ပေးသင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၈	အလုပ်သမားများ၏ ပတ်ဝန်းကျင်	B–	D	• ဆောက်လုပ်ရေးလုပ်သားများမား အကာအကွယ်ဦးထုပ်နှင့် လုံခြုံရေးခါးပတ်ကဲ့သို့ လိုအပ်သော ဘေးအန္တရာယ်ကင်းရှင်းရေး အသုံးအဆောင်များအား ထောက်ပံ့ပေးရမည်။ • ကန်ထရိုက်တာ၏ ကျန်းမာရေးအရာရှိမှ ဦးဆောင်သော ရှေးဦးသူနာပြုစုရေးရုံများအား ဆောက်လုပ်ရေးလုပ်ငန်းခွင်ရုံးခန်းအတွင်း ထားရှိရမည်။ • ဆောက်လုပ်ရေးလုပ်ငန်းခွင်အတွင်း အရေးပေါ်ယာဉ်များ အဆင်သင့် ထားရှိပေးရမည်။ • အလုပ်သမားများအား ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ သင်တန်းများ ပုံမှန်ပြုလုပ်ပေးရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
အခြား					
၂၉	မတော်တဆမှုများ	B–	D	• ယာဉ်ကြောပိတ်ဆို့မှုနှင့် ယာဉ်မတော်တဆဖြစ်မှုများအား လျော့နည်းစေရန် သက်ဆိုင်ရာအစိုးရအဖွဲ့အစည်းမှ အတည်ပြုထားသော ယာဉ်ကြောစီမံခန့်ခွဲမှုနှင့် လမ်းကြောင်းလွဲပြောင်းမှု အစီအစဉ်များအား တိကျစွာ အကောင်အထည်ဖော်ဆောင်ရွက်ရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
				• ယာဉ်သွားလာမှုအား လမ်းညွှန်ဆောင်ရွက်ပေးနိုင်ရန် ၎င်းဧရိယာတစ်လျှောက်တွင် ယာဉ်ထိန်းရဲများ သတ်မှတ်ထားရှိရမည်။ • ယာဉ်သွားလာမှုများပြားချိန်၌ ယာဉ်ကြောပိတ်ဆို့မှုအား လျော့ချရန် လမ်းတစ်လျှောက်ရှိ မြေသယ်ယာဉ်နှင့် ကွန်ကရစ်ဖျော်ယာဉ်များကဲ့သို့ ဆောက်လုပ်ရေးယာဉ်များ ရပ်နားချိန်ကို ကန့်သတ်ရမည်။	
၃၀	နေရာဒေသကျော်လွန်၍ ထိခိုက်သက်ရောက်မှုများနှင့် ရာသီဥတုပြောင်းလဲမှု	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။

A+/–: သိသာထင်ရှားသော ကောင်းကျိုး (+) ဆိုးကျိုး (–) ဖြစ်ပေါ်နိုင်ပါသည်။

B+/–: သက်ရောက်မှုအနည်းငယ်မျှသာရှိသော ကောင်းကျိုး (+) ဆိုးကျိုး (–) ဖြစ်ပေါ်နိုင်ပါသည်။

C+/–: ကောင်းကျိုး/ ဆိုးကျိုးများ၏ သက်ရောက်မှုပမာဏကို ယခုအဆင့်တွင် မသိရှိနိုင်သေးပါ။

D: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု တစ်စုံတစ်ရာ မဖြစ်ပေါ်နိုင်ပါ။

ဇယား ၆.၄ ဘုရင့်နောင်တံတားသစ်ကြောင့် သက်ရောက်မှုများအား လျော့ပါးစေရေးနည်းလမ်းများ

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
ညစ်ညမ်းမှုထိန်းချုပ်ခြင်း					
၁	လေထုညစ်ညမ်းမှု	B–	B+	• ဆောက်လုပ်ရေးလုပ်ငန်းသုံး ကိရိယာများနှင့် စက်ယန္တယားများအား ပုံမှန်ထိန်းသိမ်းကာကွယ်မှုများအား တိကျစွာ လုပ်ဆောင်ရန်နှင့် ယင်းကိရိယာနှင့် စက်ယန္တယားများ အကောင်းဆုံးလည်ပတ်မှု အခြေအနေတွင် ရှိစေရန် ပုံမှန် စစ်ဆေးမှုများ လိုအပ်သည်။ • လုပ်ငန်းခွင်အချိန်ဇယားတွင် ဆောက်လုပ်ရေးလုပ်ငန်းသုံးကိရိယာများအား အချိန်တစ်ခုအထိ ကြာရှည်စွာအသုံးပြုခြင်းမရှိစေရန် သင့်လျော်စွာ ထည့်သွင်းစဉ်းစားသင့်သည်။ • ဖုန်မှုန့်ထွက်ရှိမှုအားလျော့ချရန် အချိန်မှန်ရေဖြန်းခြင်းအား လုပ်ဆောင်သင့်သည်။ • ဒေသခံများနှင့် လမ်းသွားလမ်းလာများမှ ဖုန်မှုန့်နှင့် အငွေ့များနှင့် ပက်သက်၍ မကျေနပ်မှုများရှိလာပါက ကြိုးကြပ်မှုနှင့် ကန်ထရိုက်တာတို့၏ အတိုင်ပင်ခံမှ ဆောက်လုပ်ရေး နည်းလမ်းများအား ပြန်လည်စဉ်းစားသင့်သည်။ • လေထုညစ်ညမ်းမှုအဆင့်သည် ပတ်ဝန်းကျင်ဆိုင်ရာ စံနှုန်းများထက် သိသိသာသာ ကျော်လွန်လာပါက လောင်စာအရည်အသွေး၊ ကားအကောင်းများတင်သွင်းခြင်းနှင့် ဓာတ်ငွေ့ထုတ်လွှတ်မှု ထိန်းချုပ်ခြင်းဆိုင်ရာ စည်းမျဉ်းများကို လိုအပ်ချက်အရ ပြန်လည်ပြင်ဆင် သင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂	ရေထုညစ်ညမ်းမှု	B–	D	• ကွန်ကရစ်လောင်းခြင်းနှင့် လမ်းခင်းခြင်းမှ ယိုဖိတ်ခြင်းများအား ကာကွယ်ရန် အနီးကပ် ကြီးကြပ်ကွပ်ကဲရမည်။ • ဆောက်လုပ်ရေးလုပ်သားများမှ ထွက်ရှိသော အညစ်အကြေးများအား စနစ်တကျ စီမံခန့်ခွဲနိုင်ရန်နှင့် ရေနုတ်မြောင်းများထဲသို့ စွန့်ပစ်ခြင်းကြောင့် နောက်ထပ် ညစ်ညမ်းမှုများမှ ကာကွယ်ရန် ရွှေ့လျားအိမ်သာကဲ့သို့ ယာယီအညစ်အကြေးစွန့်ပစ်ရေး ပစ္စည်းများကို ကန်ထရိုက်တာများမှ ထောက်ပံ့ပေးရမည်။ • ရေထုညစ်ညမ်းမှုမှ ကာကွယ်ရန် ရေကြောင်းတစ်လျှောက်	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
				ဆောက်လုပ်ရေးလုပ်ငန်းသုံး ကိရိယာများအား ဆေးကြောခြင်းအား တားမြစ်ရမည်။ • မြစ်ချောင်းများအနီးရှိ ဆောက်လုပ်ရေးလုပ်ငန်းခွင်တွင် နောက်ကျိသော စွန့်ပစ်ရေများအား သတ်မှတ်နေရာ၌သာ စွန့်ပစ်ရမည်။	
၃	စွန့်ပစ်ပစ္စည်း	B–	D	• ဆောက်လုပ်ရေးနှင့် ယာယီစခန်းများမှ ထွက်ရှိသော စွန့်ပစ်ပစ္စည်းများအား ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ၏ လမ်းညွှန်ချက်အရ စွန့်ပစ်ရမည်။ • မြေဆီလွှာတွင် အဆိပ်အတောက်ဖြစ်စေသော အရာများ ပါဝင်ပါက ပြန်လည်အသုံးပြုခြင်းနှင့် စွန့်ပစ်ခြင်းများ မလုပ်မီ ပြုပြင်ရန် လိုအပ်သည်။ • ထွက်ရှိလာသောအမှိုက်များအား သင့်လျော်သည့် အခြေအနေပေါ်မူတည်၍ အခြားသို့ ပြန်လည်ရောင်းချခြင်း ပြုလုပ်နိုင်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၄	မြေဆီလွှာ ညစ်ညမ်းမှု	B–	D	• ညစ်ညမ်းသော မြေများအား သတ်မှတ်စွန့်ပစ်နေရာတွင် စွန့်ပစ်ရမည်။ • မြေဆီလွှာအရည်အသွေး စစ်ဆေးမှု လုပ်ဆောင်သင့်သည်။ • ယိုဖိတ်မှုများ မဖြစ်ပေါ်စေရန် သင့်လျော်သော ဆီစွန့်ပစ်မှုနည်းလမ်းကို ဆောင်ရွက်သင့်သည်။ • ဆီယိုစိမ့်ခြင်းမှ ကာကွယ်ရန် ဆီဖြည့် သည့်နေရာအား ကွန်ကရစ်ကြမ်းခင်းဖြင့် တည်ဆောက်သင့်သည်။ • အရည်ပါသော ဘက်ထရီအိုးများအား အရည်၊ ဓာတ်ငွေ့များ မစိမ့်ဝင်နိုင်သည့် နေရာများ၌ ထားရှိရမည်။	• မြေဆီလွှာ ညစ်ညမ်းခြင်းသည် ဘူတာရုံဝန်း၌သာ ဖြစ်ပေါ်နိုင်သဖြင့် ယိုဖိတ်ခြင်း မဖြစ်စေရန် ဆီယိုစိမ့်ခြင်းကို ဂရုပြုရမည်။ • ယိုဖိတ်မှုများ မဖြစ်ပေါ်စေရန် သင့်လျော်သော ဆီစွန့်ပစ်မှုနည်းလမ်းကို ဆောင်ရွက်သင့်သည်။
၅	ဆူညံသံနှင့် တုန်ခါမှု	B–	B±	• ကြီးမားသော ကိရိယာ အမျိုးမျိုးနှင့် အခြားဆောက်လုပ်ရေး စက်ယန္တရားများမှ ထွက်ရှိသော ဆူညံသံများအား ခွင့်ပြုထားသော ပမာဏအတွင်း ရှိစေရန် ဆူညံသံ လျှော့ချသည့်ကိရိယာများကို လိုအပ်သည်ဟု ယူဆပါက တပ်ဆင်ရမည်။ • ဆူညံသံပမာဏအား ခွင့်ပြုထားသော ပမာဏအတွင်းရှိစေရန် သတ္တုပြားနံရံများကဲ့သို့ ယာယီဆူညံသံ အကာအကွယ်များအား ဆောက်လုပ်ရေးလုပ်ငန်းခွင်တစ်ဝိုက်တွင် လိုအပ်ပါက တပ်ဆင်ရမည်။ • လူနေအိမ်၊ စီးပွားရေး ဇရိယာများနှင့် အခြား ဆူညံသံကြောင့် ထိခိုက်လွယ်သော ဇရိယာများတွင် အနှောင့်အယှက်ဖြစ်စေခြင်းမှ ရှောင်ရှားရန် ဆူညံသံမြင့်မားစွာထွက်ရှိသော ဆောက်လုပ်ရေး လုပ်ငန်းများကို နေ့ဘက် (၇:၀၀ နာရီမှ ၂၂:၀၀ နာရီ) အတွင်းသာ စီစဉ်ဆောင်ရွက်ရမည်။ • အနီးဝန်းကျင်ရှိ အဆောက်အဦများအပေါ် သက်ရောက်မှုများအား သိရှိရန် အဆောက်အဦများ၏ တုန်ခါမှု အဆင့်နှင့် အခြေအနေတို့ကို စောင့်ကြည့် လေ့လာသင့်သည်။ • ဒေသခံများမှ ဆူညံသံနှင့် တုန်ခါမှုနှင့် ပက်သက်၍ မကျေနပ်မှုများ ရှိလာပါက ကြိုးကြပ်မှုနှင့် ကန်ထရိုက်တာ တို့၏ အတိုင်ပင်ခံမှ ဆောက်လုပ်ရေး နည်းလမ်းများအား ပြန်လည် စဉ်းစားသင့်သည်။ • ဆူညံသံပမာဏသည် ပတ်ဝန်းကျင်ဆိုင်ရာ စံနှုန်းများထက် သိသိသာသာ ကျော်လွန်လာပါက ဆူညံသံလျော့ပါးစေရေးနည်းလမ်းများကို ပြုလုပ်ဆောင်ရွက်သင့်သည်	• ရထားလမ်းတွင် ဆူညံသံအကာအကွယ် တပ်ဆင်ခြင်း • သင့်လျော်သော ဆူညံသံလျော့ချရေး နည်းလမ်းများ (ဥပမာ– ဘူတာရုံ၏ ဘေးတစ်လျှောက် ဆူညံသံ အကာအကွယ်များ) တပ်ဆင်ရန်နှင့် တွက်ချက်နိုင်ရန် ဆူညံသံ စောင့်ကြပ် ကြည့်ရှုမှုအား စီမံကိန်းလည်ပတ်သည့် ကာလတွင်လည်း ဆက်လက်လုပ်ဆောင်ရမည်။ • လျှပ်ကာ / တုန်ခါမှု ကာကွယ်ပစ္စည်းများကို ရထားလမ်းအောက်ခြေတွင် တပ်ဆင်ပြီး ဆူညံသံနှင့် တုန်ခါမှုကို လျော့ချရမည်။
၆	မြေကျွံကျမှု	B–	B–	• အသေးစိတ်ဒီဇိုင်းအဆင့်တွင် အသေးစိတ် ဘူမိဗေဒဆိုင်ရာ ကွင်းဆင်းစစ်တမ်းများ လုပ်ဆောင်ရမည်။ သင့်လျော်သော အဆောက်အဦဒီဇိုင်းနှင့် ဆောက်လုပ်မှု နည်းစနစ်များကို ကွင်းဆင်းလေ့လာမှုစစ်တမ်းရလဒ်ပေါ်မူတည်၍ ဆုံးဖြတ်ရမည်။	• မြေကျွံမှုကို ပုံမှန်စောင့်ကြည့်စစ်ဆေးသင့်သည်။
၇	အနုံအသက်ဆိုးရွားမှု	B–	D	• ယာယီစခန်းမှ အထွေထွေစွန့်ပစ်ပစ္စည်းများအား ပုံမှန် သန့်ရှင်းခြင်း	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ
၈	အနည်ကျမှု အရည်အသွေး	B–	D	• မြစ်ချောင်းများအနီးတွင်အလုပ်လုပ်ပါက ဂရုပြုပါ။ • ညစ်ညမ်းသော မြေများအား သတ်မှတ်စွန့်ပစ်နေရာတွင် စွန့်ပစ်ရမည်။ • မြေဆီလွှာအရည်အသွေး စစ်ဆေးမှု လုပ်ဆောင်သင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ
သဘာဝ ပတ်ဝန်းကျင်					

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
၉	ထိန်းသိမ်းကာကွယ်ထားသော ဇီရိယာများ	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ
၁၀	ဂေဟစနစ်	B–	B–	• အဆောက်အဦအမြင့်များအောက်ရှိ ကန့်သတ်ဇီရိယာများတွင် ချုံနွယ်မျိုးစိတ် အပင်များ အစားထိုးစိုက်ပျိုးခြင်းကို လိုအပ်သည့်အလျောက် ထည့်သွင်းစဉ်းစားရမည်။ • သစ်တောဦးစီးဌာနနှင့် ပူးပေါင်း၍ သစ်တောပျိုးထောင်မှ ပြုလုပ်သင့်သည်။ • ဆောက်လုပ်ရေးလုပ်ငန်းများရှိ မြေတူးဖော်သည့်လုပ်ငန်းများတွင် ညစ်ညမ်းရေများအား လိုအပ်သလို စောင့်ကြပ်ကြည့်ရှုခြင်းနှင့် ထိန်းချုပ်ခြင်းတို့ ပြုလုပ်ရမည်။	• လျှပ်ကာ / တုန်ခါမှုကာကွယ်ပစ္စည်းများကို ရေနေဂေဟစနစ်အား သက်ရောက်မှုများမှလျှော့ချရန် တပ်ဆင်ရမည်။
၁၁	ဇလဗေဒ	B–	B–	• အသေးစိတ်ဒီဇိုင်းအဆင့်တွင် အသေးစိတ် ဇလဗေဒဆိုင်ရာ ကွင်းဆင်းစစ်တမ်းများ လုပ်ဆောင်ရမည်။ သင့်လျော်သော အဆောက်အဦဒီဇိုင်းနှင့် ဆောက်လုပ်မှု နည်းစနစ်များကို ကွင်းဆင်းလေ့လာမှုစစ်တမ်းရလဒ်ပေါ်မူတည်၍ ဆုံးဖြတ်ရမည်။ • တံတားတည်ဆောက်ခြင်းနှင့် မြစ်ရေစီးကြောင်းပေါ် တာတမံတည်ဆောက်ခြင်းတို့ကြောင့် သက်ရောက်မှုများကို သိရှိရန် ဇလဗေဒဆိုင်ရာ လေ့လာမှုအသေးစိတ်ပြုလုပ်ရန်လိုအပ်ပါသည်။	• တံတားတည်ဆောက်ခြင်းနှင့် မြစ်ရေစီးကြောင်းပေါ် တာတမံတည်ဆောက်ခြင်းတို့ကြောင့် သက်ရောက်မှုများကို သိရှိရန် ဇလဗေဒဆိုင်ရာ လေ့လာမှုအသေးစိတ်ပြုလုပ်ရန်လိုအပ်ပါသည်။
၁၂	ဘူမိဗေဒနှင့် မြေမျက်နှာသွင်ပြင်	B–	B–	• အသေးစိတ်ဒီဇိုင်းအဆင့်တွင် အသေးစိတ် ဘူမိဗေဒဆိုင်ရာ နှင့် ဘူမိနည်းပညာဆိုင်ရာ ကွင်းဆင်းစစ်တမ်းများ လုပ်ဆောင်ရမည်။ သင့်လျော်သော အဆောက်အဦဒီဇိုင်းနှင့် ဆောက်လုပ်မှု နည်းစနစ်များကို ကွင်းဆင်းလေ့လာမှုစစ်တမ်းရလဒ်ပေါ်မူတည်၍ ဆုံးဖြတ်ရမည်။	• မြေဆီလွှာတိုက်စားမှုနှင့် မြေပြိုမှု ဖြစ်နိုင်ခြေများအား ပုံမှန် စောင့်ကြပ်ကြည့်ရှုရမည်။
လူမှုဝန်းကျင်					
၁၃	မြေယာရယူခြင်း/ပြန်လည်နေရာချထားခြင်း	B–	D	• သန်းခေါင်စာရင်းကောက်ယူခြင်းနှင့် လူထုတွေ့ဆုံပွဲများ ပြုလုပ်ခြင်း • အောက်ပါနည်းလမ်းများပါဝင်သော ပြန်လည်နေရာချထားခြင်း အစီအစဉ်များ ပြင်ဆင်ခြင်း ။ ○ စီမံကိန်းသက်ရောက်ခံပြည်သူများကို လျော်ကြေးရပိုင်ခွင့်ရှိသူများအဖြစ် သတ်မှတ်ရမည်။ ○ စီမံကိန်းသက်ရောက်ခံ ပြည်သူများအတွက် ရည်ရွယ်သည့် သန်းခေါင်စာရင်းစစ်တမ်းတွင် အမည်မပါသောသူများ၏ ရပိုင်ခွင့်ကို ဖော်ထုတ်ရန်နှင့် လျော်ကြေးနှင့် အထောက်အပံ့များရရှိစေရန် ။ ○ ယခင်/ လုပ်ဆောင်ဆဲ စီမံကိန်းများမှ အလျှော့ရှင်များကို ကိုးကားပြီး လူမှုရေးဆိုင်ရာအားနည်းထိခိုက်မှု အတွက် လိုအပ်ချက်များကို စဉ်းစားဆုံးဖြတ်ပြီး လျော်ကြေးငွေပေးခြင်း။ ○ စီမံကိန်းသက်ရောက်ခံပြည်သူများလိုအပ်သည့်အခါ ပြန်လည်နေရာချထားမည့် နေရာများအား ပြင်ဆင်ထားရမည်။ • သက်မွေးဝမ်းကျောင်းမှ ပြန်လည်ထူထောင်ရေး အထောက်အပံ့များအား စီမံကိန်းသက်ရောက်ခံပြည်သူ၏ ထိခိုက်မှုအပေါ် စဉ်းစားကာ ထောက်ပံ့ပေးသင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၄	ဆင်းရဲနွမ်းပါးမှု	B–	D	• နေရပ်မှစွန့်ခွာသွားသူများအား ယင်းတို့၏လျော်ကြေးရပိုင်ခွင့်ကို ဆုံးဖြတ်ပေးနိုင်ရန် စံနှုန်း သတ်မှတ်ပေးခြင်း။ လျော်ကြေးပမာဏကိုဆုံးဖြတ်ရန်အတွက် စီမံကိန်းအကောင်အထည်ဖော်ခြင်းကြောင့် ဆုံးရှုံးသွားသောပိုင်ဆိုင်မှုအသေးစိတ်စာရင်းကိုမှတ်တမ်းတင်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၅	ဒေသခံတိုင်းရင်းသားများအပေါ် သက်ရောက်မှု	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၁၆	အလုပ်အကိုင်အခွင့်အလမ်းများနှင့် ဒေသတွင်းစီးပွား	B±	B–	• ပြန်လည်နေရာချထားခြင်း အစီအစဉ်များ ပြင်ဆင်ခြင်း • စီမံကိန်းသက်ရောက်ခံပြည်သူများ၏ သက်မွေးဝမ်းကျောင်းမှု ပြန်လည်ထူထောင်ရန် နည်းလမ်းများ ထားရှိရမည်။ • အလုပ်အကိုင်အခွင့်အလမ်းအသစ်တို့ကို စီမံကိန်းသက်ရောက်ခံပြည်သူများအား ဦးစားပေး ပေးအပ်ရန် လိုင်သာယာမြို့နယ်ဇရိယာအား အထူးပြုကာ စနစ်တကျ ဖွဲ့	• ငါးလုပ်သားများနှင့် အခြားအသက်မွေးဝမ်းကျောင်းမှုအပေါ်သက်ရောက်မှုကို ထည့်သွင်းစဉ်းစားထားသူများအတွက်လည်း သက်မွေးဝမ်းကျောင်းမှုဆိုင်ရာ

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
	ရေး အခြေအနေ			ဖြိုးတိုးတက်အောင် တိုးမြှင့်လုပ်ဆောင်ပေးပါ။	အထောက်အပံ့များ ပေးအပ်သင့်သည်။
၁၇	မြေအသုံးချမှုနှင့် ဒေသတွင်း သယံဇာတ အရင်းအမြစ်များ	B–	D	• မြေအသုံးချမှုအပေါ် သက်ရောက်မှုအား လျော့နည်းစေရန် သင့်တော်သော ဒီဇိုင်းပုံစံအား ပြင်ဆင်သင့်သည်။ • ဆောက်လုပ်ရေးပြီးဆုံးပါက ဆောက်လုပ်ရေးစခန်းနှင့် လုပ်သားစခန်းအား ယခင်မြေအသုံးချမှုအခြေအနေအတိုင်း ဖြစ်နိုင်သရွေ့ ပြန်လည်ထားရှိပါ။ မထားရှိနို်ငပါက ပိုမိုကောင်းမွန်သော မြေအသုံးချမှုပုံစံအဖြစ် ထားရှိပါ။ • ဆောက်လုပ်ရေးကာလအတွင်း ဒေသဆိုင်ရာအရင်းအမြစ်များအား လွဲမှားစွာ အသုံးပြုမှု မဖြစ်စေရန် စီစဉ်ဆောင်ရွက်ပါ။	• အရှေ့-အနောက် လမ်းကြောင်းနှင့် ဘူတာရုံ တစ်လျှောက်တွင် အစီအစဉ်မကျသော ဖွံ့ဖြိုးတိုးတက်မှုလုပ်ငန်း နှင့် ဒေသဆိုင်ရာ အရင်းအမြစ်များအား အလွန်အကျွံ သုံးစွဲမှုများ မရှိစေရန် စီစဉ် ပြင်ဆင်ပါ။
၁၈	ရေအသုံးချမှု	B–	B–	• သောက်သုံးရန်နှင့် အခြား အသုံးပြုမှုများအတွက် မြေအောက်ရေအရည်အသွေး ကို အထူးစောင့်ကြပ်စစ်ဆေးသင့်သည်။ • ရေအရည်အသွေး မပြည့်မှီပါဟု ယူဆပါက သင့်လျော်သော ရေသန့်စင်မှု နည်းလမ်းများကို ထည့်သွင်းဆောင်ရွက်သင့်သည်။	• လှိုင်မြစ်တံတားတစ်လျှောက်ရှိ ငါးဖမ်းသမားများအခွင့်အရေးနှင့် ပက်သက်၍ ငါးလုပ်သားများ၏ သက်မွေးဝမ်းကြောင်းမှုအား သက်ရောက်မှုမရှိကြောင်း သေချာစေရန် သက်ဆိုင်ရာအဆိုးရွားနှင့် ဆွေးနွေးတိုင်ပင်ပါ။
၁၉	လူမှုအဆောက်အဦနှင့် ဝန်ဆောင်မှု ကဏ္ဍ	B–	B+	• စီမံကိန်းတည်ဆောက်ရေးကာလအတွင်း ဆေရုံ၊ ကျောင်း စသည့် ထိခိုက်လွယ်သော အဆောက်အဦများအား လွယ်ကူစွာသွားလာနိုင်စေရန် ဆောင်ရွက်ပါ။ ယာဉ်ကြောပိတ်ဆို့မှု အခြေအနေအပေါ်မူတည်၍ လိုအပ်ပါက လမ်းလွှဲများထားရှိပါ။ • ဆောက်လုပ်ရေးလုပ်ငန်းများ မစတင်မီ လျှပ်စစ်ဓာတ်အား၊ ရေအား၊ ရေနုတ်မြောင်းနှင့် ဆက်သွယ်ရေးလိုင်းကဲ့သို့ လူမှုဝန်ဆောင်မှု လုပ်ငန်းများအားများအား လမ်းကြောင်းပြောင်းမည်။ • အဆောက်အဦများ နေရာချထားပြီးပါက အသုံးချဝန်ဆောင်မှုများ ဆက်လက်ရရှိအောင် ဆောင်ရွက်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၀	ဒေသတွင်း လူမှုအဖွဲ့အစည်းများ	D	D	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၁	လွဲမှားသော အကျိုးခံစားမှုနှင့် ထိခိုက်မှုများ	B–	B–	• တတိယအဖွဲ့အစည်းမှ ပြင်ပ စောင့်ကြည့်စစ်ဆေးရေးကော်မတီ ဖွဲ့စည်းခြင်း ။	• တတိယအဖွဲ့အစည်းမှ ပြင်ပ စောင့်ကြည့်စစ်ဆေးရေးကော်မတီ ဖွဲ့စည်းခြင်း
၂၂	ဒေသတွင်း အကျိုးစီးပွားဆိုင်ရာ ပဋိပက္ခများ	B–	D	• ဒေသခံပြည်သူများနှင့် ၄င်းမြို့နယ်များတွင်နေထိုင်သူများအား ဦးစားပေး၍ အလုပ်အကိုင် အခွင့်အလမ်းများပေးခြင်း။	• သက်ရောက်မှုလျော့ပါးစေရေး နည်းလမ်းများ မလိုအပ်ပါ။
၂၃	ယဉ်ကျေးမှု အမွေအနှစ်များ	D	D	• စီမံကိန်းလမ်းကြောင်းတစ်လျှောက်တွင် သမိုင်းဝင် ယဉ်ကျေးမှုဆိုင်ရာ နေရာများအားသက်ရောက်နိုင်မှုကို မမျှော်မှန်းထားပါ။ သို့သော် ဘာသာရေးနှင့် သမိုင်းဝင် အဆောက်အဦများအပေါ် သက်ရောက်မှု မရှိနိုင်ကြောင်း သေချာစေရန် အစဉ်လိုက်စိစစ်သတ်မှတ်နေစဉ်နှင့် စီမံကိန်းလမ်းကြောင်းအား အပြီးသတ်ပြီးနောက်တွင် သက်ရောက်မှုရှိခြင်းနှင့် ၎င်း၏ လွှမ်းမိုးနိုင်မှုတို့ကို အတည်ပြုရမည်။	• အနီးဝန်းကျင်ရှိ ဘာသာရေးနှင့် သမိုင်းဝင်အဆောက်အဦများ အပေါ် တုန်ခါမှု သက်ရောက်မှု ရှိခြင်းကို စစ်ဆေးရမည်။ • တုန်ခါမှုသည် သတ်မှတ်စံနှုန်းထက် ကျော်လွန်နေပါက တုန်ခါမှု လျော့ချရေးနည်းလမ်းများအား အကောင်အထည်ဖော်ဆောင်ရွက်သင့်သည်။
၂၄	မြေယာရှုခင်း	B–	D	• အဆောက်အဦများအား ၎င်း၏ပတ်ဝန်းကျင်ရှိ မြင်ကွင်းနှင့် သဟဇာတဖြစ်အောင် ဒီဇိုင်းရေးဆွဲပါ။ • အဆောက်အဦအားလုံးအား မြန်မာနိုင်ငံအဆောက်အဦဆိုင်ရာ စည်းမျဉ်းများအရ ဒီဇိုင်းရေးဆွဲမည်။ • ဆောက်လုပ်ရေးလုပ်ငန်းများအား မူလမြင်ကွင်းပသာဒကို	• မူလရှုခင်းအား ပြောင်းလဲမှုကြောင့် မြင်းကွင်းအပေါ် သက်ရောက်မှုများအား လျော့ချရန် အဆောက်အဦအမြင့်များ

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
				အနှောင့်အယှက်အနည်းဆုံးရှိစေရန် စီစဉ်ဆောင်ရွက်မည်။	အောက်ရှိ ကန့်သတ်ဧရိယာများတွင် ချွန်နယ်မျိုးစိတ်အပင်များ အစားထိုးစိုက်ပျိုးခြင်းကို လိုအပ်သည့် အလျောက် ထည့်သွင်းစဉ်းစားရမည်။
၂၅	ကျား/ မတန်းတူညီမျှမှု	B–	D	• စီမံကိန်းသက်ရောက်ခံ အမျိုးသမီးအိမ်ထောင်ဦးစီး ဦးဆောင်သော အိမ်ထောင်စုများအတွက် ထပ်ဆောင်း ဝမ်းရေးဖူလုံမှုနှင့် ပြောင်းရွှေ့နေထိုင်မှု အထောက်အပံ့များ၊ ကျွမ်းကျင်မှုသင်တန်းများနှင့် ဝင်ငွေပြန်လည်ထူထောင်ရေး အစီအစဉ်များ၊ မြို့ပြလုပ်ငန်းများတွင် အလုပ်အကိုင်အခွင့်အလမ်းများ ပါဝင်သင့်သည်။ • အမျိုးသမီးများသည် ဒေသတွင်း လူထုတွေ့ဆုံဆွေးနွေးပွဲများ၌လည်း အမျိုးသားများကဲ့သို့ ဖိတ်ကြားခံရခြင်း၊ တက်ရောက်ခွင့်ရှိခြင်းတို့ ရရှိရမည်။ • သန်းခေါင်စာရင်းစစ်တမ်းကောက်ယူခြင်းတွင် အမျိုးသမီးများအား မေးမြန်းခြင်းကျူလည်း ထည့်သွင်းစဉ်းစားရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၆	ကလေးသူငယ်အခွင့်အရေး	B–	D	• ပြန်လည်နေရာချထားမည့် တည်နေရာအား ရွေးချယ်ရာတွင် ကျောင်း/ဆေးရုံ များသို့ သွားလာရလွယ်ကူစေရန် ဆောင်ရွက်ပါ။ • ဆောက်လုပ်ရေးလုပ်ငန်းခွင်တွင် ကလေးလုပ်သားစုဆောင်းမှုအား တားမြစ်သင့်သည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၇	ကျန်းမာရေး (HIV/AIDS ကဲ့သို့ ကူးစက်ရောဂါများ)	B–	D	• HIV/ AIDS ကဲ့သို့ ကူးစက်ရောဂါများပြန့်ပွားခြင်းမှ ကာကွယ်ရန် အလုပ်သမားများအား အသိပညာပေးသင်တန်းများ ပြုလုပ်ပေးသင့်သည်။ • အသစ်ခြေချနေထိုင်သူများအား ဒေသဆိုင်ရာပြည်သူ့ကျန်းမာရေးစင်တာများမှ ကျန်းမာရေးအသိပညာပေးခြင်းတို့ စီစဉ်ဆောင်ရွက်ပေးရမည်။ • အပတ်စဉ်/ လစဉ် ကျန်းမာရေးစစ်ဆေးခြင်းအစီအစဉ် ပြုလုပ်ရမည်။	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ။
၂၈	အလုပ်သမားများ၏ ပတ်ဝန်းကျင်	B–	D	• ဆောက်လုပ်ရေးလုပ်သားများမား အကာအကွယ်ဦးထုပ်နှင့် လုံခြုံရေးခါးပတ်ကဲ့သို့ လိုအပ်သော ဘေးအန္တရာယ်ကင်းရှင်းရေး အသုံးအဆောင်များအား ထောက်ပံ့ပေးရမည်။ • ကန်ထရိုက်တာ၏ ကျန်းမာရေးအရာရှိမှ ဦးဆောင်သော ရှေးဦးသူနာပြုစုရေးရုံများအား ဆောက်လုပ်ရေးလုပ်ငန်းခွင်ရုံးခန်းအတွင်း ထားရှိရမည်။ • ဆောက်လုပ်ရေးလုပ်ငန်းခွင်အတွင်း အရေးပေါ်ယာဉ်များ အဆင်သင့် ထားရှိပေးရမည်။ • အလုပ်သမားများအား ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ သင်တန်းများ ပံ့မှန်ပြုလုပ်ပေးရမည်။	• အလုပ်သမားများအား ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာ သင်တန်းများ ပံ့မှန်ပြုလုပ်ပေးရမည်။
အခြား					
၂၉	မတော်တဆမှုများ	B–	D	• ယာဉ်ကြောပိတ်ဆို့မှုနှင့် ယာဉ်မတော်တဆဖြစ်မှုများအား လျော့နည်းစေရန် သက်ဆိုင်ရာအစိုးရအဖွဲ့အစည်းမှ အတည်ပြုထားသော ယာဉ်ကြောစီမံခန့်ခွဲမှုနှင့် လမ်းကြောင်းလွှဲပြောင်းမှု အစီအစဉ်များအား တိကျစွာ အကောင်အထည်ဖော်ဆောင်ရွက်ရမည်။ • ယာဉ်သွားလာမှုအား လမ်းညွှန်ဆောင်ရွက်ပေးနိုင်ရန် ၎င်းဧရိယာတစ်လျှောက်တွင် ယာဉ်ထိန်းရဲများ သတ်မှတ်ထားရှိရမည်။ • ယာဉ်သွားလာမှုများပြားချိန်၌ ယာဉ်ကြောပိတ်ဆို့မှုအား လျှော့ချရန် လမ်းတစ်လျှောက်ရှိ မြေသယ်ယာဉ်နှင့် ကွန်ကရစ်ဖျော်ယာဉ်များကဲ့သို့ ဆောက်လုပ်ရေးယာဉ်များ ရပ်နားချိန်ကို ကန့်သတ်ရမည်။	• ယာဉ်ကြောပိတ်ဆို့မှုနှင့် ယာဉ်မတော်တဆဖြစ်မှုများအား လျော့နည်းစေရန် သက်ဆိုင်ရာအစိုးရအဖွဲ့အစည်းမှ အတည်ပြုထားသော ယာဉ်ကြောစီမံခန့်ခွဲမှုနှင့် လမ်းကြောင်းလွှဲပြောင်းမှု အစီအစဉ်များအား တိကျစွာ အကောင်အထည်ဖော်ဆောင်ရွက်ရမည်။ • အရှေ့-အနောက် လမ်းကြောင်းတစ်လျှောက် သင့်လျော်သော မော်တော်ယာဉ်အမြန်နှုန်း

စဉ်	သက်ရောက်မှုအကြောင်းအရာများ	ဆိုးကျိုးသက်ရောက်မှု ပမာဏ		လျော့ပါးစေရေးနည်းလမ်းများ	
		စီမံကိန်းမတည်ဆောက်မီ/တည်ဆောက်စဉ် အဆင့်	စီမံကိန်းလည်ပတ်သည့် အဆင့်	စီမံကိန်းမတည်ဆောက်မီ/ တည်ဆောက်စဉ် ကာလ	စီမံကိန်းလည်ပတ်သည့် ကာလ
					ထောက်လှမ်းသည့်စနစ်ကို ထားရှိရမည်။
၃၀	နေရာဒေသကျော်လွန်၍ ထိခိုက်သက်ရောက်မှုများနှင့် ရာသီဥတုပြောင်းလဲမှု	D	B+	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ	• သက်ရောက်မှုလျော့ပါးစေရေးနည်းလမ်းများ မလိုအပ်ပါ

A+/–: သိသာထင်ရှားသော ကောင်းကျိုး (+) ဆိုးကျိုး (–) ဖြစ်ပေါ်နိုင်ပါသည်။

B+/–: သက်ရောက်မှုအနည်းငယ်မျှသာရှိသော ကောင်းကျိုး (+) ဆိုးကျိုး (–) ဖြစ်ပေါ်နိုင်ပါသည်။

C+/–: ကောင်းကျိုး/ ဆိုးကျိုးများ၏ သက်ရောက်မှုပမာဏကို ယခုအဆင့်တွင် မသိရှိနိုင်သေးပါ။

D: သိသာထင်ရှားသော ထိခိုက်သက်ရောက်မှု တစ်စုံတစ်ရာ မဖြစ်ပေါ်နိုင်ပါ။

အပိုင်း (၇) စီမံကိန်းနှင့် ပတ်သက်၍ အများပြည်သူသို့ အသိပေးရှင်းလင်းတင်ပြခြင်း

စီမံကိန်း၏အကြောင်းအရာ အချက်အလက်များကို ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာမူကြမ်း ပြင်ဆင်နေစဉ်အတွင်း အသိပေးရှင်းလင်း တင်ပြရန်မှာ အရေးပါလှပြီး စီမံကိန်းသက်ရောက်ခံပြည်သူနှင့် အခြားစီမံကိန်းနှင့်သက်ဆိုင်သော သူများ၏ ထင်မြင်ယူဆချက်ကို ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာမူကြမ်း ပြင်ဆင်နေစဉ်တွင် ထည့်သွင်းစဉ်းစားသင့်ပါသည်။ စီမံကိန်းနှင့်ပက်သက်၍ အများပြည်သူ တွေ့ဆုံဆွေးနွေးပွဲကို နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်းအဆင့်တွင် ဇွန်လ ၂၀၁၉ ခု (၃) နေရာတွင် ကျင်းပခဲ့ပြီး ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာမူကြမ်းအဆင့်တွင် ဧန်နဝါရီလ ၂၀၂၀ (၅)နေရာ ၌ ကျင်းပပြုလုပ်ခဲ့ပါသည်။ ၎င်းတွေ့ဆုံပွဲသည် ဒေသခံပြည်သူများ၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန/ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနအပါအဝင် သက်ဆိုင်ရာအစိုးရအဖွဲ့အစည်းများ၊ ပုဂ္ဂလိကကုမ္ပဏီများနှင့် သတင်းမီဒီယာများအပါအဝင် စီမံကိန်းနှင့်သက်ဆိုင်သူအများအပြားတက်ရောက် ခဲ့ပါသည်။ နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်းအဆင့်နှင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာမူကြမ်းအဆင့်တွင် ကျင်းပပြုလုပ်ခဲ့သော အများပြည်သူနှင့်တွေ့ဆုံဆွေးနွေး ပွဲများ၏ အကျဉ်းကို အောက်တွင် ဖော်ပြထားပါသည်။

ဇယား ၇.၁ နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်းအဆင့် အများပြည်သူနှင့်တွေ့ဆုံဆွေးနွေးပွဲ အကျဉ်းချုပ်

စဉ်	အချိန် နှင့် နေရာ	ကျင်းပသည့် မြို့နယ်	အကျဉ်းချုပ်

စဉ်	အချိန် နှင့် နေရာ	ကျင်းပသည့် မြို့နယ်	အကျဉ်းချုပ်
၁	၂၀၁၉၊ ဇွန်လ ၁ ရက်၊ စနေနေ့၊ နံနက် ၉:၀၀ နာရီ မှ ၁၂:၀၀ နာရီ အထိ	လှိုင်သာယာ	တက်ရောက်သူများ: ဒေသခံပြည်သူများ၊ သတင်းမီဒီယာများ၊ အစိုးရအရာရှိများ၊ လွတ်တော်ကိုယ်စားလှယ်များ၊ NGO/ INGO များ၊ ပုဂ္ဂလိက ကုမ္ပဏီများ၊ စိတ်ပါဝင်စားသူများအပါအဝင် စုစုပေါင်း (၁၄၅၆) ဦး
၂	၂၀၁၉၊ ဇွန်လ ၈ ရက်၊ စနေနေ့၊ နံနက် ၉:၀၀ နာရီ မှ ၁၂:၀၀ နာရီ အထိ	လှိုင်/ မရမ်းကုန်း	တက်ရောက်သူများ: ဒေသခံပြည်သူများ၊ သတင်းမီဒီယာများ၊ အစိုးရအရာရှိများ၊ လွတ်တော်ကိုယ်စားလှယ်များ၊ NGO/ INGO များ၊ ပုဂ္ဂလိက ကုမ္ပဏီများ၊ စိတ်ပါဝင်စားသူများအပါအဝင် စုစုပေါင်း (၃၄၇) ဦး
၃	၂၀၁၉၊ ဇွန်လ ၈ ရက်၊ စနေနေ့၊ နေ့လည် ၁၃:၀၀ နာရီ မှ ၁၆:၀၀ နာရီ အထိ	ရန်ကင်း/ တောင်ဥက္ကလာပ	တက်ရောက်သူများ: ဒေသခံပြည်သူများ၊ သတင်းမီဒီယာများ၊ အစိုးရအရာရှိများ၊ လွတ်တော်ကိုယ်စားလှယ်များ၊ NGO/ INGO များ၊ ပုဂ္ဂလိက ကုမ္ပဏီများ၊ စိတ်ပါဝင်စားသူများအပါအဝင် စုစုပေါင်း (၁၈၃) ဦး

Source: JICA Study Team

ဇယား ၇.၂ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာမူကြမ်းအဆင့် အများပြည်သူနှင့်တွေ့ဆုံဆွေးနွေးပွဲ အကျဉ်းချုပ်

စဉ်	အချိန် နှင့် နေရာ	ကျင်းပသည့် မြို့နယ်	အကျဉ်းချုပ်
၁	၂၀၂၀၊ ဇန်နဝါရီလ ၁၂ ရက်၊ တနင်္လာနေ့၊ နံနက် ၈:၀၀ နာရီ မှ ၁၁:၀၀ နာရီ အထိ	မရမ်းကုန်း	တက်ရောက်သူများ: ဒေသခံပြည်သူများ၊ သတင်းမီဒီယာများ၊ အစိုးရအရာရှိများ၊ လွှတ်တော်ကိုယ်စားလှယ်များ၊ NGO/ INGO များ၊ ပုဂ္ဂလိက ကုမ္ပဏီများ၊ စိတ်ပါဝင်စားသူများအပါအဝင် စုစုပေါင်း (၇၇) ဦး
၂	၂၀၂၀၊ ဇန်နဝါရီလ ၁၂ ရက်၊ တနင်္လာနေ့၊ နေ့လည် ၁၄:၀၀ နာရီ မှ ၁၇:၀၀ နာရီ အထိ	ထန်းတပင်	တက်ရောက်သူများ: ဒေသခံပြည်သူများ၊ သတင်းမီဒီယာများ၊ အစိုးရအရာရှိများ၊ လွှတ်တော်ကိုယ်စားလှယ်များ၊ NGO/ INGO များ၊ ပုဂ္ဂလိက ကုမ္ပဏီများ၊ စိတ်ပါဝင်စားသူများအပါအဝင် စုစုပေါင်း (၁၃၇) ဦး
၃	၂၀၂၀၊ ဇန်နဝါရီလ ၁၃ရက်၊ တနလ်ာနေ့၊ နေ့လည် ၁၄:၀၀ နာရီ မှ ၁၇:၀၀ နာရီ အထိ	ရန်ကင်း/ တောင်ဥက္ကလာပ	တက်ရောက်သူများ: ဒေသခံပြည်သူများ၊ သတင်းမီဒီယာများ၊ အစိုးရအရာရှိများ၊ လွှတ်တော်ကိုယ်စားလှယ်များ၊ NGO/ INGO များ၊ ပုဂ္ဂလိက ကုမ္ပဏီများ၊ စိတ်ပါဝင်စားသူများအပါအဝင် စုစုပေါင်း (၁၃၄) ဦး
၄	၂၀၂၀၊ ဇန်နဝါရီလ ၁၄ ရက်၊ အင်္ဂါနေ့၊ နံနက် ၈:၀၀ နာရီ မှ ၁၁:၀၀ နာရီ အထိ	လှိုင်သာယာ	တက်ရောက်သူများ: ဒေသခံပြည်သူများ၊ သတင်းမီဒီယာများ၊ အစိုးရအရာရှိများ၊ လွှတ်တော်ကိုယ်စားလှယ်များ၊ NGO/ INGO များ၊ ပုဂ္ဂလိက ကုမ္ပဏီများ၊ စိတ်ပါဝင်စားသူများအပါအဝင် စုစုပေါင်း (၉၂၂)ဦး
၅	၂၀၂၀၊ ဇန်နဝါရီလ ၁၄ရက်၊ အင်္ဂါနေ့၊ နေ့လည် ၁၄:၀၀ နာရီ မှ ၁၇:၀၀ နာရီ အထိ	လှိုင်	တက်ရောက်သူများ: ဒေသခံပြည်သူများ၊ သတင်းမီဒီယာများ၊ အစိုးရအရာရှိများ၊ လွှတ်တော်ကိုယ်စားလှယ်များ၊ NGO/ INGO များ၊ ပုဂ္ဂလိက ကုမ္ပဏီများ၊ စိတ်ပါဝင်စားသူများအပါအဝင် စုစုပေါင်း (၁၁၃) ဦး

Source: JICA Study Team

အများပြည်သူနှင့် တွေ့ဆုံဆွေးနွေးပွဲများကို အောက်ပါအစီအစဉ်များအတိုင်း ကျင်းပပြုလုပ်ခဲ့သည်။

၁) အဖွင့်အမှာစကားပြောကြားခြင်း

၂) အဆိုပြုစီမံကိန်းနှင့်ပက်သက်၍ ရှင်းလင်းတင်ပြခြင်း

၃) သဘာဝပတ်ဝန်းကျင်နှင့် လူမှုပတ်ဝန်းကျင်ဆိုင်ရာ ကိစ္စရပ်များနှင့် ပက်သက်၍ ရှင်းလင်းတင်ပြခြင်း

၄) အမေး/ အဖြေကဏ္ဍ

၅) နိဂုံးချုပ်စကားပြောကြားခြင်း

အထက်ပါအခမ်းအနားအစီအစဉ်များအရ မြန်မာ့မီးရထားသည် အများပြည်သူနှင့်တွေ့ဆုံဆွေးနွေးပွဲ ပြုလုပ်ရခြင်း၏ ရည်ရွယ်ချက်၊ စီမံကိန်း၏ ရည်မှန်းချက်နှင့် စီမံကိန်းပိုင်ရှင်၊ စီမံကိန်း တည်နေရာ၊ စီမံကိန်း အချိန်ဇယားနှင့် စီမံကိန်းနှင့် ပက်သက်၍ ဆက်သွယ်ရန်ပုဂ္ဂိုလ် တို့အား ပါဝါပွိုင့် တင်ဆက်မှုကို အသုံးပြုကာ တက်ရောက်လာသူများအား ရှင်းလင်းတင်ပြခဲ့ပါသည်။ ထို့နောက် သဘာပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာထိခိုက်မှုဆန်းစစ်ခြင်း အကြံပေးမှ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းလုပ်ငန်းစဉ်၊ စီမံကိန်း၏ ပတ်ဝန်းကျင်အမျိုးအစား၊

ပတ်ဝန်းကျင်ဆိုင်ရာ အခြေအနေ၊ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း စစ်တမ်း၏ လုပ်ငန်းတာဝန်များ၊ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း စစ်တမ်း၏ ရလဒ်များ၊ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း၊ လျော့ပါးစေရေး နည်းလမ်းများ နှင့် စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ်တို့အား ရှင်းလင်းတင်ပြခဲ့ပါသည်။ အမေး/ အဖြေကဏ္ဍတွင် တက်ရောက်လာသူများမှမေး မြန်းလာသော ပတ်ဝန်းကျင်ထိခိုက်မှု၊ အခြားဆောင်ရွက်နိုင်သော နည်းလမ်းများ၊ မြေယာရယူခြင်းနှင့် ပြန်လည်နေရာချထားခြင်း၊ လျော့ပါးမှု နည်းလမ်းများ၊ စီမံကိန်း ကာလ နှင့် စီမံကိန်းအကြောင်း အရာတို့နှင့်သက်ဆိုင်သော မေးခွန်းများနှင့် ထင်မြင်ယူဆချက်များကို မြန်မာ့မီးရထားနှင့် ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း အကြံပေးမှ ဖြေကြားခဲ့ပါသည်။

အပိုင်း (၈) နိဂုံး

အထက်တွင်ဖော်ပြခဲ့သည့်အတိုင်း စီမံကိန်းကြောင့် ဖြစ်ပေါ်နိုင်သော ဆိုးကျိုးသက်ရောက်မှု အဆင့်သည် အလယ်အလတ်တွင်ရှိမည်ဟု ယေဘုယျအားဖြင့် တွက်ချက်ထားသည်။ စီမံကိန်း၏ အကျိုးရလဒ်များတိုးပွား လာစေရန်နှင့် စီမံကိန်း၏ကုန်ကျစားရိတ်များလျော့ကျစေရန် သတ်မှတ်ထားသော လျော့ပါးစေရေးနည်းလမ်း များအား ထိရောက်စွာအကောင်အထည်ဖော် ဆောင်ရွက်ရန်နှင့် ဆောက်လုပ်ရေး လုပ်ငန်းစဉ်အား ဂရုပြုစောင့်ကြပ်ကြည့်ရှုရန်မှာ အရေးပါလှသည်။ လက်တွေ့အသုံးချ လျော့ပါးစေရေးနည်းလမ်းများနှင့် စောင့်ကြပ်ကြည့်ရှုမှု အစီအစဉ်တို့ကို JICA Study Team မှ အဆိုပြုထားပြီးဖြစ်ပြီး မြန်မာ့မီးရထားမှ စီမံကိန်းကြောင့်သက်ရောက်မှုများအားလျော့ချရန်အလို့ငှာ ယင်းအဆိုပြုချက်များအား ထည့်သွင်းရန် သဘောတူညီပြီးဖြစ်သည်။ ယင်းသို့ဆောင်ရွက်ရာတွင် မြန်မာ့မီးရထားမှ ပို့ဆောင်ရေးနှင့် ဆက်သွယ်ရေး ဝန်ကြီးဌာန၊ လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၊ ရန်ကုန်တိုင်းဒေသကြီးအစိုးရအဖွဲ့နှင့် ရန်ကုန်မြို့တော်စည်ပင် သာယာရေးကော်မတီကဲ့သို့ အဖွဲ့အစည်းများနှင့် နီးကပ်စွာ ပူးပေါင်းလုပ်ကိုင်သင့်ပြီး ပြည်သူအများနှင့် စီမံကိန်းသက်ရောက်ခံ ပြည်သူများနှင့်အတူ စီမံကိန်းဖြစ်မြောက်အောင် ရှေ့သို့ဆက်လက်ရွှေ့လျား ဆောင်ရွက်ရမည် ဖြစ်သည်။

CHAPTER 2 INTRODUCTION

2.1 High-Priority for the Project

High-Priority for the project should be explained as the first section of this scoping report. This project has been commenced from May, 2018 as JICA's preparatory survey study, and the following meetings have been regularly held so far, and various issues have been discussed in the Technical committee at expert level, in the Working committee at operating organization level, and in the Steering committee at Union level.

Table 2. 1 Implemented Meeting at Various Levels as of February, 2020

Year	2018								2019												2020	
Month	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2
Technical Committee	11/5 1	28/6 2		7/8 3	11/9 4	11/10 5	19/11 6	6/12 7	28/1 8		26/3 9		7/5 10	11/6 11	25/7 12			2/10 13				
Working Committee	11/5 1				13/9 2					1/2 3	29/3 4				26/7 5					4/12 6		
Steering Committee											4/3 1	3/4 2				28/8 3				9/12 4		
Cut-Off Date														6/5								

Initially the project was positioned as a joint venture project with MOTC and YRG, but after much discussion in the committees at expert level and at operating organization level, it was decided that the project should be dealt with in the 1st steering committee which has held in March 2019 from the view point of the project's publicity as a transportation social infrastructure and the view point of impact on local communities and various industries. Subsequently, it was clarified that the project became a National project under the leadership of Chief Minister, YRG and Minister of MOTC at the second steering meeting in April 2019, and the Cut-Off Date by the Chief Minister was declared on May 6th, 2019.

2.2 Background

Myanmar is now redirecting its development policy to enable the transition to a more open market economy. For the transport sector this will require a sustained and multi-dimensional effort to improve and upgrade the country’s infrastructure and facilities, as well as its human resource capacity. Under such new direction, the metropolitan area of Yangon, the economic center of Myanmar, has been attracting domestic as well as international investment and growing rapidly. The population of the metropolitan area of Yangon increased from about 5.6 million in 2011 to about 6.19 million in 2016. In parallel with such rapid urbanization and population increase, the number of cars has been increasing, while the development of the road network and public transport services has lagged behind the increasing demand. As a result, serious traffic congestion has been observed in many places in the Yangon metropolitan area.

"The Project for Strategic Urban Development Plan of the Greater Yangon (SUDP)" in 2012, and "The Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA II)" in 2017, (both of which received technical support from JICA), inform that the population will increase to 9.5 million in 2035. Accordingly, traffic demand is forecasted to increase by 2.4 times from 6.54 million trips in 2013 to 15.61 million in 2035. YUTRA II recommends that the provision of urban transit services is indispensable, and if those investments are made, 60% of mechanized trips could be by public transport in 2035.

As part of such an effort, the Yangon Circular Railway Line Upgrading Project has been implemented with technical and financial support from the Japanese ODA, and a technical assistance project for bus service improvement in Yangon has also been underway. In order to cope with the increasing future travel demand, development of further public transport services is essential. In line with this understanding, the urban mass rapid transit (UMRT) Line 1 (North-South Line) and Line 2 (East–West Line) projects were recommended by YUTRA II as being of the highest priority.

The recommendation was appreciated by the Government of Myanmar, and accordingly a request for conducting a feasibility study on the Yangon urban mass transit construction project was made to the Government of Japan by the Ministry of Transport and Communication (MOTC) on January 8, 2018.

The request was well received by the Government of Japan, and JICA has hired a JV of Japanese consulting firms to carry out the Study entitled the "Yangon Urban Mass Rapid Transit Construction Project" (the Project or YUMRT).

2.3 Objective of the Project

The objectives of this construction project are summarized as follows, which are in line with the recommended transport policies and strategies by SUDP II and YUTRA II:

(1) Contribute to developing a comprehensive transit network for the sustainable social and economic development of Yangon;
(2) Contribute to Yangon becoming a world class city, and as the international gateway city of Myanmar;
(3) Contribute to the reduction of greenhouse gas emissions and the resultant climate change impacts;
(4) Contribute to increasing the quality of life of Yangon residents;
(5) Contribute to increasing the attractiveness and opportunities for visitors and investors;
(6) Contribute to increasing the economic value of the region;
(7) Contribute to reforming the spatial structure (guided by upstream policies);
(8) Contribute to improving the urban transport environment (air quality, noise, etc.);
(9) Provide quality urban public transport services in a sustainable manner; and
(10) Alleviate the existing and anticipated traffic congestion in the Greater Yangon area.

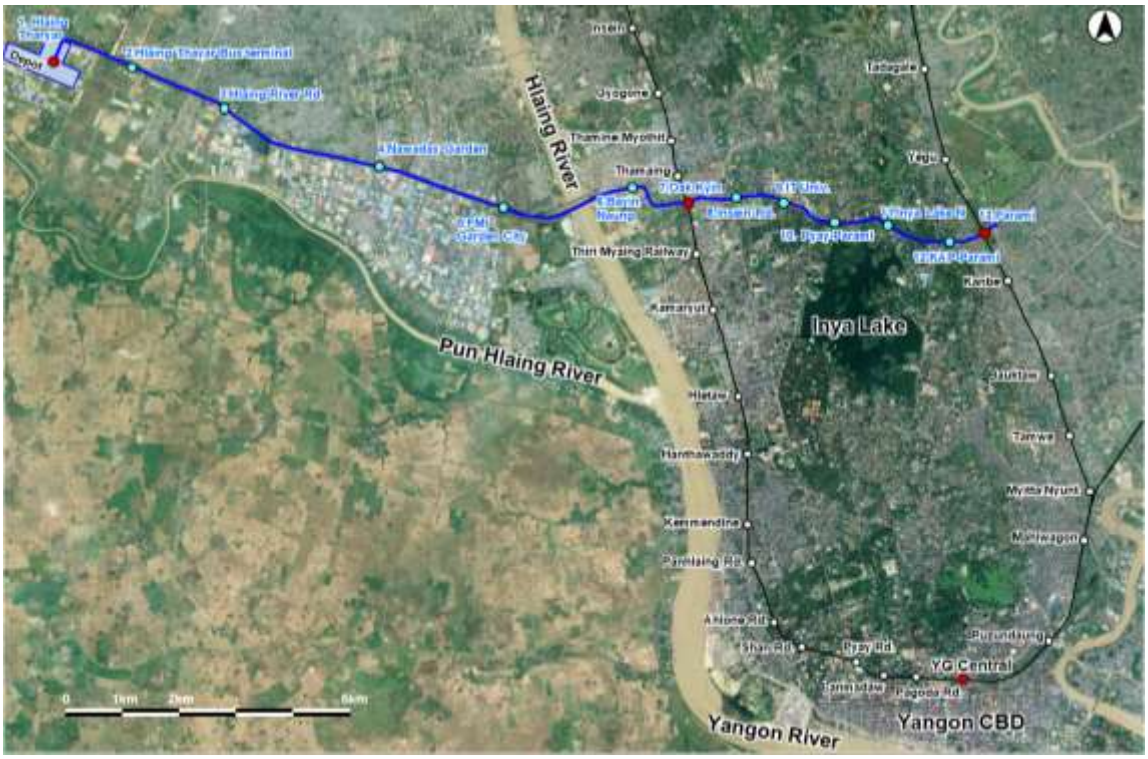
2.4 Location of the Project and Components

The project section (priority section designated by the 3rd Working Committee), which lies between Hlaing Tharyar and Parami of the EW Line, is shown in the Figure 2.1. The length of the project section is approximately 18 km starting from the existing Hlaing Tharyar MR station to the Parami MR station. In total 13 stations are planned along this section. Planned project components are as follows;

(1) Construction of elevated viaduct and pier (Total length approx.18 km)
(2) 13 elevated stations
(3) River Bridge crossing point at Hlaing River (Total length approx.0.4 km)
(4) Rolling stock yard including a receiving substation at Hlaing Tharyar Station (Total area approx.55 acres)

In addition, the following areas/sites will be included as target areas for EIA implementation;

(1) Quarry, Borrow Pit and Damping Sites
(2) Construction Yards and Base camp for workers
(3) Access and approach roads for construction
(4) Other related infrastructure facilities (ex. Water supply or Electricity facilities)



Source: JICA study team based on satellite image by Google Earth

Figure 2. 1 Proposed Route of YUMRT E-W Line in Yangon Metropolitan Area

2.5 Project Proponent

2.5.1 Contact Details of MR

The project proponent is Myanma Railways (MR), which would carry out the project under the supervision of the Ministry of Transport and Communications (MOTC). JICA plans to provide technical and financial assistance (i.e. ODA Loan) for the project. Detail of the project proponent is shown below.

Table 2. 2 Contact Details of MR

Name of Organization	Myanmar Railway (MR)
Address	Nay Pyi Taw Station Compound, Nay Pyi Taw, Myanmar
TEL/FAX	+95-67-77164
Contact Person and Responsibility	- U Aung Thu Latt, General Manager, Lower Myanmar Administration, Address: Lower Myanmar Administration Office, Lower Block, Thein Phyu Road, Botahaung Tsp, Yangon Myanmar Tel: +95-1-298631 Fax: +95-1-298594 Email: gmlowermyanmar@gmail.com - U Phyo Htet Kyaw, Assistant General Manager (Planning), Planning and Administration Department Address: Naypyitaw Station Compound, Naypyitaw, Myanmar Tel: +95-67-77087 Fax: +95-67-77164 Email: kozin6893@gmail.com

Source: MR

2.5.2 Organizational Structure of MR

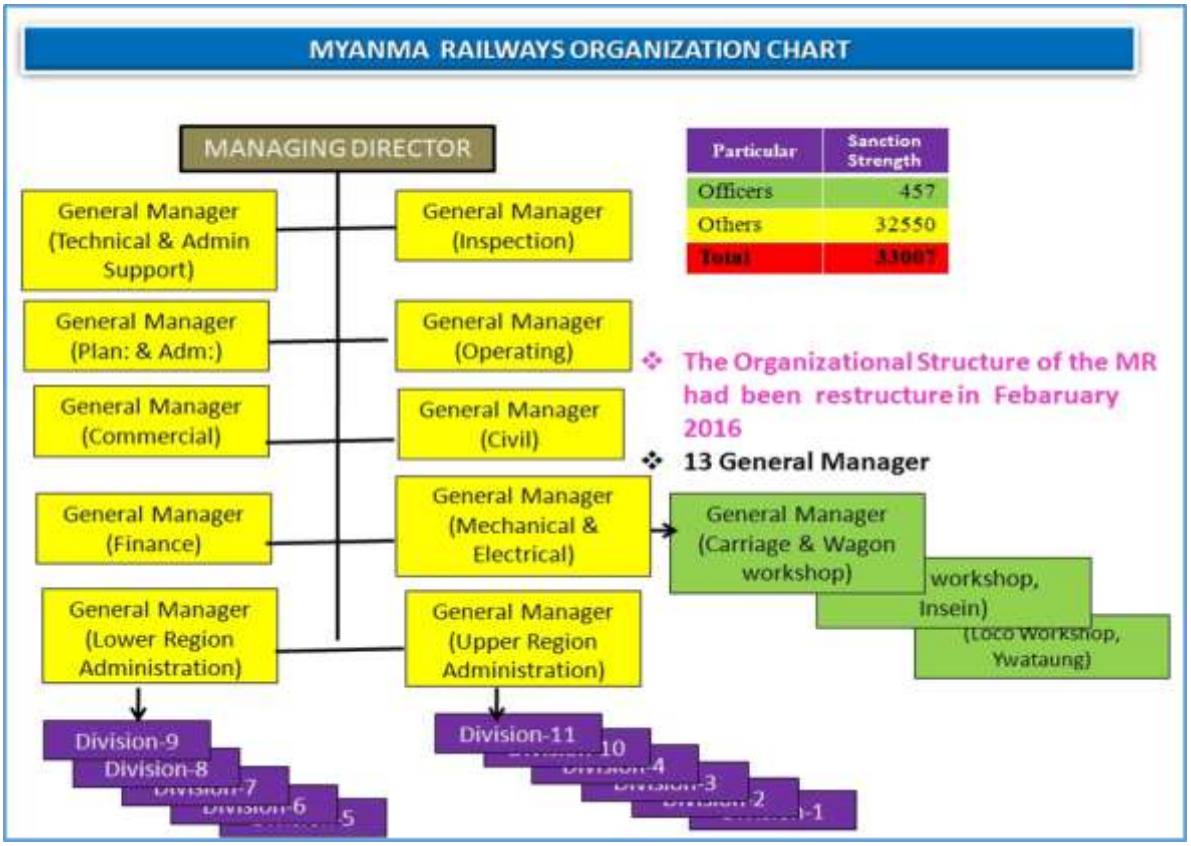
MR is the one of main transportation enterprises located under MOTC and is organized by 457 officers and 32,550 supporting staff members, according to the 'Facts about Myanmar Railways' (March 2017) supplemented by interviews with MR. The organization consists of one Managing Director, 13 General Managers (GMs) and other staffs that spread across 11 Divisions. Tasks of the 13 GMs can be described as follows:

GMs (2[1]): overall administration (i.e. one GM for Upper Myanmar and one GM for Lower Myanmar)

GMs (8): management of each of their own eight departments in MR's headquarters: 1) Technical and Admin Support; 2) Inspection; 3) Planning and Administration; 4) Operating; 5) Commercial; 6) Civil Work; 7) Finance; and 8) Mechanical and Electrical

GM (3): management of three workshops/factories: 1) carriage and wagon workshop at Myitnge; 2) locomotive workshop at Ywa-htaung; and 3) locomotive workshop at Insein.

[1] Numbers shown in brackets represent the number of GMs responsible for the tasks.



Source: MR

Figure 2. 2 Present Organizational Chart of MR

2.6 EIA Consultants

This EIA study has been carried out by E Guard Environmental Services Company Limited under the supervision of JICA Study Team on approval of MONREC. A list of member of the EIA consultant is shown in the below Table along with their roles and responsibilities and academic qualifications. The table describes their work experiences in the past. Contact address of the EIA consultant is shown as below:

Name of Company: E Guard Environmental Services Company Limited
Address: No. 11, Airport Avenue Road, Yangon Airport Road, Saw Bwar Gyi Gone Quarter, Insein Township, Yangon 11011, Myanmar.
Tel/Fax: +951-667953
URL: *www.eguardservices.com*

Table 2. 3 Positions, Responsibility and Academic Qualification of EIA Consultant

No.	Name	Role	Responsibility	Academic Qualification
1	Daw Yu Wai Yan Thein Tan	Team Leader	Overall supervision and guidance of the study	M. Eng. (Environmental Engineering Management)
2	Daw Khine Mar Kyaw	Water Pollution Control	Environnemental quality survey and analysis	M. Eng. (Environmental Engineering Management)
3	U Kaung Htet Swan	Air Pollution Control	Environnemental quality	M. Eng. (Environmental

			survey and analysis	Engineering Management)
4	U Naing Zaw Win	Social Environmental Expert	Socio-economic survey and analysis	B.Sc. (Forestry)
5	Daw Htet Shwe Sin Aung	Zoologist	Ecosystem Survey and Analysis	M.Sc. (Zoology)
6	Daw Hay Marn Hnin	Botanist	Ecosystem Survey and Analysis	M.Sc. (Botany)
7	U Kyaw Soe Moe	Transportation Engineer	Transportation survey and Analysis	B.E. (Civil Engineering)
8	U Si Thu Min Naing	GIS/CAD Field Surveyor,	GIS/CAD Field Surveyor,	B.E. (Mining Engineering)
9	Daw Thet Shwe Yee Aung	Geologist	Geological structural Survey	B.Sc. (Geology)
10	Daw May Thu Win	Lawyer	Provide Legislative advice	LL.B
11	Daw Shwe Sin Chue Lae	Surveyor and Enumerator	Collection of baseline data	B.E. (Electronic Communication Engineering)
12	U Thant Zin Aung	Surveyor and Enumerator	Collection of baseline data	B.E. (Mining Engineering)
13	Daw Khine Yin Nyein	Chemist	Collection of baseline Data	B.Sc. (Industrial Chemistry)

Table 2. 4 Work Experiences of EIA Consultant Members

1. Daw Yu Wai Yan Thein Tan
Daw Yu Wai Yan Thein Tan is a senior consultant who holds a master's degree in engineering specialized in Environmental engineering and management from the Asian Institute of Technology in Thailand and a Master Engineering specializing in Chemical Engineering from Mandalay Technology University. She has over six years of experience in the environmental field including her master's degree research. She also served as an engineer at Mandalay City Development Committee for three years. She oversees all aspects of E Guard's environmental projects including peer review, quality assurance, budget and schedule. Her professional experience includes air and water quality analyses, environmental consulting, environmental management and sustainable development, EIA, industry and environmental protection, and life cycle assessment. Contact: 09-798788196; yu.yuwaiyan@gmail.com
2. Daw Khine Mar Kyaw (Associate Consultant)
Daw Khine Mar Kyaw is an associate consultant in E Guard Environmental Services. She completed Master Degree with specializing in Environmental Engineering and Management from Asian Institute of Technology in Thailand and Bachelor of Pharmacy from University of Pharmacy, Mandalay. She participated in Myanmar Norway Hazardous Waste Management Plan. She has led in writing initial environmental examination (IEE) report for automobile technician school and service center, environmental impact assessment (EIA-scoping) report for production and sale of porcelain tableware project, and environmental conservation and prevention plan (ECPP) report for asphalt emulsion plant project. Before associate consultant, she had one year experience in Environmental Management Representative in one factory, which include format and procedure implementation, record keeping, leadership and knowledge sharing about ISO 9001, 14001 and 18001 to staffs, collaborate with other departments, clients & stakeholders (local & foreign), dealing with external auditor for ISO and Organic (local & foreign), energy conservation and sustainability, air pollution management, chemical control, solid waste control, wastewater treatment, preparing report and participating CSR activities in this factory. Contact: 09-797005212; khinemarkyaw@gmail.com
3. U Kaung Htet Swan (Associate Consultant)
U Kaung Htet Swan is an Associate Consultant, who holds Master of Engineering with specializing in Environmental Engineering and Management from Asian Institute of Technology, Bangkok in 2018 and Bachelor of Engineering with specializing in Mechanical Engineering from West Yangon Technological University, Yangon in 2016. He has experiences in air pollution control management, air quality modeling, environmental risk assessment, mechanical engineering and interpretation. His responsibilities are concerning with project management and compilation of the report for the project, including public and stakeholder's consultation. Contact: 09-797005213; kaunghtetswan.mm@gmail.com
4 U Naing Zaw Win (Project Assistant)

U Naing Zaw Win is a Project Assistant, who received his Bachelor Degree in Forestry from the University of Forestry in 2015. He has one-year experiences on environmental site survey and socio-economic surveys. Another experience is to cooperate with clients and to conduct stakeholder's engagement and public consultations. He also participates in the activities of social survey, biodiversity survey, data entry and analysis, environmental quality measuring such as air, water, noise quality and public hearing in this project. Contact: 09-795005182; naingzawwin93@gmail.com
5. Daw Htet Shwe Sin Aung (Project Associate)
Daw Htet Shwe Sin Aung is a project associate. Her background is Master of Science in Zoology from Yangon University. She has two years experience in laboratory works, surveying the fauna (mammals, birds, reptiles and fishes), recording, identification, communication with clients, social survey. Contact: 09-797005207;shwesinhtet@gmail.com
6. Daw Hay Marn Hnin (Project Associate)
Daw Hay Marn Hnin is a project associate. Her background is Master of Science in Botany from University of Pathein. She has two years experience in surveying the flora, recording, identification, communication with clients, social survey. Contact: 09-797005188;haymarnhin@gmail.com
7. U Kyaw Soe Moe (Transportation Engineer)
U Kyaw Soe Moe is a Project Assistant who received Bachelor of Civil Engineering from Taunggyi Technological University in 2016. He has more than one year of experiences in conduction stakeholder engagement, public consultation, social survey and site visit. His contributions on preparation of EIA for this project are secondary data and laws and regulations collection, writing environmental quality report and environmental assessment the transportation system and design of this project for safe traffic flow. Contact : 09-797005211; kyawsoemoe@eguardservices.com
8. U Si Thu Min Naing (GIA/CAD)
U Si Thu Min Naing is a project assistant, who received his Bachelor Engineer in Mining from the Technology University Mandalay. He has one year experience in communication with clients, regulators such as analytical laboratories. He is also familiar with conducting social survey. Contact: 09-09797005217; sithu581993@gmail.com
9. Daw Thet Shwe Yee Aung (Geologist)
Daw Thet Shwe Yee Aung is working as Project Assistant in E Guard Environmental Services. She completed her Bachelor Degree in Geology from University of Yangon in 2018. She went to Chauk, Popa, Kyauk Se Township and Southern Shan State to study the geological structure of those areas and also participated in writing geological reports. She has more than one experience in conduction stakeholder engagement and public consultation, site visit. She is currently assisting in preparing environmental reports, public consultation and information gathering processes. Contact : 09797005173: thetshweyeeaung@eguardservices.com
10. Daw May Thu Win (Lawyer)
Daw May Thu Win is working as project assistant in E-Guard Environmental Services Co., Ltd. She obtained her Bachelor Degree in Law from East Yangon University (Tarwa) in 2018. She is currently assisting in preparing Laws, Rules, Regulations, Policies, Directions and Notifications use for environmental reports, public consultations and information gathering process. Contact: 09-797005183: maythuwin@eguardservice.com
11. Daw Shwe Sin Chue Lae (Environmental Quality Project Assistant)
Daw Shwe Sin Chue Lae is a project assistant who holds a bachelor degree in engineering specializing in Electronic Engineering from Government Technological University in Myingyan. She also served as an engineer in discussing primary data for environmental quality (EQ) monitoring parameters with client and project information and determined the survey points. In addition to her experience in field surveys, she also has experience in environmental field like writing environmental quality (EQ) report. Contact:09-797005170: chue@eguardservices.com
12. U Thant Zin Aung(Project Assistant)
U Thant Zin Aung is a project assistant, who received her Bachelor Engineer in Mining from the Yangon Technology University. He has experience in communication with clients and familiar with conducting social surveys. He also served as an engineer in discussing primary data for environmental quality (EQ) monitoring parameters with client and project information and determined the survey points. Contact: 09-797005182; thantzinaung@eguardservice.com
13. Daw Khine Yin Nyein (Project Assistant)
Daw Khine Yin Nyein is a Project Assistant. She finished her Bachelor Degree of Industrial Chemistry from University of Yangon in 2018. She has knowledges in industrial chemistry field. She has one year experience in

collecting secondary data, site visiting, taking social surveys and LARAP surveys and facilitating public consultations.
Contact: 09-797005197; khineyinnyein@eguardservices.com

Source: E Guard Environmental Services Company Limited

CHAPTER 3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This chapter explains about the policies, legislation and guidelines in Myanmar that are of relevance to the project. The environmental and social policy of MR, the project proponent, will be presented first followed by other legislation.

3.1 Environmental and Social Policy of MR

MR has developed in 2014 their environmental and social policy that will be applied also to this project. In concrete, MR aims to fulfill its missions described below with regards to environmental and social considerations:

(1) to encourage the use of environmentally-friendly transport systems (e.g. less noise, less vibration, less emission gases, and higher fuel-efficiency) especially in built-up areas including progressive use of modern, more fuel-efficient (i.e. low carbon emission) technologies in the transport industry;
(2) to quickly improve traffic safety significantly and reduce the growing number of traffic accidents on railways;
(3) to raise awareness among the population of the need to behave in a more environmentally-friendly and safer manner;
(4) to upgrade the level of safety and security in transporting fuels and other hazardous materials along designated corridors; and
(5) to develop all-weather and natural disaster-preventive land transportation by programmed upgrading and maintenance of existing railways, bridges and drainage structures

3.2 Legal Framework for Environmental and Social Considerations

3.2.1 Overview of Legislations Related to Environmental and Social Considerations

Policies, legislation and guidelines in Myanmar that are of relevance to the project are summarized in Table 3.1. Those that are of particular importance are described in more detail in the sections that follow.

Table 3. 1 Applicable Laws and Legal Commitments for YUMRT Construction Project in Yangon

No.	Name of Laws and Regulations	Year
1	The Environmental Conservation Law	2012
2	The Environmental Conservation Rules	2014
3	Environmental Impact Assessment Procedure	2015
4	Emission Quality Standards Guideline	2015
5	The Myanmar Investment Law	2016
6	Myanmar Investment Rule	2017
7	The Rights of National Races Law	2015
8	The Public Health Law	1972
9	Prevention and Control of Communicable Disease Law	1995
10	The Control of Smoking and Consumption of Tobacco Product Law	2006
11	Myanmar Fire Force Law	2015

No.	Name of Laws and Regulations	Year
12	The Motor Vehicle Law (2015) and Rules (1987)	2015
13	The Myanmar Insurance Law	1993
14	Labor Organization Law	2011
15	The Second Amendment of the Settlement of Labor Disputes law	2019
16	The Development of Employment and Skill Law	2013
17	Minimum Wages Law	2013
18	Payment of Wages Law	2016
19	Law Amending The Workmen's Compensation Act (1923)	2005
20	Law Amending The Leaves and Holiday Act (1951)	2014
21	Social Security Law	2012
22	Petroleum and Petroleum and Product of petroleum law	2016
23	The Petroleum Rules	1937
24	Conservation of Water Resources and Rivers Law	2006
25	Freshwater Fisheries Law	1991
26	The Protection and Preservation of Cultural Heritage Regions Law	1998
27	The Protection and Preservation of Antique Objects Law	2015
28	The Protection and Preservation of Ancient Monument Law	2015
29	The Engineering Council Law	2013
30	Import and Export law	2012
31	Farm Land Law	2012
32	The Administration of Vacant, Fallow and Virgin Land Law	2012
33	Railway Transportation Service Law	2016
34	Forest Law	2018
35	Protection of Biodiversity and Protected Area Law	2018
36	Yangon City Development Council Law	2018
37	Land acquisition, Resettlement and Rehabilitation Law	2019

(1) The Environmental Conservation Law (2012)

Purpose: To construct a healthy and clean environment and to conserve natural and cultural heritage for the benefit of present and future generations; to maintain the sustainable development through effective management of natural resources and to enable to promote international, regional and bilateral cooperation in the matters of environmental conservation.

- The project proponent has to pay the compensation for damages if the project will causes injuries to environment, under the sub-section (o) of section 7 of said law.
- The project proponent has to purify, emit, dispose and keep the polluted materials in line with the stipulated standards, under section 14 of said law.
- The project proponent has to install or use the apparatus which can control or help to reduce, manage, control or monitor the impacts on the environment, under section 15 of said law.
- The project proponent has to allow relevant governmental organization or department to inspect whether performing is conformity with the terms and condition included in prior permission, stipulated by the ministry, or not, under section 24 of said law.
- The project proponent has to comply with the terms and conditions included in prior permission, under section25 of said law.
- The project proponent has to abide by the stipulations included in the rules, regulation, by-law, order, notification and procedure, which are issued by said law, under section 29.

(2) The Environmental Conservation Rules (2014)

- The project proponent has to avoid emit, discharge or dispose the materials which can pollute to environment, or hazardous waste or hazardous material prescribed by notification in the place where directly or indirectly injure to public, under sub- rule (a) of rule 68.
- The project proponent has to avoid performing to damage to ecosystem and the environment generated by said ecosystem, under sub-rule (b) of rule 68.

(3) Environment Impact Assessment Procedure (2015)

- The project proponent has to be liable for all adverse impacts caused by doing or omitting of project owner or contractor, sub-contractor, officer, employee, representative or consultant who is appointed or hired to perform on behalf of project owner, under sub-paragraph (a) of paragraph 102.
- The project proponent has to support, after consultation with effected persons by project, relevant government organization, government department and other related persons, to resettlement and rehabilitation for livelihood until the effected persons by the project receiving the stable socio-economy which is not lower than the status in pre-project, under sub-paragraph (b) of paragraph 102.
- The project proponent has to implement fully all commitments of project and conditions included in EMP. Moreover the project proponent has to be liable for contractor and sub-contractor who perform on behalf of him/her have to fully abide by the relevant laws, rules, this procedure, EMP and all conditions, under paragraph 103.
- The project proponent has to be liable and fully & effectively implement all requirements included in ECC, relevant laws and rules, this procedure and standards under rule 104.
- The project proponent has to inform the completed information, after specifying the adverse impacts caused by the project, from time to time, under paragraph 105.
- The project proponent has to continuously monitor all adverse impacts in the pre-construction phrase, construction phrase, operation phrase, suspension phrase, closure phrase and post-closure phrase, moreover has to implement the EMP with abiding the all conditions included in ECC, relevant laws & rules and this procedure, under paragraph 106.
- The project proponent has to submit, as soon as possible, the failures of his or her responsibility, other implementation, ECC or EMP. If dangerous impact caused by this failure or failure should be known by the Ministry the project proponent has to submit within 24 hours and other than this situation has to submit within 7 days from knowing it, under paragraph 107.
- The project proponent has to submit the monitoring report dually or prescribed time by Ministry in line with the schedule of EMP, under paragraph 108.
- The project proponent has to prepare the monitoring report in accord with the rule 109.
- The project proponent has to show this monitoring report in public place such as library, hall and website and office of project for the purpose to know this report by public within 10 days from the date which the report is submitted to the Ministry. Moreover has to give the copy of this report, by email or other way which way agreed with the asked

person, to any asked person or organization, under paragraph 110.

- The project proponent has to allow inspector to enter and inspect in working time and if it is needed by Ministry has to allow inspector to enter and inspect in the office and work-place of project and other work-place related to this project in any time, under paragraph 113.
- The project proponent has to allow inspector to immediately enter and inspect in any time if it is emergency or failure to implement the requirements related to social or environment or caused to it, under paragraph 115.
- The project proponent has to allow inspector to inspect the contractor and sub-contractor who implement on behalf of project, under paragraph 117.

(4) Emission Quality Standards Guideline (2015)

- The project proponent has to emit, discharge or dispose in line with the standards stipulated in said guideline.

(5) The Myanmar Investment Law (2016)

Purpose: To ensure the appointing of employees, fulfilling the rights of employees, avoiding any injury to environment, social and cultural heritage, insure the prescribed insurance in line with the above law. This law focuses as follows;

- The project proponent has to appoint the nationalities in the various levels of administrative, technical and expert work by the arrangement to develop their expertise, in line with the sub-section (b) of section51of said law.
- The project proponent has to appoint the nationalities only in normal work without expertise, in line with the sub-section (c) of section51of said law.
- The project proponent has to appoint either foreigner or nationality with the appointment agreement in accord with the law, in line with the sub-section (d) of section51of said law.
- The project proponent has to comply with the international best practices, existing laws, rules and procedures to not damage, pollute, and injure to environment, cultural heritage and social, in line with the sub-section (g) of section65of said law.
- The project proponent has to close the project after paying the compensation to the employees in accord with the existing laws if violates the appointment agreement or terminate, transfer or suspend the investment or reduce the number of employees , in line with the sub-section (i) of section65of said law.
- The project proponent has to pay the wages or salary to the employees in accord with the laws, rules, order and procedures in the suspension period, in line with the sub-section (j) of section65of said law.
- The project proponent has to pay the compensation or injured fees to the respected employees or their inheritors if injury in or loss of part of body or death caused by work, in line with the sub-section (k) of section65of said law.
- The project proponent has to stipulate the foreign employees to respect the culture and custom and abide by the existing laws, rules, orders, directives, in line with the sub-section (l) of section65of said law.

- The project proponent has to abide by labor laws, in line with the sub-section (m) of section65of said law.
- The project proponent has to pay the compensation, to the injured person for damages if damage to environment or socio-economy is occurred by misuse of project, in line with the sub-section (o) of section65of said law.
- The project proponent has to allow to inspect in anywhere of project if Myanmar Investment Commission inform to inspect the project, in line with the sub-section (p) of section65of said law.
- The project proponent has to obtain the permission of MIC before EIA process and report back this process to Myanmar Investment Commission, in line with the sub-section (q) of section 65of said law.
- The project proponent has to insure the prescribed insurance by rules, under section 73 of said law.

(6) Myanmar Investment Rules (2016)

- The project proponent has to comply with the conditions of the permit issued by MIC and applicable laws when making the investment, under rule 202.
- The project proponent has to fully assist while negotiating with the authority for settling the grievance of the local community which has been affected due to investment, under rule 203.
- The project proponent has to submit the passport, expertise evidence or document of degree and profile to the MIC office for approval if decide to appoint a foreigner as a senior management, technician expert or consultant according to sub-section (a) of section 51 of Myanmar Investment Law, under rule 206.

(7) Protection the Rights of National Races Law (2015)

Purpose: To ensure to disclose to residents ethnic nationalities about the project fully, moreover to ensure to cooperate with them. This law focuses the following matters;

- The project proponent has to disclose to the residents national races all about the project fully.
- The project proponent has to cooperate with the residents national races.

(8) The Public Health Law (1972)

Purpose: To ensure the public health include not only employees but also resident people and cooperation with the authorized person or organization of health department. This law focuses as follows;

- The project owner has to cooperate with the authorized person or organization in line with the section 3 and 5 of said law.
- Section 3 - The project proponent has to abide by any instruction or stipulation for public health.
- Section 5 - The project proponent has to allow any inspection, anytime, anywhere if it is

needed.

(9) Prevention and Control of Communicable Diseases Law (1995)

Purpose: To ensure the healthy work environment and prevention the communicable diseases by the cooperation with the relevant health department. This law focuses as follows;

- The project proponent has to build the housing in line with the health standards, distribute the healthful drinking water & using water and arrange to systematically discharge the garbage & sewage, under clause (9) of sub-section (a) of section 3 of said law.
- The project proponent has to abide by any instruction or stipulation by Department of health and Ministry of Health, under section 4 of said law.
- The project proponent has to inform promptly to the nearest health department or hospital if the following are occurred: (section 9).
  (1) Mass death of animals included in birds or chicken;
  (2) Mass death of mouse
  (3) Suspense of occurring of communicable disease or occurring of communicable disease;
  (4) Occurring of communicable disease which must be informed.
- The project proponent has to allow any inspection, anytime, anywhere if it is need to inspect by health officer, under section 11 of said law.

(10) The Control of Smoking and Consumption of Tobacco Product Law (2006)

Purpose: To ensure the creation of smoking area and non-smoking area in the power plant area for health and control of smoking. This law focuses as follows;

- The project proponent has to keep the caption and mark referring that is non- smoking area in the project area, under sub-section (a) of section 9 of said law.
- The project proponent has to arrange the specific place for smoking in the project area and keep the caption and mark in accordance with the stipulations, under sub-section (b) of section 9 of said law.
- The project proponent has to supervise and carry out the measures so that no one shall smoke at the non-smoking area, under sub-section (c) of section 9 of said law.
- The project proponent has to allow the inspection of supervisory body in the power plant area, under sub-section (d) of section 9 of said law.

(11) The Myanmar Fire Force Law (2015)

Purpose: To ensure to prevent the fire, to provide the precautionary material and apparatuses, if the fire caused in the project area to be defeated because the project is business in which electricity and any inflammable materials such as petroleum are used. So, the project owner has to institute the specific fire service in line with the above law. This law focuses the following

- The project proponent has to institute the specific fire services, under sub-section (a) of section 25 of said law.
- The project owner has to provide materials and apparatuses for fire precaution and prevention, under sub-section (b) of section 25of said law.

(12) The Motor Vehicles law (2015) and Rules (1987)

Purpose: When the construction period and if it is needed in operation and production period for the all vehicles.

- The project proponent has to promise to abide by the nearly all provisions of said law and rules, especially the provisions related to air pollution, noise pollution and life safety.

(13) The Myanmar Insurance Law (1993)

Purpose: The project can cause the damages to the environment and injuries to public so to ensure the needed insurances are insured at Myanmar Insurance. This law focuses the following matters;

- Section 15- If the project proponent uses the owned vehicles the project owner has to insure the insurance for injured person.
- Section 16The project proponent has to insure the insurance to compensate for general damages because the project may cause the damages to the environment and injury to public.

(14) Labor Organization Law (2011)

Purpose: To ensure protection the rights of the employees, having the good relationships between the employees and employer and enabling to form and carry out the labor organizations systematically and independently.

- Section 17- The project owner has to allow the labor organization to negotiate and settle with the employer if the workers are unable to obtain and enjoy the rights of the workers contained in the labor laws and to summit demands to the employer and claim in accord with the relevant law if the agreement cannot be reached.
- Section 18- The project proponent has to allow the demand for the re-appointment of worker who is dismissed by the employer without the conformity with the labor laws.
- Section 19- The project proponent has to send the representatives to the Conciliation Body in settling a dispute between the employer and the worker.
- Section 20- The project proponent has to allow the labor organization to participate and discuss in discussing with the government, the employer and the complaining employees in respect of employee's rights or interest contained in the labor laws.
- Section 21- The project proponent has to allow the labor organization to participate in solving the collective bargains of the employees in accord with the labor laws.
- Section 22- The project proponent has to allow the labor organization to carry out the holding the meetings, going on strike and other collective activities in line with the procedure, regulation ,by-law and directive of relevant Chief Labor Organization .

(15) The Second Amendment of the Settlement of Labor Disputes Law (2019)

Purpose: To ensure negotiation and discussion between employees and project proponent, abiding the decision of Tribunal. This law focuses as follows;

- The project proponent has to not absent to negotiation within the stipulated time for complaint, under section 38 of said law.
- The project proponent has to not change the existing stipulations for employees within conducting period before Tribunal, under section 39 of said law.
- The project proponent has to not close the work without negotiation, discussion on dispute in accord with this law, decision by Tribunal, under section 40 of said law.
- The project proponent has to pay the compensation decided by Tribunal if violates any act or any omission to damage the interest of labor by reducing of product without efficient cause, under section 51 of said Law.

(16) The Development of Employment and Skill Development Law (2013)

Purpose: To ensure the job security and to develop the employee's skill with the fund of project owner. This law focuses as followings;

- The project proponent has to appoint employees with the contract in line with the provision of section 5 of said law.
- The project proponent has to carry out the training programs with the policy of Skill Development Body to develop the employment skill of employees who is appointed or will be appointed, under section 14 of said law.
- The project proponent has to monthly pay to the fund, which is fund for development of skill of employees, not less below 0.5 percentage of the total payment to the level of worker supervisor and the workers below such level under sub-section (a) of section 30 of said law.
- The project proponent has to promise not to deduct from the payment of employees for above mentioned fund under sub-section (b) of section 30 of said law.

(17) The Minimum Wages Law (2013)

Purpose: To ensure the project owner pay the wages not less than prescribed wages and notify obviously this wages in work place, moreover to be inspected. This law focuses as followings;

- The project proponent has to pay the wages in line with section 12 of said law.
- The project proponent has to notify the prescribed wages obviously in work place, under sub-section (a) of section 13 of said law.
- The project proponent has to correctly record the lists, schedules, documents and wages and report these to the relevant department and give if these are asked while inspecting, in accord with the stipulations under sub-section (b) (c) (d) of section13 of said law.
- The project proponent has to allow to be inspected by the inspector, under sub-section (d) and (e) of section 13 and section 18 of said law.
- The project proponent has to allow holiday for medical treatment if the employee' health is not fit to work, under sub-section (f) of section 13 of said law.
- The project proponent has to allow holidays without deducting from the wages if one of

parents or one of family dies, under sub-section (g) of section 13 of said law.

(18) Payment of Wages Law (2016)

Purpose: To ensure the way of payment and avoiding delay payment to the employees. This law focuses as follows;

- The project proponent has to pay the wages in accord with the section 3 and 4 of said law, under section 3 & 4 of said law.
- The project proponent has to submit with the agreements of employees & reasonable ground to department if it is difficult to pay because of force majeure included in natural disaster, under section 5 of said law.
- The project proponent has to abide by the provisions of section 7 to 13 in chapter (3) in respect of deduction from wages.
- The project proponent has to pay the overtime fees, prescribed by law, to the employees who work over working hours, under section 14 of said law.

(19) Law Amending the Workmen's Compensation Act (2005)

Purpose: To ensure the compensations to injured employee while implementing in line with the above law and to pay the prescribed compensations in various kinds of injury. This law focuses as follow;

- Section 13 -The project proponent has to pay the compensation in line with the provisions of said law base on kind of injury and case by case.

(20) Law Amending the Leaves and Holiday Act (2016)

Purpose: The employees can take the leaves and get the holidays legally and to ensure the right to get the holidays and leaves. This law focuses the follow;

- The project proponent has to allow the leaves and holidays in line with the law.

(21) Social Security Law

Purpose: The project proponent has to create the social security for the employees because the project is the business under the Myanmar Citizen Investment Law. To ensure the social security for employees of the project, the project owner has to register to the social security offices and to pay the prescribed fund. This law focuses as follows;

- The project proponent has to register to the respected social security office, under sub-section (a) of section 11 of said law.
- The project proponent has to pay the social security fund for at least four types of social security included in sub-section (a) of section 15, under section 15 of said law.
- The project proponent has to pay the fund which has to be paid myself and together with the fund which has to be paid from their salary by the employees .Moreover the project owner will pay the cost for paying the above mentioned fund only myself under sub-section (b) of section 18 of said law.
- The project proponent has to pay the fund for accidence, under sub-section (b) of section

48 of said law. (but this fund is not related to workmen compensation)

- The project proponent has to make correctly and submit the list and record provided in section 75 to respected social security office, under section 75 of said law.

(22) Petroleum and Product of Petroleum Law (2017)

Purpose: The project will transport and store the fuel in any phrase. To ensure to take the license for importation and storage and abide by the stipulations in the license

- The project proponent has to transport the fuel by the vehicle or vessel which is licensed by the Ministry of Transportation and Communication under sub-section (a) of section 9 of said law.
- The project proponent has to abide by the procedures and conditions specified by the Ministry of Transportation and Communication under sub-section (e) of section 9 of said law.
- The project proponent has to transport after obtaining the transportation license issued by the Ministry of Natural Resource and Environmental Conservation under sub-section (b) of section 10 of said law.
- The project proponent has to allow inspection by the Ministry of Natural Resource and Environmental Conservation under sub-section (d) of section 10 of said law.
- The project proponent has to store the fuel in the tank which is licensed by the Ministry of Natural Resource and Environmental Conservation under sub-section (a) of section 10 of said law.
- The project proponent has to show the notice of danger on the tank or container of fuel under section 11 of said law.

(23) The Petroleum Rules (1937)

Purpose: To ensure the project owner has to abide by the stipulations for transportation of oil.

- The project proponent will abide by the provision of chapter (3) of the Petroleum Rules for transportation and the provisions of chapter (4) of said rules for storage.

(24) Conservation of Water Resources and Rivers Law (2006)

Purpose: The project proponent will avoid the disposal of stipulated materials into river-creek. This law focuses as follows;

- The project proponent has to avoid any performing to damage to the river, creek and water resource, under sub-section (a) of section 8.
- The project proponent has to avoid the violation of conditions stipulated by the directorate for prevention of water pollution, under sub-section (b) of section 24.

(25) Freshwater Fisheries Law (1991)

Purpose: According to the sub-section (e) of section 2 of said law, the freshwater area includes any river, creek, pond and water area so the project will be near by the river or creek which is freshwater area the safety of freshwater and aquatics. This law focuses as follow;

- The project proponent has to avoid any water pollution and disturbing to fish & other aquatic lives in any fresh-water such as river or creek, under section 40 of said law.

(26) The Protection and Preservation of Cultural Heritage Regions Law (1998)

Purpose: To ensure the protection of cultural heritages and the cultural heritage area from the damage by the natural disaster or man-made. This law focuses as follows;

- Section 13 - The project proponent has to apply to get the prior permission of Directorate of Ancient-Research to build the road, bridge or dam in the cultural heritage area.
- Section 22 - The project proponent promises not to build the building which is not in line with the stipulations prescribed by the Ministry of Culture in the cultural heritage area.

(27) The Protection and Preservation of Antique Objective Law (2015)

Purpose: To ensure the protection of ancient monument and inform about it if it was in the project area. This law focuses as follow;

- The project proponent has to inform to the village-tract or ward administrator if any antique objective is found in project area under section 12 of said law.

(28) The Protection and Preservation of Ancient Monument Law (2015)

Purpose: To ensure the protection of ancient monument and information about it if it was in the project area. This law focuses as follows;

- Section 12 - The project proponent has to report to the village-tract or ward administrators if the project proponent will find any ancient monument under the ground or on the ground or under the water.
- Section 15 - The project proponent has to obtain the prior permission of Department of Ancient Research Museum if the project area is in the prescribed area of Ancient monument.
- Sub-section (f) of section 20 - The project proponent has to obtain the prior permission, by written, of Department of Ancient Research and National Museum if the project proponent disposes the chemical and solid waste in the Ancient Monument.

(29) The Engineering Council Law (2013)

Purpose: To ensure the safety in technical and engineering work in the project. This law focuses the following;

- The project proponent has to appoint the employees, who obtained the registration certificate issued by the Myanmar Engineering Council, in the technical and engineering work, under section 37 of said law.
- The project proponent has to ensure the employees who are engineers abide to the provisions of Myanmar Engineering Council law, prohibitions included in the rules, order and directive issued under said law, conditions included in the registration

certificate issued by the Myanmar Engineering Council, under section 34 of said law.

(30) Import and Export Law (2012)

Purpose: To ensure to abide by the permission for import

- The project proponent has to abide by the conditions contained in permission for import if the boiler is imported, under section 7 of said law.

(31) The Farm Land Law (2012)

Purpose: To ensure the right to use the farm land and sufficient compensation for acquisition of the farm land. This law focuses the following matters;

- The project owner has to abide by the decision of relevant Ministry with the coordination with the Central Administrative Body of the Farmland for paying the compensation if it is needed acquisition farm land, under section 26 of said law.
- The project proponent has to obtain the permission of the Central Administrative Body of Farmland for the land use change from paddy field land to other land use under sub-section (a) of section 30.
- The project proponent has to obtain the permission of the Yangon Region Government with the recommendation of Yangon Region Administrative Body of Farmland for the land use change from farm land other than paddy field land to other land use under sub-section (b) of section 30.

(32) Vacant, Virgin and Fallow Land Law (2012)

Purpose: To ensure the project land is clearly get as the project land.

- Sub-section (d) of section 10 - The project proponent will ensure to get permitted areas for the project land by the Central Administrative Body on Vacant, Virgin and Fallow Land.
- Sub-section (a) of section 19 - The project proponent will promise to return the land if any antique object is found in the project area.
- Sub-section (d) of section 19 - The project proponent will promise to return the land if any resource is found in the project.

(33) Railway Transportation Service Law (2016)

Purpose: To ensure safe construction, legally obtain the land use right for transit and required permissions for construction. This law focuses as follows;

- The project proponent has to submit the specific particulars of the land to be acquired for the project, in accord with the existing laws and procedure, to the Central Supervisory Board under sub-section (b) of section 14.
- The project proponent has to negotiate with land owner to be acquired for the railway if the required land is private land firstly under sub-section (b) of section 16
- The project proponent has to submit the situation that the land owner refused the use of land for railway although negotiation was conducted with land owner to the Central Supervisory Body under sub-section (c) of section16.
- The project proponent has to obtain the permission for construction of temporary or

permanent inclined planes, arches, tunnels, culverts, embankments, aqueducts, bridges, roads, railways paths, conduits, drains, piers, cuttings and fences under or over any land or water under sub-section (a) of section 28.

- The project proponent has to obtain the permission for diverting the course of river, steam, book or spring for to flow easily over, under or by the side of railway and raising or lowering the level of ground of different types of roads if necessary under sub- section (b) of section 28.
- The project proponent has to obtain the approval of Central Supervisory Body for constructing drains or piping into, under or through any land adjoining the railway for the purpose of conveying water from or to the railway under sub- section (c) of section 28.
- The project proponent has to obtain the approval of Central Supervisory Body for constructing warehouses, offices, houses and other buildings, yards, stations, and carrying other works under sub- section (d)of section 28.
- The project proponent has to obtain the approval of Central Supervisory Body for generating electricity for the railway transport service in accordance with the existing laws under sub-section (e) of section 28. (if necessary)
- The project proponent has to obtain the approval of Central Supervisory Body for altering position of gas, water and pressure pipelines, electric cables, communication cables, and position of drains which are not main drains under sub-section (f) of section 28.(if necessary)
- The project proponent has to send a notice which states the nature and volume of work exactly to land user or occupant for objection to any work, if any, by stating purpose and reason before carrying out the works under section 28 under sub- section (a) and (b) of section 29. Also has to give the copy of this notice to the Central Supervisory Body under sub-section (c) of section 29.
- The project proponent has to accept the representative of land user or occupant to object or negotiate for or to supervise and cooperate in carrying out the work under sub-section (a) of section 30.
- The project proponent has to carry out the work taking into consideration of the submission of the representatives of land user or occupant and arrange to supply gas, water, pressure pipeline, electricity and communication system continuously while carrying out the works and to maintain drains under sub- section (b)of section 30.
- The project proponent has to contract and maintain flyovers, bridges, arches, culverts, and paths over, under or by the sides of railway to reduce and remove the inconvenience caused by construction of railway under sub-section (a) of section 36.
- The project proponent has to contract and maintain flyovers, bridges, arches, culverts, and paths over, under or by the sides of railway where necessary in order to flow water as the most similar condition before construction of railway under sub-section (b) of section 36.
- The project proponent has to make and repair boundary marks or fences along the railway or portion of the railway or at connected roads, within the prescribed by the Central Supervisory Body, under sub-section (a) of section 37.

- The project proponent has to construct suitable bridges, rotating gates or fix and renew. Chains, bars or hand rails and appoint the permanent staff to open and close these apparatus if the railway is constructed across the public road, within the prescribed by the Central Supervisory Body, under sub-section (b) of section 37.

(34) Forest Law (2018)

Purpose: To ensure in carrying out the project with the permission of Ministry of Natural Resources and Environmental Conservation if the project land is forest land or forest covered land. This law focuses as follow;

- The project proponent has to obtain the permission of Ministry of Natural Resources and Environmental Conservation before starting the work if the project land is forest land or forest covered under sub- section (a) of section 12.

(35) Protection of Biodiversity and Protected Area Law (2018)

Purpose: To ensure abiding by the prohibitions and stipulations to protect biodiversity and protected area

- The project proponent has to avoid entering the prohibited area located in protected area without permission under sub-section (a) of section 35.
- The project proponent has to avoid digging on the land or carrying out any activity in protected area under sub-section (c) of section 35.
- The project proponent has to avoid extracting, collecting or destroying in any manner, any kind of wild or cultivated plant in protected area under sub-section (d) of section 35.
- The project proponent has to avoid polluting soil, water and air, damaging a water-course or poisoning water, electrification, using chemical or explosive materials in protected area under sub-section (a) of section 39.
- The project proponent has to avoid possessing or disposing of toxic objectives or mineral wastes in protected area under sub-section (b) of section 39.

(36) Yangon City Development council Law (2018)

Purpose: To ensure abiding the stipulations for construction, cleaning environment in carrying out the work of project

- The project proponent has to abide by all provisions for construction and cleaning environment.

(37) Land acquisition, Resettlement and rehabilitation Law (2019)

The project proponent shall provide concern with the compensation to landowner for the land acquisition and other related persons as the following processes-

- In the confiscated land, if there are no permanent buildings and other business buildings, the compensation for this land shall be issued to the landowner and the person concerned in the confiscated land, under sub-section (a) of section 39.
- In the confiscated land, if there are permanent buildings and other business buildings, the compensation for land and building shall be issued to the landowner with local current market price, under sub-section (b) of section 39.

- In the confiscated land, if there are no perennial plants, seasonal crops and livelihood business, the compensation for this land shall be issued to the landowner with local current market price, under sub-section (c) of section 39.
- In the confiscated land, if there are perennial plants, seasonal crops and livelihood business as the following, under sub-section (d) of section 39
    (1) Three times of local current market price for perennial crop currently grown
    (2) Three times of local current market price based on the yield per acre for paddy and other crops grown
    (3) Estimated loss of income due to loss of livelihood and employment
    (4) Animals, other livestock and materials loss

The representative or effective person shall be identified and compensated for compensation, under sub-section (e) of section 39.

The project proponent shall implement resettlement or rehabilitation as the following plan

- As soon as the process of land acquisition and transfer of land is commenced, the landowner is simultaneously given the right to re-enforce the resettlement process, under sub-section (a) of section 46.
- The resettlement process including housing development process, the necessary infrastructure and facilities for the livelihood of the households and other needs for development of ward and village development, under sub-section (b) of section 46.
- Confiscated land based rehabilitation processes which include livelihood activities and job placement arrangements, under sub-section (c) of section 46.

CHAPTER 4 PROJECT DESCRIPTION AND ALTERNATIVE SELECTION

4.1 Project Description

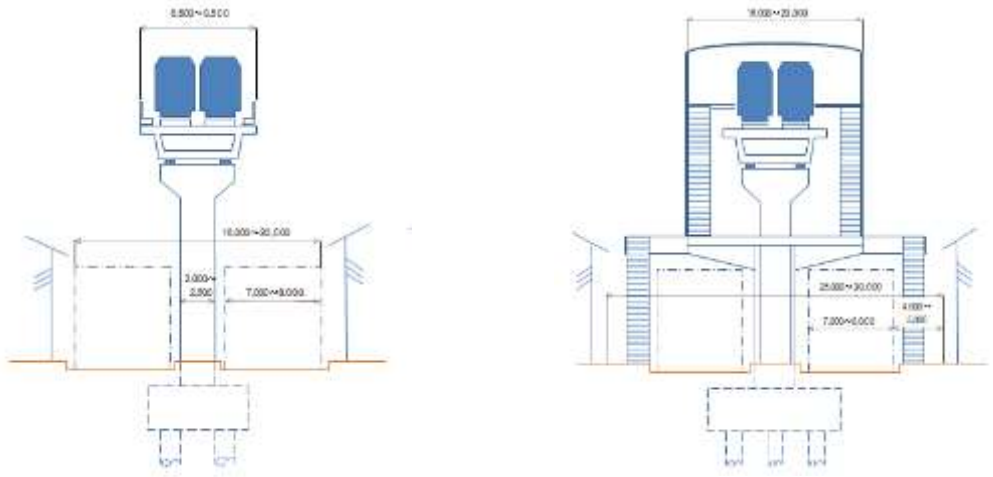
The project involves a construction of new elevated railway structure, which has the length approximately 18 km, with 13 elevated stations. A new railway depot construction including a receiving substation is also planned adjacent to the existing Haling Tharyar MR station, and a new Bayint Naung bridge construction to cross Hlaing River. The proposed design criteria of the project are shown in Table 4.1.

Table 4. 1 Proposed Design Criteria

Criteria			Description/ Value
1	Gauge		1,435mm (Standard Gauge)
2	Speed	Maximum	80km/h (Elevated)
		Schedule	30km/h
3	Minimum horizontal curvature	Main track	160m (Absolute minimum: 100m)
	Platform		400m
4	Gradient		35%
5	Traction power supply System	System	Overhead Catenary
		Voltage	1500V DC
6	Required Power Supply	Megawatts	37.1

Reference: JICA study team

4.1.1 New Elevated Railway Structure Construction (2 lanes, Total length approx. 18 km)



Reference: JICA study team

Figure 4. 1 Typical Elevated Structure of for YUMRT (Straight and Station Section)



Image of Straight Section (Bangkok BTS)



Image of Station Section (Bangkok BTS)

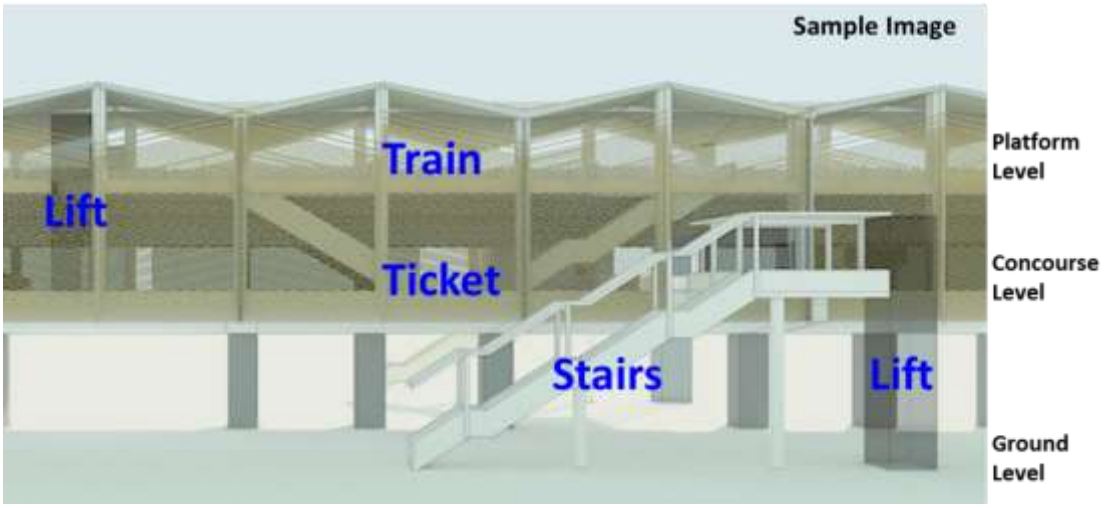


Image of Straight Section (Bangkok BTS)

Reference: Google Map etc.

Figure 4. 2 Example of Elevated Structure

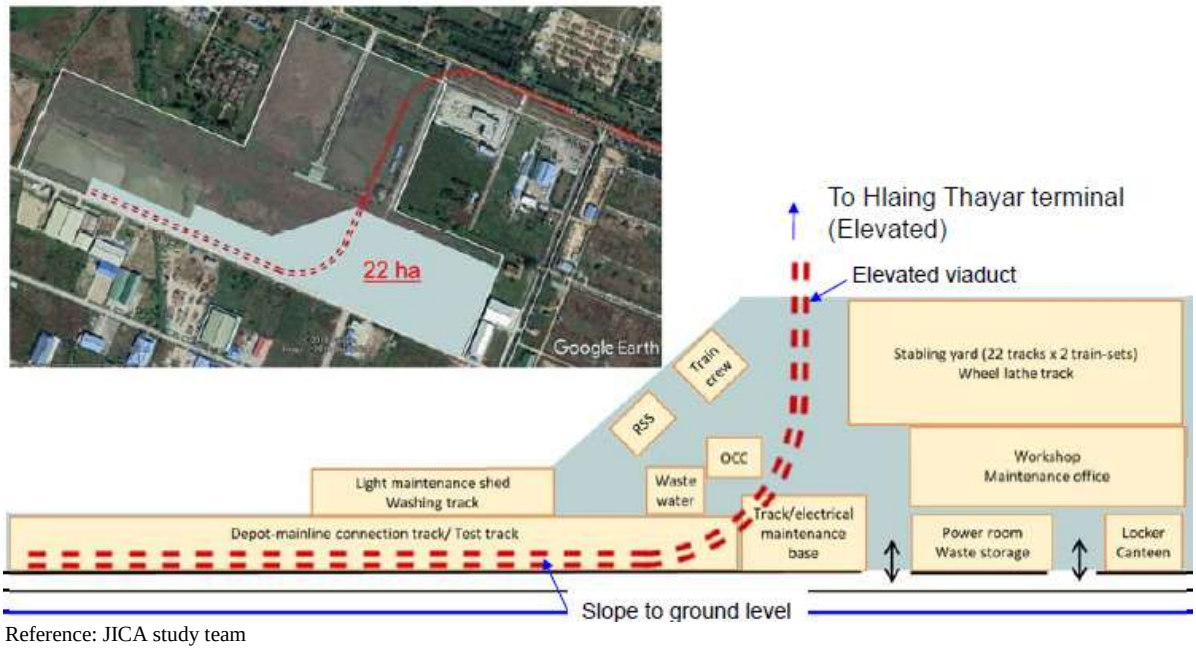
4.1.2 13 Elevated Stations and the Stairs Connecting to the Stations



Reference: JICA study team

Figure 4. 3 Sample image of elevated station for YUMRT

4.1.3 A Rolling Stock Yard Including a Receiving Substation (RSS) for YUMRT in Hlaing Thayar



Reference: JICA study team

Figure 4. 4 Tentative Layout Plan of Rolling Stock Yard for YUMRT



Reference: JICA study team

Figure 4. 5 Sample Image of Rolling Stock Yard (MRT Jakarta in Jakarta)

4.1.4 A New Bayint Naung Bridge for YUMRT over Hlaing River (approx. 0.4km)

To across Hlaing River, a bridge for YUMRT planned to be constructed with approx.15m of height and with approx.10m of width much as an image sample of Kiyosuna Bridge in Tokyo. As next step, Study on Bridge Landscape design will be implemented.

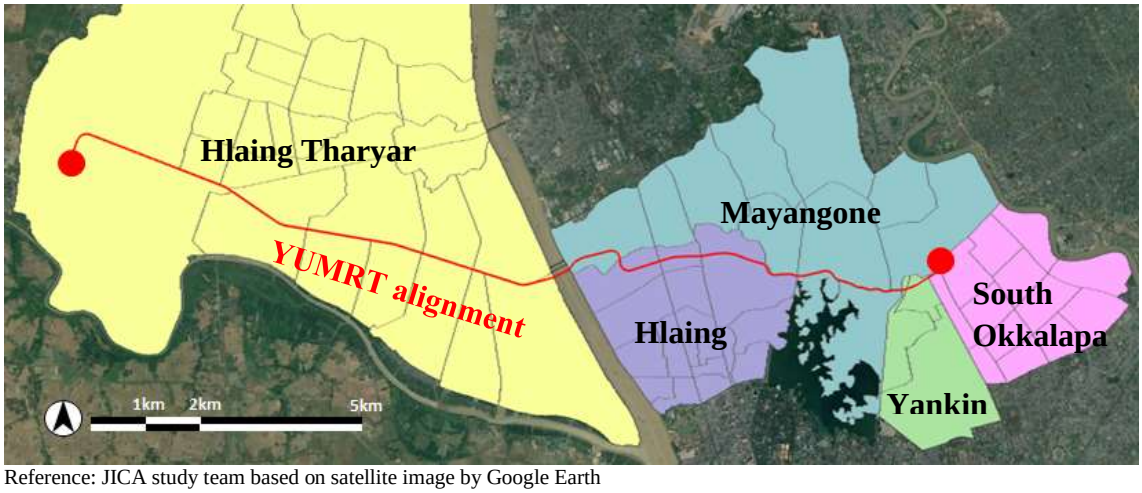


Reference: JICA study team

Figure 4. 6 Sample Image of New Railway Bridge (Kiyosuna-bridge in Tokyo)

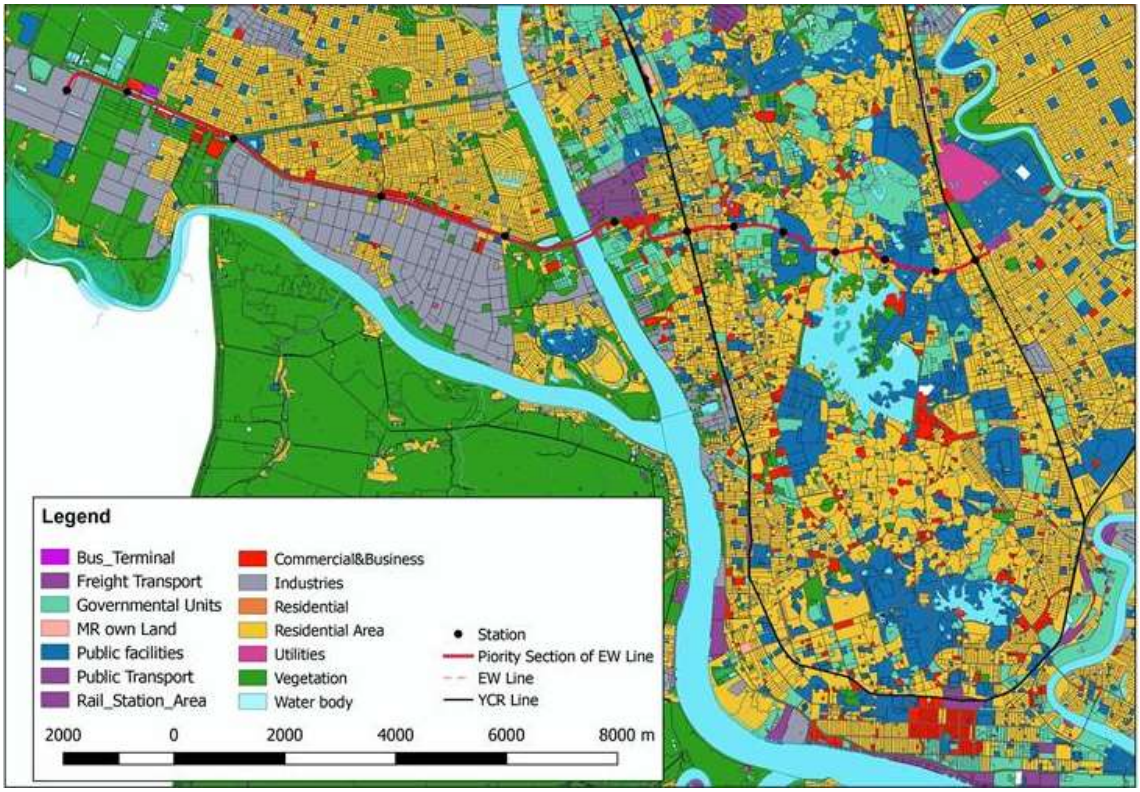
4.2 Status of Land Registration and Use in and near the Project Site

The project alignment will pass through six townships (i.e. Hlaing Tharyar, Mayangone, Hlaing, Yankin, South Okkalapa) lie next to each other as shown in the below map. Almost of land along the project alignment is utilized as residential area and industrial area except around Hlaing Tharyar St. where agricultural land is widespread. Regarding the area along Parami Rd., there are several public facilities related to university and army.



Reference: JICA study team based on satellite image by Google Earth

Figure 4. 7 Township Map along the Project Alignment



Reference: JICA study team

Figure 4. 8 Status of Land Registration and Use in and near the Project Site

4.2.1 Hlaing Tharyar St. to Hlaing River Rd. St.



Reference: JICA study team based on satellite image by Google Earth

Figure 4. 9 Satellite Image from Hlaing Tharyar St. to Hlaing River Rd. St.

(1) Hlaing Tharyar St.

Depot area for YUMRT is proposed in front of existing MR Haling Tharyar St. with approx. 54 acres, owned by Myanmar Railway. Current condition is undeveloped field which has a pond at the western side.



Proposed depot area



MR Hlaing Thayar Station

Reference: JICA study team

Figure 4. 10 Picture of Depot Area and Hlaing Tharyar St.

(2) Hlaing Tharyar Bus Terminal St.

Hlaing Tharyar St. will be located near existing Dagon Ayar Highway Bus Terminal in order to form seamless transit between Bus and YUMRT. On the other hand, illegal dwellers area along Pathein Rd. begins to spread out until FMI Garden City St.



Reference: JICA study team

Figure 4. 11 Traffic Condition of Dagon Ayar Highway Bus Terminal

(3) Hlaing River Rd. St.

Hlaing River Rd. St. is located at the intersection of Yangon - Pathein Rd. with Hlaing River Rd. Therefore, this station has a possibility of traffic bottle neck.



Reference: JICA study team

Figure 4. 12 Picture of the Intersection of Yangon - Pathein Rd. with Hlaing River Rd.

4.2.2 Hlaing river Rd. St. to Nawaday Garden City St.



Reference: JICA study team based on satellite image by Google Earth

Figure 4. 13 Satellite Image from Hlaing River Rd. St. to Nawaday Garden City St.

(1)Nawaday Garden City St.

Nawaday Garden City St. is proposed between a residential area at the northern side and an industrial area at the southern side in anticipation of large passenger for commuters to factories and for neighborhood.



In front of Nawaday Garden City

Reference: JICA study team

Figure 4. 14 Picture of Nawaday Garden City

4.2.3 Nawaday Garden City St.to Hlaing River



Reference: JICA study team based on satellite image by Google Earth

Figure 4. 15 Satellite Image from Nawaday Garden City St. to FMI Garden City West S t.

(1) FMI Garden City West St.

FMI Garden City West St. is sandwiched by a residential area at the northern side, an industrial area at the southwestern side and a military area at the southeastern side shown as above map. The cross section of Hlaing River has two alternatives at the moment. Although original option was alternative 2, it has a matter of concern; gazing a military area and a receiving substation (RSS). JICA study team recognizes that discussions with Ministry of Defense (MOD), Ministry of Electricity and Energy (MOEE) and Ministry of Construction (MOC) should be inevitable regarding YUMRT alignment across Hlaing River.



In front of FMI Garden City



Bayint Naung Bridge

Reference: JICA study team

Figure 4. 16 Pictures of FMI Garden City and Bayint Naung Bridge

4.2.4 Hlaing River to IT University St.



Reference: JICA study team based on satellite image by Google Earth

Figure 4. 17 Satellite Image from Hlaing River to IT University St.

(1) Bayint Naung St.

Bayint Naung St. is proposed near Bayint Naung Junction where traffic jam occurs frequently. After the station, since the alignment will pass through a military area, a discussion with MOD should be indispensable.



Bayint Naung Junction



Side road of Bayint Naung Junction



Yan Kinn Pagoda



Hlaing Creek

Reference: JICA study team

Figure 4. 18 Pictures of Bayint Naung Junction and Hlaing Creek

(2) Oak Kyin St.

Since Oak Kyin St. is expected as a connecting station for Yangon circular railway, large passenger will be also anticipated.



Reference: JICA study team

Figure 4. 19 Picture of Railway Crossing with Parami Rd at Oak Kyin St.

(3) Insein Rd. St.

Insein Rd. St. is proposed near the intersection of Insein Rd. with Parami Rd. where a generation point of frequent traffic jam.



Reference: JICA study team

Figure 4. 20 Picture of Intersection of Insein Rd. with Parami Rd.

(4) IT University St.

IT Univ. St. is proposed at the location sandwiched by two University; IT University at northern side and Yangon University at southern side. Therefore, it is expected that both university student will utilized YUMRT as a commuter tool.



University of Information Technology



In front of Entrance of Yangon Univ. of Economy

Reference: JICA study team

Figure 4. 21 Pictures of the Universities

4.2.5 IT University St. to Parami St.



Reference: JICA study team based on satellite image by Google Earth

Figure 4. 22 Satellite Image from IT University St. to Parami St.

(1) Pyay-Parami Rd. Intersection St.

Pyay-Parami Rd. intersection St. is proposed at the intersection of Pyay Rd. with Parami Rd. as named. The station is planned to construct on Inya Lay Lake in order to avoid a deterioration of traffic congestion.



Inya Lay Lake beside Parami Rd.



Intersection of Pyay Rd. with Parami Rd.

Reference: JICA study team

Figure 4. 23 Picture of Inya Lay Lake and Intersection of Pyay Rd. with Parami Rd.

(2) Inya Lake north St.

Inya Lake north St. is proposed at the location sandwiched by residential area with the narrow section of Parami Rd. After the station, since the alignment will pass through a military area, a discussion with MOD should be indispensable.



Reference: JICA study team

Figure 4. 24 Picture of Proposed location of Inya Lake north St.

(3) Kabaraya Pagoda -Parami Rd. St.

Kabaraya Pagoda -Parami Rd. St. is proposed at the intersection of Kabar Aye Pagoda Rd. with Parami Rd. as named.



Parami Hospital



Intersection of Kabar Aye Pagoda Rd. - Parami Rd

Reference: JICA study team

Figure 4. 25 Picture of Intersection of Kabar Aye Pagoda Rd. with Parami Rd.

(4) Parami St.

Since Parami St. is also expected as a connecting station for Yangon circular railway, large passenger will be also anticipated. Myanmar Railway (MR) also expects to develop Transit-Oriented Development (TOD) around YCR Parami station owned by MR. After the station, since the alignment will pass through a military area, a discussion with MOD should be indispensable.



Flyover section of Parami Rd. under YRG Parami St.



Northern side of flyover at Parami St.



Rainbow Pre-school

Reference: JICA study team

Figure 4. 26 Picture of Proposed Location for Parami St.

4.3 Road Boundary, Affected Area and Facilities

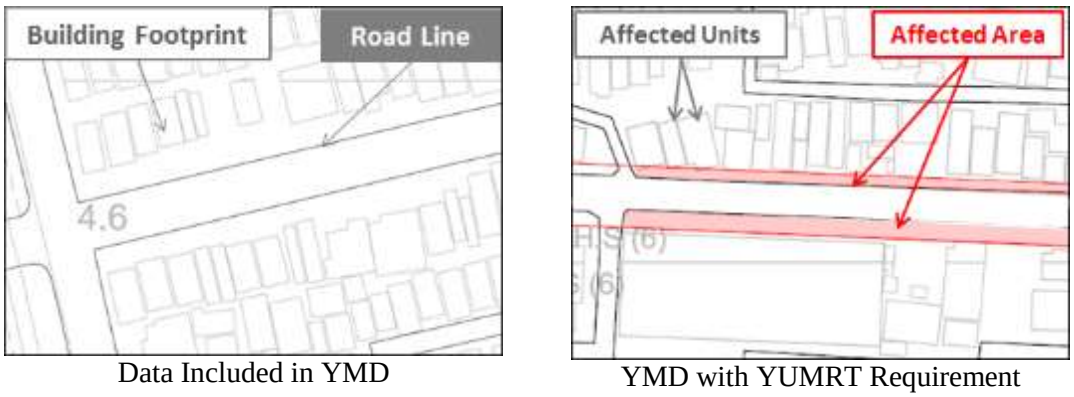
The road boundary is not clearly defined at each street by the government. In addition, topography survey was not conducted in Feasibility study stage. Therefore, in this project, Yangon Mapping Data (YMD) was used as it is the most accurate digitized map available to date, covering the entire project area. YMD is a digitized map developed from 1:5,000 scale satellite images prepared by YRG/YCDC assisted by JICA. The data includes building footprints with Global Positioning System (GPS) coordinates and road line which is depicting the carriage way.

By using available data, the survey assumed carriage way of YMD as road boundary to identify “Affected area”. As shown in the figure below, the area between YMD line and YUMRT alignment will be considered as affected land and the buildings within the affected land will be identified as affected units.

Under these conditions, it is found that there are affected sections along the almost of alignment including Private land and Government land. In case of Yangon-Pathein Rd., all

sections are occupied by Government land; Myanma Railway, Ministry of Construction, YCDC and Ministry of Defence. Along Parami Rd., more than half of the Rd. is overlapped with the land owned by Ministry of Defence, Ministry of Education, YCDC and Private.

Table 4. 2 Concept of Road Boundary and Affected Area



Data Included in YMD | YMD with YUMRT Requirement

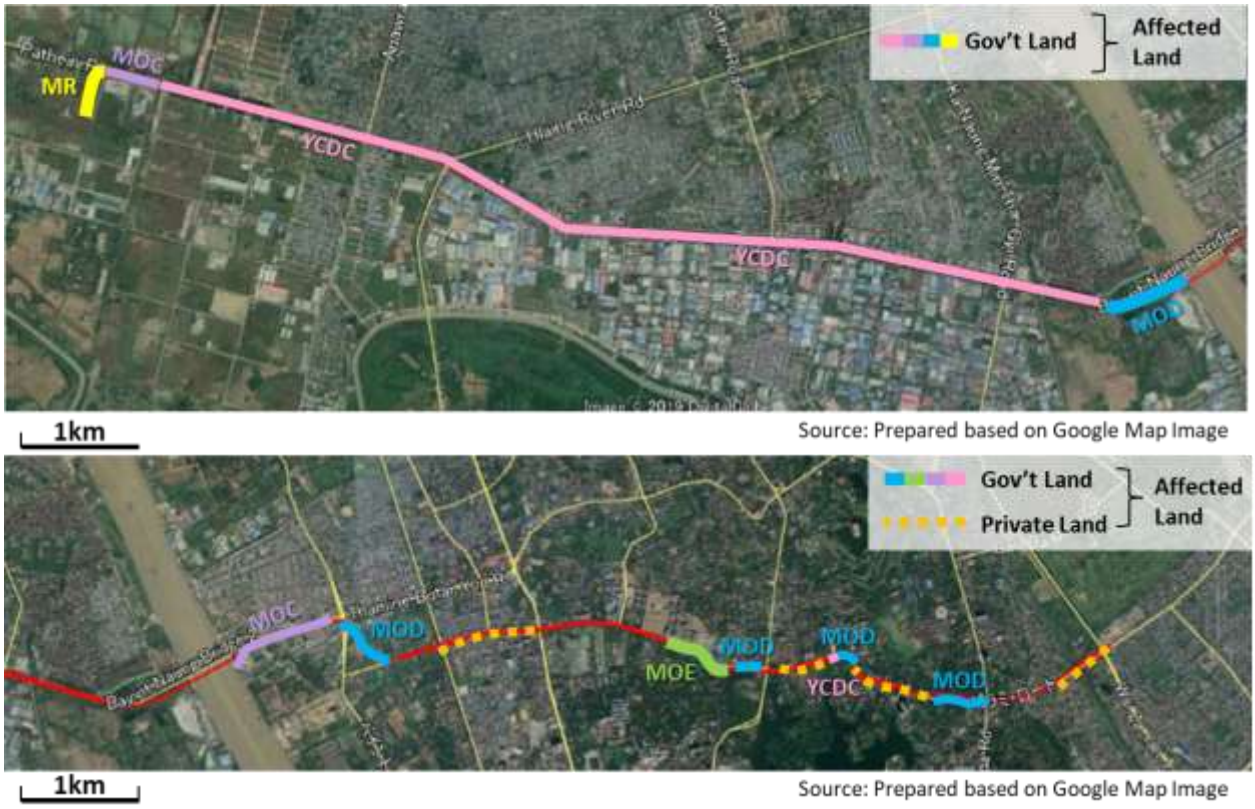


Figure 4. 27 Main Affected Sections along YUMRT Alignment

4.4 Receiving Required Power for YUMRT

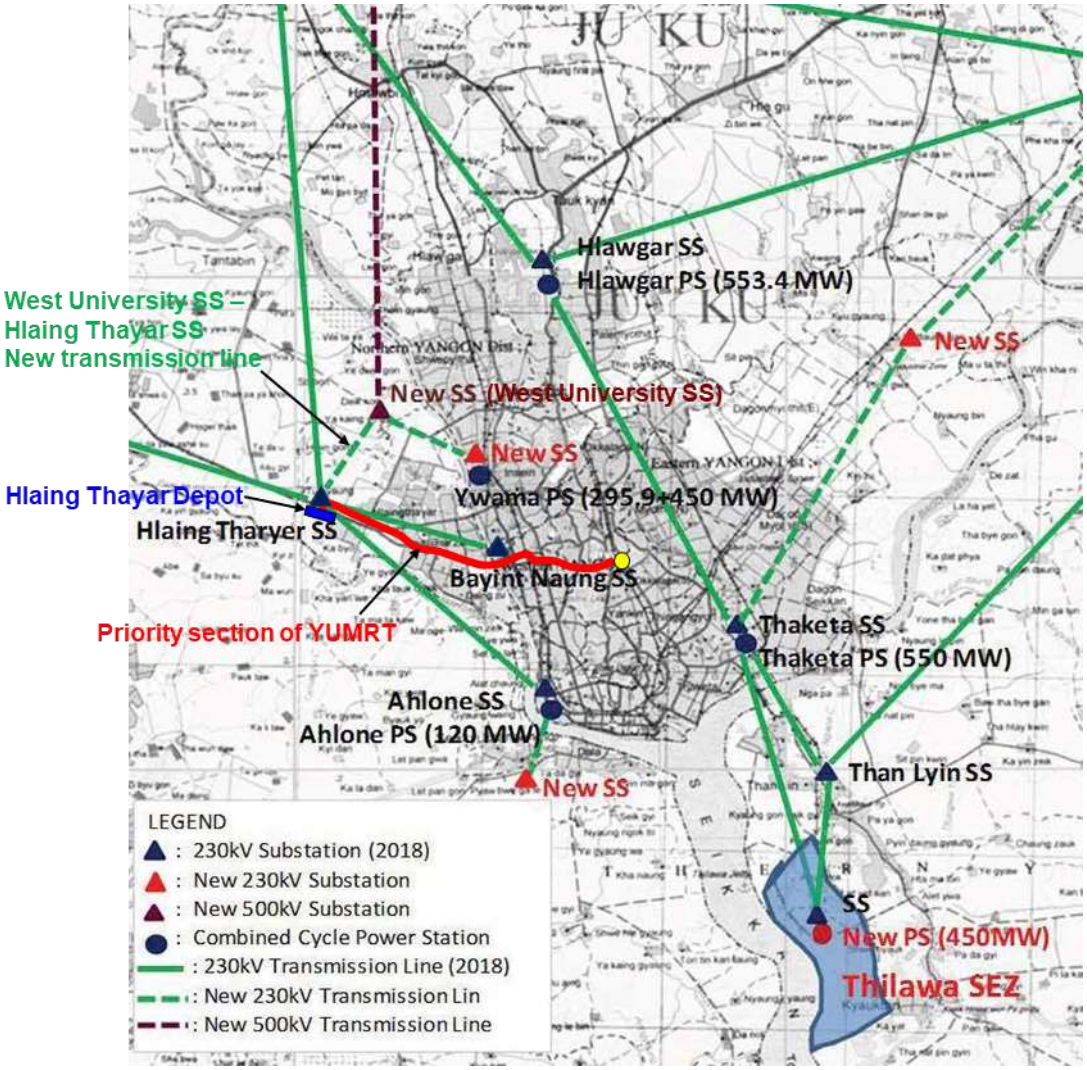
In order to construct the stable power supply system for required power consumption, it is necessary that below preconditions are achieved. However, since this precondition is under discussion with Ministry of Electricity and Energy (MoEE), there is a possibility that it will change in the stage of detail design.

(1) To construct Receiving Substation for YUMRT
(2) To connect two transmission lines between different two power grid and Receiving Substation

4.4.1 Location Plan of Receiving Substation for YUMRT

Location survey for Receiving Substation based on the below preconditions has been conducted.

(1) To secure approx. 2,000 m^2 to 3,000 m^2 land
(2) To be power grid nearby (refer to Figure 4.27)
(3) To connect with different two power grid



Reference: JICA Study Team

Figure 4. 28 Positional Relationship between YUMRT and MOEE Power Grid in 2025

As a result of the study, it is found out that there is a high possibility with the place planned for Depot in Hlaing Tharyar as Figure 4.28.

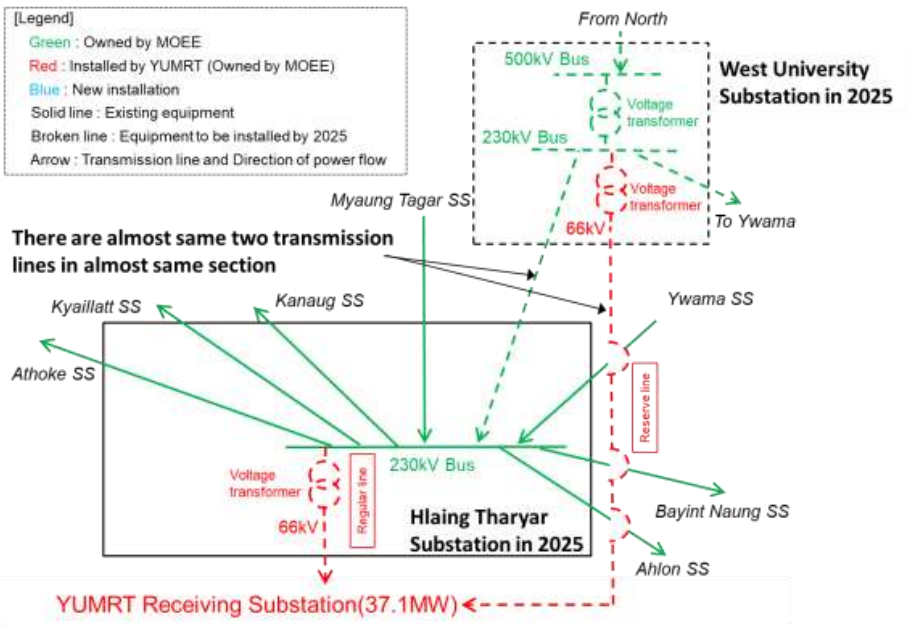


Reference: JICA Study Team

Figure 4. 29 Positional Relationship between YUMRT Depot and MOEE Hlaing Tharyar Substation

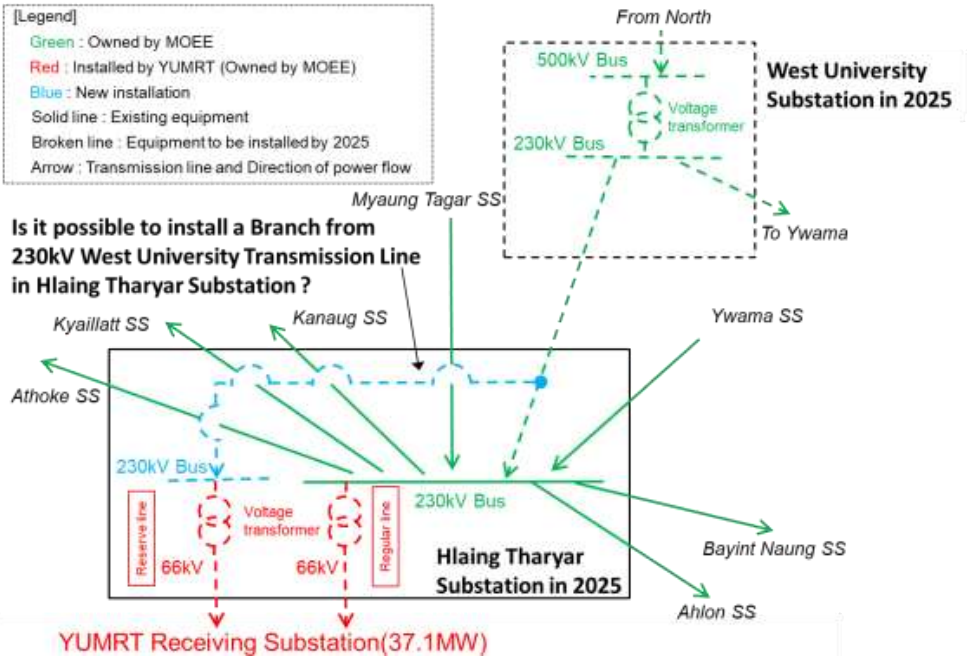
4.4.2 Two Transmission Lines Connection between Different Two Power Grid and Receiving Substation

A site survey with MOEE and MR has been conducted regarding two transmission lines connection between different two power grid and Receiving Substation. As the result, one of two transmission lines will be connected between the 230 [kV] bus in Hlaing Tharyar Substation and Receiving Substation. In the middle of this line, equipment to transform 230 [kV] to 66 [kV] will be installed in available space of Hlaing Tharyar Substation as shown in Figure 4.8. With regards to another transmission line, MOEE suggested the connection with length of 11.5km approximately from West University new Receiving Substation (RSS), planned to be constructed by other project, to Hlaing Tharyar by underground wire directly as shown in Figure 4.29 and 4.30, which was decided officially in the 3rd Steering Committee held on 28th August, 2019.



Reference: JICA Study Team

Figure 4. 30 Over Vew of Two Transmission Lines Connection Suggested by MOEE



Reference: JICA Study Team

Figure 4. 31 Over View of Two Transmission Lines Connection Proposed by JST

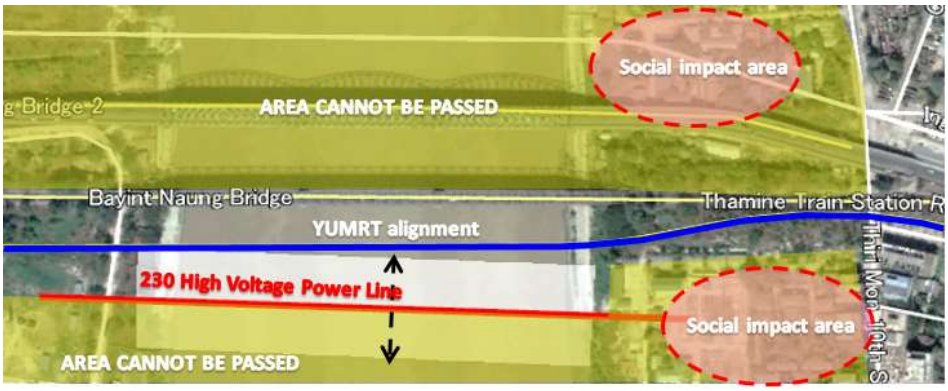


Reference: JICA Study Team

Figure 4. 32 Proposed Route of Transmission Line for YUMRT

4.5 Passing Route over Hlaing River

In the beginning stage of the study, the YUMRT alignment over Hlaing river was proposed to be on the southern side of the existing Bayint Naung Bridge (old) to secure enough distance (80m or more: same as the distance between the two road bridge) from the existing bridge to avoid scoured impact. However, it has been revealed that alignment must be closer to the road bridge due to the MOEE regulation – to keep 50m or more away from the high voltage power line. Therefore, there is the only one option, which means that YUMRT alignment should be located at the south side 40-50m away from Bayint Naung Bridge as below figure. Social impact will be minimized.



Reference: JICA Study Team

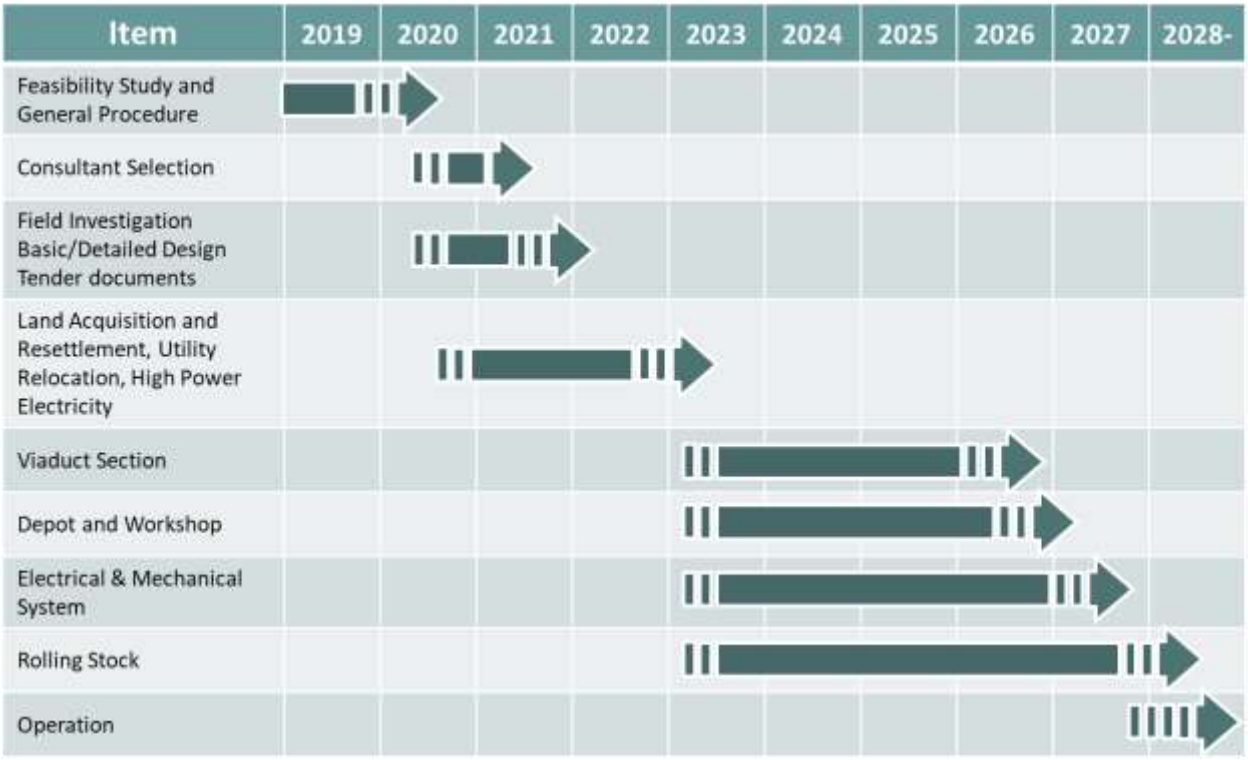
Figure 4. 33 YUMRT alignment passing over Hlaing river

4.6 Project Implementation schedule

As of 2020, the project is positioned in Feasibility study and general procedure. From now onward, the construction will be commenced in early 2023 passing through the procedure of Consultant selection, Field investigation, Basic and Detailed design, Land acquisition and

resettlement etc. After the construction period for approx.5 years, the operation period will start in 2027 or 2028 shown as below table.

Table 4. 3 Project implementation schedule as of 2020



4.7 Project Alternatives

It is important in any development project to aim to strike a well balance among the economic, technical, environmental and social costs and benefits such project brings in consideration of the socioeconomic context in which the host country or other geographical area resides. Under this study, the following three alternative options were proposed and compared against each other having in mind this view. The proposed three alternative options are:

(1) No Project;
(2) Construction of YUMRT 1 (N-S line); and
(3) Construction of YUMRT 2 (E-W line).

In order to select the best-balanced and most suitable alternative, the comparison study was implemented with the following four evaluation items. However, since evaluation item for "demand" and "Environment & Society" has 2 detail items respectively, their average score is evaluated. Each evaluation index was assessed in the five stages A to E as shown below.

(1)Demand

Passenger (person/day)	Passenger (person/hour)
A：Over 2,000,001	A：Over 40,001
B：1,750,001 - 2,000,000	B：35,001 - 40,000

C：1,500,001 - 1,750,000	C：30,001 - 35,000
D：1,250,001 - 1,500,000	D：25,001 - 30,000
E：Less than 1,250,000	E：Less than 25,000

(2) Cost

Cost for construction, land acquisition and resettlement (billion USD)

A：Less than 2
B：2.1 - 2.5
C：2.6 - 3.0
D：3.1 - 3.5
E：Over 3.6

(3) Technic

Obstacle is existed or not

A：Nothing
B：Present but avoidable
C：Need additional survey
D：Difficult to avoid
E：Inevitable

(4) Environment and Society

No. of adjacent historical buildings	No. of Project Affected Household
A：0	A：0
B：1 - 3	B：1 - 500
C：4 - 6	C：501 - 1,000
D：7 - 9	D：1,001 - 1,500
E：Over 10	E：Over 1,501

Respective proposed alternative corridor was evaluated with A=20 points, B=15points, C=10 points, D=5 points and E= 0 point, and the alternate corridor with the highest score was selected as the optimum proposed option. A summary of an analysis on each option is described below followed by a table presenting an outcome of the evaluation.

Option 1: No Project

Analysis

In the case of no project implementation, land acquisition and resettlement are no longer necessary in the affected area. Currently, main transportation vehicle is a bus transit because most of Yangon citizen doesn't have income level that they can own their car. Modal shift will be promoted in case of developing YUMRT before increasing number of middle-income groups which own their car. However, in case of no developing YUMRT, future traffic congestion will be deteriorated due to insufficient road capacity affected by increasing traffic demand such as private vehicle, bus and taxi. The congestion will have negative impact on environmental aspect of air pollution, Noise and vibration, and aspect of traffic safety. All vehicles' velocity decreases by traffic jam aggravation, may also increase volume of greenhouse gas emission. Although multiple positive impacts are predicted, the negative impact assumed from an economic and environmental point of view is significant. For this

reason, it is evaluated that "No Project" option is undesirable in this case.

Option 2: Construction of YUMRT 1 (N-S line)

Analysis

The N-S line is a line passing from the vicinity of the Yangon international airport as the northern railhead to Twante District as the southern one via Yangon airport Rd, Pyay Rd., Kabar Aye Pagoda Rd. (hereinafter “KAP Rd.”) passing through the east of Inya lake and crossing over Yangon River. Especially, the south section from Inya Lake is set as the underground alignment because there has been already density populated area of houses and commercial facilities and enough space for construction of elevated section cannot be secured. Additionally, the underground section is configured to be minimum required one because the construction cost for underground structure will be much higher than the elevated section cost.

Option 3: Construction of YUMRT 2 (E-W line)

Analysis

The E-W line is a corridor passing from existing Hlaing Tharyar St. as the western railhead to existing Toe Kyaung Ka Lay St. as the eastern one via Yangon Pathein Rd., Parami Rd. after crossing over Hlaing River, Pinlon Rd. YUMRT 2 (E-W line) has the lowest construction cost due to shortest track length among the other alternatives. Higher passenger demand is also predicted for this track line due to the existence or construction plans of large-sized customer facilities such as university and hotel along the Parami Rd. Implementation of the E-W line will create better connectivity with YCR compared with other options (large-scale development plan around Parami St.: Inno City) and it is also easier to acquire construction space for YUMRT than other options because Parami Rd. is a 4-lane Rd. Meanwhile, for an area adjacent to Parami St. as the east end of priority development section, it is difficult to secure the area because a large-scale development project has already been commenced, and complaints about noise and vibration from YUMRT are also predicted due to overcrowded residential area. However, the benefit accrued from the construction of E-W line is considered to be profound largely outweighing the costs abovementioned.

Conclusion

In conclusion, after giving a rating to each of the above three options from a demand, cost, technic and environment and social point of view, E-W line had the first priority due to higher evaluation score from the view point of demand, cost and environment and society compared with N-S line whose score were same or lower for all evaluation items. In consultation with Myanmar government, the policy focusing on cost aspect and environmental social aspect was confirmed, and the E-W line was selected as the proposed option for YUMRT with higher evaluation from these aspects (57.5 out of 80).

Table 4. 4 Comparison of Project Alternatives (N-S line and E-W line)

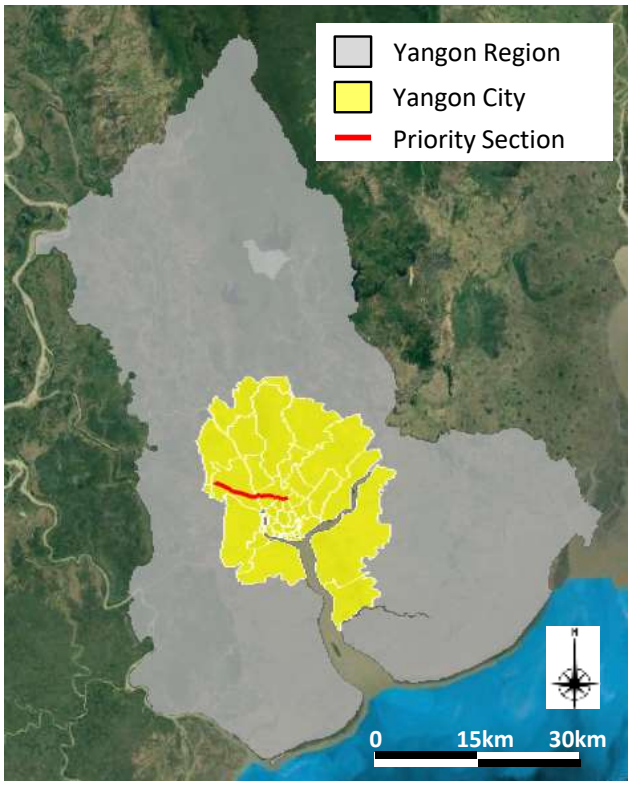
Corridor	N-S line		E-W line	
Outline	Total length: 27.4 km Underground section: 7.9 km		Total length: 25.2km No underground section	
Corridor Map Side-view	 **Side-view (E-W line)**			
Demand	Passenger: 1,054,000 person/day 23,200 person/hour	E E (Average: 0)	Passenger: 1,770,000 person/day 44,300 person/hour	B A (Average: 17.5)
Cost	Construction cost: 3.3 billion USD	D	Construction cost: 2.5 billion USD	B
Technic	Obstacle: Need additional survey for Sule Pagoda	C	Obstacle: Need additional survey for transmission line	C
Environment and Social	No. of historical building: 9 No. of Project Affected Household: 700	D C (Average: 7.5)	No. of historical building: 1 No. of Project Affected Household: 450	B B (Average: 15)
Evaluation	Score = 22.5		**Proposed Alternative**	**Score = 57.5**

CHAPTER 5 DESCRIPTION OF THE SUROUNDING ENVIRONMENT

5.1 Social Environment

5.1.1 Population and Demography

Yangon is the most populous region in Myanmar. Because of the metropolitan area of Yangon, the economic center of Myanmar has been attracting domestic as well as international investment and growing rapidly. YUMRT alignment falls within Yangon city located in the Yangon region as shown in the figure below. According to the census 2014, the population of Yangon city is 5,211,431 persons, accounting for 70.8% of the population of the Yangon region and 10.1% of that of the country. The urban population of Yangon region is 70% among which Yangon city has the significantly high population density of 9,048 persons/km^2. On the other hand, the average number of family members in Yangon city is 4.4, a slightly lower than that of Yangon region which is 4.7. The population of study area is summarised in the table below. It is formed with four districts, 45 townships and 1,364 wards and village-tracts.



Source: JICA Study Team based on Google Earth

Figure 5. 1 Priority Section and Administrative Boundary

Table 5. 1 Population of the Study Area

Area	Population (person)	Area (km^2)	Density (person/km^2)	Urban Population (%)	No. of Family Members (person)
Myanmar	51,486,253	676,553	76	29.6	4.7
Yangon Region	7,360,703	10,170	716	70.1	4.4
Yangon City	5,211,431	576	9,048	-	-

Source: 2015 Myanmar Statistical Yearbook/Central Statistical Organization, Ministry of National Planning and Economic Development

Along the section Yangon Urban Mass Rapid Transit (YUMRT), local communities live in 5 townships_ Hlaing Thayar, Hlaing, Mayangone, South Okkalapa and Yankin. Table 5.2 provides a general overview of the 5 townships.

Table 5. 2 General and Demographic Condition in 5 Townships

No.	Township	Size (Sq. miles)	Highest Point above sea level (feet)	Total Population			Male : Female Ratio	Population Growth Rate (2017%/year)	No. of Households
				Total	Male	Female			
1.	Hlaing Thayar	26.01	100	414,209	198,169	216,040	1:1.1	2.39	80,701
2.	Hlaing	5.29	36	125,060	58,635	66,425	1:1.13	0.19	29,668
3.	Mayangone	9.78	100	189,821	90,051	99,770	1:1.11	0.64	33,738
4.	South Okkalapa	3.93	30	154,068	72,956	81,112	1:0.9	0.27	33,665
5.	Yankin	1.94	80	66,949	30,263	36,686	1:1.21	-	14,514

Source: GAD

5.1.2 Religion and Races

Yangon is the most ethnically diverse city in the country and the primary religions practiced in Yangon are Buddhism, Christianity, Hinduism, and Islam. According to township data from the GAD at the township level, the majority of people in 5 townships, which are related with YUMRT are as shown in Table 5.3. Races of the people living in the townships along the section are shown in Table 5.4.

Table 5. 3 Religion in 5 Townships

No.	Township	Buddhist	Christian	Hindu	Islam	Other	Total
1.	Hlaing Thayar	395,789	6,400	8,320	3,700	-	414,209
2.	Hlaing	114,238	2,314	4,051	2,911	1,546	125,060
3.	Mayangone	161,265	24,012	1,665	2,879	-	189,821
4.	South Okkalapa	148,120	1,181	1,199	3,568	-	154,068
5.	Yankin	61,019	1,306	3,549	984	91	66,946

Source: GAD

Table 5. 4 Races in 5 Townships

No.	Township	Kachin	Kayah	Kayin	Chin	Mon	Burma	Rakhine	Shan	Other
1.	Hlaing Thayar	160	57	6,035	962	510	387,331	5,405	627	13,122
2.	Hlaing	203	45	2,520	922	982	104,966	2,640	964	11,818
3.	Mayangone	122	85	5,914	297	444	178,765	2,312	632	1,250
4.	South Okkalapa	299	11	1,120	197	1,496	140,176	5,103	286	5,380
5.	Yankin	137	37	1,005	232	256	58,532	1,072	440	5,238

Source: GAD

5.1.3 Poverty Level and Employment Status

The average monthly expenditure per household in Yangon region is 195,060 Kyat/month (Approx. 13,500 JPY: 1 Kyat=0.07 JPY), which is higher than 167,434 Kyat/month of

country average. Poverty line in Myanmar is set as 376,151 Kyat/year, whereas Yangon region is set as 354,860 Kyat/year (Approx. 25,000 JPY: 1 Kyat=0.07 JPY).

Table 5. 5 Average Expense and Poverty Line in Project Area

Area	Average Expense[*1] (Kyat/month)	Poverty Line[*2] (Kyat/year)
Myanmar	167,434	376,151
Yangon Region	195,060	354,860

Source: *1 Myanmar Statistical Yearbook/Central Statistical Organization, Ministry of National Planning and Economic Development 2012

*2 A regional perspective on poverty in Myanmar / UNDP 2013

Labour force participation rate in Yangon region is 60.5% which is lower than country average of 64.4%. Differences in labour force participation rate between of male and female is significantly high; 78.3% for male and 44.6% for female. Unemployment rate in Yangon region is 4.1% almost the same level as the country average and there is little disparity among gender.

Table 5. 6 Employment Status in Survey Area

Area	Labour Force Participation Rate (%)			Unemployment Rate (%)		
	Total	Male	Female	Total	Male	Female
Myanmar	64.4	81.9	48.4	4.0	3.9	4.1
Yangon Region	60.5	78.3	44.6	4.1	4.3	3.9

Note: Statistics between the age of 15-64

Source: Myanmar Population and Housing Census, Yangon Region, Census Report Volume 3, Department of Population Ministry of Immigration and Population, 2015

According to information from the GAD at the township level, the average persons of about 90.18% of workable persons are employed and 9.82% unemployed. A breakdown of each targeted township is shown in Table 5.7.

Table 5. 7 Status of Employment in 5 Townships

No.	Township	Total Population	No. of Workable Person	No. of Employed Person	No. of Unemployed Person	% of Employed Person	%of Unemployed Person
1.	Hlaing Thayar	414,209	289,554	279,356	10,198	96.3	3.7
2.	Hlaing	125,060	94,282	60,577	33,705	64.25	35.75
3.	Mayangone	189,821	130,299	129,536	763	99.41	0.59
4.	South Okkalapa	154,068	121,326	116,425	4,901	95.96	4.04
5.	Yankin	66,949	30,263	28,748	1,515	95	5
Total (number/average)		950,107	665,724	614,642	51,082	90.18	9.82

Source: GAD

5.1.4 Economic Status

Economic activities in 5 townships located along the YUMRT alignment were examined according to the information provided by respective township GAD officials. Industrial laborers are common in Hlaing Tharyar Township where small scale livestock farming also operate. In Hlaing Township, servicing businesses and production businesses are mostly found. Human resource based works such as government works, company works; day laboring and small scale businesses operate in other townships. In general, all these townships can be regarded to be economically developed.

5.1.5 Literacy Rate and Education Status

The adult literacy rate of Yangon city is 97.2% which is higher than that of the country average (92.7%). The difference of literacy rate between male and female in Yangon city is

relatively small; 98.4% and 96.2%, respectively. Furthermore, in Yangon city, 26.6% of the population over the age of 25 has the university degree, which is considerably high compared to 8.7% of the country average.

Table 5. 8 Literacy Rate in the Study Area

Area	Total (%)	Male (%)	Female (%)
Myanmar	92.7	92.6	86.9
Yangon Region	96.6	98.0	95.5
Yangon City	97.2	98.4	96.2

Note: Statistics of the population over the age of 15
Source: Myanmar Population and Housing Census, Department of Population Ministry of Immigration and Population, 2015

Table 5. 9 Educational Level in the Study Area

Area	No education (%)	Primary (%)	Secondary (%)	High school (%)	University and above (%)	Others (%)
Myanmar	16.2	45.2	18.0	10.2	8.7	1.8
Yangon Region	6.4	22.5	21.7	22.0	25.5	1.9
Yangon City	5.8	21.3	21.8	22.7	26.6	1.8

Note: Statistics of final degree of education of the population over the age of 25
Source: Myanmar Population and Housing Census, Department of Population Ministry of Immigration and Population, 2015

The following table 5.10 and 5.11 show the literacy percentage and educational status of 5 townships along the project area as per township information. There is no much gap the rate of illiterate group between Hlaing and Mayangone townships with 8.28 % and 6.02 %. The number of university students in Hlaing Tharyar Township is the highest among of the 5 townships presumably because of existence of West Yangon Technological University and West Yangon University. There has Private High School in South Okkalapa Township and the numbers of students are 685 people. The percentage of Literacy in Hlaing and South Okkalapa are full rate and other townships with above 98%.

Table 5. 10 Literacy in 5 Townships

No.	Township	Total Population of Township	Above 15 Years Old	Population of Literacy	Literacy (%)
1.	Hlaing Tharyar	414,209	279,356	279,356	100
2.	Hlaing	125,060	112,133	110,877	98.88
3.	Mayangone	189,821	146,800	145,155	98.88
4.	South Okkalapa	154,068	116,929	116,929	100
5.	Yankin	66,949	56,700	56,694	99.99

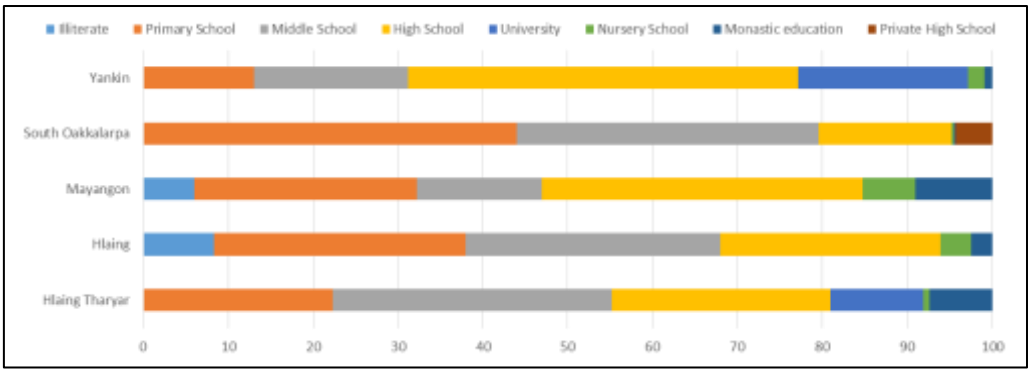
Source: GAD

Table 5. 11 Educational Status in 5 Townships

Township / Status	Hlaing Tharyar		Hlaing		Mayangone		South Okkalapa		Yankin	
	No.	%	No.	%	No.	%	No.	%	No.	%
Illiterate	-	-	1,256	8.3	1,645	6.0	-	-	6	0.1
Primary School	23,059	22.3	4,505	29.7	7,150	26.2	7,000	44.0	1,298	13.00
Middle School	34,033	32.9	4,554	30.0	4,026	14.74	5,659	35.6	1,811	18.1
High School	26,625	25.7	3,945	26.0	10,331	37.8	2,494	15.67	4,589	46.0
University	11,340	11.0	-	-	-	-	-	-	1,999	20.0
Nursery School	722	0.7	535	3.5	1,681	6.2	40	0.3	194	1.9
Monastic education	7,673	7.4	382	2.5	2,475	9.1	42	0.3	89	0.9

Township / Status	Hlaing Tharyar		Hlaing		Mayangone		South Okkalapa		Yankin	
	No.	%	No.	%	No.	%	No.	%	No.	%
Private High School	-	-	-	-	-	-	685	4.3	-	-
Total	103,452	100	15,177	100	27,308	100	15,920	100	9,986	100

Source: GAD



Source: GAD

Figure 5. 2 Educational Status in 5 Townships

5.1.6 Health Conditions

Major affected diseases in Myanmar include: labour complications (12%), diarrhoea and gastroenteritis (6%) and viral infection (4%). Yangon region has 23.7% of the total hospitals and clinics in Myanmar. Number of population per medical institution in the Yangon region is higher than country average whereas the number of population per bed is less.

Table 5. 12 Number of hospitals and clinics in the project area

Area	No. of Hospitals	No. of Clinics*	No. of Beds	No. of Population per Hospital & Clinic	No. of Population per Bed
Myanmar	975	576	44,133	33,196	1,167
Yangon Region	82	92	10,462	42,303	704

Note: *Based on 2013-2014 data
Source: Myanmar Statistical Yearbook/Central Statistical Organization, Ministry of National Planning and Economic Development 2016

The following table 5.13 shows the statistics of the most common diseases seen in the 5 townships along the YUMRT namely, malaria, diarrhea, tuberculosis (TB), dysentery, hepatitis, respiratory diseases, acute respiratory infection (ARI), and HIV/AIDS. It can be seen that malaria, respiratory diseases, acute respiratory infection (ARI) are not occurred in this 5 townships. According to the table, most recorded cases of diarrhea with a total of 274 cases are found in South Okkalapa. The data also shows a large number of cases of tuberculosis (TB) in almost all townships with the highest being 560 cases in Hlaing. The highest number of dysentery was recorded in Hlaing Tharyar and the lowest number was recorded in Yankin. The data shows no recorded cases of dysentery in Hlaing, Mayangone and South Okkalapa. According to the GAD, the only township with 5 recorded cases of hepatitis was Hlaing Tharyar. The number of HIV/AIDS cases varies among townships with the highest being Hlaing with 64 cases.

Table 5. 13 Common Diseases and HIV Patients in 5 Townships

No.	Township	Most Common Diseases							HIV/AIDS (2015-2017)
		Malaria	Diarrhea	TB	Dysentery	Hepatitis	Respiratory Diseases	ARI	
1.	Hlaing Tharyar	-	37	67	21	5	-	-	-
2.	Hlaing	-	62	560	-	-	-	-	64
3.	Mayangone	-	12	141	-	-	-	-	6
4.	South Okkalapa	-	274	435	-	-	-	-	50
5.	Yankin	-	50	291	1	-	-	-	2

Source: GAD

5.1.7 Transportation

The following table 5.14 shows the types of transportation available in the 5 townships along the project area. Means of transportation are categorized into four different types: airplane, watercraft, train and bus. In addition, the number of roads going in and out of the townships is also presented.

All the townships have no air transport available. Similarly, water transportation is also not available in majority of the townships with the exception of Mayangone which has small port. According to the data, almost all the townships have small number of train stations (i.e. one to three) available with the exception of Hlaing Tharyar.

The number of bus terminal located in Hlaing Tharyar is a good reference to find out the availability of bus transportation. The number of bus terminals in Hlaing Tharyar is documented to be 41.Yankin and South Okkalapa have only one bus terminal. Hlaing and Mayangone have no bus terminal.

Furthermore, the number of roads going in and out of the townships is also added to the table. Almost townships have a relatively small-scale (one to seven) expect Yankin Township. The township with the most recorded was Mayangone with twelve roads in total.

Table 5. 14 Number of Available Transportation Modes in 5 Townships

No.	Township	Airport	Water Port	Train Station	Bus Terminal	In/Outward Road
1.	Hlaing Tharyar	-	-	-	41	4
2.	Hlaing	-	-	3	-	11
3.	Mayangone	-	1	3	-	12
4.	South Okkalapa	-	-	1	1	7
5.	Yankin	-	-	3	1	4

Source: GAD

5.1.8 Traffic Condition in Yangon

The city of Yangon, with a population of about 5.21 million as of 2014 according to the year 2014 Census Survey, is the largest economic centre of the country, and has been experiencing rapid urbanization recently. With the recent economic reform and corresponding deregulation, the number of imported cars (mainly passenger cars and motorcycles) has increased sharply. According to the Comprehensive Urban Transport Master Plan of the Greater Yangon (YUTRA), the number of registered vehicles in the Yangon Region dramatically increased

from 260,000 cars in 2011/2012 to some 370,000 cars in 2012/2013. Imported used cars are used mainly for personal commuting purposes, and the Yangon residents are now suffered from serious traffic congestion day by day. While the number of private cars has increased, the service level of public bus has remains almost the same as before. Public buses in the city have been kept crowded, but majority of the people have no alternative modes of public transport.

The modal share of mechanized modes of transport in the Greater Yangon area is as follows: 63.8% by bus, 10.5% by car/van, 9.9% by taxi, 3.2% by water transport, 1.7% by truck, and 1.4% by rail. Because motorcycles are banned in the city, bus trip is comparatively large among other modes. Since access transport means (e.g. feeder bus services to the rail stations) are provided insufficiently, there is almost no choice for the majority of the residents other than crowded buses for their whole travel. The transportation demand in Yangon City will continue to increase as the economy and the population grows (from 7.4 million in 2014 to over 10 million in the Yangon Region in 2035).

5.1.9 Traffic Accidents

The table below describes the annual traffic accidents information collected by No.2 Office of Traffic Police between the year 2017 and 2019 through five townships along the YUMRT alignment. In this table, the numbers of accidents are categorized by crime sections, amount of deaths per year and amount of person injured per year. According to the table, township with the most traffic accident was recorded as Hlaing Tharyar Township where, in 2018, 175 criminal cases caused 49 death and 187 injuries. In 2017, the most traffic accidents happened in Mayangone Township with the total number of 168 accidents with 14 people death and 175 injuries which was the highest rate recorded within three years. Hlaing Tharyar Township experienced the most traffic accidents in each category annually while the second most accidents occurred was in Mayangone Township. However, in 2019, traffic accident rate significantly decreased. Among these townships, accidents with the least death and injuries occurred at Yankin Township where only 28 accident cases happened in 2018. In Hlaing Township, cases of injury caused by traffic accidents slightly increased from 2017 to 2019 although the total number of death decreased from 72 to 61. 2019 in South Okkalapa Township, only 30 accidents with 9 deaths and 23 injuries occurred which was the lowest amount when compared to the past years.

Table 5. 15 Annual Traffic Accident Rate in 5 Townships

Year	No.	Township	Criminal Case Section					Death			Injured		
			279	337	338	304-A	Total	Male	Female	Total	Male	Female	Total
2017	1	Hlaing Tharyar	11	6	86	45	**148**	35	13	**48**	121	73	**194**
	2	Hlaing	26	5	27	11	**69**	10	1	**11**	48	20	**68**
	3	Mayangone	60	14	81	13	**168**	10	4	**14**	111	64	**175**
	4	Yankin	14	4	16	4	**38**	4	-	**4**	39	14	**53**
	5	South Okkalapa	7	4	22	12	**45**	9	3	**12**	42	8	**50**
2018	6	Hlaing Tharyar	13	10	106	46	**175**	37	12	**49**	132	55	**187**
	7	Hlaing	18	5	37	12	**72**	10	1	**11**	43	28	**71**
	8	Mayangone	39	10	59	16	**124**	17	3	**20**	111	39	**150**
	9	Yankin	12	3	4	9	**28**	3	1	**4**	15	-	**15**
	10	South Okkalapa	7	4	19	12	**42**	10	2	**12**	31	13	**44**
2019	11	Hlaing Tharyar	12	11	87	59	**169**	47	14	**61**	128	82	**210**
	12	Hlaing	17	4	32	8	**61**	7	1	**8**	45	35	**80**
	13	Mayangone	14	5	28	7	**54**	6	2	**8**	33	21	**54**
	14	Yankin	8	2	7	5	**22**	4	1	**5**	16	-	**16**
	15	South Okkalapa	3	-	18	9	**30**	6	3	**9**	**19**	**4**	**23**

Source: No.2 Office of Traffic Police

5.1.10 Solid Waste Management System in Yangon Area

Solid waste management services are provided in the surrounding areas of Yangon. Various wastes from households, restaurants, bazars, hospitals and other places are collected by using bell- ringing system and then these wastes are disposed to the dumping sites, or by means of land filling. As mentioned above, there are two land fill site in the vicinity of YUMRT alignment; Hta Wal Chaung Final Disposal Site in North Dagon township and Htein Pin final disposal site in Hlaing Thayar township. They daily accept approx. 1,000 tons and 1,500 tons respectively. The remained capacity of Hta Wal Chaung will be exhausted within 2 or 3 years, but the capacity of Htein Pin will be accured for over 5 years with the assist of advanced technology funded by UN-Habitat, Fukuoka City, Japan and Poland. In near future, dumping sites are also planned with the regional operation system of Yangon Regional Government.

Yangon has established an efficient system of waste collection. The collection staffs is engaged to collect the waste two time a day-morning (from 6:00am to 10:00 am) and evening (6:00 pm to 11:00 pm)

5.1.11 Sewage System

The existing sewerage system collects and treats only toilet wastewater (black water), and grey water is discharged to storm water drain without treatment. In addition wastewater collecting system is unique so called “ejector system” which was introduced by British in 19th century. Ejector system was designed based on the design wastewater flow and the capacity of the system will be insufficient for the design wastewater flow in 2040. In addition

to separate and combined systems, interceptor sewerage system can be considered as temporary system. Interceptor sewerage system is finally converted to conventional systems. Conventional Sewerage System consists of:

1. Gravity sewers
2. 39 pneumatic ejector stations
3. Air distribution main
4. Two sewage force mains and outlet

The sewage system operated by Yangon City Development Committee (YCDC) is constructed only in the central business district area.
Sewage system is in general divided into two categories, viz. separate system and combined system. In addition to separate and combined systems, interceptor sewerage system can be considered as temporary system. Interceptor sewerage system is finally converted to conventional systems. There are no YCDC regulations regarding sewerage system.

1. Existing sewerage system is separate system
2. Rainfall intensity is very high resulting in excessively large diameter of combined pipes
3. Rainfall runoff is easily collected and discharged to nearby rivers and creeks
4. Reduction of pollutant load is larger than that of combined system, and this is an advantage for water pollution control.

The sewage system operated by YCDC is constructed only in the central business district area. The development of sewage system in Yangon area is the major issue and its future service is planned to cover 50% of the population to cover in 2040. Conversely, advanced sewage water treatment system is probable to be installed in the future industrial development in Thanlyin and Kyauktan Townships in securing its competitiveness. The sewage systems in these areas do not need to be connected to other sewage networks and could be operated independently.

5.1.12 Cultural Heritage

According to the Protection and Preservation of Cultural Heritage Regions Law (1998), the buildings or sites that had existed before 1886 or which have been determined as cultural heritage regions by the Government are subject to protection and preservation under the law.

In May 1996, YCDC issued a list of 189 heritage buildings in Yangon. It included religious buildings, like pagodas, monasteries, churches, mosques, Hindu and Chinese Temples, building of administrative and institutional nature, commercial and educational buildings as well as those of ethnic communities. However, privately owned buildings were not yet included. In 2001, after one monastery had been replaced, the list contained 188 buildings.

In February 2010, the ministry of Culture announced that 16 ancient pagodas in Yangon Region, including the famous Shwedagon Pagoda which was notified both as Ancient Monument Zone as well as Protected and Preserved Zone, has been notified as cultural heritage sites. 15 were listed as Ancient Monument Zones. 11 of 16 are located in Yangon City, and all of them are listed heritage of YCDC as well.

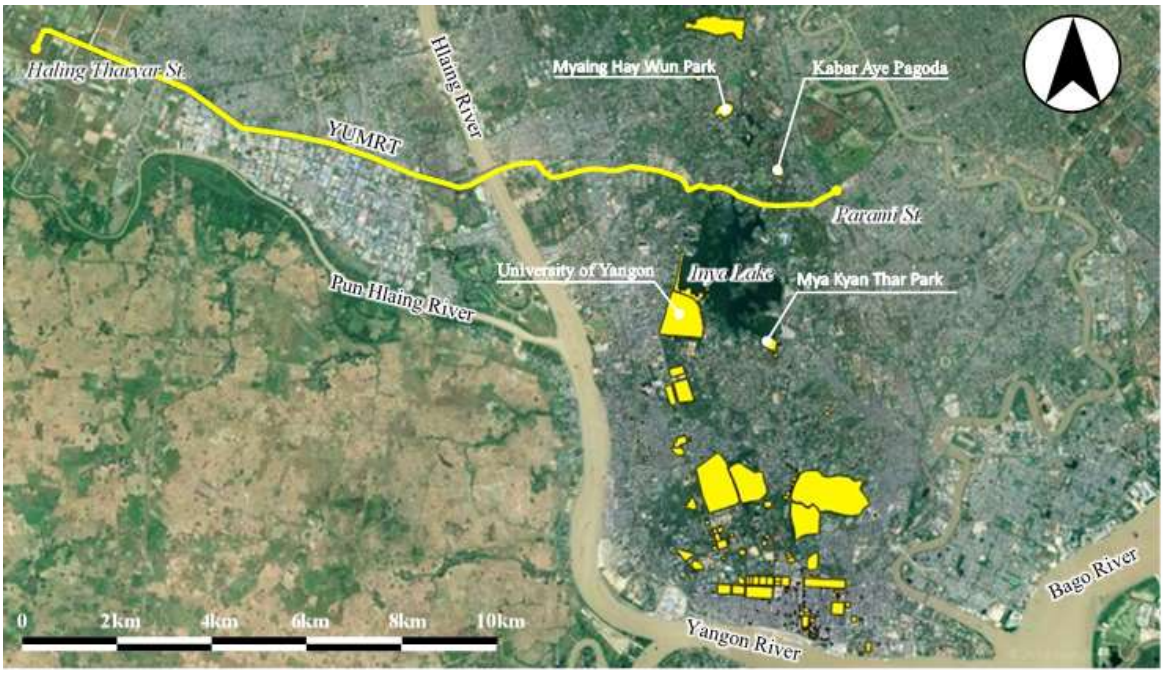
Among 5 townships along YUMRT, three have YCDC listed heritage buildings. The following table describes heritage buildings nearest to the alignment with their location, type and approximated distance from the alignment respectively.

Table 5. 16 Yangon City Heritages near Alignment

No.	Structure	Township	Type	Address	Distance from Alignment (km) (Approximate)
1.	Aung Shwebontha Dhamma Beikman Monastery	Mayangone	Monastery	9 Mile Junction, Pyay Road	2.13
2.	Kaba Aye Pagoda		Pagoda	Kaba Aye Pagoda Road	6.8
3.	Kyaik Waing Pagoda		Pagoda	Kyaik Waing Pagoda Road	1.1
4.	Sri Mariammee Temple	Hlaing	Temple	(49) Insein Road	2.15
5.	Kalayana Temple (Zekwet Pagoda)	Yankin	Temple	Dhamar Yone Street	1.6
6.	Moe Kaung Pagoda		Pagoda	Moe Kaung Pagoda Road	1.6
7.	Nagalinga Pagoda		Temple	Kanbe Station Street	0.98
8.	Supramanayan Hindu Temple		Temple	Kanbe Station Street	1.43

Source: Yangon Heritage Trust

As shown in Figure 5.3, there are no buildings registered as precious cultural heritage along the YUMRT alignment. The closest heritage building is Kabar Aye Pagoda, located about 0.7km north.



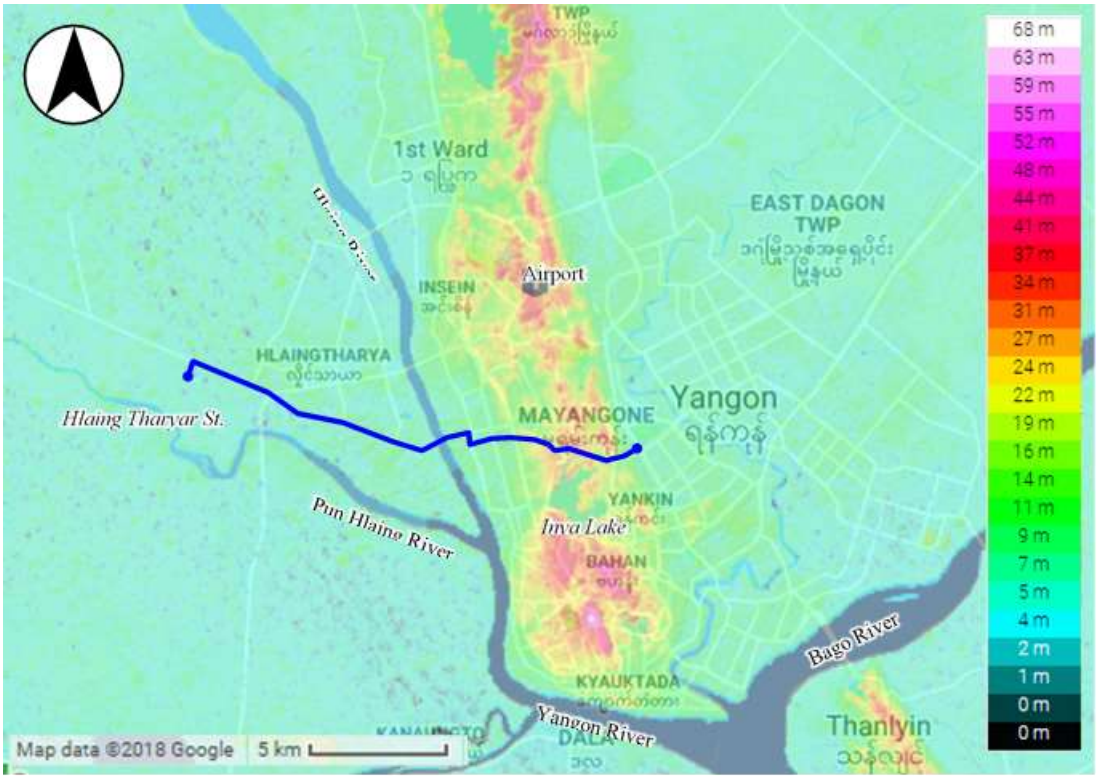
Reference: JICA study team based on satellite image by Google Earth

Figure 5. 3 Main Heritage Buildings/ Areas in Yangon City

5.2 Natural Environment

5.2.1 Geology, Hydrology and Topography

Yangon urban area covers from lat. 16°35' N to 17°06' N and from long. 95°58' E to 96°24' E and is located at east side of a lower delta formed by Ayeyarwady River. Yangon City has low hills, which is bordered by Bago Region to the north and east, the Gulf of Mottama to the south and Ayeyarwady Region to the west. A hilly zone named as Bago Yoma, whose altitude from 25m to 30m, is distributed from north to south through the center of the metropolitan area. Yangon metropolitan area is located between Hlaing River, Yangon River and Bago River. After flowing from the north to the city center, the Nga Moeyeik River changes, its name to Pazundaung River and joins the Bago River in the city center. Yangon River has the biggest water surface of the river in Myanmar, and occupies more than 27% of the entire surface of the rivers. It is managed under the Myanmar Port Authority. As the altitude of other lowland area is only several meters, flooded areas have been sometimes recorded partially in rainy season. Regarding Hydrogy, there are several water receivers in the metropolitan area; Kandawgyi Lake, Inya Lake, Hlawga Lake etc., which serve an essential function as water resources. The Thilawa is located in the opposite side of Yangon across Bago River.



Reference: topographic-map.com

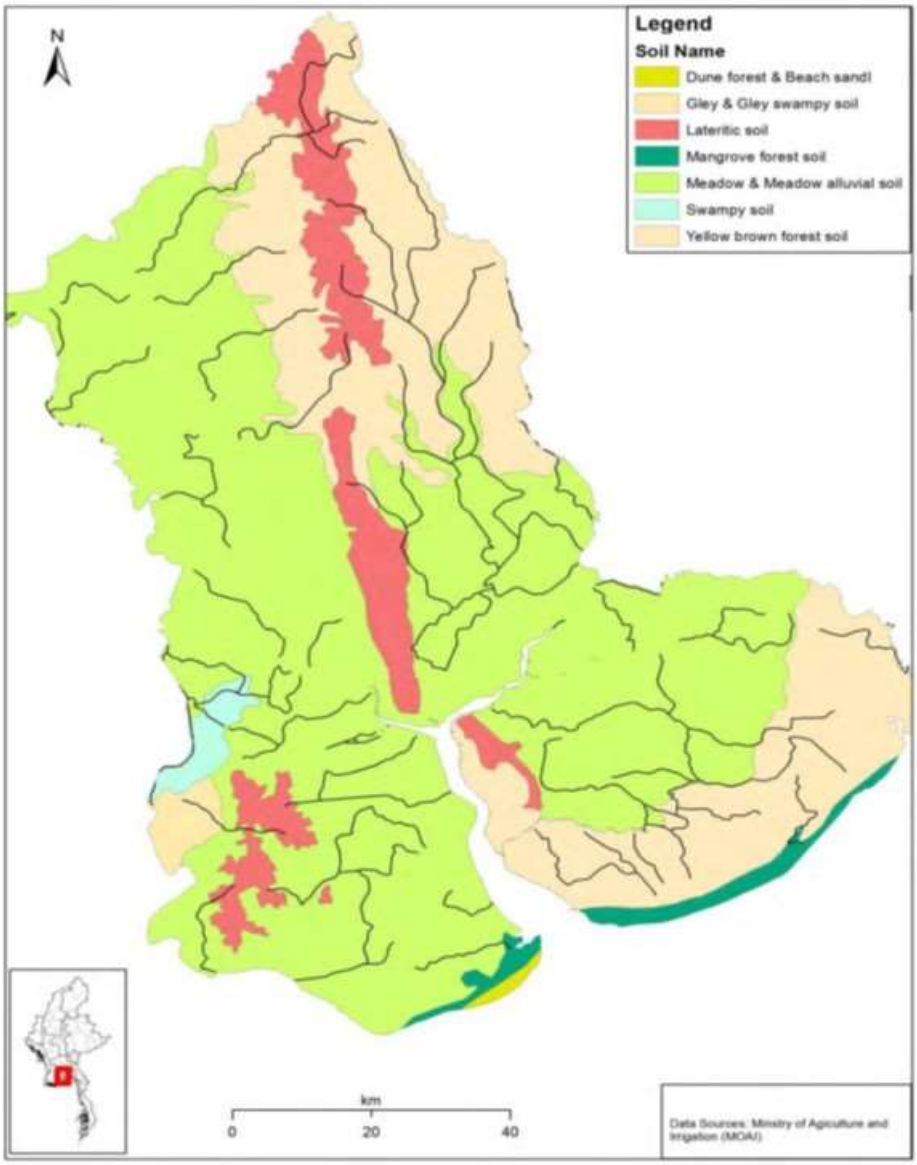
Figure 5. 4 Topographic Maps in Yangon Metropolitan Area

5.2.2 Soil Data of Yangon

River sediments are distributed along the Yangon River and Bago River. Alluvial deposits beneath this river sediment are thought to have deposited viscous soil and sandy soil. Sandy

soil is distributed on the right bank side of the Bago River. On the other hand, viscous soil is distributed on the left bank side of it.

There are several soil types in Yangon Region: (1) meadow soils and meadow alluvial soils, (2) Clay and clay swampy soils, (3) Swampy soils, (4) lateritic soils, (5) Yellow brown forest soils, (6) Dune forest and beach sand, (7) Mangrove forest soils, (8) Saline swampy meadow and gray soils. Of them, mostly found soil types in the Project area are (1) meadow soils and meadow alluvial soils, and (2) lateritic soils. Soil map of Yangon is shown in Figure 5.5.



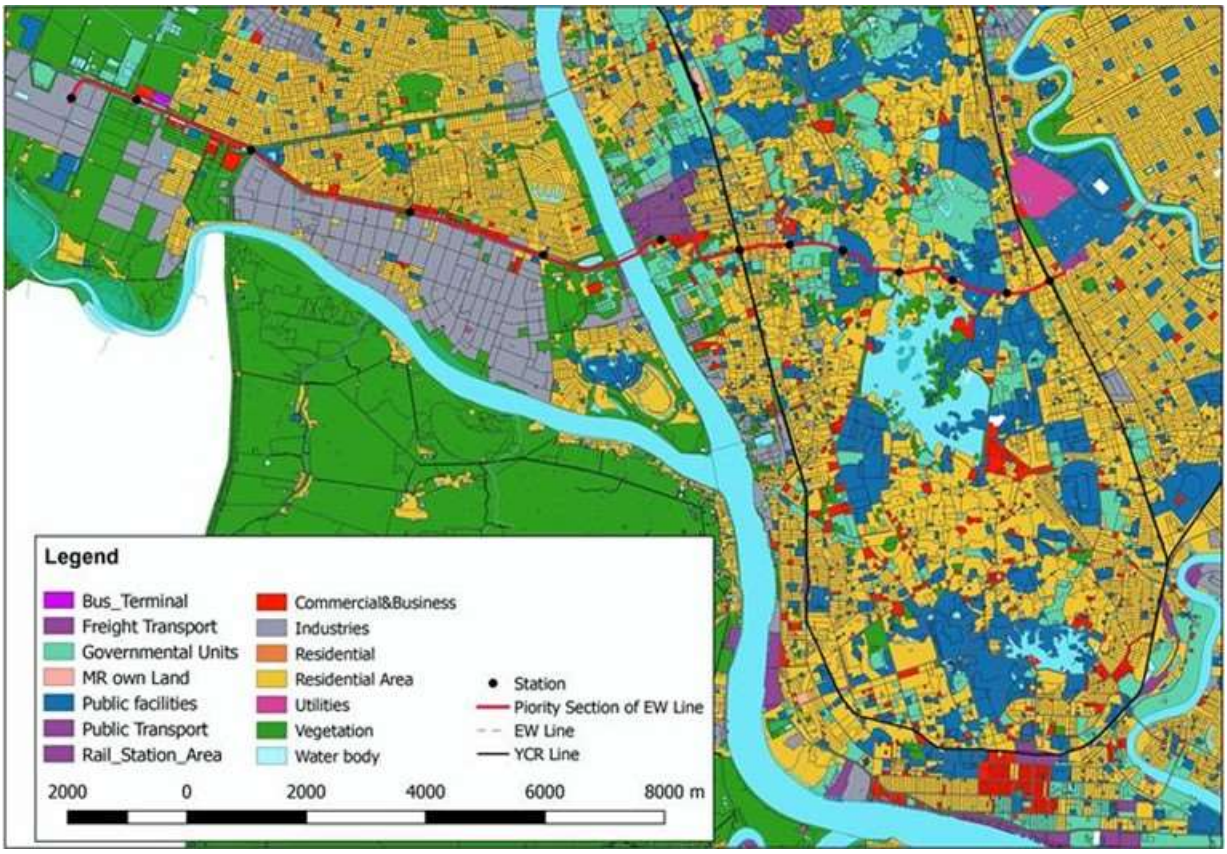
Source: Ministry of Agriculture and Irrigation (MOAI)

Figure 5. 5 Soil Map of Yangon Region

5.2.3 Land Use

Most of the area along YUMRT alignment is utilized as residential areas and industrial areas except for the area around Hlaing Tharyar St. where agricultural land spreads. In addition to

residential areas along Parami Rd., public areas such as university facilities and military sites are adjacent in patches.



Source: JICA Study Team

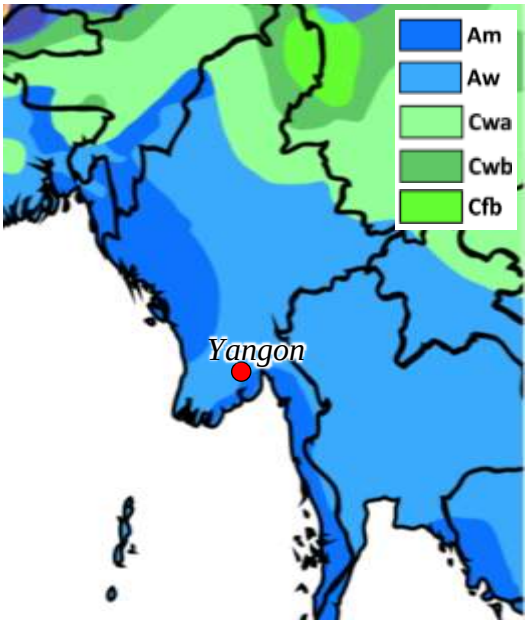
Figure 5. 6 Land Use along YUMRT Alignment

5.2.4 Climate

The climate of Myanmar is roughly divided into 3 seasons: summer, rainy season and cold season. Generally, Myanmar's climate is a tropical monsoon climate. The highest temperature in Central Myanmar during the summer months March and April is above 43.3°C, in Northern Myanmar is about 36.1°C, and on the Shan Plateau is between 29.4°C and 35°C. Temperatures of towns vary according to their locations and elevations. In the Köppen climate classification, Myanmar is divided into the Oceanic climate (Cfb), Subtropical dry winter (Cwa, Cwb), Savanna climate (Aw), Tropical monsoon climate (Am) listed from the north. Yangon has a tropical monsoonal climate with a dry season and a heavy monsoon the rest of year, no cold season and the temperature rises to around 40°C in the intense heat season. The average annual and monthly temperature of Yangon is shown in Figure 5.8 and Figure 5.9.

Based on data for 20 years from 1998 to 2017, the average rainfall amounts are recorded as 2,874mm/year at the Kabar Aye Observatory and 2,598 mm/year at Mingalardon Observatory in Yangon Division which are the observatories adjacent to the project area. Approximately 75% of the rainfall at both observatories will be concentrated from June to September. On the other hand, the maximum temperature is recorded in April and exceeds

30°C on average, but it is slightly below 25°C even in January when the lowest temperature is recorded. Therefore it can be said that high temperature are recorded throughout the year in Yangon.



Source: Peel, M. C., Finlayson, B. L., and McMahon, T. A. (2007) (University of Melbourne)

Figure 5. 7 Köppen Climate Classifications in Myanmar

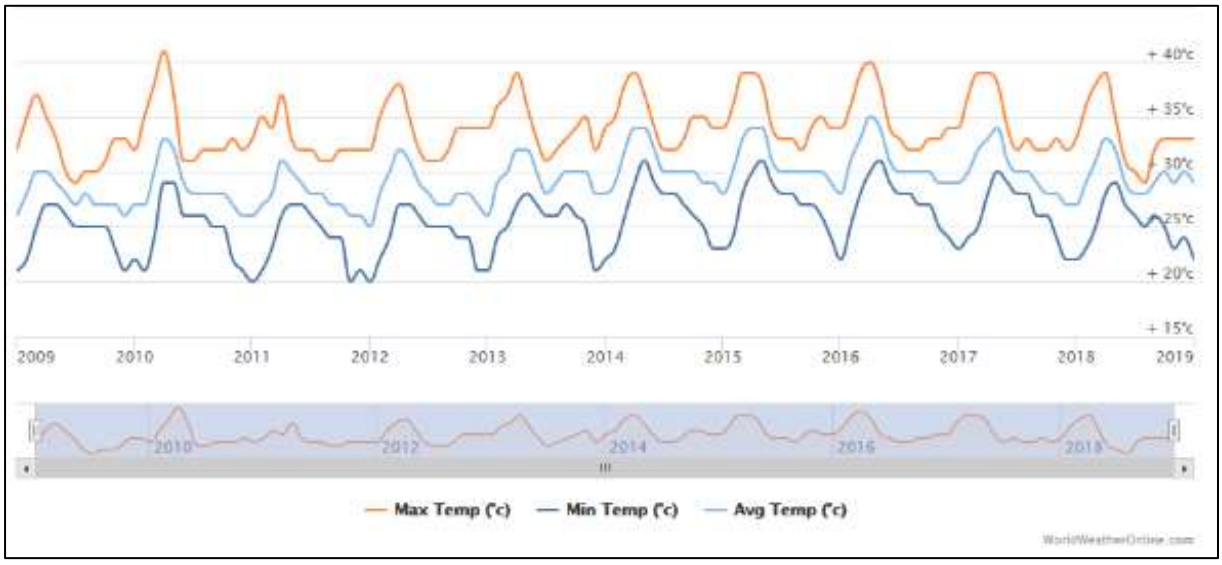
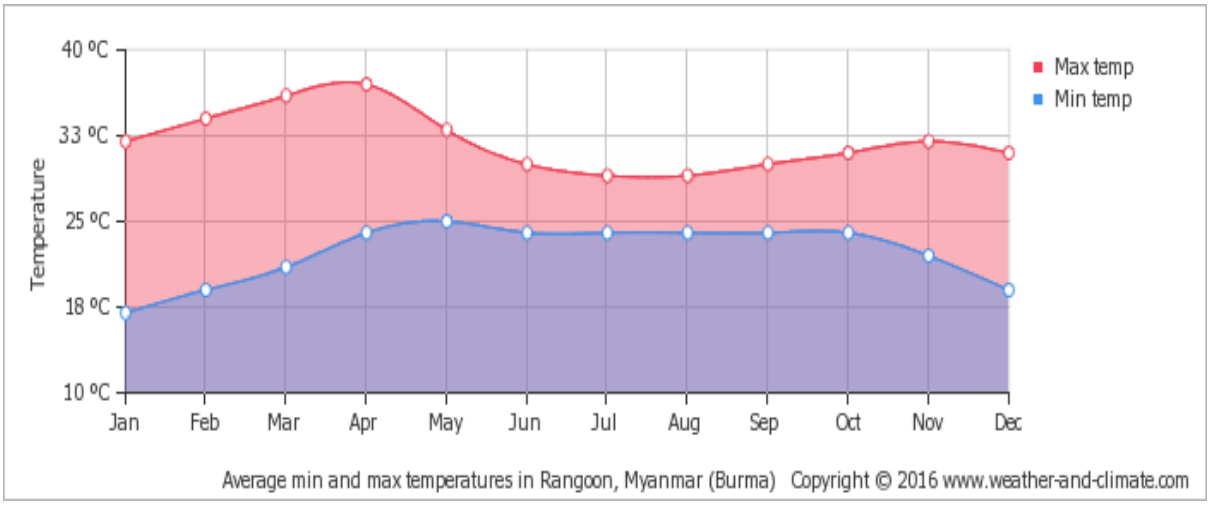


Figure 5. 8 Annual Temperatures in Yangon



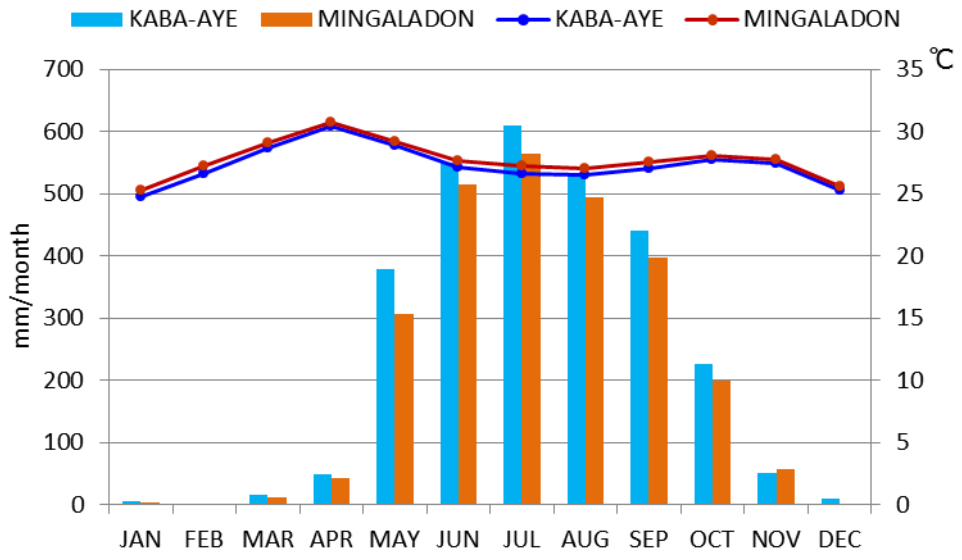
Source: World Weather and Climate Information

Figure 5. 9 Monthly Average Temperatures in Yangon

Table 5. 17 Rainfall and Temperature of Monthly Average at Observatories in the vicinity of Project Site (1998 - 2017)

Item	Observatory Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall	Kabar Aye	5	2	16	49	380	550	610	534	441	227	51	9	2,874
	Mingaladon	4	1	12	43	306	515	565	494	398	199	58	2	2,598
Temp.	Kabar Aye	24.8	26.6	28.7	30.5	28.9	27.1	26.7	26.6	27.0	27.8	27.4	25.3	27.6
	Mingaladon	25.3	27.3	29.1	30.7	29.2	27.6	27.3	27.1	27.6	28.1	27.7	25.6	27.7

Reference: JICA Study Team, DMH, ID



Reference: JICA Study Team, DMH, ID

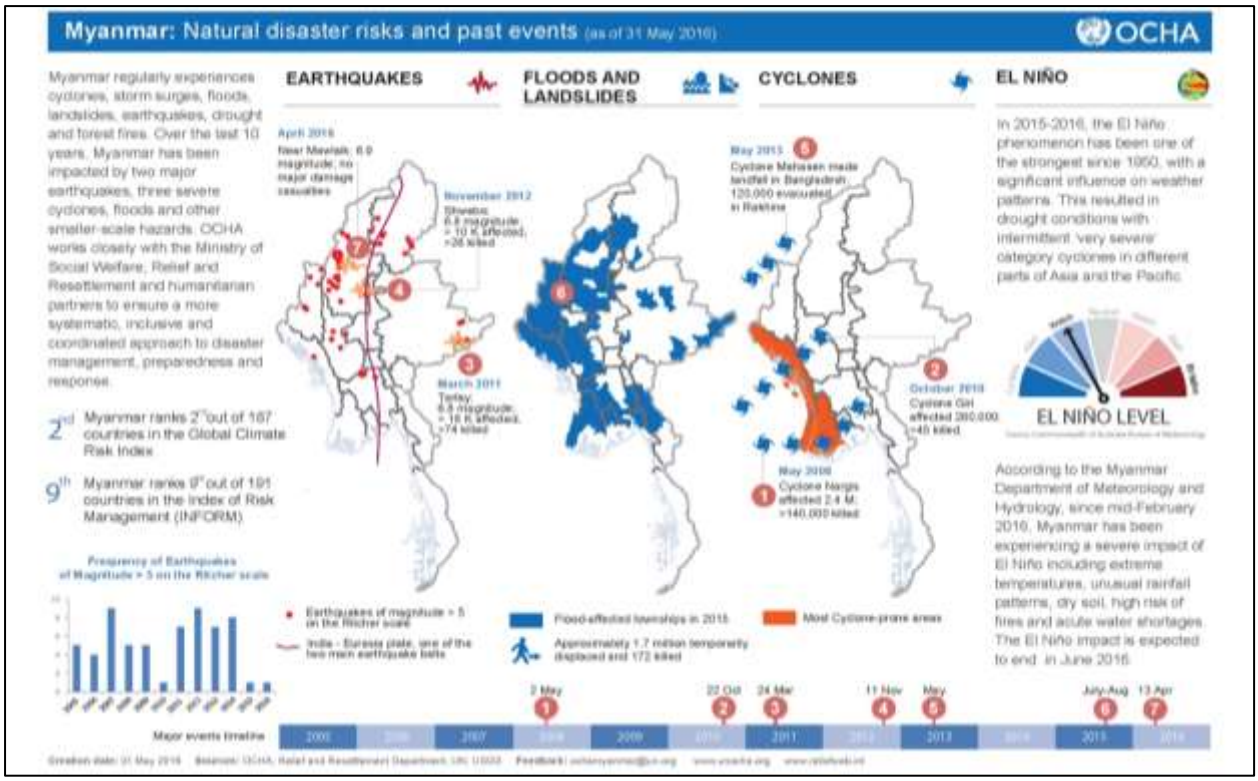
Figure 5. 10 Rainfall and Temperature of Monthly Average at Observatories Near Project Site (1998 - 2017)

5.2.5 Natural Disaster

Myanmar is the one of countries exposed to a number of natural hazards such as earthquakes, floods, cyclones, droughts, landslides, domestic fires, tsunamis, storm surges and so on. In

fact, the country is considered the second most vulnerable country out of 187 countries, according to the United Nations Climate Risk Index (2016).

United Nations Offices for the Coordination of Humanitarian Affairs (UNOCHA) revealed the record of natural disaster risks and past events in Myanmar, in coordination with the Ministry of Social Welfare, Relief and Resettlement of Myanmar. The report covered major disasters that took place from 2005 to 2016. According to the report, it can be said that no major natural disaster took place in the project area (i.e. along the alignment from Hlaing Tharyar to Parami). Figure 5.11 and Table 5.18 show.



Source: UNOCHA (2016)

Figure 5. 11 Major Natural Disasters in Myanmar (2005–2016)

Table 5. 18 Major Natural Disasters in Myanmar (2005–2016)

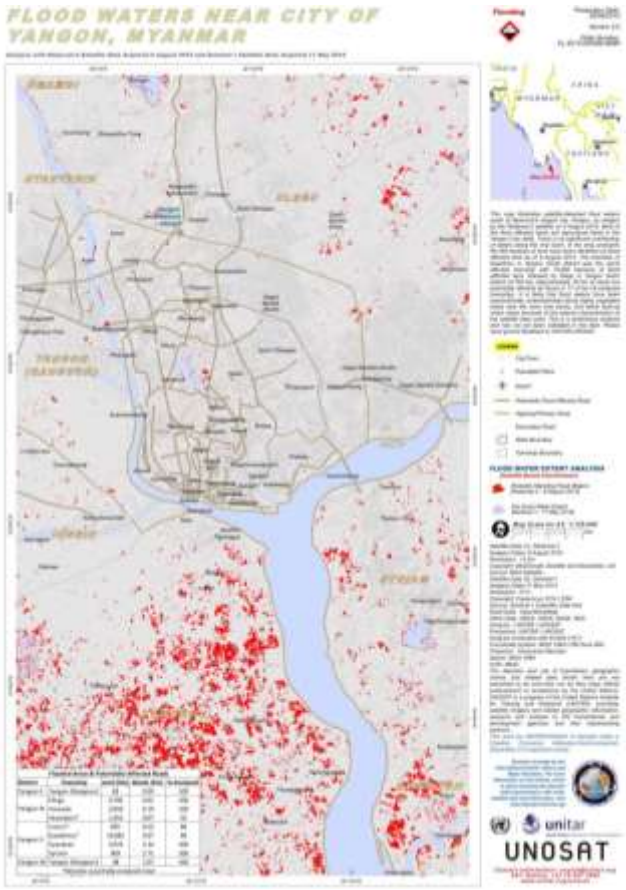
No.	Period	Disasters Type	Affected State/Region	Description
1	May 2, 2008	Cyclone	Ayeyarwady, Yangon	Cyclone Nargis affected 2.4 million people and killed 140,000 people.
2	Oct 22, 2010	Cyclone	Rakhine, Magway	Cyclone Giri affected 260,000 people and killed 45 people.
3	Mar 24, 2011	Earthquake	Shan (Eastern)	6.8 magnitude earthquake in Tarlay affected 18,000 people and killed 74 people.
4	Nov 11, 2012	Earthquake	Sagaing	6.8 magnitude earthquakes in Tarlay affected 10,000 people and killed 26 people.
5	May, 2013	Cyclone	Rakhine	Cyclone Mahasen made landfall in Bangladesh and 120,000 people had to be evacuated in Rakhine State.
6	Jul–Aug, 2015	Flood	Most part of the country	Heavy and torrential rainfall that lasted for long days had flooded northern part of Ayeyarwady and Yangon Regions, South-east Bago Region, Northern Kayin State,

No.	Period	Disasters Type	Affected State/Region	Description
				all-over Magway Region and Chin State, Northern Rakhine State, most part of Sagaing Region, and some parts of Kachin State.
7	Apr 13, 2016	Earthquake	Sagaing	6.9 magnitude earthquakes in Mawlaik Township broke out but there was no major damage or casualties.

Source: UNOCHA (2016)

5.2.6 Flood

The flood risk in Yangon urban area is relatively high due to the lower delta area, formed by Ayeyarwady River, which was seriously damaged by storm surges, Cyclone Nargis in 2008. In Yangon Metropolitan area, there are some high flood risk areas around Inya Lake according to the flood risk map, 2015.



Source: Flood Waters Near City of Yangon, Myanmar, the United Nations Institute for Training and Research

Figure 5. 12 Flood Risk Map in Yangon Region, 2015

5.2.7 Tree logging

As of April 2019, over 1,500 trees, not included in the government area shown as below table, may be logged or transplanted due to the construction of YUMRT. Especially in Hlaing Tharyar Township, it is estimated that approx. 1,200 trees will be affected.

Table 5. 19 Estimated Number of Logged Trees along the YUMRT Alignment

No.	Township	Public area		Private area	Government area	Total (Provisional)
		North Side	South Side			
1	South Okkalapa	23	-	20	Unknown	43
2	Yankin	35	12	3		50
3	Hlaing	96	93	3		192
4	Mayangone	18	21	0		39
5	Hlaing Tharyar	417	755	10		1,182
Total		589	881	36		1,506

Reference: JICA study team

5.2.8 Habitat of Animal and Plant

IBA (Important Birds Area) and KBA (Key Biodiversity Area) do not exist in and around the project area. The nearest IBA is Gulf of Mottama, located in the area about 60km east of Yangon city.



Reference: http://datazone.birdlife.org/site/factsheet/gulf-of-mottama-iba-myanmar

Figure 5. 13 IBA Map Adjacent to the Project Area

5.2.9 Protected Areas and National Park

Protected areas in Myanmar are presented with location in Table 5.20. The project area is located in Yangon City. Only Hkawga Wildlife Park is located in Yangon Region.

Table 5. 20 Protected Areas in Myanmar

No.	Name	Location	Remarks
1	Hkakaborazi National Park	Kachin State	ASEAN Heritage Park
2	Hponganrazi Wildlife Sanctuary	Kachin State	Established PA
3	Bumhpabum Wildlife Sanctuary	Kachin State	Established PA
4	Hukaung Valley Wildlife Sanctuary	Kachin State	Established PA
5	Hukaung Valley Wildlife Sanctuary (Extension)	Kachin State	Established PA
6	Padauk Wildlife Sanctuary	Kachin State	Established PA
7	Indawgyi Wetland Wildlife Sanctuary	Kachin State	ASEAN Heritage Park
8	Htamanthi Wildlife Sanctuary	Sagaing Region	Established PA
9	Mahamyaing Wildlife Sanctuary	Sagaing Region	Proposed PA
10	Chatthin Wildlife Sanctuary	Sagaing Region	Established PA
11	Alaungdaw Kathapa National Park	Sagaing Region	ASEAN Heritage Park
12	Chung Pon Kan Wildlife Sanctuary	Sagaing Region	Established PA
13	Bawditahtaung Nature Reserve	Sagaing Region	Proposed PA
14	Minwun Taung Wildlife Sanctuary	Sagaing Region	Established PA

No.	Name	Location	Remarks
15	Minsontaung Wildlife Sanctuary	Mandalay Region	Established PA
16	Shwe U Daung Wildlife Sanctuary	Mandalay Region and Shan State	Established PA
17	Pyin Oo Lwin Bird Sanctuary	Mandalay Region	Established PA
18	Lawkanandar Wildlife Park	Mandalay Region	-
19	Popa Mountain Park	Mandalay Region	Established PA
20	Wetthe Kan Bird Sanctuary	Magway Region	Proposed PA
21	Shwesattaw Wildlife Sanctuary	Magway Region	Established PA
22	Shinpinkyettauk Wildlife Sanctuary	Bago Region	Proposed PA
23	North Zamari Elephant Range	Bago Region	Proposed PA
24	Moeyungyi Wetland Wildlife Sanctuary	Bago Region	Ramsar Site
25	Hkawga Wildlife Park	Yangon Region	Established PA
26	Meinmahla Kyun Wildlife Sanctuary	Ayeyarwaddy Region	ASEAN Heritage Park
27	Thamihla Kyun Wildlife Sanctuary	Ayeyarwaddy Region	-
28	Kyaikthiyo Wildlife Sanctuary	Mon State	Established PA
29	Kelathataung Wildlife Sanctuary	Mon State	Established PA
30	Kahilu Wildlife Sanctuary	Mon State	Established PA
31	Mulayit Wildlife Sanctuary	Kayin State	Established PA
32	Taninthayi Nature Reserve	Taninthayi Region	Established PA
33	Moscos Islands Wildlife Sanctuary	Taninthayi Region	Established PA
34	Taninthayi National Park	Taninthayi Region	Proposed PA
35	Lenya National Park	Taninthayi Region	Proposed PA
36	Lenya National Park (Extension)	Taninthayi Region	Proposed PA
37	Lampi Marine National Park	Taninthayi Region	ASEAN Heritage Park
38	Natmataung National Park	Chin State	ASEAN Heritage Park
39	Kyauk Pa Taung Wildlife Sanctuary	Chin State	Established PA
40	Palaung Pyadalin Wildlife Sanctuary	Shan State (South)	Established PA
41	Taunggyi Bird Sanctuary	Shan State (South)	Established PA
42	Inlay Wetland Bird Sanctuary	Shan State (South)	ASEAN Heritage Site
43	Loimwe Protected Area	Shan State (East)	Established PA
44	Parsar Protected Area	Shan State (East)	Established PA

Source: Ministry of Environmental Conservation and Forestry, March 2014, Fifth National Report to the Convention on Biological Diversity
Reference: JICA study team based on satellite image by Google Earth

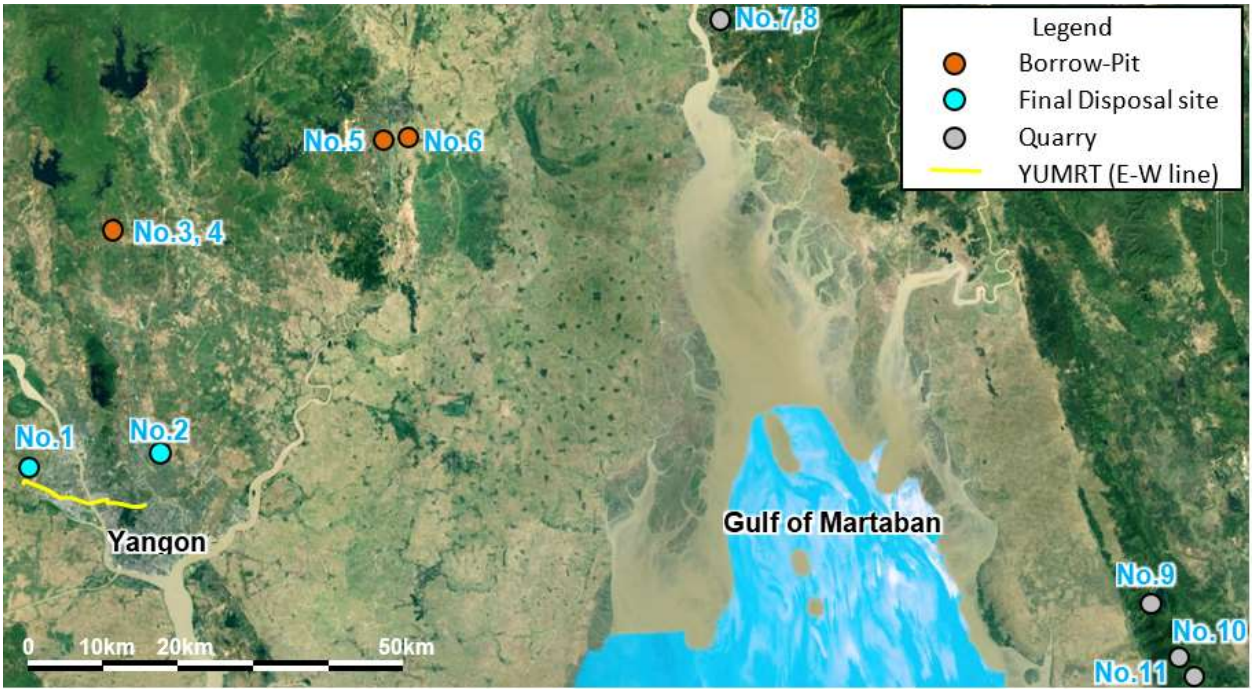
In Myanmar, 58 areas are categorized as protected area including wildlife and wild bird sanctuary, national park and natural preservation etc. As shown in the Figure above, the Hlawga Lake National Park is the only protected area categorized in the Yangon region, which has a land area of about 1,228 ha, of which 313 ha is assigned to the wildlife park. The park is located about 25 km north of the center of Yangon and was established as an environmental education center in 1982 to protect peculiar wildlife in Myanmar, and in the 1992 survey, it was confirmed that there were at least 21 species of mammals, 145 species of birds and 8 species of reptiles in the park. In addition, there are no other legally protected areas within the project area.



Figure 5. 14 Protected Area Adjacent to the Project Area

5.2.10 Quarry, Borrow Pit and Damping Site

Candidate list for the sites is as below. Operation of borrow pits, quarry sites and construction yards have potential negative impacts. However, as of now whether these facilities are utilized or not are unfixed because it is one of the contractor's matters on the pre-construction phase.



Reference: JICA study team

Figure 5. 15 Potential Sites for Borrow-Pit, Final Disposal Site and Quarry in the Vicinity of YUMRT

Table 5. 21 Potential Sites for Borrow-Pit, Final Disposal Site and Quarry in the Vicinity of YUMRT

No	Site type	Name	Coordinate		Owner
			Latitude(N)	Longitude(E)	
1	Final disposal site	Htein Bin	16°53'45.07"	96° 1'13.80"	YCDC
2	Final disposal site	HtweiChaung	16°55'4.49"	96°10'56.56"	YCDC
3	Borrow-pit	Kyee Inn Taung	17°11'18.73"	96° 6'27.95"	(not identify)
4	Borrow-pit	Ngar Suu Taung	17°11'38.36"	96° 6'34.78"	(not identify)
5	Borrow-pit	Shwe Tun Company	17° 5'35.24"	96°27'3.57"	Zoyar Aung
6	Borrow-pit	Kawa	17° 6'11.08"	96°30'23.90"	Aung Soe Poing
7	Quarry	Taw Win Yoe Ma	17°26'47.4"	96°53'43.1"	-
8	Quarry	A.O.K	17°28'03.4"	96°53'31.6"	-
9	Quarry	Long Life Aggregate Mining Co., Ltd.	16º43′12.61″	97º27′14.52″	KyawZaw Win
10	Quarry	REHMONNYA UNITED Co., Ltd.	16° 38' 1.9"	97° 30' 57.6"	(not identify)
11	Quarry	Global Vertex Group Co., Ltd	16˚ 39′ 44.28″	97˚ 30′ 31.05″	U Min Thu

Reference: JICA study team

5.3 Ambient Environmental Quality

5.3.1 Air Quality

In order to understand the ambient air quality along the alignment of YUMRT Project and to know the baseline data, dust (PM_{10} and $PM_{2.5}$) and gases (SO_2, CO and NO_2) were measured using HAZ-SCANNER air monitoring station, and ozone (O_3) was measured using Aeroqual S- 500 Gas level monitor. The items to be monitored were selected with reference to the NEQ (National Emission Quality) Guidelines in Myanmar. Measured data was analyzed and compared with the permissible maximum values prescribed in the NEQ Guidelines for

ambient air quality. The results serve as a useful input into considering effective ways to mitigate the potential impacts on the air quality as well as into formulating practical and robust environmental monitoring plan.

The air quality survey were conducted in fourteen locations along the YUMRT alignment for dry and wet seasons to grasp the atmospheric environment, which is affected seriously by traffic congestion at this moment. Additionally, these two measurements were also conducted at four locations along the proposed route of transmission line (from West University Receiving Substation to Hlaing Tharyar Receiving Substation) which will supply electricity to operate YUMRT. The survey points are presented in Table 5.22 and Figure 5.16, and the equipment used is shown in Table 5.23 respectively.



Source: JICA Study Team

Figure 5. 16 Location of Air Quality Measurement

Table 5. 22 Locations of Air Quality Survey

Point No.	Location (Latitude and Longitude)	Latitude	Longitude	Survey Date	
				Dry Season	Wet Season
A-1	Hlaing Tharyar St.	16°52'47.22"N	96°0'33.89"E	18.3.19	2.6.19
A-2	Dagon-Ayar Bus St.	16°52'43.10"N	96°1'22.48"E	19.3.19	3.6.19
A-3	INTXN point of BOC and Twan Tay	16°52'16.79"N	96°2'21.55"E	20.3.19	4.6.19
A-4	Mee Khwat Market	16°51'52.56"N	96°3'9.14"E	21.3.19	5.6.19
A-5	Na Wa Day INTXN (Na Wa Day Housing)	16°51'44.06"N	96°3'50.98"E	22.3.19	6.6.19
A-6	FMI	16°51'20.34"N	96°5'10.03"E	23.3.19	7.6.19
A-7	Under Ba Yint Naung Bridge	16°51'22.64"N	96°6'0.72"E	24.3.19	8.6.19
A-8	Ba Yin Naung Pwel Yoan (Thiri Mon P Lar Zar) (Yan Kin Monastery)	16°51'32.00"N	96°6'25.20"E	25.3.19	9.6.19

Point No.	Location (Latitude and Longitude)	Latitude	Longitude	Survey Date	
				Dry Season	Wet Season
A-9	INTXN of parami Rd. and East 50’ Rd.	16°51'26.89"N	96°7'10.85"E	26.3.19	10.6.19
A-10	INTXN of Pyay Rd. and Inn Sein Rd.	16°51'26.25"N	96° 7'25.22"E	28.3.19	12.6.19
A-11	INTXN of Pyay Rd. and Parami Rd.	16°51'11.56"N	96° 8'25.92"E	29.3.19	13.6.19
A-12	Inya Lake North-East St.	16°51'6.96"N	96° 8'58.40"E	30.3.19	14.6.19
A-13	INTXN of Parami Rd. and Ka Bar Aye Rd.	16°51'0.25"N	96° 9'29.01"E	31.3.19	15.6.19
A-14	Parami St.	16°51'8.87"N	96° 9'55.05"E	10.5.19	16.6.19
A-15	West Yangon University	16°56'20.15"N	96° 2'27.62"E		14.8.19
A-16	Htan tapin Police Outpost	16°55'35.49"N	96° 2'57.94"E		15.8.19
A-17	B.E.H.S No. (8), Hlaing Tharyar Township	16°53'59.89"N	96° 2'46.10"E		16.8.19
A-18	Yadanar Thiri Myoe Oo Monastery	16°52'56.86"N	96° 2'10.26"E		17.8.19

Source: JICA Study Team

Table 5. 23 Instrument Used for Air Quality Measurement

No.	Name and Model of Instrument Used	Measurement Items	Image
1	EPAS Haz-Scanner	PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, Temperature, and Relative Humidity	
2	Aeroqual S500	O_3	

Photograph 5. 1 Air Quality Survey at Dry Season

	
A-1	A-2
	
A-3	A-4
	
A-5	A-6

	
A-7	A-8
	
A-9	A-10
	
A-11	A-12

	
A-13	A-14

Photograph 5. 2 Air Quality Survey at Wet Season

	
A-1	A-2
	
A-3	A-4



A-5



A-6



A-7



A-8



A-9



A-10





A-11	A-12
	
A-13	A-14
	
A-15	A-16
	
A-17	A-18

A summary of the results is shown in Table 5.24. It can be seen that the level of concentration for PM_{10}, $PM_{2.5}$ and SO_2 exceeded the NEQ Guideline values at almost all sample points not only in dry season but also in wet season. It can be said that atmospheric environment in Yangon has already been under extremely serious condition due to heavy traffic congestion and industrialized land use. Therefore installation of YUMRT as zero-emission's infrastructure will improve the condition.

Table 5. 24 Result of Ambient Air Quality Measurement (unit: µg/m^3, ppm)

Point No.	Season	Standard Values (NEQ and WHO)					
		PM_{10} (24 Hr Average)	$PM_{2.5}$ (24 Hr Average)	NO_2 (1 Hr Average)	SO_2 (24 Hr Average)	CO (8 Hr Average)	O_3 (8 Hr Average)
		50 µg/m^3 (NEQ)	25 µg/m^3 (NEQ)	200 µg/m^3 (NEQ)	20 µg/m^3 (NEQ)	9 ppm (Air NEPM)	100 µg/m^3 (NEQ)
		Results					
A-1	Dry	**180**	**112**	89	2	0	67
	Wet	**51**	**33**	102	**45**	0	6
A-2	Dry	**199**	**134**	95	**208**	2 *10^{-8}	41
	Wet	49	**32**	74	**39**	2*10^{-5}	10
A-3	Dry	**225**	**136**	93	**256**	3*10^{-8}	57
	Wet	**60**	**43**	41	**47**	3.7*10^{-4}	8
A-4	Dry	**188**	**133**	105	**426**	3 *10^{-7}	61
	Wet	**58**	**41**	43	**45**	3.8*10^{-4}	12
A-5	Dry	**228**	**147**	92	**405**	3 *10^{-7}	63
	Wet	**61**	**39**	102	**38**	4.3*10^{-4}	8
A-6	Dry	**211**	**141**	74	**477**	0	75
	Wet	**454**	**74**	5	**45**	1.2*10^{-4}	14
A-7	Dry	**190**	**110**	98	**348**	0	61
	Wet	**154**	**61**	4	**43**	4*10^{-4}	2
A-8	Dry	**248**	**113**	99	**621**	1*10^{-8}	55
	Wet	33	**34**	18	**22**	9*10^{-5}	12
A-9	Dry	**158**	**86**	93	**514**	1.2*10^{-6}	51
	Wet	38	**25**	74	**75**	3.5*10^{-4}	10
A-10	Dry	**169**	**129**	127	**551**	7*10^{-8}	57
	Wet	39	16	4	**22**	1.2*10^{-4}	6
A-11	Dry	**169**	**131**	113	**514**	1*10^{-7}	69
	Wet	**53**	**32**	47	**39**	1.5*10^{-4}	14
A-12	Dry	**181**	**128**	140	**551**	7*10^{-8}	67
	Wet	**50**	**29**	37	**39**	3.3*10^{-4}	4
A-13	Dry	**313**	**104**	93	**524**	1.5*10^{-7}	65
	Wet	33	21	21	**27**	3*10^{-4}	14
A-14	Dry	**153**	**90**	177	**612**	1.7*10^{-7}	71
	Wet	43	18	19	**45**	1.3*10^{-4}	12
A-15	Wet	31	16	99	12	2.9*10^{-7}	23
A-16	Wet	**57**	**26**	93	**22**	1.4*10^{-8}	20
A-17	Wet	**69**	**30**	92	**24**	4.4*10^{-8}	26
A-18	Wet	**67**	**37**	84	**22**	2.9*10^{-7}	21

*Measurement values that exceed the NEQ Guideline values are shown in a red word.
Source: E Guard Study Team

(1) Particulate Matters (PM_{10} and $PM_{2.5}$)

PM_{10} and $PM_{2.5}$ refer to particulate matter 10 micrometers or less in diameter and particulate matter 2.5 micrometers or less in diameter, respectively. $PM_{2.5}$ is generally described as fine particles. The major components of PMs are sulfate, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water. It consists of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air.

Dust emission level was checked by measuring the concentration level of PM_{10} and $PM_{2.5}$ for 24 hours at fourteen sample points. All values are found that exceeded the NEQ guideline of 50 µg/m^3 and 25µg/m^3 in dry season. In wet season, PM_{10} values of point A-2, A-8, A-9, A-10, A-13, A-14 and A-15 are within the guideline values and the rests are higher than the

guideline values in which values of point A-6 and A-7 are much higher. For $PM_{2.5}$, all values apart from point A-10, A-13, A-14 and A-15 exceed the guideline values.

(2) Nitrogen Dioxide (NO_2)

Nitric oxide (NO) and nitrogen dioxide (NO_2) are the two principle nitrogen oxides. It can be generated from operation and maintenance of vehicles and on-site power generation facilities. The quantity of nitrogen oxides depends on the available nitrogen and oxygen concentration, reaction time, and temperature. It can cause bronchitis and edema in lungs.

Concentration of ambient NO_2 levels was measured for 24 hours in the survey. The average concentration for 1 hour was, for instance, 89 $\mu g/m^3$ (dry season) and 102 $\mu g/m^3$ (wet season) at A1. All measurements were found to be lower than 200 $\mu g/m^3$, the guideline value specified in the in the NEQ (emission) Guidelines.

(3) Sulfur Dioxide (SO_2)

Sulfur dioxide is generated from combustion of fuel such as oil, and as a by-product of some chemical products. On-road and off-road vehicles can also be emission sources of SO_2 which may cause respiratory diseases and irritation of throat and eyes. All results from both seasons except A-1 from dry season with a value of 2 $\mu g/m^3$ and A-15 from wet season with a value of 15 $\mu g/m^3$ were found to be much higher than 20 $\mu g/m^3$, the guideline value stipulated in the National Environmental Quality (emission) Guidelines.

(4) Carbon Monoxide (CO)

Carbon monoxide is a poisonous gas which has no taste or smell. It is mainly generated from incomplete combustion of carbon, i.e., when there is not enough supply of oxygen to produce carbon dioxide (CO_2), only half of the oxygen is combine with carbon and carbon monoxide if formed. It is also formed from the combustion of fossil fuels, motor vehicle exhausts and industrial fumes. When carbon monoxide is inhaled, it enters the bloodstream of the body and inhibits the carriage of oxygen and the lack of oxygen causes the function of body cells and tissues to fail. Excess inhalation of carbon monoxide can even lead to death. In 24 hour measured values of CO level concentration, all average concentrations for 8 hours are within the Australian Ambient Air Quality Standards**,** also known as National Environment Protection (Ambient Air Quality) Measure (Air NEPM), stipulated by National Environmental Protection Council(Australia).

(5) Ozone (O_3)

Ground level ozone is not emitted directly to the air. It is created from chemical reactions between oxides of nitrogen and volatile organic compounds in the presence of sunlight. Gas exhausted from industrial facilities, motor vehicles, internal combustion engines, especially automobiles, and coal fire power plants are main sources of nitrogen oxides and VOCs. In

addition to damage in vegetation and ecosystem, ground level ozone may cause variety of health issues such as lung damage and irritation along respiratory tract when inhaled.

Concentration of ozone was recorded for 8 hours at each point. In comparing the resultant average concentrations with the NEQ guideline, it can be seen that all the values are under the guideline value 100 µg/m^3.

5.3.2 Wind Speed and Wind Direction

The following figures show the wind speed and direction at points along the alignment which are the same as air quality survey points. Wind speed and direction at each measured point in dry and wet can be seen in Table 5.25.

Table 5. 25 Wind Speed and Direction

Point	Dry Season	Wet Season
A-1	- E to W (0.5-2.1 m/s), - N to S (2.1-3.6 m/s) - SE to NW (2.1-3.6 m/s)	- W and NW to E and SE (0.5-2.1 m/s) - W and SW to E and NE (2.1-3.6 m/s) - NW to SE (3.6 - 5.7 m/s)
A-2	- N to S (0.5-2.1 m/s) - N and NW to S and SE (0.5-2.1 m/s)	- N to S (2.1-3.6 m/s)
A-3	- N and NE to S and SW (2.1-3.6m/s) - E to W (2.1-3.6m/s)	- N to S (0.5-2.1 m/s) - N and NW to S and SE (2.1-3.6 m/s)
A-4	- NE to SW (0.5-2.1 m/s) - N to S (0.5-2.1 m/s),	- N to S (0.5-2.1 m/s) - N and NE to S and SW (2.1-3.6 m/s) - NE to SE (0.5-2.1 m/s)
A-5	- SW to NE (0.5-2.1 m/s)	- E to W (2.1-3.6 m/s) - W to E (2.1-3.6 m/s) - E and SE to W and NW (2.1-3.6 m/s)
A-6	- W and SW to E and NE (2.1-3.6m/s)	- W and NW to E and SE (2.1-3.6 m/s) - E and SE to W and NW (2.1-3.6 m/s)
A-7	- E and SE to W and NW (2.1-3.6m/s) - W to E (2.1-3.6m/s)	- N to S (2.1-3.6 m/s)
A-8	- ES to W and NW (0.5-2.1 m/s) - W and SW to E and NE (0.5-2.1 m/s) - S and SE to N and NW (0.5-2.1 m/s)	- W and SW to E and NE (0.5-2.1 m/s)
A-9	- SE to NE (0.5-2.1 m/s)	- N and NE to S and SW (0.5-2.1 m/s)
A-10	- E and SE to W and NW (0.5-2.1 m/s)	- SE to NW (3.6-5.7 m/s)
A-11	- NE to SW (0.5-2.1 m/s)	- S and SE to W and NW (0.5-2.1 m/s)
A-12	- E to W (2.1-3.6 m/s) - E and NE to W and SW (0.5-2.1 m/s)	- NW to SE (0.5-2.1 m/s) - SE to NW (0.5-2.1 m/s)
A-13	- S to N (0.5-2.1 m/s)	- W and NW o E and SE (2.1-3.6 m/s) - W and SW to E and NE (2.1-3.6 m/s)
A-14	- NW to SE (0.5-2.1 m/s) - N and NE to S and SW (8.8-11.1 m/s)	- N to S (2.1-3.6 m/s) - W and SW to E and SE (2.1-3.6 m/s) - NW to SE (0.5-2.1 m/s)
A-15	- E to W (0.5-2.1 m/s)	
A-16	- N and NE to S and SW (2.1-3.6 m/s)	
A-17	- W and NW to E and SE (3.6-5.7 m/s)	
A-18	- W to E (3.6-5.7 m/s)	



Dry Season

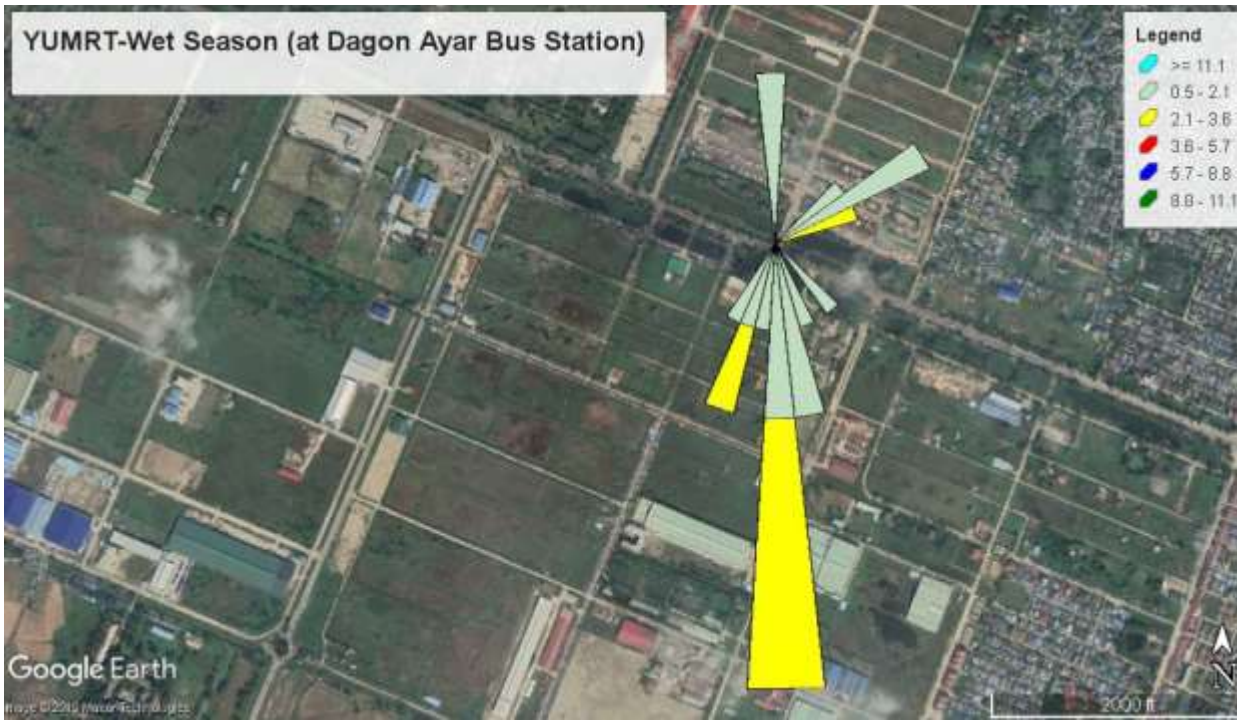


Wet Season

Figure 5. 17 Wind Speed and Direction at A-1

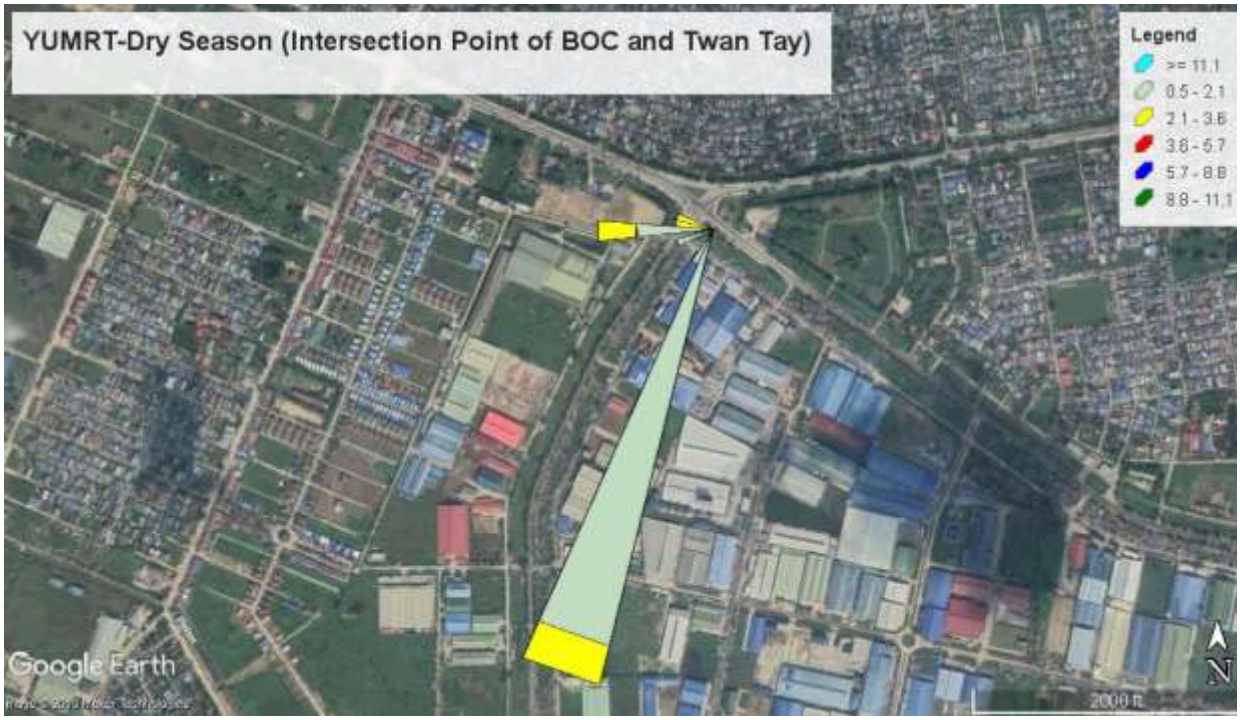


Dry Season

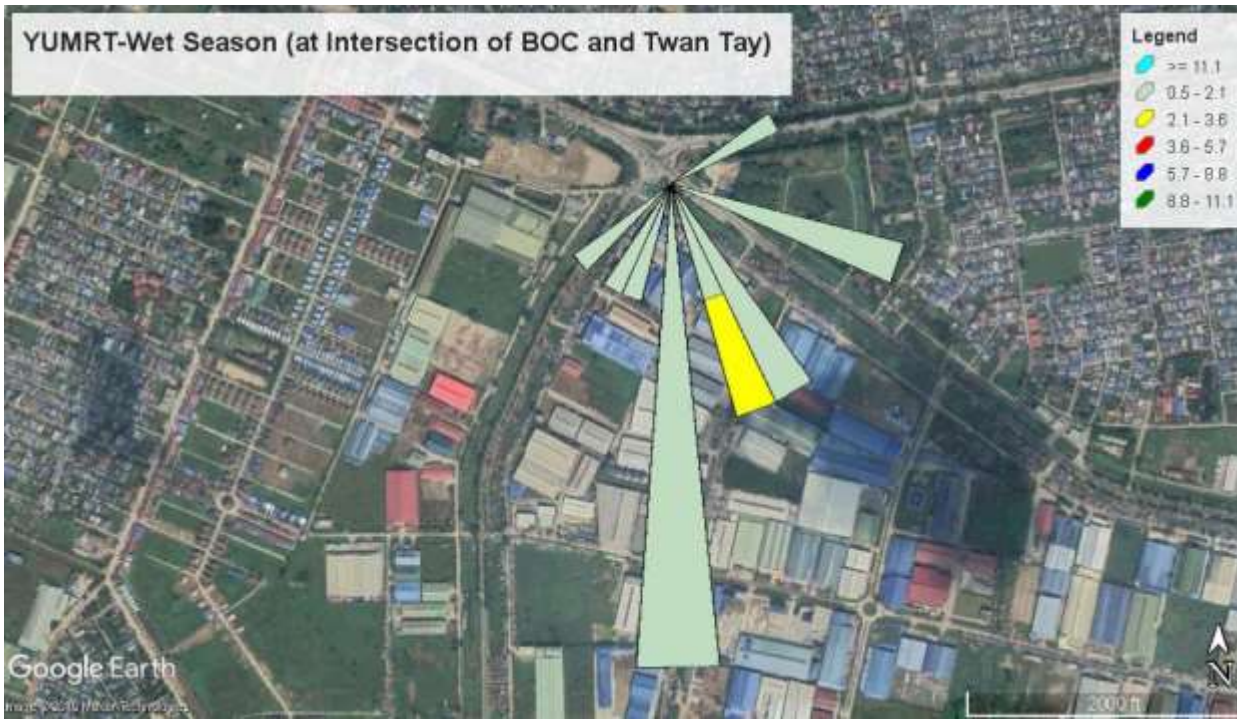


Wet Season

Figure 5. 18 Wind Speed and Direction at A-2

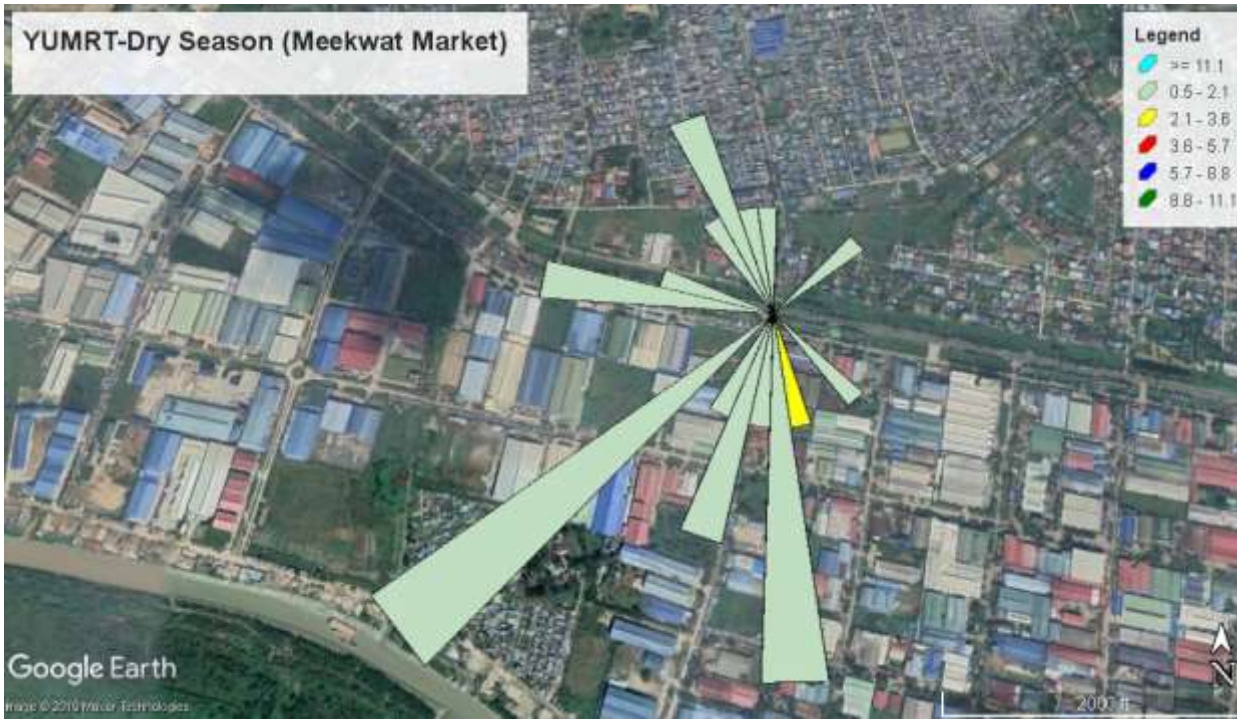


Dry Season



Wet Season

Figure 5. 19 Wind Speed and Direction at A-3



Dry Season

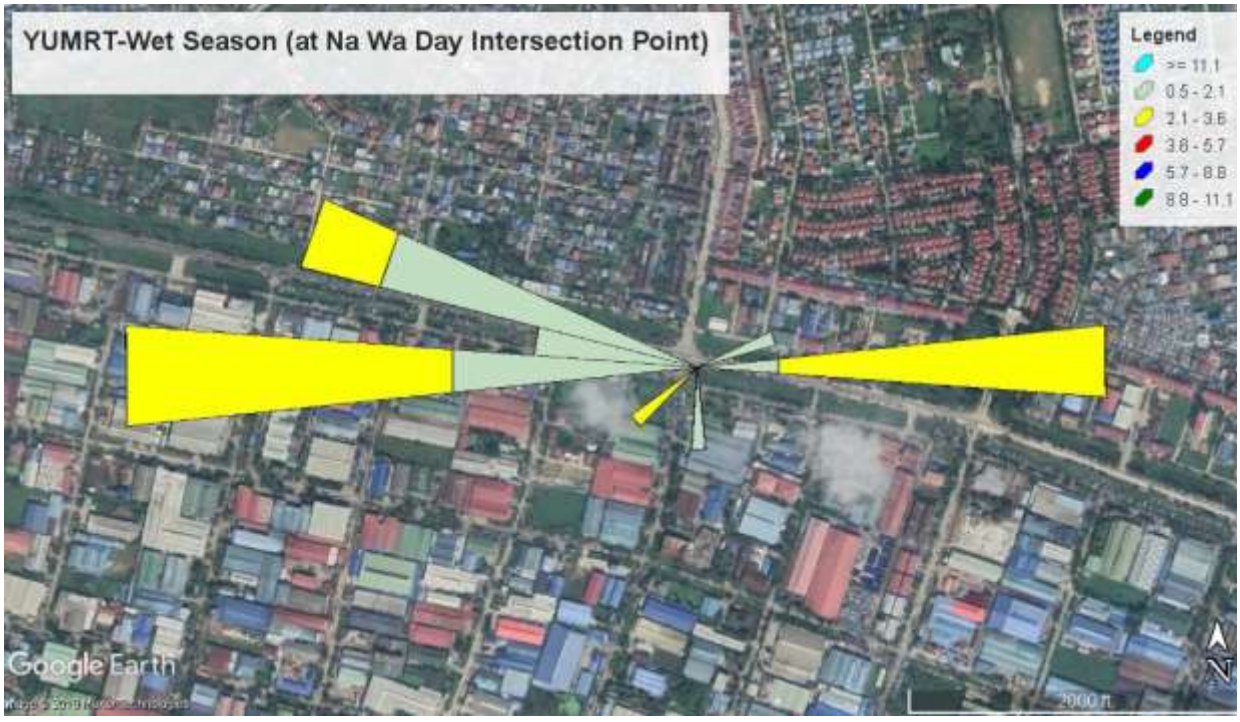


Wet Season

Figure 5. 20 Wind Speed and Direction at A-4



Dry Season



Wet Season

Figure 5. 21 Wind Speed and Direction at A-5



Dry Season



Wet Season

Figure 5. 22 Wind Speed and Direction at A-6



Dry Season



Wet Season

Figure 5. 23 Wind Speed and Direction at A-7



Dry Season

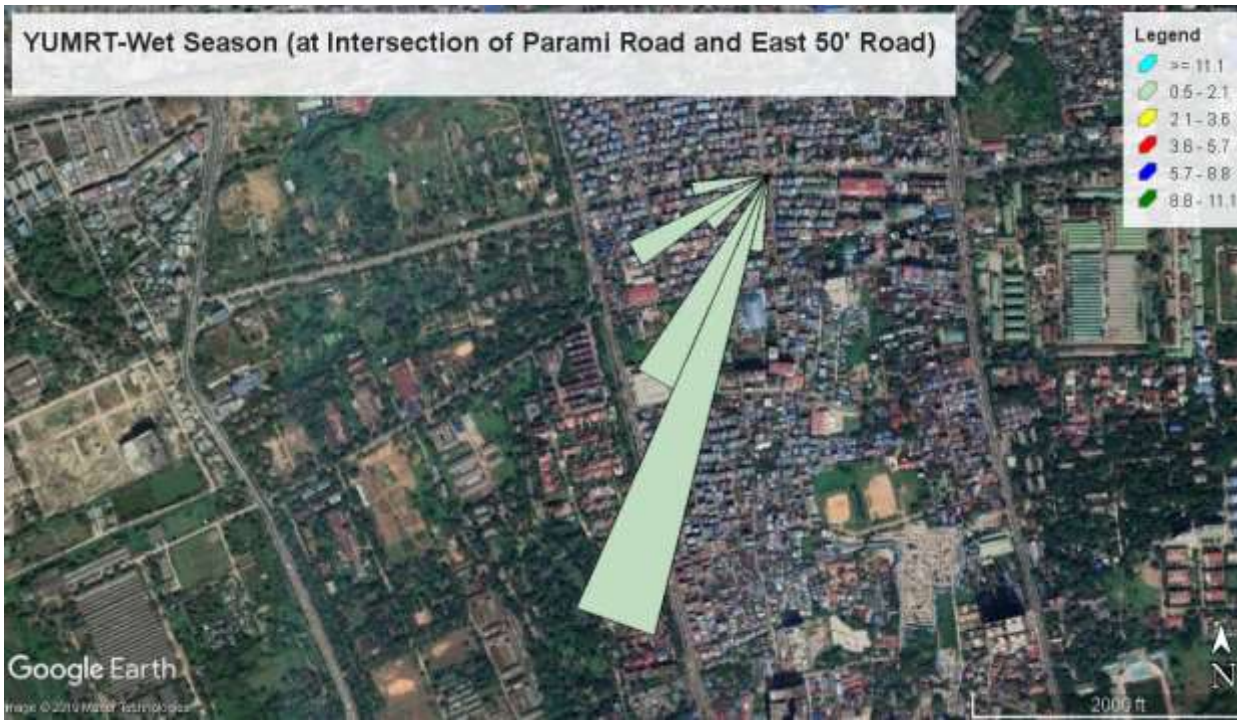


Wet Season

Figure 5. 24 Wind Speed and Direction at A-8

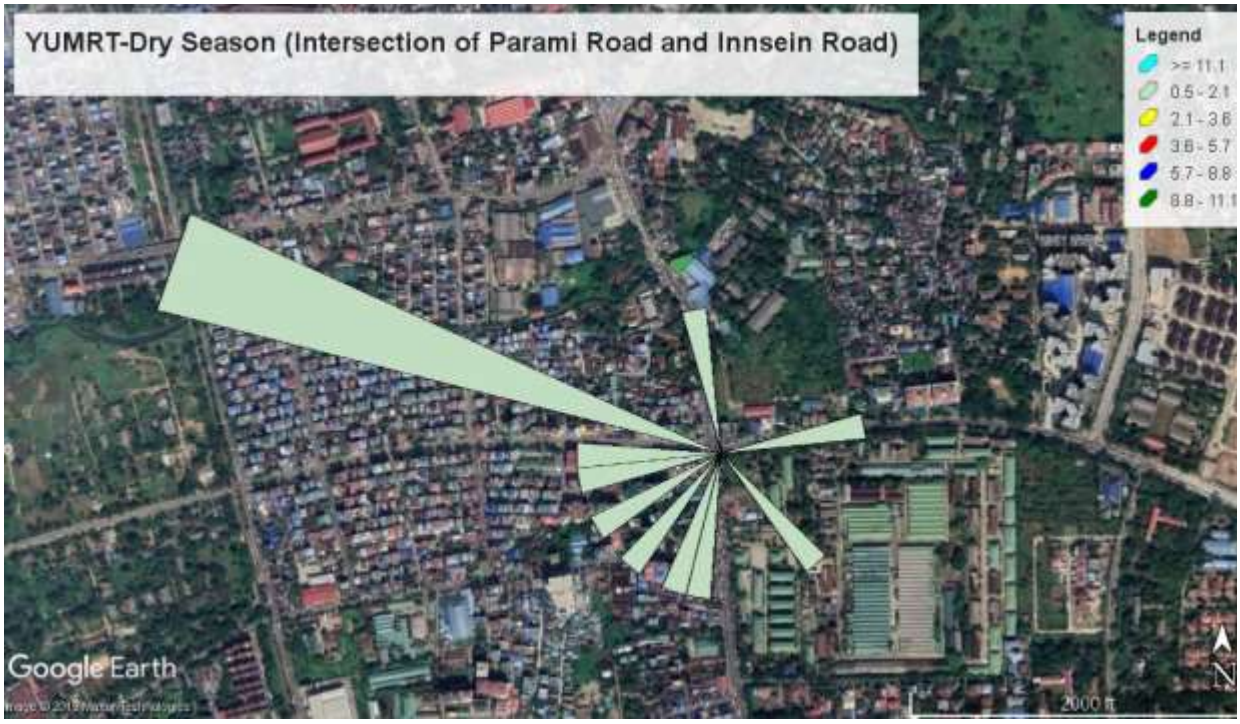


Dry Season

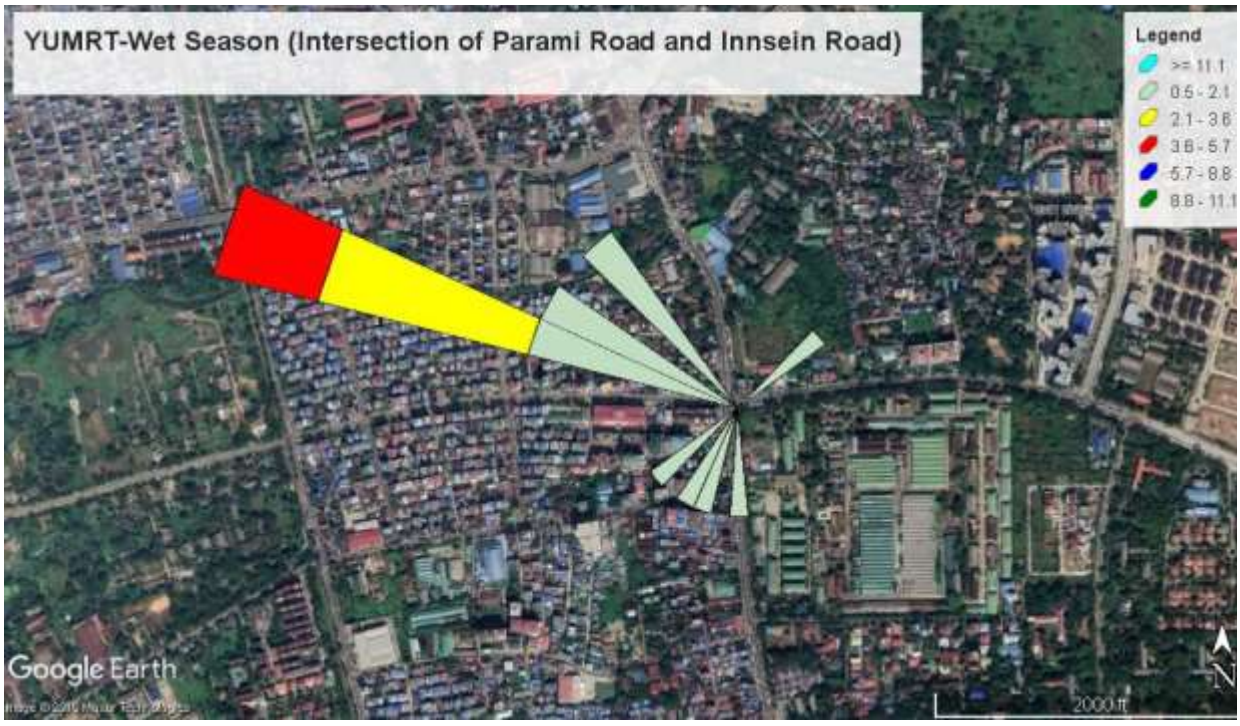


Wet Season

Figure 5. 25 Wind Speed and Direction at A-9

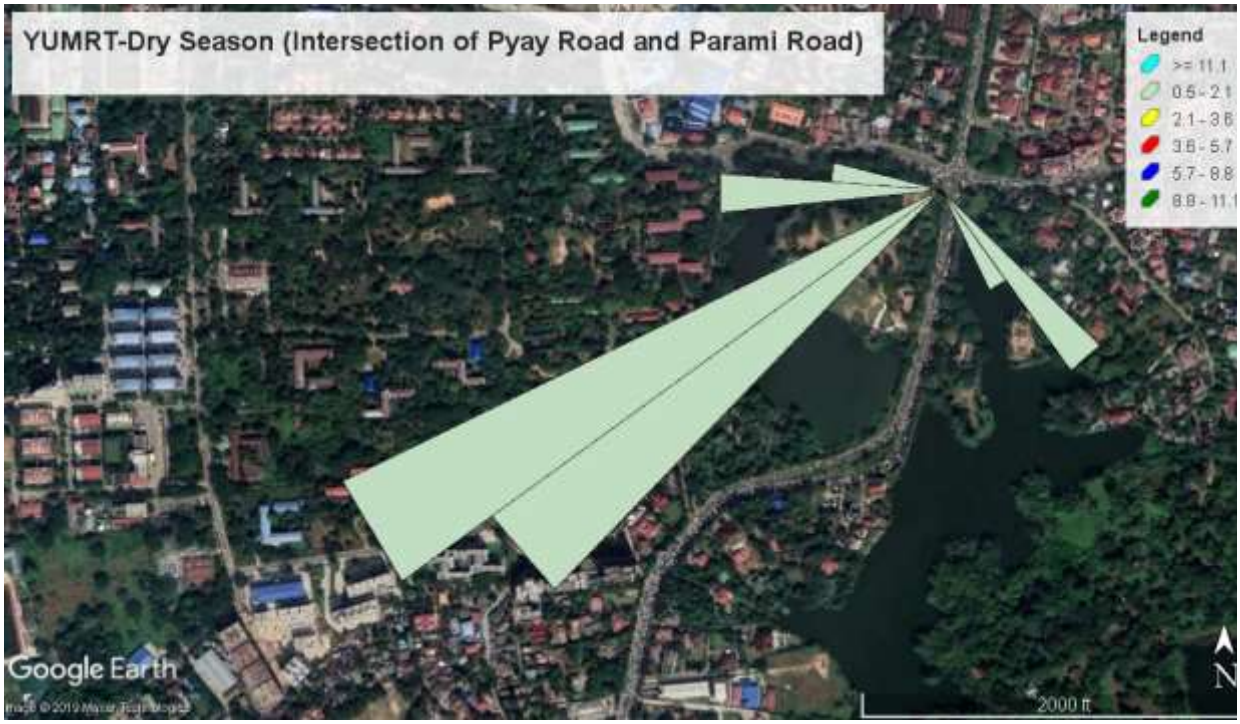


Dry Season

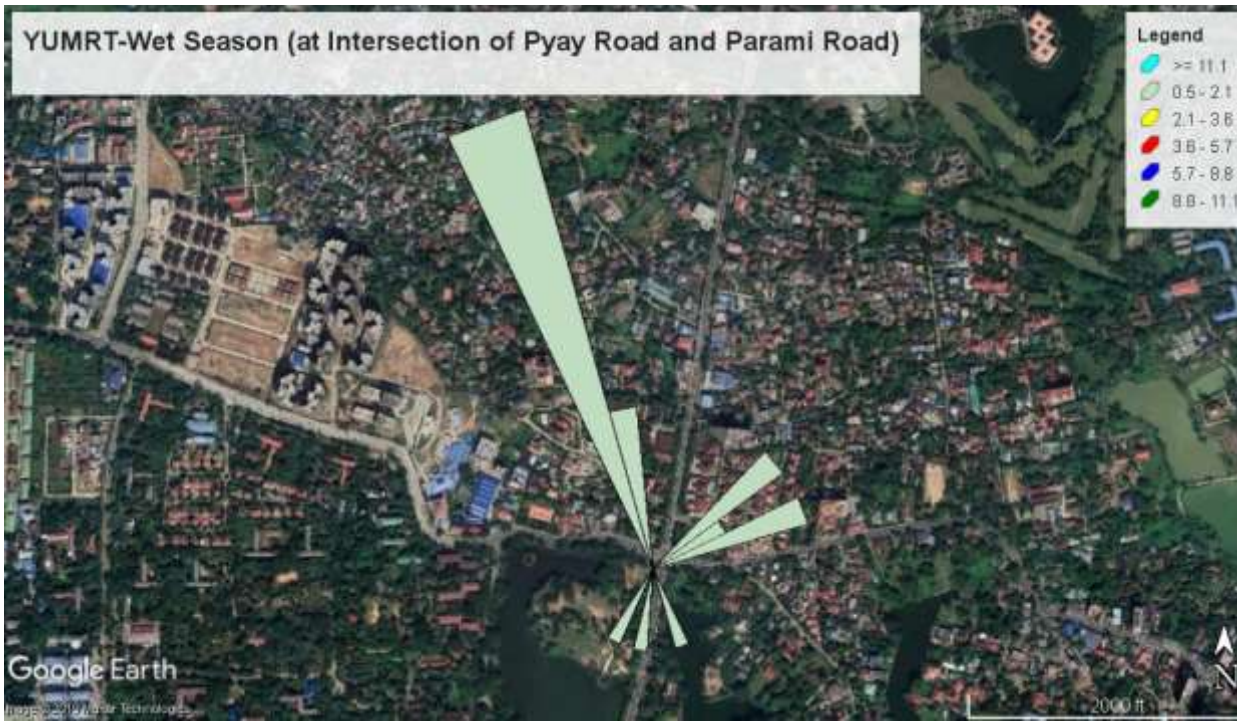


Wet Season

Figure 5. 26 Wind Speed and Direction at A-10

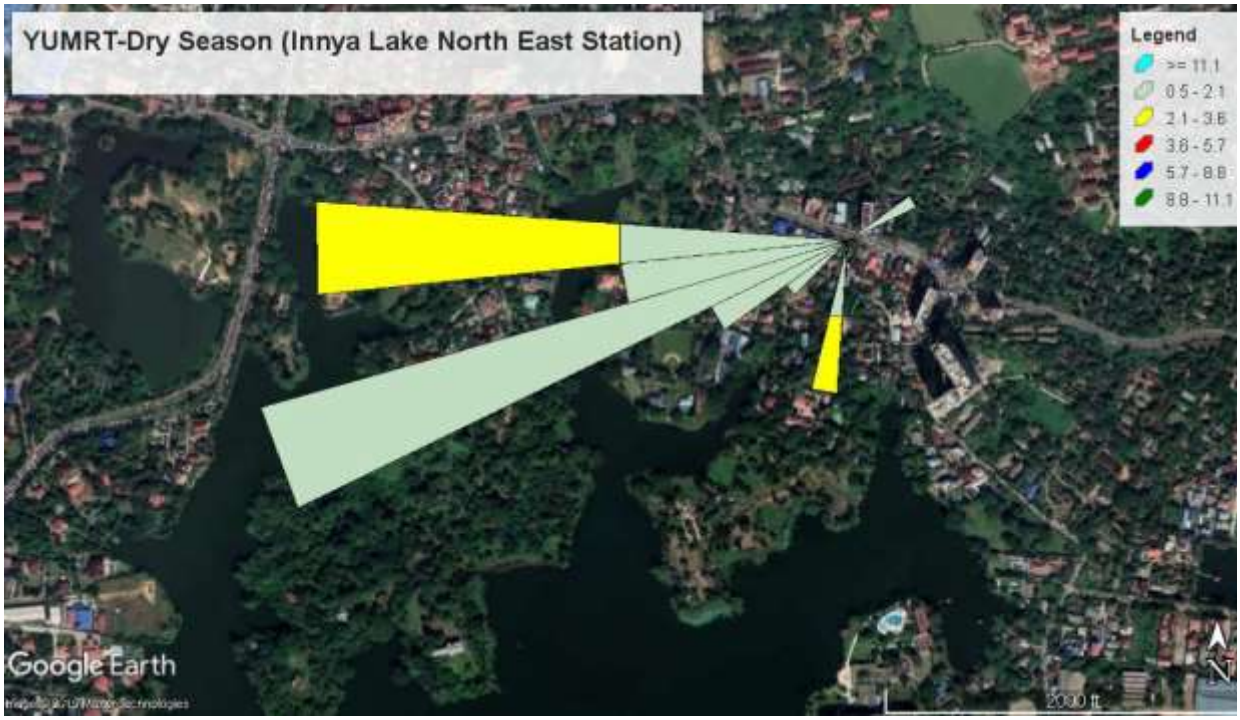


Dry Season



Wet Season

Figure 5. 27 Wind Speed and Direction at A-11

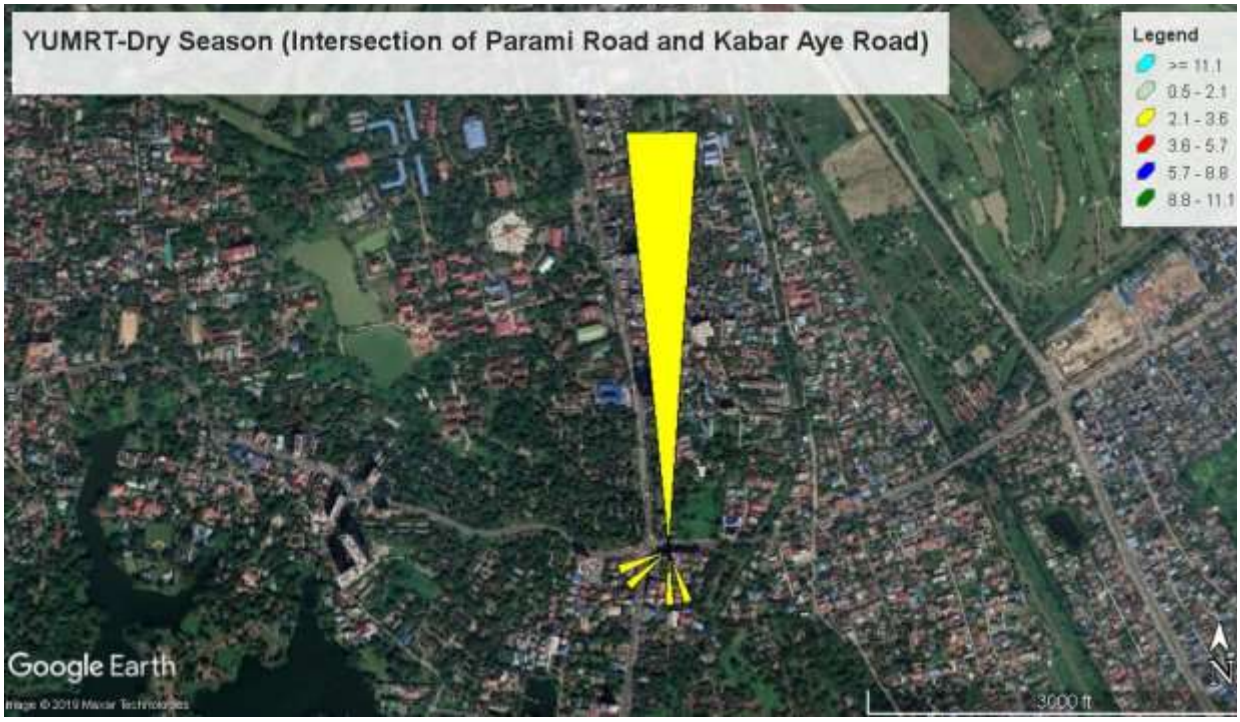


Dry Season



Wet Season

Figure 5. 28 Wind Speed and Direction at A-12

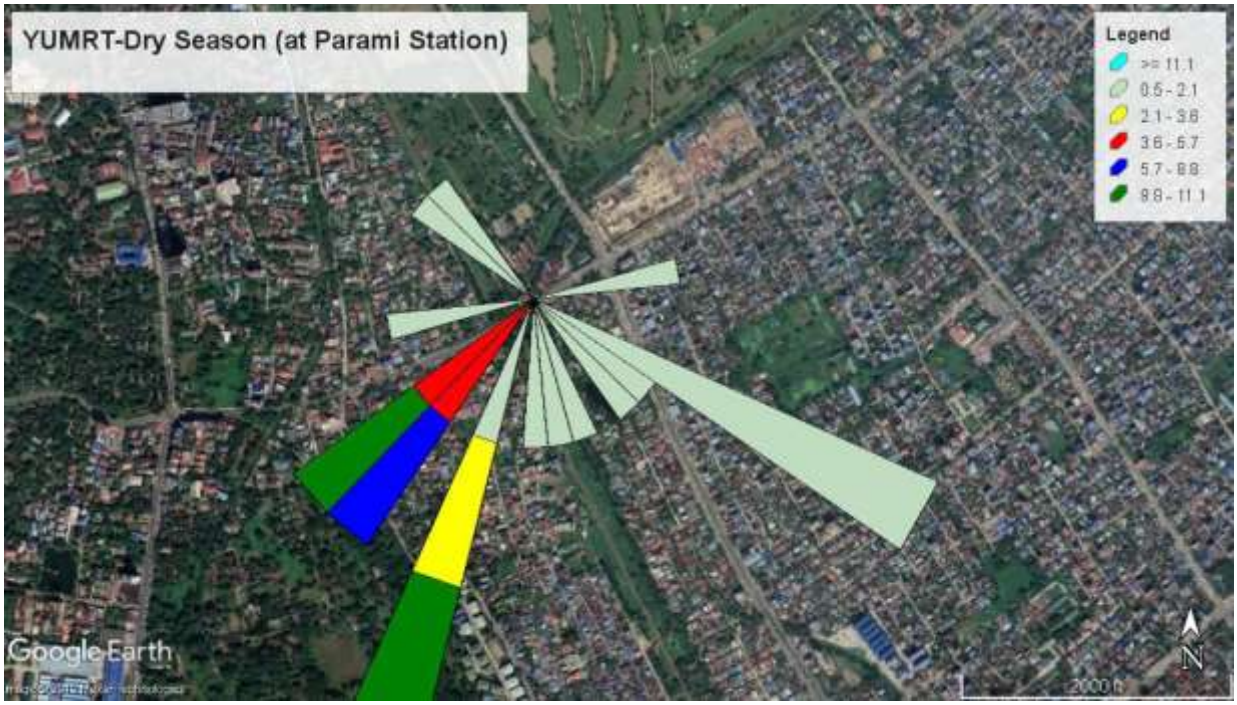


Dry Season

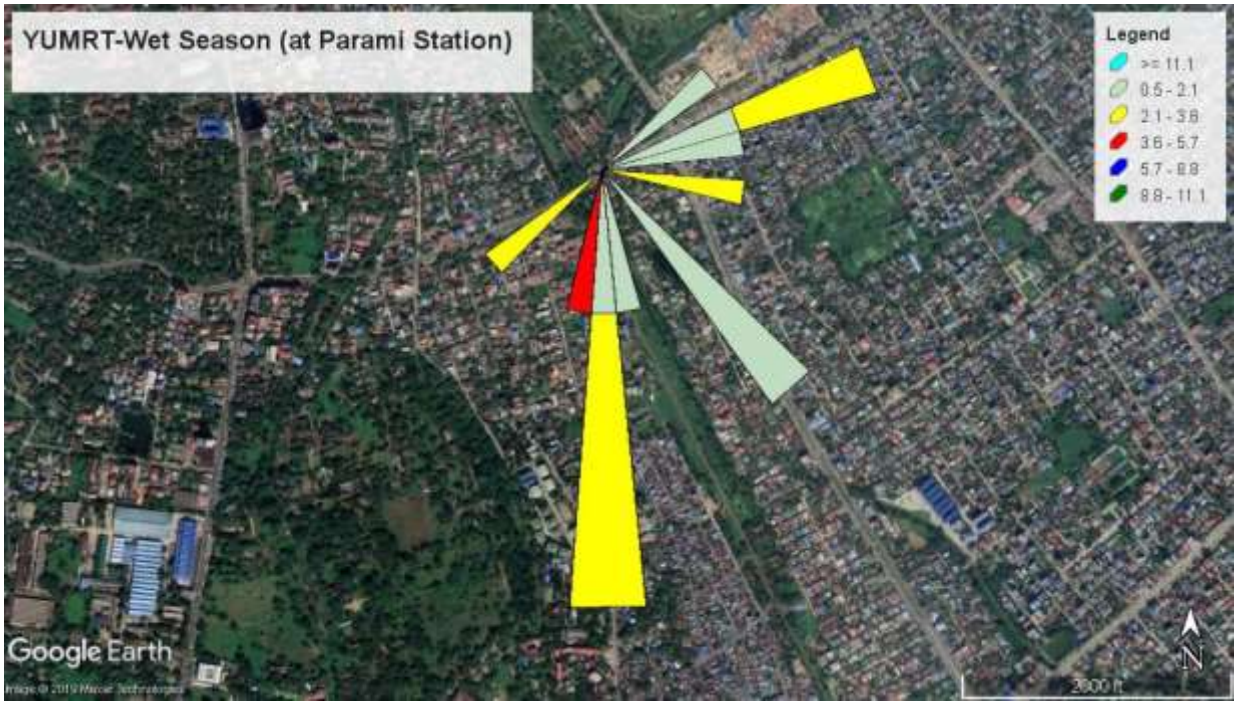


Wet Season

Figure 5. 29 Wind Speed and Direction at A-13



Dry Season



Wet Season

Figure 5. 30 Wind Speed and Direction at A-14

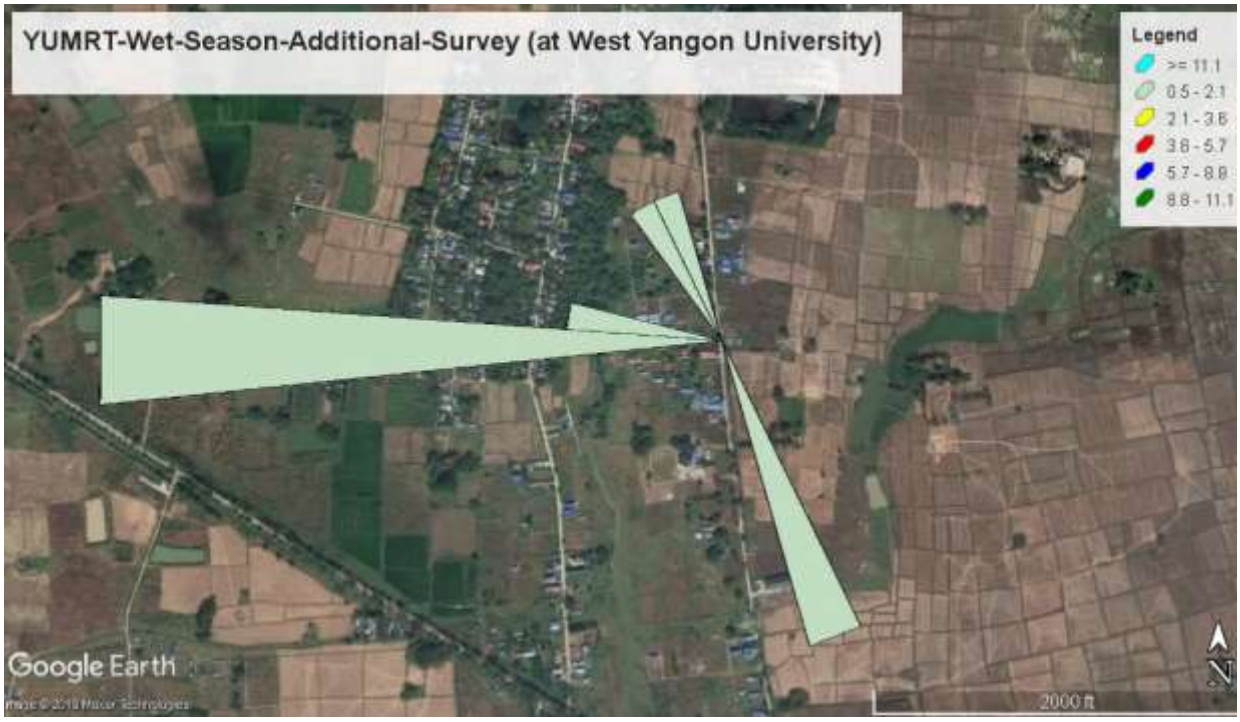


Figure 5. 31 Wind Speed and Direction at A-15

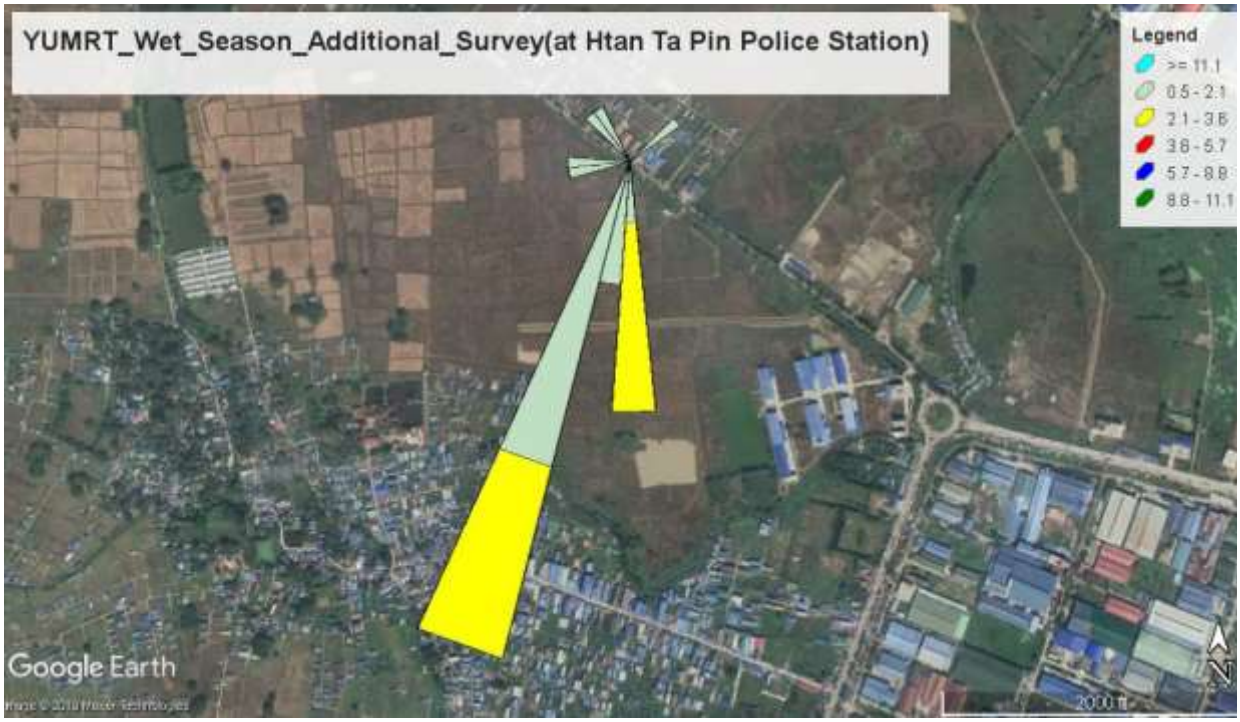


Figure 5. 32 Wind Speed and Direction at A-16

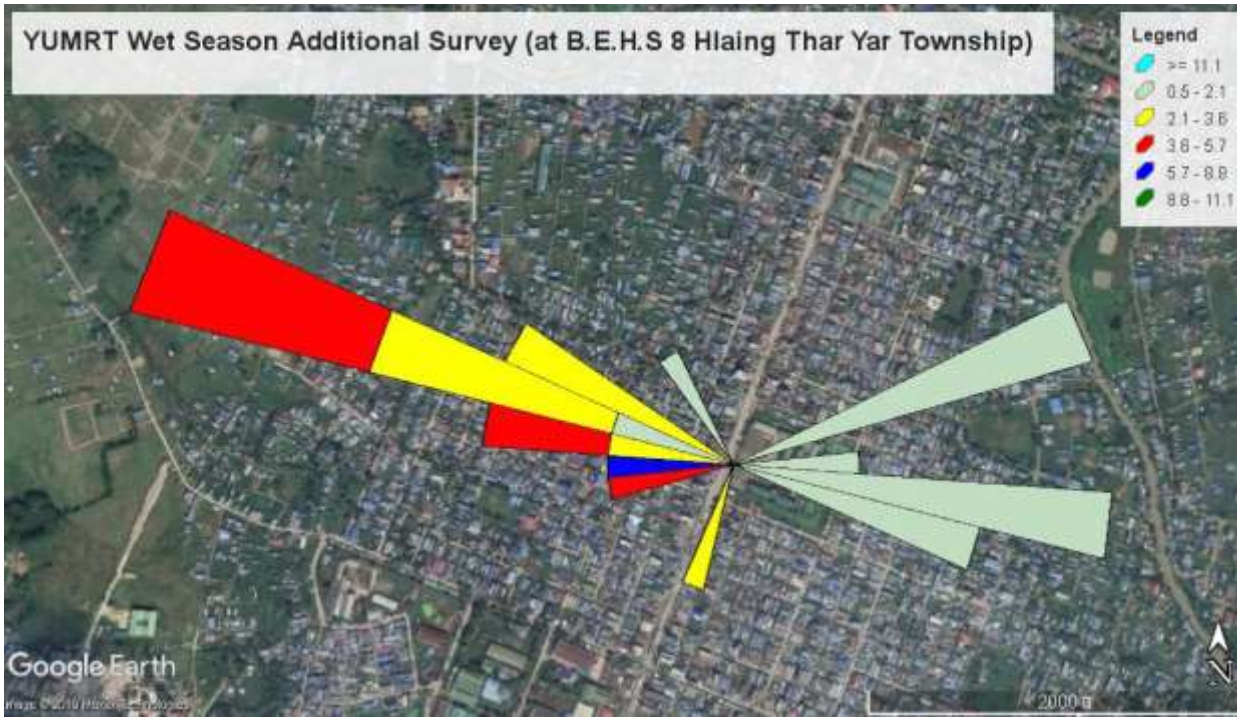
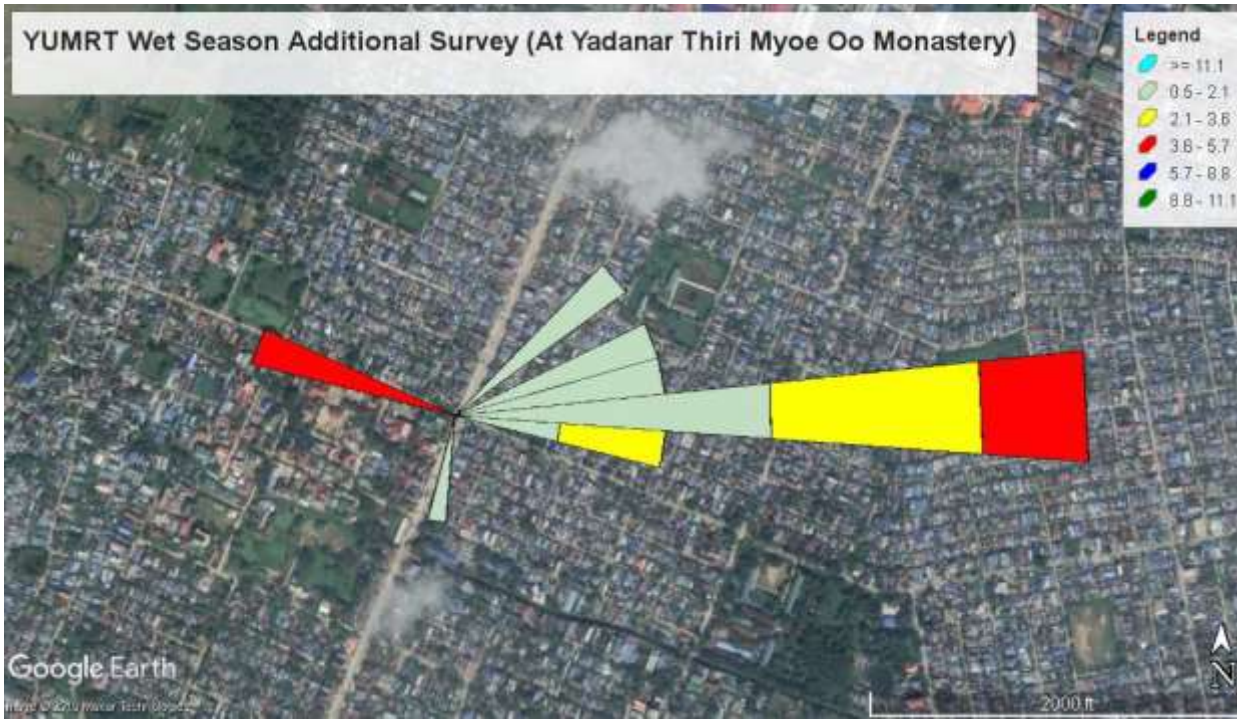


Figure 5. 33 Wind Speed and Direction at A-17



Source: E Guard Study Team

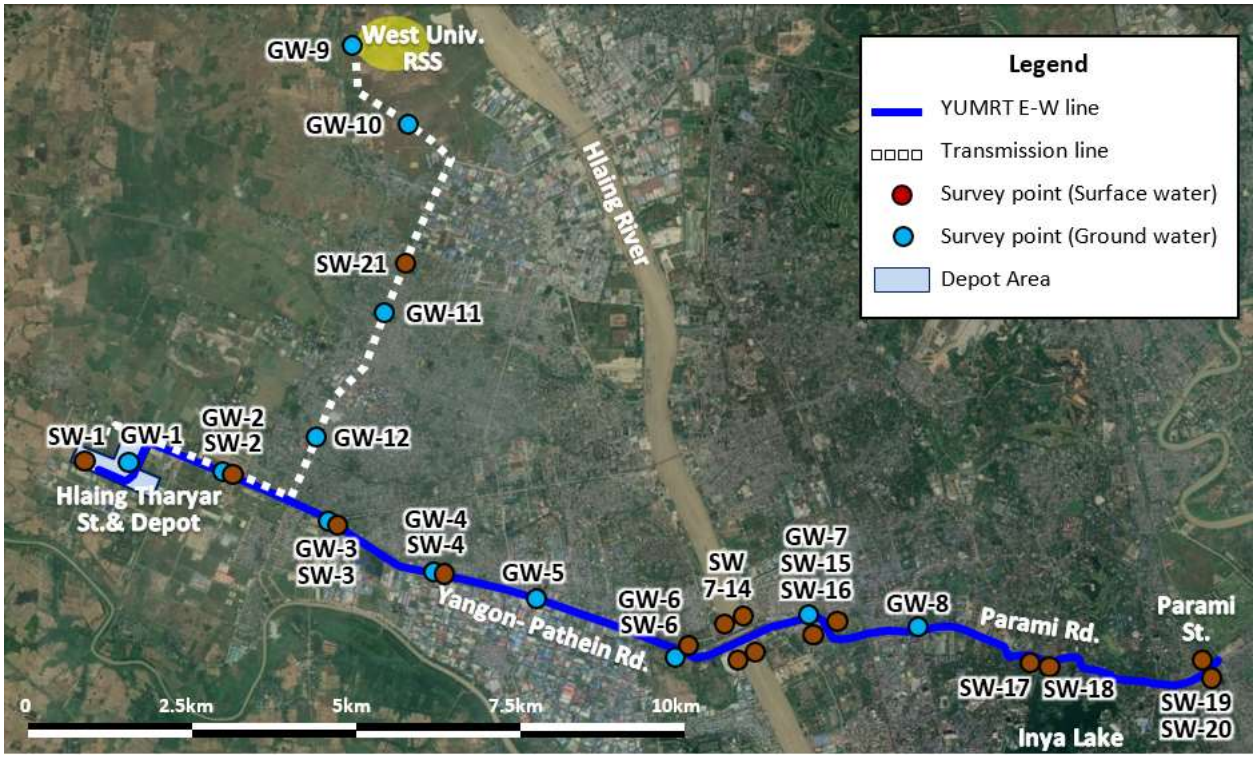
Figure 5. 34 Wind Speed and Direction at A-18

5.3.3 Water Quality

Water Quality is measured by sampling the water from lakes and streams including Hlaing River along the alignment. A total of thirty three points including twelve ground water points

and twenty one surface water points are considered to be sampled the water quality measurements. In which, eight ground water samples and twenty surface water samples were collected in both dry season and wet season and the other five samples were only conducted as additional survey in wet season. The wet season and dry season water quality samplings have been conducted on October, 2018 and on March, 2019 and the additional water quality samplings along the proposed route of transmission line have been implemented on August, 2019 respectively.

One gallon of water from each location was sampled at each point. A clean bucket of approximately 10L capacity was used to collect the water sample. The bottle was dipped into the river, firmly held and plunged downwards to a depth of approximately 0.5m. Samples were then transferred to the laboratory (i.e. SGS Limited, ISO Tech Laboratory, Supreme and Occupational, and Environmental Health Laboratory and United Analysts and Engineering Consultants Co., Ltd (UAE)). Their physicochemical data on acidity (pH) , Iron, Suspended solids, Dissolved solids, Temperature, Lead (Pb), Arsenic (As), Chlorine, Ammonia (NH_3), COD, BOD, Zinc (Zn), Copper (Si), Mercury, Selenium, Oil and Grease, Cadmium, Chromium, Aluminum, Nickel content were assessed in the laboratory by standard procedures. The location of water quality sampling, equipment and parameters used are shown in the figure 5.35 and tables below.



Source: JICA Study Team

Figure 5. 35 Locations of Water Quality Measurement

Table 5. 26 Locations of Water Quality Sampling (Ground Water)

Point	Location	Location		Date of Sampling		Items Analyzed
		Latitude	Longitude	Dry Season	Wet Season	
GW-1	Hlaing Tharyar St.	16°52'44.91"N	96° 0'37.50"E	21.3.2019	10.10.2018	pH, Total Dissolved Solids (TDS), Arsenic (AS), Iron (Fe), Manganese (Mn), Chloride
GW-2	Dagon-Ayar Bus St.	16°52'47.54"N (dry season) 16°52'47.12"N (wet season)	96° 1'22.66"E (dry season) 96° 1'27.09"E (wet season)	21.3.2019	10.10.2018	
GW-3	INTXN Point of BOC and Twan Tay	16°52'18.52"N	96° 2'22.24"E	21.3.2019	10.10.2018	
GW-4	Mee Khwat Market	16°51'50.27"N	96° 3'14.93"E	21.3.2019	10.10.2018	
GW-5	Na Wa Day INTXN point (Na WA Day Housing)	16°51'45.76"N	96° 4'11.75"E	21.3.2019	11.10.2018	
GW-6	FMI	16°51'17.17"N	96° 5'21.39"E	21.3.2019	11.10.2018	
GW-7	Ba Yin Naung Pwel Yoan (Thiri Mon P Lar Zar) (Yan Kin Monstary)	16°51'34.09"N	96° 6'25.97"E	21.3.2019	11.10.2018	
GW-8	INTXN of Pyay Rd. and Inn Sein Rd.	16°51'27.17"N	96° 7'21.59"E	26.3.2019	11.10.2018	
GW-9	West Yangon University	16°56'19.54"N	96° 2'26.32"E	8.8.2019		
GW-10	Htan tapin Police Outpost	16°55'34.36"N	96° 2'58.09"E	8.8.2019		
GW-11	B.E.H.S No. (8), Hlaing Tharyar Township	16°54'0.14"N	96° 2'49.74"E	8.8.2019		
GW-12	Yadanar Thiri Myoe Oo Monastery	16°52'56.28"N	96° 2'9.01"E	8.8.2019		

Table 5. 27 Location of Water Quality Sampling (Surface Water)

Point	Location	Location		Date of Sampling		Items Analyzed
		Latitude	Longitude	Dry Season	Wet Season	
SW-1	Hlaing Tharyar St.	16°52'45.13"N	96° 0'13.96"E	21.3.2019	10.10.2018	Water, pH, Turbidity, Total organic carbon, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Total Nitrogen (T-N), Total Phosphorous (T-P), Oil and Grease, Total Suspended Solids (TSS), Dissolved Oxygen (DO), Total Coliform Count
SW-2	Dagon-Ayar Bus St.	16°52'44.31"N	96° 1'22.91"E	21.3.2019	10.10.2018	
SW-3	INTXN point of BOC and Twan Tay	16°52'16.45"N	96° 2'22.06"E	21.3.2019	10.10.2018	
SW-4	Mee Khwat Market	16°51'54.26"N	96° 3'10.96"E	21.3.2019	10.10.2018	
SW-5	Na Wa Day INTXN point (Na Wa Day Housing)	16°51'42.71"N	96° 4'8.38"E	21.3.2019	10.10.2018	
SW-6	FMI	16°51'16.35"N	96° 5'21.07"E	21.3.2019	11.10.2018	
SW-7	Under Ba Yint Naung Bridge (Upstream, West, Surface)	16°51'28.37"N	96° 5'45.08"E	26.3.2019	11.10.2018	
SW-8	Under Ba Yint Naung Bridge (Upstream, West, Deep)	16°51'28.50"N	96° 5'45.26"E	26.3.2019	11.10.2018	
SW-9	Under Ba Yint Naung Bridge (Upstream, East, Surface)	16°51'32.24"N	96° 5'52.31"E	26.3.2019	11.10.2018	
SW-10	Under Ba Yint Naung Bridge (Upstream, East, Deep)	16°51'32.74"N	96° 5'52.61"E	26.3.2019	11.10.2018	
SW-11	Under Ba Yint Naung Bridge (Downstream, West, Surface)	16°51'13.82"N	96° 5'52.49"E	26.3.2019	11.10.2018	
SW-12	Under Ba Yint Naung Bridge (Downstream, West, Deep)	16°51'13.34"N	96° 5'52.47"E	26.3.2019	11.10.2018	
SW-13	Under Ba Yint Naung Bridge (Downstream, East, Surface)	16°51'16.92"N	96° 5'59.50"E	26.3.2019	11.10.2018	
SW-14	Under Ba Yint Naung Bridge (Downstream, East, Deep)	16°51'15.90"N	96° 5'59.95"E	26.3.2019	11.10.2018	
SW-15	Hlaing Creek (Downstream)	16°51'25.59"N	96° 6'29.59"E	26.3.2019	11.10.2018	
SW-16	Hlaing Creek (Upstream)	16°51'30.90"N	96° 6'39.60"E	26.3.2019	11.10.2018	
SW-17	Inya Lay Lake	16°51'12.86"N	96° 8'20.66"E	26.3.2019	11.10.2018	
SW-18	Inya Lake	16°51'9.91"N	96° 8'27.08"E	26.3.2019	11.10.2018	

Point	Location	Location		Date of Sampling		Items Analyzed
		Latitude	Longitude	Dry Season	Wet Season	
SW-19	Parami St. (Upstream)	16°51'9.90"N	96° 9'54.54"E	26.3.2019	11.10.2018	
SW-20	Parami St. (Downstream)	16°51'7.56"N	96° 9'54.21"E	26.3.2019	11.10.2018	
SW-21	Shwe Lin Ban Creek, Downstream	16°54'25.67"N	96° 2'56.74"E	8.8.2019		

Table 5. 28 Instruments Used for In-situ Water Quality Measurement

Name and Model of Instrument Used	Measurement Items	Image
Horiba U-50	Temperature, pH, DO, EC, TDS and Salinity, Turbidity, water depth, oxidation, reduction potential (ORP)	

Photograph 5. 3 Ground Water Quality Sampling at Wet Season



GW-1



GW-2



GW-3



GW-4

	
GW-5	GW-6
	
GW-7	GW-8

Photograph 5. 4 Surface Water Quality Sampling at Wet Season

	
SW-1	SW_2

	
SW-3	SW-4
	
SW-5	SW-6
	
SW-7	SW-8

	
SW-9	SW-10
	
SW-11	SW-12
	
SW-13	SW-14

	
SW-15	SW-16
	
SW-17	SW-18
	
SW-19	SW-20

Photograph 5. 5 Ground Water Quality Sampling at Dry Season



GW-1



GW-2



GW-3



GW-4



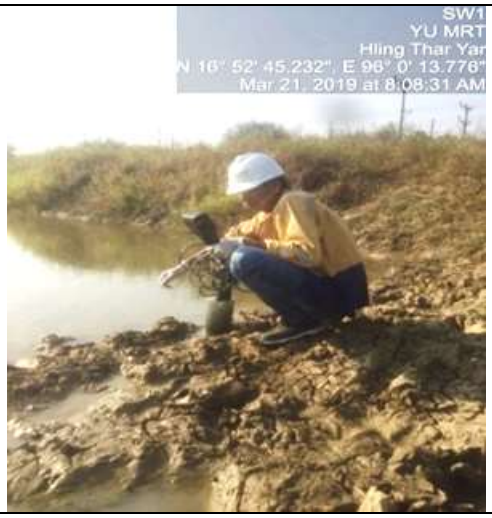
GW-5



GW-6

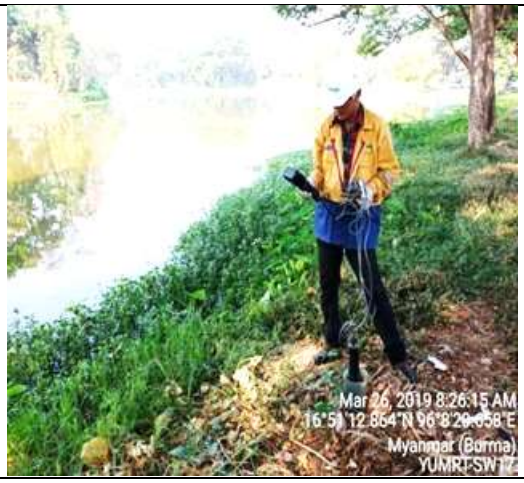
	
GW-7	GW-8

Photograph 5. 6 Surface Water Quality Sampling at Dry Season

	
SW-1	SW-2
	
SW-3	SW-4

	
SW-5	SW-6
	
SW-7	SW-8
	
SW-9	SW-10

	
SW-11	SW-12
	
SW-13	SW-14
	
SW-15	SW-16

	
SW-17	SW-18
	
SW-19	SW-20

Photograph 5. 7 Ground Water Quality Sampling along Proposed Route of Transmission Line

	
GW-9	GW-10

	
GW-11	GW-12

Photograph 5. 8 Surface Water Quality Sampling along Proposed Route of Transmission Line



SW-21

Table 5. 29 Result of Water Quality Measurements and Analyses (Surface Water)

Parameter	Season	Location										NEQG Value	Unit	Name of Lab
		SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10			
Temperature	Dry	29.1	30.3	27.5	29.3	29.3	29.5	30.4	31.0	30.8	30.6	-	°C	Onsite
	Wet	30.6	30.4	28.4	28.3	28.3	30.7	29.2	29.7	29.1	29.1			
pH	Dry	7.3	7.4	7.1	7.3	6.8	7.1	7.8	7.8	7.8	7.7	6.0-9.0		ISO
	Wet	7.1	6.9	6.8	7.1	7.2	7.8	7.6	7.5	7.4	7.3			
Turbidity	Dry	268	66	198	130	212	220	2200	2000	3400	3200	-	NTU	ISO
	Wet	46	29	22	68	55	89	122	136	144	140			
Total Organic Carbon (TOC)	Dry	14.00	11.94	26.60	39.82	42.33	33.74	3.67	3.29	3.27	3.32	-	mg/L	UAE
	Wet	5.10	4.05	11.95	4.98	8.93	6.02	4.60	2.71	5.24	4.85			
Biological Oxygen Demand (BOD)	Dry	**31**	30	**92**	**44**	**54**	**31**	20	25	12	**58**	30	mg/L	SGS
	Wet	5	6	5	12	13	8	15	7	14	11			
Chemical Oxygen Demand (COD)	Dry	57	58	167	175	236	**264**	95	164	188	152	250	mg/L	SGS
	Wet	26	28	40	69	68	20	25	12	19	21			
Total Nitrogen (T-N)	Dry	1.12	<1	14.00	**29.68**	**35.28**	<1	2.24	3.36	2.80	3.36	15	mg/L	SGS
	Wet	<1	<1	1.82	1.96	3.36	<1	5.60	6.16	6.16	7.00			
Total Phosphorous (T-P)	Dry	0.05	0.03	0.78	0.02	1.37	<0.01	0.29	0.96	0.58	0.46	5	mg/L	SGS
	Wet	0.05	0.03	1.07	1.49	1.21	0.10	0.63	0.15	0.57	0.75			
Oil and Grease	Dry	<5	7.9	<5	<5	5.8	<5	<5	<5	<5	<5	10	mg/L	SGS
	Wet	<5	<5	<5	<5	5.52	<5	<5	<5	<5	<5			
Total Suspended Solid (TSS)	Dry	<20	<20	**159**	**55**	**54**	**40**	**1,127**	**2,599**	**2,880**	**2,812**	25	mg/L	SGS
	Wet	**26**	23	**34**	21	24	15	**328**	**376**	**393**	**555**			
Dissolved Oxygen (DO)	Dry	3.6	4	Nil	Nil	Nil	Nil	5.8	6.2	5.6	5.6	-	mg/L	Supreme
	Wet	5.2	4.7	3.3	3.1	3	4.3	4.4	4	4.4	3.7			
Total Coliform Count	Dry	12	10	100	80	60	60	90	3	110	100	-	CFU/ 100ml	ISO
	Wet	5	4	6	20	12	10	14	16	12	14			
Water Level	Dry	2.5	2.5	2.0	2.0	1.0	0.8	23	23	23	23	-	m	Onsite
	Wet	3.0	3.0	3.0	4.5	2.5	1.5	40	40	40	42			

Parameter	Season	Location										NEQG Value	Unit	Name of Lab
		SW-11	SW-12	SW-13	SW-14	SW-15	SW-16	SW-17	SW-18	SW-19	SW-20	SW-21			
Temperature	Dry	29.8	30.3	31.2	30.0	28.4	28.8	29.2	28.8	27.5	27.5	-	-	ºC	Onsite
	Wet	29.9	29.8	29.9	29.9	27.5	26.4	26.0	29.9	27.0	26.0				
pH	Dry	7.7	7.7	7.8	7.8	7.6	7.4	7.1	7.1	7.1	6.9	6.9	6.0-9.0		ISO
	Wet	7.4	7.3	7.1	7.1	7.2	7.1	6.9	7	7.1	6.2				
Turbidity	Dry	2,000	2,800	3,600	3,400	110	128	290	142	1,300	400	146	-	NTU	ISO
	Wet	130	133	122	189	66	155	50	58	128	88				
Total Organic Carbon (TOC)	Dry	3.31	3.47	2.66	2.79	14.76	7.56	22.36	7.00	10.07	10.82	-	-	mg/L	
	Wet	2.68	4.08	3.29	2.51	3.96	4.37	4.23	2.28	3.44	2.07				
Biological Oxygen Demand (BOD)	Dry	**59**	**90**	**37**	**55**	**39**	9	9	9	5	9	<2	30	mg/L	SGS
	Wet	<2	<2	<2	<2	<2	<2	13	5	12	12				
Chemical Oxygen Demand (COD)	Dry	124	194	118	120	80	110	103	83	51	32	21.5	250	mg/L	SGS
	Wet	<10	<10	<10	<10	17	13	24	<10	18	21				
Total Nitrogen (T-N)	Dry	1.68	3.36	2.80	3.36	11.20	12.88	4.48	3.36	5.60	6.16	2.52	15	mg/L	SGS
	Wet	<1	<1	<1	<1	5.04	5.32	1.40	<1	3.92	3.36				
Total Phosphorous (T-P)	Dry	0.39	0.30	0.81	0.21	1.14	1.27	0.47	0.28	1.00	0.84	0.684	5	mg/L	SGS
	Wet	0.19	0.15	0.07	0.01	0.58	0.64	0.12	0.09	0.41	0.37				
Oil and Grease	Dry	<5	7.5	7.6	7.7	<5	6.19	<5	<5	<5	<5	<5	10	mg/L	SGS
	Wet	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5				
Total Suspended Solid (TSS)	Dry	**866**	**1,632**	**2,192**	**2,727**	22	**28**	**52**	15	**157**	**91**	24.50	25	mg/L	SGS
	Wet	**417**	**655**	**514**	**616**	**141**	**71**	**62**	20	**165**	**135**				
Dissolved Oxygen (DO)	Dry	6	5.8	6	5.6	2	3	1.6	2.2	0.6	0.6	-	-	mg/L	Supreme
	Wet	4.8	4.7	4.6	4.7	3	3	2.4	3.3	2.7	2.8				
Total Coliform Count	Dry	80	60	120	110	30	40	100	90	80	50	30	-	CFU/ 100ml	ISO
	Wet	16	12	20	20	10	14	18	20	20	16				
Water Level	Dry	23	23	23	23	1.0	1.5	1.5	2.0	2.0	2.0	-	-	m	Onsite
	Wet	38	38	38	38	1.5	1.8	2.0	2.6	3.4	3.1				

Table 5. 30 Result of Water Quality Measurements and Analyses (Ground Water)

Parameter	Season	Location												National Drinking Water Quality Standards	Unit	Name of Lab
		GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW 9	GW 10	GW 11	GW 12			
pH	Dry	7.2	6.8	6.7	6.5	6.9	6.5	6.6	**6.2**	7.1	6.5	6.7	6.9	6.5-8.5		ISO
	Wet	7.1	7.2	6.7	6.6	6.7	**6.2**	**6.4**	**6.4**							
Total Dissolved Solids (TDS)	Dry	**5,048**	**2,681**	**2,759**	**2,742**	357	347	819	38	614	91	**2,708**	100	1000	mg/l	SGS
	Wet	**4,567**	**2,706**	**2,731**	**2,922**	320	340	390	88							
Arsenic (As)	Dry	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.01	0.05	mg/l	
	Wet	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil							
Iron (Fe)	Dry	0.21	**50.17**	0.38	0.58	0.34	0.16	0.29	0.03	0.27	**7.31**	<0.01	<0.01	1	mg/l	SGS
	Wet	0.44	**9.59**	0.41	**1.07**	0.21	0.06	<0.01	<0.01							
Manganese (Mn)	Dry	**2.2**	**5.8**	**2.3**	**3.0**	**1.2**	**2.3**	**1.9**	-	0.04	**1.0**	0.01	**1.2**	0.4	mg/l	Supreme
	Wet	**0.6**	**2.5**	**2.5**	**1.1**	**0.7**	**1.8**	**1.3**	**0.9**							
Chloride	Dry	**2,591**	**1,425**	**1,453**	**1,578**	106	135	**337**	13	243	9	**1,393**	3.50	250	mg/l	SGS
	Wet	**2,028**	**1,176**	**1,319**	**1,365**	117	145	181	28							

For surface water quality measurement, in comparing against the NEQ (Emission) Guideline Values, values of BOD, COD, Total Nitrogen and TSS at some points are found to be higher than the Guidelines. Concentrations of BOD at points from dry season (SW-1, SW-3 to SW-6 and SW-10 to SW-15) exceed the guideline values. Measured values of total nitrogen at point SW-4 and SW-5 (dry season) shows the excess concentration over the guideline values. In Chemical Oxygen Demand concentration values, only point SW-6 at dry season slightly exceeds the guideline values. And total suspended solid concentration obtained from almost all the sample points (except from SW-1, SW-2, SW-15and SW-18 in dry season and Point SW-2, SW-4,SW-5,SW-6 and SW-18 in wet season) are much higher than the guideline values. Especially it was detected with extremely high concentration at survey points in Hlaing River. The highest one was over 115 times of the standard one.

Regarding Ground Water, the sampling result was compared against National Drinking Water Quality Standards specified by Ministry of Health Myanmar. According to the laboratory results, concentrations of total dissolved solids (TDS) at points from GW-1 to GW-4 for both seasons and at point of G-11 were extremely higher than the standard value of 1,000 mg/l. It was also found that all concentrations of manganese except point GW-8 of dry season, GW-9 and Gw-11, and concentration of chloride at points from GW-1 to GW-4, GW-7 in dry season and GW-11 in wet season were above the standard values. The standard value for manganese is 0.5 mg/l and for chloride, which is 250mg/l. Both of these values are specified in the Heath based WHO Guideline Values. At the point of GW-2 and GW-10, iron concentration was much higher than the specified value. Documents showing the water quality tests and results are shown in Appendix 3 and 4.

5.3.4 Noise and vibration

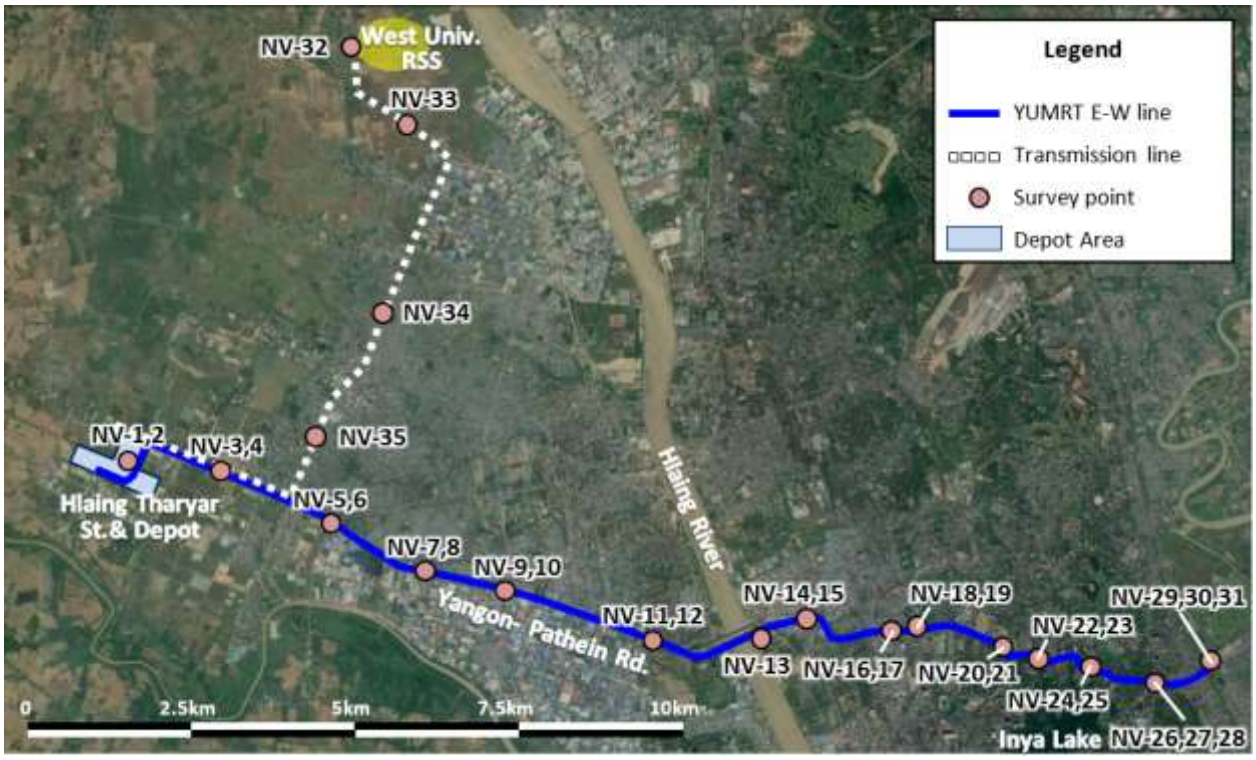


Figure 5. 36 Location of Noise Level and Vibration Level Measurement

Noise and Vibration levels were measured at points along the proposed YUMRT alignment and along the proposed route of transmission line. There were a total of thirty five noise and vibration points. Seventeen of which (NV-1, NV-3,NV-5, NV-7, NV-9, NV-11, NV-13, NV-14, NV-16, NV-18, NV-20, NV-22, NV-24, NV-26, NV-27, NV-29, NV-30, NV-31, NV-32, NV-33, NV-34 and NV-35) are measured along the alignment and the route as source points and the rests (NV-2, NV-4, NV-6,NV-8,NV-10, NV-12, NV-15,NV-17,NV-19,NV-21, NV-23, NV-25, NV-28 and NV-31) are measured as receptor points which are within 50m from the alignment. All these measurements are conducted in five townships (Hlaing Tharyar, Hlaing, Mayangone, Yankin, and South Okkalapa) from March to August, 2019. The above figure 5.36 shows the location of noise and vibration level measurement.

Photograph 5. 9 Noise and Vibration Measurement

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>NV-1</td><td>NV-2</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>NV-3</td><td>NV-4</td></tr>
</table>

	
NV-5	NV-6
	
NV-7	NV-8
	
NV-9	NV-10
	

NV-11	NV-12
	
NV-13	NV-14
	
NV-15	NV-16
	
NV-17	NV-18

	
NV-19	NV-20
	
NV-21	NV-22
	
NV-23	NV-24

	
NV-25	NV-26
	
NV-27	NV-28
	
NV-29	NV-30



NV-31



NV-32



NV-33



NV-34



NV-35

The environmental noise quality was recorded using Digital Sound Level Meter. Measurement range of the noise measuring unit is 20-130 dBA. The environmental noise quality was recorded at every 1 minute for 24 hours. The equipment used for noise level measurement is shown in Table 5.24 and hourly averaged noise levels are shown and compared with NEQ guidelines of Myanmar in Table 5.25 below in energy weighted values in day and night time average.

Table 5. 31 Instruments Used for Noise Level Measurement

Name and Model of Instrument Used	Measurement Items	Image
Digital Sound Level Meter	Noise	

Table 5. 32 Results of Noise Level Measurement

Point	Date	Location (A: Along the alignment, B:Backside)		Upper: Latitude Lower: Longitude	Period	LAeq (dB)	NEQG Value (dB)
NV-1	18.3.2019	Hlaing Tharyar St.	A	16°52'44.20"N	Day	50.6	70 (Day/Night)
				96°0'37.97"E	Night	52.9	
NV-2	18.3.2019	Hlaing Tharyar St.	B	16°52'45.02"N	Day	67.9	
				96°0'39.80"E	Night	57.4	
NV-3	19.3.2019	Dagon-Ayar Bus St.	A	16°52'42.16"N	Day	**76.9**	
				96°1'22.54"E	Night	**74.5**	
NV-4	19.3.2019	Dagon-Ayar Bus St.	B	16°52'40.22"N	Day	**86.3**	
				96°1'21.51"E	Night	64.9	
NV-5	20.3.2019	INTXN point of BOC and Twan Tay	A	16°52'16.40"N	Day	**70.2**	
				96°2'22.27"E	Night	**73.6**	
NV-6	20.3.2019	INTXN point of BOC and Twan Tay	B	16°52'14.86"N	Day	66.3	
				96°2'21.39"E	Night	48.1	
NV-7	21.3.2019	Mee Khwat Market	A	16°51'53.44"N	Day	**73.3**	
				96°3'7.67"E	Night	**71.9**	
NV-8	21.3.2019	Mee Khwat Market	B	16°51'54.41"N	Day	64.6	
				96°3'7.67"E	Night	65.5	
NV-9	22.3.2019	Na Wa Day INTXN point (Na Wa Day Housing)	A	16°51'43.99"N	Day	**71.4**	
				96°3'51.73"E	Night	**72.7**	
NV-10	22.3.2019	Na Wa Day INTXN point (Na Wa Day Housing)	B	16°51'43.08"N	Day	**73.6**	
				96°3'51.30"E	Night	61.8	
NV-11	23.3.2019	FMI	A	16°51'20.87"N	Day	**71.4**	
				96°5'8.25"E	Night	**74.6**	
NV-12	23.3.2019	FMI	B	16°51'22.06"N	Day	62.7	
				96°5'8.88"E	Night	65.3	
NV-13	24.3.2019	Under Ba Yint Naung Bridge	B	16°51'22.78"N	Day	59.9	
				96°6'0.63"E	Night	59.1	
NV-14	25.3.2019	Ba Yint Naung Pwel Yoan (Thiri Mon Pa Lar Zar)	A	16°51'31.64"N	Day	**73.0**	
				96°6'22.17"E	Night	**75.2**	
NV-15	25.3.2019	Ba Yint Naung Pwel Yoan (Thiri Mon Pa Lar Zar)	B	16°51'29.57"N	Day	66.2	
				96°6'22.84"E	Night	56.8	
NV-16	26.3.2019	INTXN of Parami Rd. and East 50' Rd.	A	16°51'26.73"N	Day	**82.8**	
				96°7'11.08"E	Night	**75.8**	
NV-17	26.3.2019	INTXN of Parami Rd. and East 50' Rd.	B	16°51'25.11"N	Day	**77.8**	
				96°7'11.38"E	Night	60.9	
NV-18	28.3.2019	INTXN of Parami Rd. and Inn Sein Rd.	A	16°51'27.62"N	Day	**80.1**	
				96°7'24.29"E	Night	**72.3**	
NV-19	28.3.2019	INTXN of Parami Rd. and Inn Sein Rd.	B	16°51'27.94"N	Day	61.9	70 (Day/Night)
				96°7'23.48"E	Night	69.2	
NV-20	2.4.2019	IT University	A	16°51'19.20"N	Day	**71.2**	
				96°8'7.62"E	Night	**70.3**	
NV-21	2.4.2019	IT University	B	16°51'17.80"N	Day	58.5	
				96°8'7.03"E	Night	57.6	
NV-22	29.3.2019	INTXN of Pyay Rd. and	A	16°51'12.86"N	Day	**78.3**	

Point	Date	Location (A: Along the alignment, B:Backside)		Upper: Latitude Lower: Longitude	Period	LAeq (dB)	NEQG Value (dB)
		Parami Rd.		96°8'25.89"E	Night	**75.5**	
NV-23	29.3.2019	INTXN of Pyay Rd. and Parami Rd.	B	16°51'14.34"N	Day	**73.2**	
				96°8'26.88"E	Night	**73.8**	
NV-24	30.3.2019	Inya Lake North-East St.	A	16°51'6.97"N	Day	**81.5**	
				96°8'58.42"E	Night	**83.2**	
NV-25	30.3.2019	Inya Lake North-East St.	B	16°51'5.24"N	Day	59.3	
				96°8'57.20"E	Night	58.5	
NV-26	24.3.2019	Parami General Hospital	A	16°50'59.68"N	Day	66.3	
				96°9'23.47"E	Night	67.2	
NV-27	31.3.2019	INTXN of Parami Road and Ka Bar Aye Rd.	A	16°51'0.25"N	Day	**76.3**	
				96°9'29.01"E	Night	**73.5**	
NV-28	31.3.2019	INTXN of Parami Road and Ka Bar Aye Rd.	B	16°50'58.13"N	Day	57.2	
				96°9'29.13"E	Night	58.4	
NV-29	3.4.2019	In front of Kinder garden (Rainbow Pre-school)	A	16°51'5.98"N	Day	66.6	
				96°9'49.35"E	Night	63.2	
NV-30	10.5.2019	Parami St.	B	16°51'9.40"N	Day	61.4	
				96°9'55.09"E	Night	60.8	
NV-31	10.5.2019	Parami St.	B	16°51'10.04"N	Day	61.1	
				96°9'54.54"E	Night	61.4	
NV-32	14.8.2019	West Yangon University	A	16°56'20.15"N	Day	65.7	
				96° 2'27.62"E	Night	63.9	
NV-33	15.8.2019	Htan tapin Police Outpost	A	16°55'35.49"N	Day	**76.5**	
				96° 2'57.94"E	Night	**72.4**	
NV-34	16.8.2019	B.E.H.S No. (8), Hlaing Tharyar Township	A	16°53'59.89"N	Day	**74.7**	
				96° 2'46.10"E	Night	68.6	
NV-35	17.8.2019	Yadanar Thiri Myoe Oo Monastery	A	16°52'56.86"N	Day	**79.4**	
				96° 2'10.26"E	Night	**76.3**	

*Measurement values that exceed the NEQ Guideline values are shown in a red word.
Source: E Guard Study Team

According to the measured results, both day time and night time noise levels at all road side (Type: A) points except NV-1, NV-26, NV-29 and N-32 exceeded the National Environmental Quality (Emission) Guideline values for industrial areas which is specified as 70 dB at day time and 70 dB at night time. Especially along Parami Rd., the value at some point exceeded 80dB in day time, which is with annoying and interferes with conversation. Regarding Back side point (Type: B), it can be seen that average noise level values are below the guideline values in both daytime and night-time except day time at NV-4, NV-10, NV-17 and all day time at NV-23. In case of NV-23, it was affected by traffic noise because of the location along Pyay Rd.

As for vibration, measurements were done with Vibration Level Meter VM-55 which is designed to meet the measurement requirements of audio engineers, audio installers, health prevention in various environments and all other vibration measurement applications. Measurement includes data analysis and test services to minimize environmental impacts. The analysis describes the existing vibration environment in the project area and identifies the potential for significant impacts. The results of vibration studies are shown in table below. As the Environmental Quality Emission Guidelines (NEQG) Myanmar does not specify the standard for vibration, the vibration standards for Japan developed by Ministry of Environmental was referred as regulatory standards for this study.

Table 5. 33 Instruments Used for Vibration Level Measurement

Name and Model of Instrument Used	Measurement Items	Image
Vibration Level Meter VM-55	Vibration	

Table 5. 34 Regulatory Standards for Vibration Emitted from Ministry of Environment Government of Japan

Time Area	Day Time	Night Time	Applicable Areas
I	65 dB	60 dB	Areas where maintenance of quiet is particularly needed to preserve a good living environment and where quiet is called for as they are used for residential purposes.
II	70 dB	65 dB	Areas used for commercial and industrial as well as residential purposes where there is a need to preserve the living environment of local inhabitants and areas mainly serving industrial purposes which are in need of measures to prevent the living environment of local residents from deteriorating.

Table 5. 35 Comparison of Vibration Monitoring Results and Regulatory Standards

Point	Date	Location (A: Along the alignment) (B: Backside)		Period	Vibration Level Lv	Standard MOE Japan (dB)
NV-1	18.3.2019	Hlaing Tharyar St.	A	Day	25.29	Day:70 Night:65
				Night	25.70	
NV-2	18.3.2019	Hlaing Tharyar St.	B	Day	30.67	
				Night	44.18	
NV-3	19.3.2019	Dagon-Ayar Bus St.	A	Day	28.78	
				Night	30.43	
NV-4	19.3.2019	Dagon-Ayar Bus St.	B	Day	24.57	
				Night	28.11	
NV-5	20.3.2019	INTXN point of BOC and Twan Tay	A	Day	51.12	
				Night	37.38	
NV-6	20.3.2019	INTXN point of BOC and Twan Tay	B	Day	27.34	
				Night	25.05	
NV-7	21.3.2019	Mee Khwat Market	A	Day	51.75	
				Night	49.69	
NV-8	21.3.2019	Mee Khwat Market	B	Day	37.87	
				Night	28.89	
NV-9	22.3.2019	Na Wa Day INTXN point (Na Wa Day Housing)	A	Day	45.37	Day:70 Night:65
				Night	40.72	
NV-10	22.3.2019	Na Wa Day INTXN point (Na Wa Day Housing)	B	Day	25.13	
				Night	29.64	
NV-11	23.3.2019	FMI	A	Day	43.20	
				Night	41.86	
NV-12	23.3.2019	FMI	B	Day	29.06	
				Night	38.4	
NV-13	24.3.2019	Under Ba Yint Naung Bridge	B	Day	39.80	
				Night	30.51	
NV-14	25.3.2019	Ba Yint Naung Pwel Yoan (Thiri Mon Pa Lar Zar)	A	Day	25.27	
				Night	34.63	
NV-15	25.3.2019	Ba Yint Naung Pwel Yoan (Thiri Mon Pa Lar Zar)	B	Day	49.96	
				Night	47.21	
NV-16	26.3.2019	INTXN of Parami Rd. and East 50'	A	Day	27.53	

Point	Date	Location (A: Along the alignment) (B: Backside)		Period	Vibration Level Lv	Standard MOE Japan (dB)
		Rd.		Night	27.75	
NV-17	26.3.2019	INTXN of Parami Rd. and East 50' Rd.	B	Day	39.40	
				Night	34.12	
NV-18	28.3.2019	INTXN of Parami Rd. and Inn Sein Rd.	A	Day	29.99	
				Night	20.82	
NV-19	28.3.2019	INTXN of Parami Rd. and Inn Sein Rd.	B	Day	42.24	
				Night	37.71	
NV-20	2.4.2019	IT University	A	Day	26.83	
				Night	24.65	
NV-21	2.4.2019	IT University	B	Day	36.31	
				Night	32.31	
NV-22	29.3.2019	INTXN of Pyay Rd. and Parami Rd.	A	Day	32.32	
				Night	26.33	
NV-23	29.3.2019	INTXN of Pyay Rd. and Parami Rd.	B	Day	42.78	
				Night	37.90	
NV-24	30.3.2019	Inya Lake North-East St.	A	Day	40.61	
				Night	46.02	
NV-25	30.3.2019	Inya Lake North-East St.	B	Day	34.35	
				Night	48.73	
NV-26	24.3.2019	Parami General Hospital	A	Day	29.83	
				Night	48.07	
NV-27	31.3.2019	INTXN of Parami Road and Ka Bar Aye Rd.	A	Day	31.10	
				Night	48.07	
NV-28	31.3.2019	INTXN of Parami Road and Ka Bar Aye Rd.	B	Day	43.89	
				Night	31.35	
NV-29	3.4.2019	In front of Kinder garden (Rainbow Pre-school)	A	Day	69.31	
				Night	56.54	
N-V30	10.5.2019	Parami St.	B	Day	30.09	
				Night	44.90	
NV-31	10.5.2019	Parami St.	B	Day	31.36	
				Night	40.85	Day:70 Night:65
N-V32	14.8.2019	West Yangon University	A	Day	42.52	
				Night	33.67	
NV-33	15.8.2019	Htan tapin Police Outpost	A	Day	45.54	
				Night	33.50	
NV-34	16.8.2019	B.E.H.S No. (8), Hlaing Tharyar Township	A	Day	37.25	
				Night	43.16	
NV-35	17.8.2019	Yadanar Thiri Myoe Oo Monastery	A	Day	62.46	
				Night	44.17	

*Measurement values that exceed MOE Japan Standards are shown in a red word.
Source: E Guard Study Team

In vibration level measurements, all the resultant values are found to be within the regulatory standards of vibration specified from Ministry of Environment, Government of Japan.

5.3.5 Soil and Bottom Sediment Quality

Soil samples were taken at 11 points along the proposed alignment. As there is no guideline for soil in National Emission Quality Guidelines (NEQG), the results of some parameters were compared with Thailand Environmental Standard for habitat or agriculture which topography is similar to Myanmar. Exact location of soil sampling points and results for each samples are shown in tables below and location of soil quality sampling is shown in the following Figure 5.37.



Figure 5. 37 Location of Soil Quality Sampling

Table 5. 36 Sampling Points for Soil Quality Survey

No.	Survey Points	Location	
		Latitude	Longitude
So-1	Hlaing Tharyar St.	16°52'44.69"N	96° 0'36.82"E
So-2	Dagon-Ayar Bus St.	16°52'41.83"N	96° 1'23.07"E
So-3	INTXN of BOC and Twan Tay	16°52'17.79"N	96° 2'21.87"E
So-4	Mee Khwat Market	16°51'53.48"N	96° 3'9.73"E
So-5	Na Wa Day INTXN (Na Wa Day Housing)	16°51'45.10"N	96° 3'51.21"E
So-6	FMI	16°51'20.83"N	96° 5'9.10"E
So-7	Ba Yint Naung Pwel Yoan (Thiri Mon Pa Lar Zar) (Yan Kin Monastery))	16°51'33.07"N	96° 6'20.83"E
So-8	INTXN of Parami Rd. and Inn Sein Rd.	16°51'26.20"N	96° 7'25.56"E
So-9	INTXN of Pyay Rd. and Parami Rd.	16°51'11.86"N	96° 8'25.71"E
So-10	INTXN of Parami Rd. and Ka Bar Aye Rd.	16°51'1.50"N	96° 9'28.05"E
So-11	Parami St.	16°51'8.92"N	96° 9'55.10"E

Photograph 5. 10 Soil Quality Sampling



So-1



So-2

	
So-3	So-4
	
So-5	So-6
	
So-7	So-8
	
So-9	So-10



So-11

Table 5. 37 Results of Soil Quality Analysis

Survey Point	Thailand Environmental Standard (mg/kg)				
	Arsenic	Cadmium	Chromium Hexavalent	Chromium	Lead
	3.9	37	300	-	400
	Result				
So-1	**5.97**	-	-	68.5	16.3
So-2	**5.87**	-	0.689	46.0	22.8
So-3	**4.67**	-	-	62.0	22.6
So-4	**10.2**	-	-	73.4	20.9
So-5	**7.08**	-	-	62.0	21.6
So-6	**7.52**	-	-	68.7	26.0
So-7	**5.26**	-	-	36.3	23.1
So-8	3.26	-	-	43.3	8.5
So-9	**4.07**	-	-	34.6	21.6
So-10	3.52	-	-	49.1	52.8
So-11	3.39	-	-	29.4	27.6

In comparing the results with Thailand environmental soil quality standard, it can be seen that soil values from each samples under the standard value except Arsenic.

Similarly, bottom sediment samples are taken at four points namely BS-1 (Under Ba Yint Naung Bridge), BS-2 (Ba Yint Naung Pwel Yoan), BS-3 (Thiri Mon Housing) and BS-4 (Parami Station). Location of the sampling points and results of each samples are expressed in figure and Table 5.38.



Figure 5. 38 Location of Bottom Sediment Sampling

Table 5. 38 Sampling Points for Bottom Sediment

No.	Survey Points	Location	
		Latitude	Longitude
BS-1	Under Ba Yint Naung Bridge	16°51'27.43"N	96° 5'44.03"E
BS-2	Ba Yint Naung Pwel Yoan	16°51'19.19"N	96° 6'0.40"E
BS-3	Thiri Mon Housing	16°51'27.49"N	96° 6'35.84"E
BS-4	Parami St.	16°51'7.54"N	96° 9'54.37"E

Photograph 5. 11 Bottom Sediment Sampling



BS-1



BS-2



BS-3



BS-4

Table 5. 39 Results of Bottom Sediment Analysis

No.	Arsenic	Cadmium	Chromium Hexavalent	Chromium	Lead
BS-1	6.35	-	-	42.4	13.8
BS-2	4.52	-	-	47.2	15.4
BS-3	6.99	-	-	121	82.5
BS-4	9.40	-	-	57.6	36.3

5.3.6 Geological Survey

Geological Survey was implemented at 21 points along the proposed alignment to investigate soil hardness and soil quality. Exact location of boring points and results for each point are shown in tables below and survey location is shown in the following Figure 5.39.



Source: JICA Study Team

Figure 5. 39 Location of Geological Survey

Table 5. 40 Coordinates and Boring Points

No.	Easting (E)	Northing (N)	Elevation EL: (m)
BH-01	96° 0'29.89"E	16°52'46.30"N	0.00
BH-02	96° 0'39.15"E	16°52'45.50"N	0.00
BH-03	96° 0'38.70"E	16°52'39.93"N	0.00
BH-04	96° 1'23.42"E	16°52'42.86"N	0.00
BH-05	96° 1'50.63"E	16°52'31.81"N	0.00
BH-06	96° 2'19.24"E	16°52'18.02"N	0.00
BH-07	96° 3'4.49"E	16°51'53.25"N	0.00
BH-08	96° 3'46.98"E	16°51'45.77"N	0.00
BH-09	96° 4'24.68"E	16°51'35.42"N	0.00
BH-10	96° 4'59.39"E	16°51'23.72"N	0.00
BH-11	96° 5'34.06"E	16°51'14.98"N	0.00
BH-12	96° 5'46.18"E	16°51'17.23"N	0.00
BH-13	96° 6'1.94"E	16°51'26.62"N	0.00
BH-14	96° 6'10.75"E	16°51'29.06"N	0.00
BH-15	96° 6'57.49"E	16°51'23.31"N	0.00
BH-16	96° 7'28.46"E	16°51'26.70"N	0.00
BH-17	96° 7'54.24"E	16°51'23.49"N	0.00
BH-18	96° 8'21.00"E	16°51'12.94"N	0.00
BH-19	96° 8'45.95"E	16°51'15.11"N	0.00
BH-20	96° 9'33.53"E	16°51'0.39"N	0.00
BH-21	96° 9'52.38"E	16°51'6.28"N	0.00

(1) Boring Works

For boring works, rotary direct circulation method was appropriately applied using metal crown bits attached to casings of Ø127mm, Ø112mm and metal crown bits of Ø64mm in diameter setting with single core tube were also properly applied depending on soil condition to drilling process. The drilling machines were operated by setting on the stage with maintaining horizontal level of drilling machine and vertical position of drilling direction while drilling on field investigation works. Boring and SPT testing in all the points were operated from drilling stage maintaining the stability of boring machine. In the way of direct circulation of drilling fluid, water and bentonite slurry was inevitably utilized to control the circulation of the sludge. The schematic diagram of boring equipment is shown in following Figure 5.40.

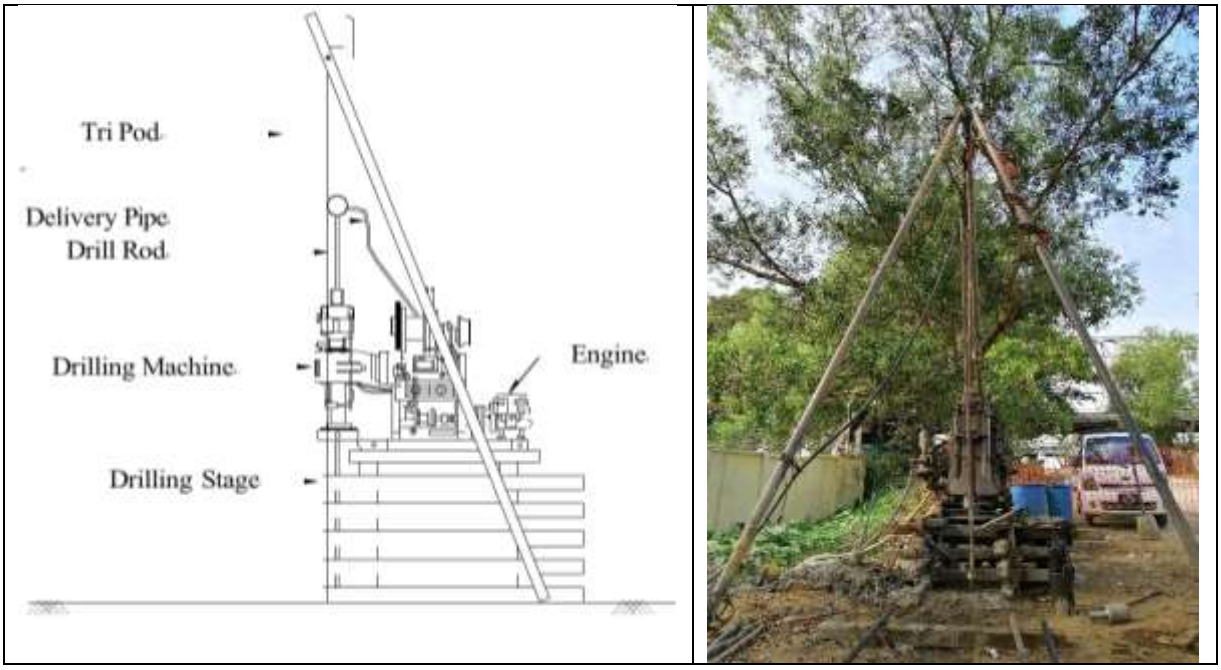


Figure 5. 40 Schematic View of Drilling Machine Setting

(2) Standard Penetration Test (SPT)

The standard penetration test was implemented in accordance with the JIS (Japanese Industrial Standard) A 1219 (2013). Generally, the test is performed using a spilt barrel sampler (50 mm diameter) connected to the end of boring rods. The sampler is driven into the soil by means of a 63.5 kg hammer falling freely through the height of 76 cm onto the anvil attached to the rod. The sampler is driven 450 mm into the soil. SPT N-value is recorded for each 150 mm and three time of 100 mm penetration of the sampling tube. In this case, seating drive of 150 mm is first reached and the blow count for the seating drive is not applied because the bottom of the hole may be apart from natural condition at a certain extent. The resistance, N-value, is taken as number of blow for the penetration of test drive of next 300 mm. When 50 blows are reached before the full penetration 300 mm, no other blows are applied but final penetration is recorded. At the conclusion of the test, the retained soil sample is extracted and stored in plastic bag for further analysis. In which, Figure 5.41 indicates the procedure and apparatus of standard penetration test. The distribution of N-value for each stratum is summarized in Figure from 5.43 to 5.48.

Photograph 5. 12 View of Standard Penetration Test and SPT Sample

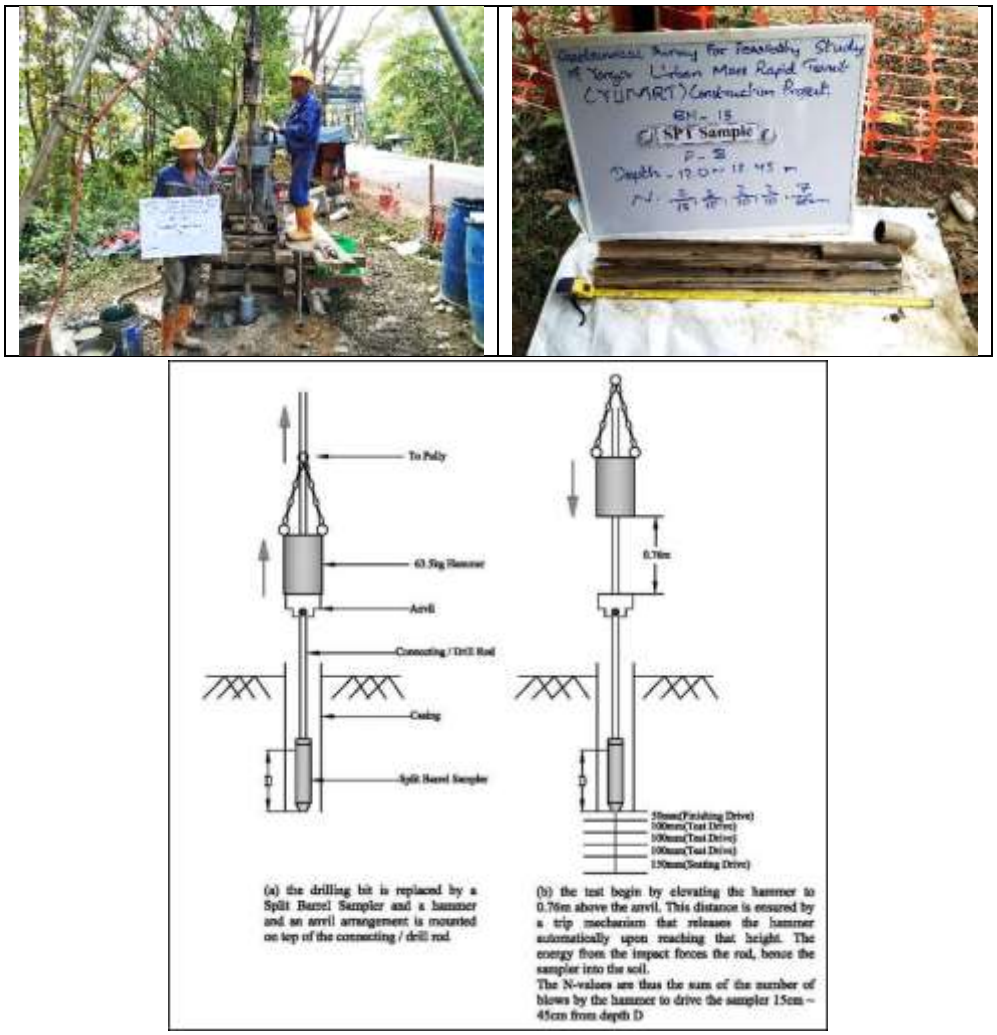


Figure 5. 41 Procedure and Apparatus of Standard Penetration Test

Photograph 5. 13 Geological Survey



BH-1	BH-2

	
BH-3	BH-4
	
BH-5	BH-6
	
BH-7	BH-8
	
BH-9	BH-10

	
BH-11	BH-12
	
BH-13	BH-14
	
BH-15	BH-16
	
BH-17	BH-18



BH-19



BH-20



BH-21

(3) Observation of Groundwater Level

During the boring works, groundwater level recording was carefully carried out by using automatic alarm water level indicator twice a day in the borehole before and completion of drilling works. The groundwater table was recorded from ground elevation between GL-1.00 m in minimum and 5.20 m in maximum shown in Table 5.41.

Table 5. 41 Groundwater Level of Investigation Points through Project Area

BH-No.	Groundwater Level EL - (m)	Measured Date
BH-01	-1.30	14.11.2018
BH-02	-1.30	15.11.2018
BH-03	-1.80	17.11.2018
BH-04	-1.00	26.11.2018
BH-05	-1.80	26.11.2018
BH-06	-2.40	27.11.2018
BH-07	-1.30	30.11.2018
BH-08	-3.00	01.12.2018
BH-09	-1.80	02.12.2018
BH-10	-1.30	05.12.2018
BH-11	-3.80	07.12.2018
BH-12	-1.10	10.12.2018
BH-13	-5.20	10.12.2018
BH-14	-1.30	07.12.2018
BH-15	-5.20	09.11.2018
BH-16	-1.30	12.12.2018
BH-17	-1.30	13.12.2018
BH-18	-1.00	14.12.2018
BH-19	-2.60	17.12.2018
BH-20	-2.50	20.12.2018
BH-21	-1.30	10.11.2018

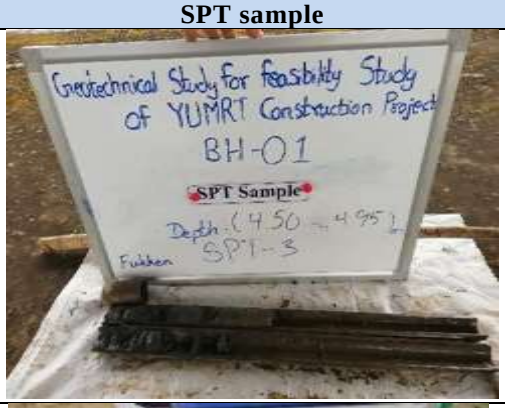
(4) Characteristics of Soil Strata Relying on Field Test

According to the investigation results, soil profile was drawn based on not only visual check of soil samples at site and SPT results of the boreholes but also laboratory test results to determine the cross section throughout project area. Borehole Location Map is shown in Figure 5.42. Figure 5.43-48 shows the soil profile through the project area.

There are 21 samples of boreholes; the depth of boreholes was a minimum 24.0m and a maximum 69.0m from ground level with the performance of Standard Penetration Test.

In this operation, total 8 different layers at depot area have been recognized. The soil layers are classified in accordance with their physical properties and/or their relative density. The 8 different layers observed in project area were described from top to bottom as follows.

Table 5. 42 Description of Observed Layers in the Project Area

Description	SPT sample
1. CLAY-I According to the investigation results, the uppermost soil layer is almost observed as CLAY-I. The thickness of this layer is about 2.0m to 6.0m. The color of this layer is yellowish brown to gray and brown. The plasticity of this layer is low to medium plasticity and the water content is moist. SPT N- value of this layer is 4/30 to 8/30 blows. Therefore, it can be described as soft to firm in consistency.	
2. Silty SAND-I This layer is also well observed in all investigated boreholes and the name of this layer is Silty SAND-I. The thickness of it is a minimum 4.5m and a maximum 13.0m. The color of it is gray to yellowish brown. The grained size of this layer is fine grained and the water content is moist. SPT N-value range is 4/30 to 26/30 blows. Therefore, the relative density of this layer is loose to medium dense.	
3. Silty SAND-II The third sub-soil layer is Silty SAND-II and this layer is also well observed in this project area. The thickness of this layer is a minimum 13.5m and a maximum 18.0m. The color of this layer is gray to yellowish brown. The grained size of sand is fine to medium grained, and the water content is moist. SPT N-value of it is 11/30 to 39/30 blows, and it can be described as medium dense to dense in relative density.	

Description	SPT sample
4. Silty SAND-III The fourth sub-soil layer is also well observed at BH-01 and BH-03 and the name is Silty SAND-III due to its characteristics. The thickness of it is a minimum 6.0m and a maximum 9.0m. The color of it is gray and the water content is moist. The grained size of sand is fine to medium grained. SPT N-value of it is 22/30 to 38/30 blows. According to the investigation results, the relative density of this layer is medium dense to dense.	
5. CLAY-II According to the investigation results, CLAY-II layer is observed as the fifth sub-soil layer. The thickness of this layer is a minimum 1.5m and a maximum 15.0m. The color of this layer is gray and the water content is moist. The plasticity of this layer is low plasticity. Moreover, trace of silt is including in this layer. SPT N-value is 5/30 to 19/30 blows. The consistency of this layer is firm to very stiff in consistency.	
6. Silty SAND-IV The sixth sub-soil layer is Silty SAND-IV layer and this layer is also well observed in this project area. The thickness of this layer is a minimum 3.0m and a maximum 12.0m. The color of this layer is gray and the water content is moist. The grained size of sand is fine grained. SPT N-value range of this layer is 25/30 to 50/18 blows. According to the investigation results, the relative density of this layer is medium dense to very dense.	
7. Silty SAND-V The seventh sub-soil layer is Silty SAND-V layer, and this layer is well observed in all investigated holes. The thickness of this layer cannot be estimated because of BH-02 and BH-03 are terminated in this layer. But, the thickness of this layer is more than 4.0m. The color of it is gray color and the water content is moist. The grained size of sand is fine to medium grained. SPT N-value range of this layer is 30/30 to 50/18 blows, and it can be described as medium dense to very dense in relative density.	

Description	SPT sample
8. Sandy CLAY According to the investigation results, the last sub-soil layer is Sandy CLAY and this layer is only observed at BH-01. The thickness of this layer cannot be estimated because of these boreholes are terminated in this layer. But, the thickness of this layer is more than 0.93m. The plasticity of this layer is low plasticity and the gained size of sand is fine grained. SPT N-value range of this layer is about 50/28 blows. Therefore, the consistency of this layer is hard.	

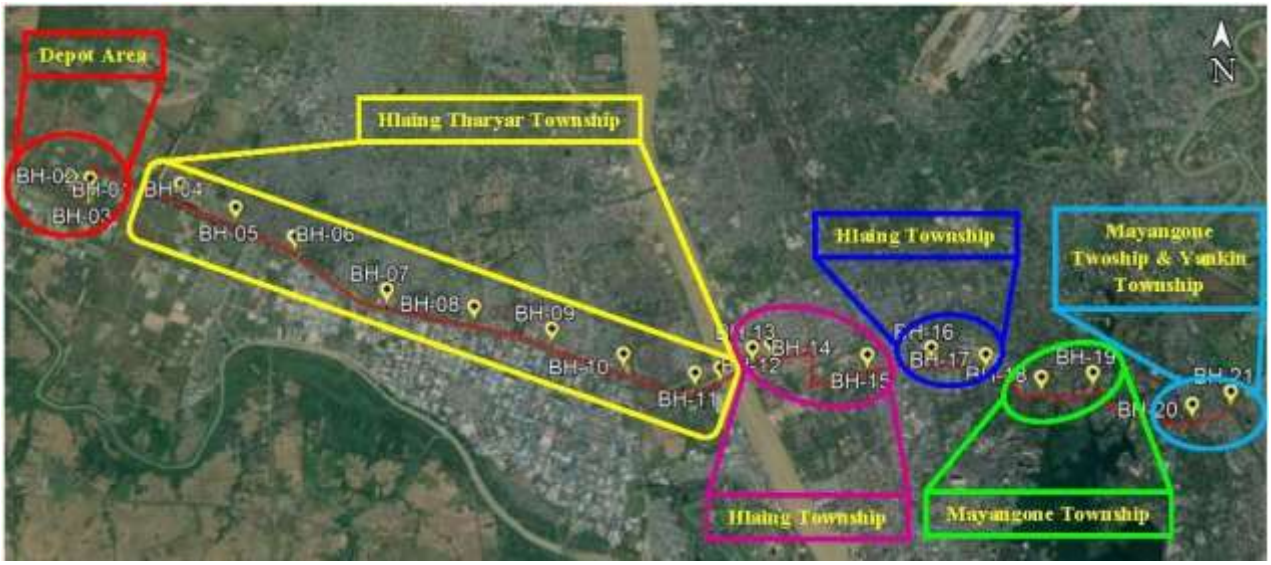


Figure 5. 42 Borehole Location Map of Project Area

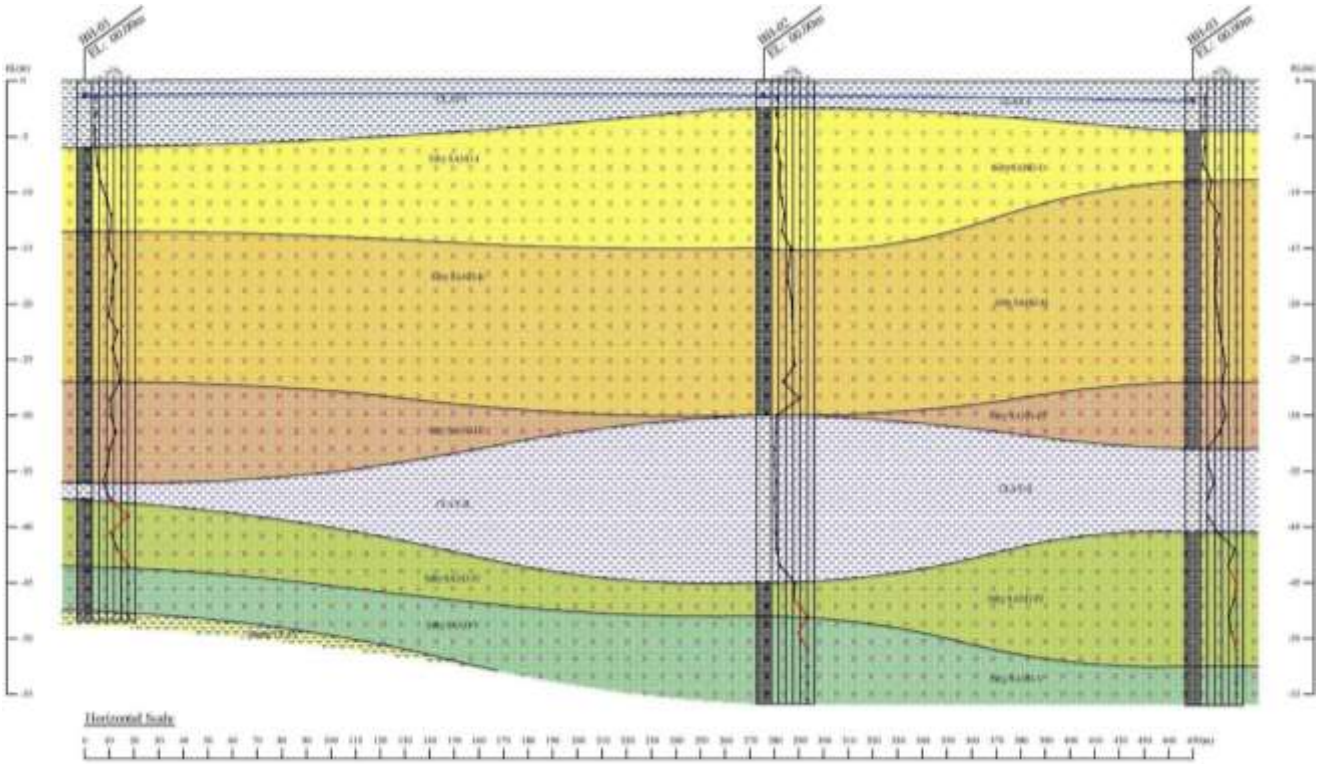


Figure 5. 43 Soil Profile through Depot Area from BH-01 to BH-03

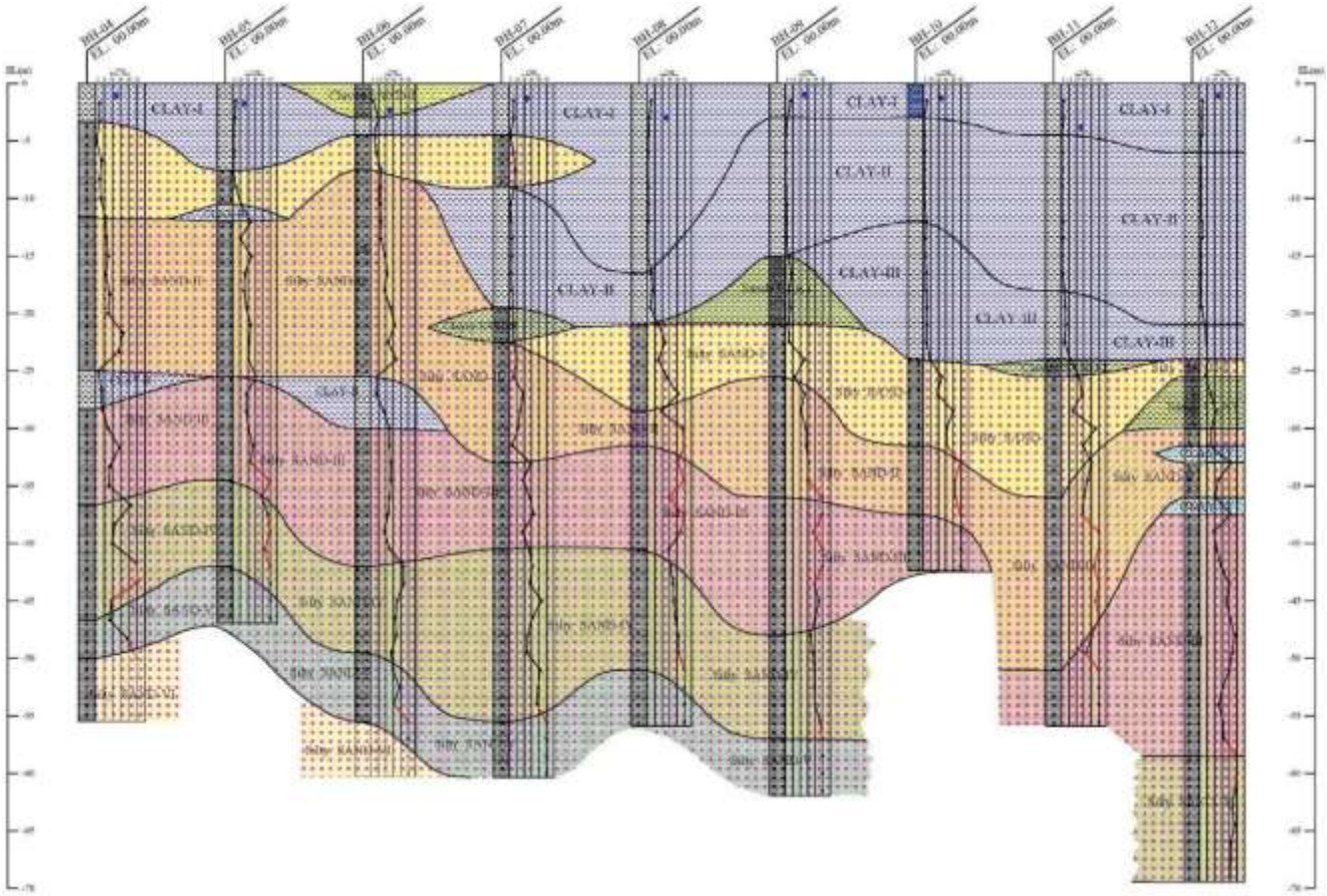


Figure 5. 44 Soil Profile through Hlaing Tharyar Township from BH-04 to BH-12

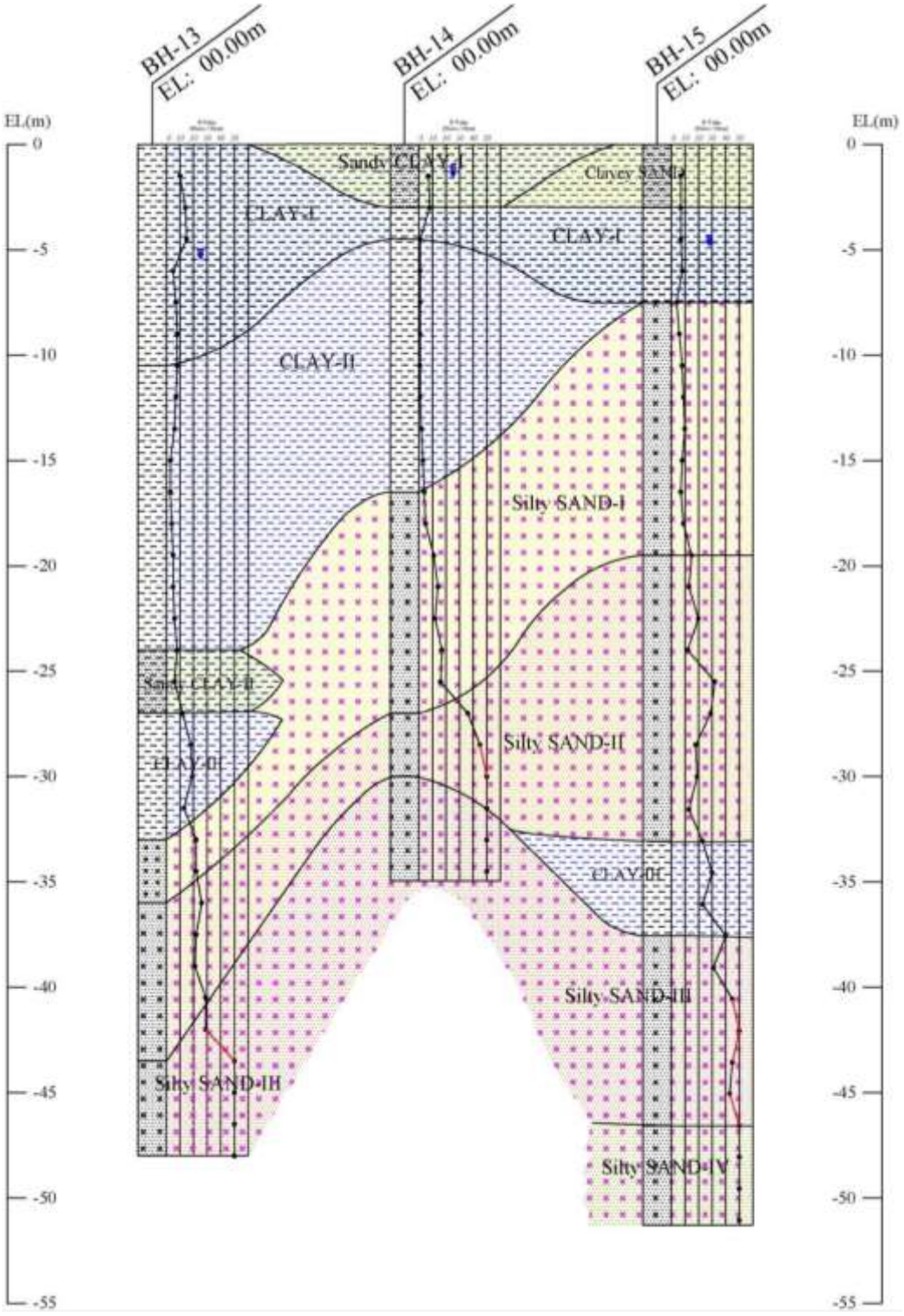


Figure 5. 45 Soil Profile through the Hlaing Township from BH-13 to BH-15

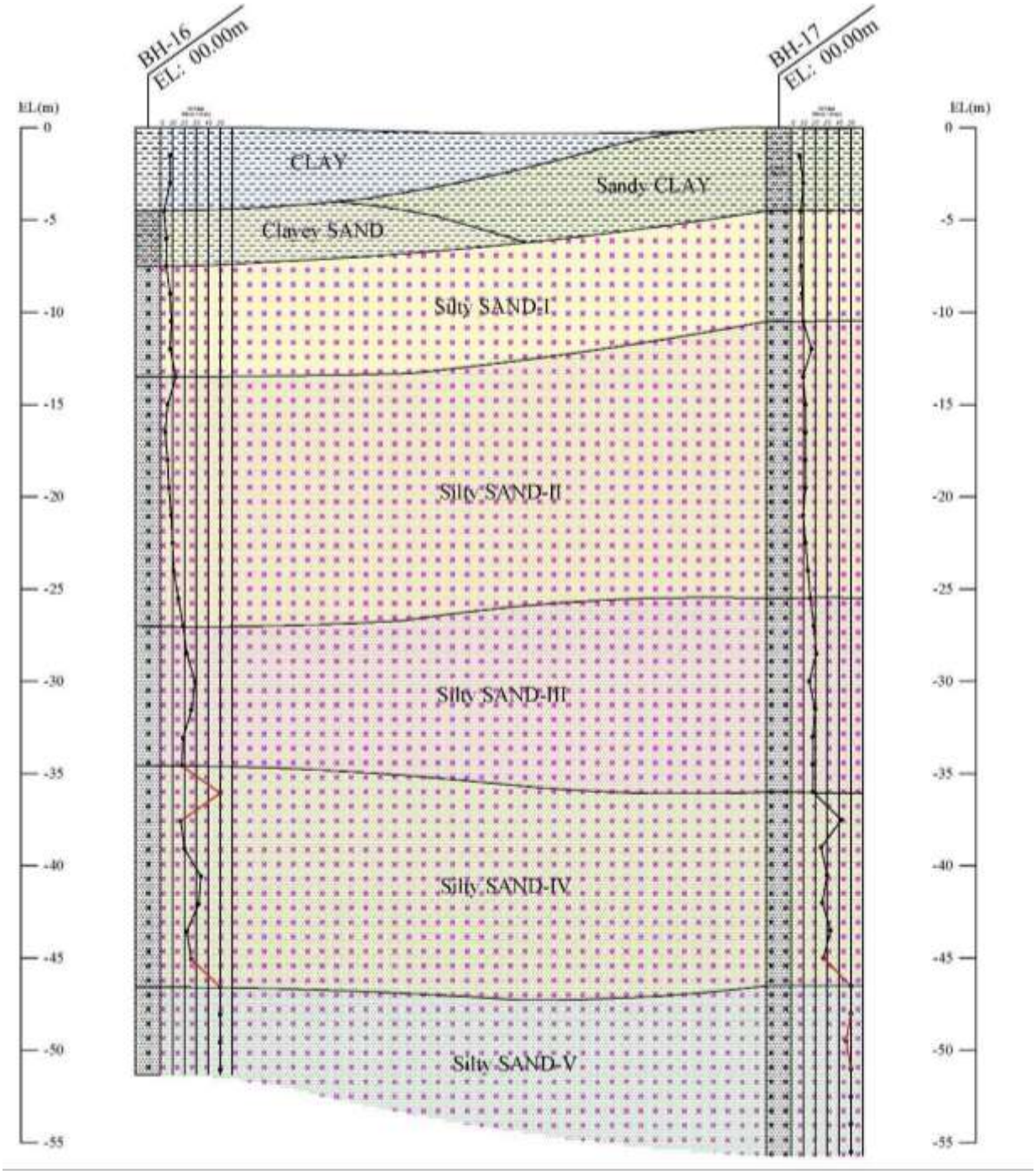


Figure 5. 46 Soil Profile through Hlaing Township from BH-16 to BH-17

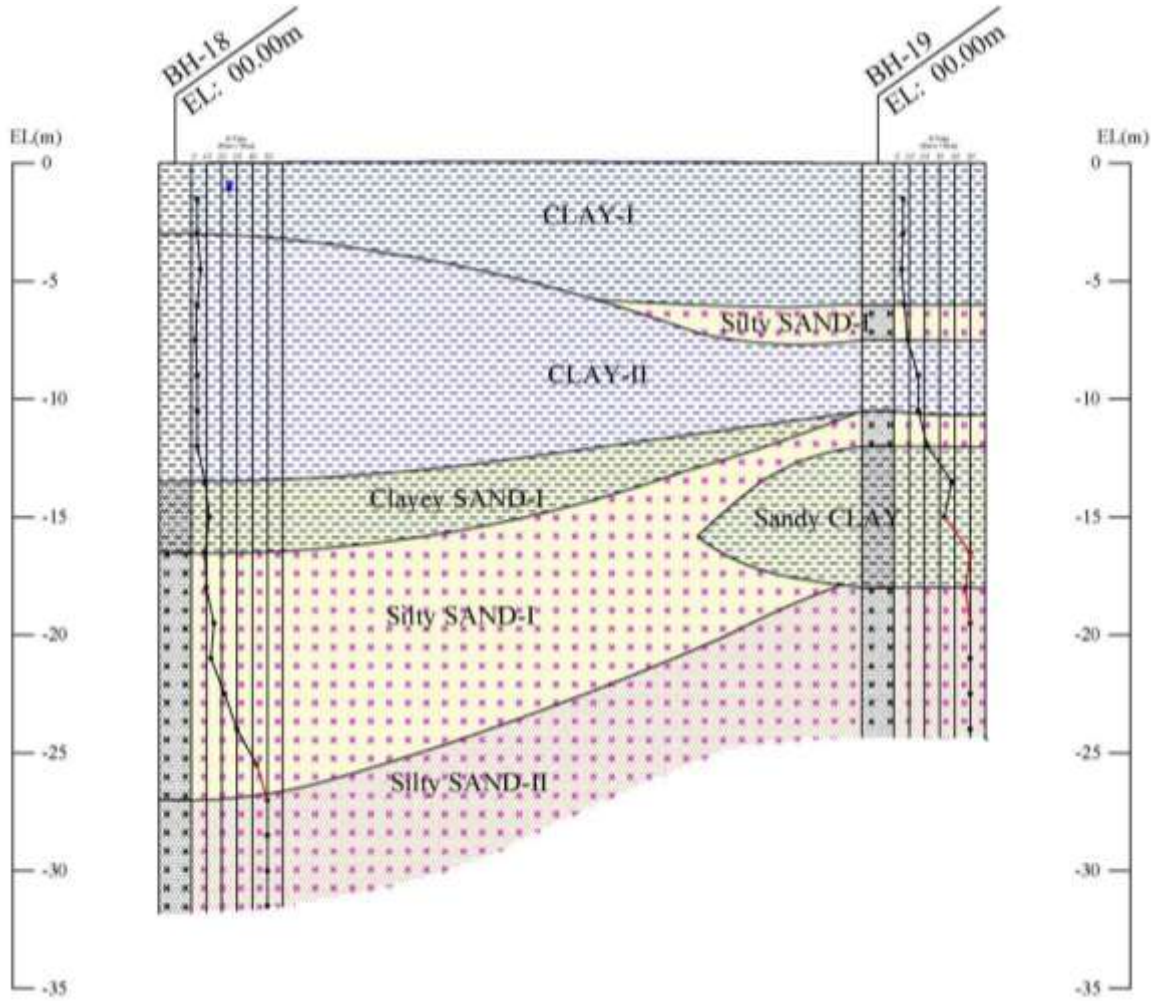


Figure 5. 47 Soil Profile through Mayangone Township from BH-18 to BH-19

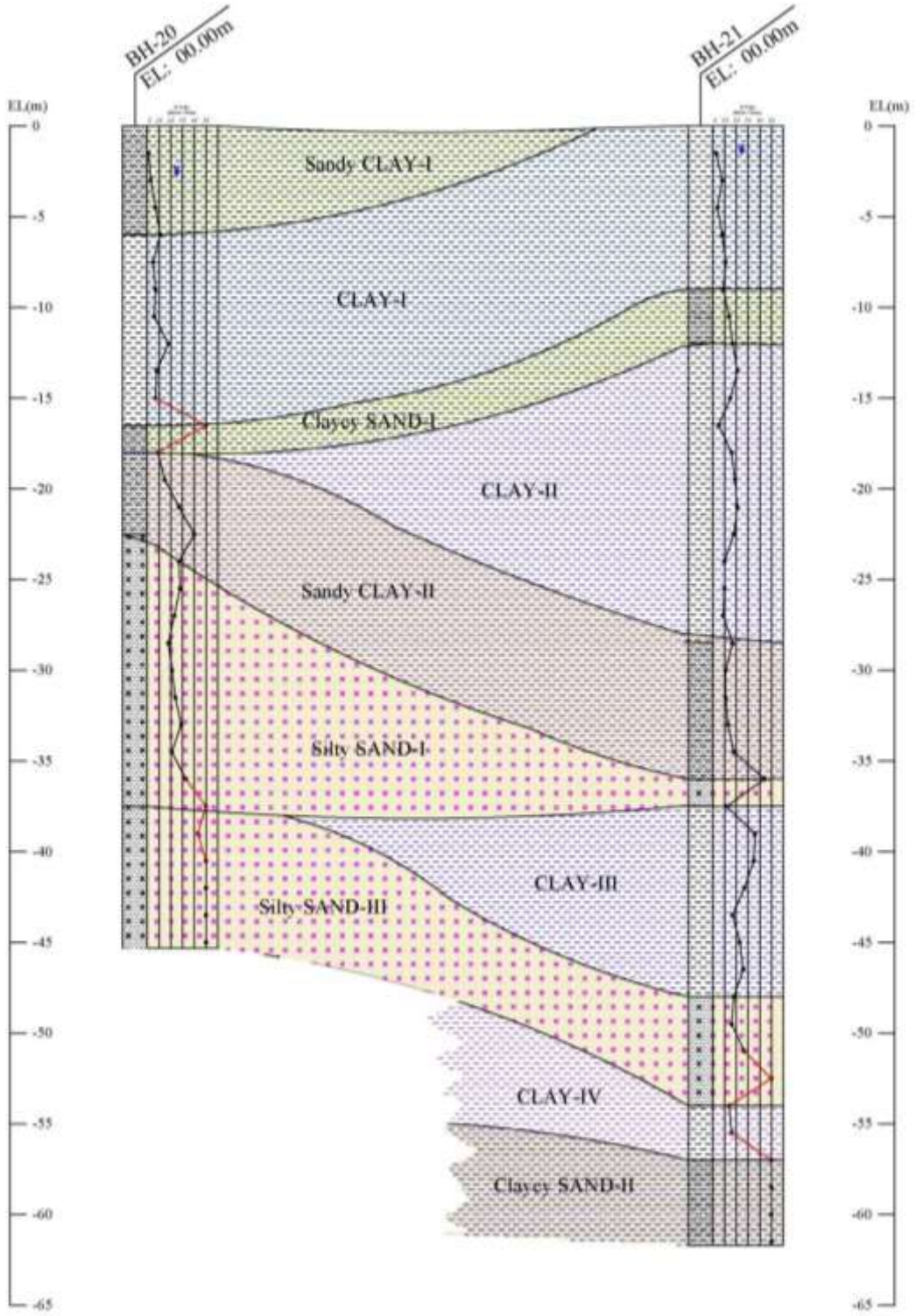


Figure 5. 48 Soil Profile through Mayangone Township & Yankin Township from BH-20 to BH-21

5.4 Ecosystem

5.4.1 Biodiversity Survey

As shown in Figure 5.49, the proposed alignment will pass over 5 Townships: Hlaing Tharyar, Hlaing, Mayangone, Yankin and South Okkalapa. It will start from Hlaing Tharyar Station and end at the Parami Station. The way that is connecting from Hlaing Tharyar to Parami is one of the route with heavy traffic. On the other hand, there is no protected area or natural reserved area in the vicinity of the alignment.



Figure 5. 49 Biodiversity Survey Points for Wet and Dry Season

(1) Material and method:

- Avifauna: Point count method was used for the survey with the help of binocular and FUJIFLIM camera. The bird list was identified by following after Kyaw Nyunt Lwin and Khin Ma Ma Thwin (2003) and BANCA (2014).

- Fish: The survey was done by interviewing with the fishers at Hlaing River. The recorded fishes were identified following after the list of Department of Fisheries (2008).

- Insecta: The recorded insects were identified according to the Patrick Hook (2013).

- Flora: The data was collected by using transect method which can be considered when surveying an entire study area which needs to be covered quickly. Specimen collection of trees, shrubs and herbs was also carried out on the transect lines in the survey area. And the identification of specimens was undertaken by using taxonomic keys, published in the Checklist for Trees, Shrubs, Herbs, and Climbers in Myanmar (W. John Kress *et al*, 2003), certain related guidebooks, journals and websites comparison with herbarium specimens, by consultation with taxonomic experts and by interviewing with local people. The recorded plant species were categorized according to the IUCN (International Union for Conservation of Nature) Red List. The IUCN Red List Categories and Criteria are easily and widely recognized as a system for classifying species on the verge of extinction.

Table 5. 43 Conservation Status on IUCN Red List for Flora and Fauna

Species	Conservation Status on IUCN Red list	Sensitivity
Flora and Fauna	EX: Extinct EW: Extinct in the wild CR: Critically Endangered	High
	EN: Endangered VU: Vulnerable	Medium
	NT: Near Threatened LC: Least Concern	Low

There are 7 areas in total for flora and fauna survey along YUMRT alignment. It took a week to carry out the survey for each season. The following activities were performed during the survey;

- Record of observed animals and plants by the photography
- Record of sampling points by GPS
- Record of characteristics of the plants and animals
- Interview with fishers
- Measurement and sampling of some unidentified plants.

Table 5. 44 Schedule of Survey in Wet and Dry Season

Point No.	Location (Latitude and Longitude)	Survey Date	
		Dry Season	Wet Season
BD-1	Hlaing Tharyar St.	25.3.19	2.11.18
BD-2	Dagon-Ayar Bus St.		
BD-3	INTXN point of BOC and Twan Tay	26.3.19	5.11.18
BD-4	Mee Khwat Market		
BD-5	Under Ba Yint Naung Bridge	26.3.19 28.3.19	5.11.18 6.11.18
BD-6	Inya Lake	28.3.19 29.3.19	6.11.18 7.11.18
BD-7	Parami St.	29.3.19	7.11.18

(2) Flora Survey

Regarding Flora, 55 species in total were identified in both seasons shown as below table. In the list, there are 1 species categorized as Endangered (EN) and Vulnerable (VU) on IUCN red list. Regarding Endangered species, Burmese rose wood whose scientific name is *Pterocarpus indicus* is the cultivated plant type which can grow and survive in most part of Myanmar. Regarding Vulnerable species, Mahogany, whose scientific name is *Swietenia macrophylla* and which is an exotic species, was observed at a public park which might not be directly affected. The coordinates of above mentioned species as categorized EN and VU are shown in Table 5.46 and the photographs of all observed species are described in Appendix (5).

Table 5. 45 List of Observed Plant Species

No.	Scientific Name	Common Name	Family name	Habitat	IUCN	Wet	Dry
1	*Abelmoschus esculentus*	Lady's finger	Malvaceae	Shrub	-	✓	
2	*Acacia auriculiformis*	Acacia	Fabaceae	Tree	LC	✓	✓

No.	Scientific Name	Common Name	Family name	Habitat	IUCN	Wet	Dry
3	*Acanthus ilicifolius*	Kha-Yar-Kayan	Acanthaceae	Shrub	LC		✓
4	*Adiantum capillus-veneris*	Venus hair fern	Pteridaceae	Fern	LC	✓	
5	*Albizia lebbek*	Kokko	Mimosaceae	Tree	LC	✓	✓
6	*Albizia procera*	Sit, Thit-pyu	Mimosaceae	Tree	LC	✓	
7	*Alternanthera sessilis*	Pazun-sar	Amaranthaceae	Herb	LC		✓
8	*Avicennia officinalis*	Lamu	Acanthaceae	Tree	LC		✓
9	*Bauhinia acuminate*	White Orchid-Tree	Fabaceae	Shrub	-	✓	
10	*Bombax ceiba*	Red silk-cotton tree	Malvaceae	Tree	LC	✓	✓
11	*Borassus flabellifer*	Toddy palm, Htan	Arecaceae	Tree	-	✓	✓
12	*Capsicum annuum*	Chilli	Solanaceae	Herbs	LC	✓	
13	*Carica papaya*	Thinbaw	Caricaceae	Small tree	DD	✓	✓
14	*Casuarina equisetifolia*	Pinle-kabwe	Casuarinaceaec	Tree	LC	✓	
15	*Cenchrus setaceus Morrone*	African Fountaingrass	Poaceae	Grass	-	✓	
16	*Cephalandra indica*	Kinmon	Cucurbitaceae	Climber	-	✓	✓
17	*Cheilocostus speciosus*	Pha Lan Taung Whay	Costaceae	Herb	-	✓	
17	*Chromolaena odorata*	Bezat	Asteraceae	Shrub	-	✓	✓
18	*Cocos nucifera*	Ohn	Arecaceae	Tree	-	✓	✓
19	*Colocasia esculenta*	Pain	Araceae	Herb	LC	✓	✓
20	*Cyperus eragrostis*	Tall flatsedge	Cyperaceae	Herb	LC	✓	
21	*Delonix regia*	Sein Pan Ni	Caesalpiniaceae	Tree	LC	✓	
22	*Eichhornia crassipes*	Beda-pin	Pontederiaceae	Aquatic	-	✓	✓
23	*Evolvulusnummularius*	Kyauk-hkwe-pin	Convolvulaceae	Herb	-		✓
24	*Ficus racemose*	Indian Fig Tree	Moraceae	Tree	-	✓	✓
25	*Heliotropium indium*	Sin Hna Maung	Boraginaceae	Herb	-		✓
26	*Hibiscus sabdariffa*	Chinbaung-Ni	Malvaceae	Shrub	-	✓	
27	*Hibiscus tiliaceus*	Thaman-shaw	Malvaceae	Small tree	-		✓
28	*Hygrophila phlomoides*	Migyaung-kunbat	Acanthaceae	Herb	-		✓
29	*Hyptianthera stricta*	Kyetyo	Rubiaceae	Small tree	-		✓
30	*Ipomoea aquatica*	Rabbit greens	Convolvulaceae	Climber	LC	✓	✓
31	*Lagenaria siceraria*	Bu	Cucurbitaceae	Climber	-		✓
32	*Lagerstroemia speciose*	Pyinma	Lythraceae	Tree	-	✓	✓
33	*Lemna aequinoctialis*	Bae-Zar- Pin	Araceae	Aquatic	LC	✓	
34	*Leucaena leucocephala*	Bawzagaing	Mimosaceae	Tree	-	✓	✓
35	*Mimosa pudica*	Hti-ga-yon	Mimosaceae	Herb	LC	✓	✓
36	*Mimusops elengi*	Khayay	Sapotaceae	Tree	LC	✓	✓
37	*Mitragyna diversifolia*	Binga	Rubiaceae	Tree	-	✓	✓
38	*Moringa oleifera*	Drumstick Tree	Moringaceae	Tree	-	✓	✓
39	*Mucuna pruriens*	Khwele-ya	Fabaceae	Climber	-	✓	
40	*Muntingia calabura*	Jamaica cherry	Muntingiaceae	Tree	-	✓	
41	*Musa sapientum*	Banana	Musaceae	Herb	-	✓	✓
42	*Oryza sativa*	Asian rice, Paddy	Poaceae	Grass	LC	✓	
43	*Phagneticola calendulacea*	Nay Kyar Kalay	Asteraceae	Herb	-	✓	
44	*Pithecellobium dulce Benth*	Manila tamarind	Fabaceae	Tree	LC	✓	✓
45	*Polygonum aviculare*	Knotweed	Polygonaceae	Herb	-	✓	✓
46	*Psidium guajava*	Guava	Myrtaceae	Small tree	LC	✓	
47	*Pterocarpus indicus*	Burmese Rose Wood, Pan-padauk	Fabaceae	Tree	**EN**	✓	✓
48	*Sesbania grandiflora*	Paukpan-phyu	Fabaceae	Small tree	-	✓	✓
49	*Sesbania sesban*	Ye-thagyi	Fabaceae	Small tree	-		✓
50	*Solanum indicum*	Black Nightshade	Solanaceae	Shrub	-	✓	✓

No.	Scientific Name	Common Name	Family name	Habitat	IUCN	Wet	Dry
51	*Swietenia macrophylla*	Mahogany	Meliaceae	Tree	VU	✓	✓
52	*Tectona grandis*	Kyun	Verbenaceae	Tree	-	✓	✓
53	*Terminalia catappa*	Banda	Combretaceae	Tree	-	✓	
54	*Triumfetta*	Katsi-hne	Malvaceae	Shrub	LC		✓
55	*Ziziphus jujuba*	Zi	Rhamnaceae	Tree	LC	✓	

DD: Data Deficiency; LC: Least Concern; VU: Vulnerable; EN: Endangered

Table 5. 46 Identified Coordinates of Plant Species as Categorized EN and VU

No.	Scientific name	Common Name	Survey Points	Latitude Longitude	IUCN
1	*Pterocarpus indicus*	Burmese Rose Wood, Pan-padauk	BD-2: Dagon-Ayar Bus St.	16°52'43.31"N 96°1'21.62"E	EN
2	*Swietenia macrophylla*	Mahogany	BD-3: INTXN point of BOC and Twan Tay	16°52'14.25"N 96° 2'31.43"E	VU

(3) Fauna Survey

Since the survey area contains urban and downtown area as shown in Figure 5.49, there is no habitat for wildlife. 49 fauna species were observed in total during the survey for both seasons. The list of these fauna with their scientific names, common names, habitat and IUCN category were shown in the following table. According to the IUCN status, there was only one threatened species (NT) which is River tern. The photos of these species were attached in Appendix (5).

Table 5. 47 List of Recorded Fauna Species

No.		Scientific Name	Common Name	Habitat	IUCN	Wet	Dry
1	Mammal	*Rattus* sp.	Rat	Countryside, cities, garden, field, attic	LC	✓	
2	Reptiles	*Cobra* sp.	Cobra	Paddy fields, swamps, mangroves, grasslands, shrub lands, forests, agricultural land human settlements including cities	LC	✓	
3		*Calotes* sp.1	Lizard	Hedges, Trees	LC	✓	✓
4		*Calotes* sp.2	Lizard	Hedges, Trees	LC	✓	✓
5		*Eutropis* sp.	Common Garden Skink	Open areas of lowland, sub-mountain forest, secondary vegetation, bamboo or coconut groves	LC	✓	
6		*Ardeola grayii*	Indian Pond Heron	Marsh, ponds, fields, mangroves	LC	✓	✓
7	Aves	*Carvus* sp.	Crow	Urban, mangrove, countryside, cities	LC	✓	✓
8		*Columba livia*	Pigeon	Rakkine costal region, along the Ayeyarwady river bank, cities, urban, countryside	LC	✓	✓
9		*Copsychus saularis*	Oriental magpie- robin	Open woodland and cultivated areas often close to human habitations	LC		✓
10		*Dicrurs macrocercus*	Black Drongo	Open country and usually perches and hunts close to the ground, fields, and urban habitats	LC		✓
11		*Egreetta garretta*	Little egret	Marsh, ponds, streams, fields, mangrove, fields	LC	✓	✓
12		*Hypsipetes, leucocephalus*	Black Bulbul	Found in forest and higher land	LC		✓
13		*Milvus migrans*	Black Kite	Plains, coastal region, Rivers, Port	LC	✓	

No.		Scientific Name	Common Name	Habitat	IUCN	Wet	Dry
14		*Nectarinia jugularis*	Olive backed sunbird	Canopy, Garden	LC	✓	
15		*Passer domesticus*	Sparrow	Villages, cities, countryside, parks, fields, urban area	LC	✓	✓
16		*Phalacrocorax niger*	Little Commorant	Marsh, pond, river, coastal region	LC	✓	✓
17		*Pycnonotus, blanfordi*	Streak-eared, Bulbul	Gardens, cultivations, coastal scrub and plains	LC		✓
18		*Sterna aurantia*	River Tern	Resident breeder along inland rivers from Iran east into the Indian Subcontinent and further to Myanmar to Thailand	NT		✓
19		*Surniculus lugubris*	Cuckko	Forest, shrub, gardens, cultivated lands	LC	✓	✓
20	Fishes	*Channa striata*	Snakeheaded Murrel	Freshwater, Brackish	LC	✓	
21	Fishes	*Cirrhinus mrigala*	Mrigal	Freshwater bodies, rarely in brackish water; some common habitats are- ponds, ditch	NE		✓
22	Fishes	*Clarias batrachus*	Walking Catfish	Freshwater, Brackish	LC	✓	
23	Fishes	*Exocoetus volitans*	Tropical two-wing flyingfish	Surface waters both in the open ocean and close to the coast	LC		✓
24	Fishes	*Hyopostomus* sp.	Sucker Fish	Freshwater, sluggish stream	NE	✓	
25	Fishes	*Labeo rohita*	Rohu	Freshwater, Brackish	LC	✓	✓
26	Fishes	*Mystus vittatus*	Striped dwarf catfish	Freshwater, brackish	LC		✓
27	Fishes	*Notopterus notopterus*	Featherback	Clear streams and enters brackish waters, sluggish waters of lakes, floodplains, canals and ponds	LC		✓
28	Fishes	*Osteobrama alfredianus*	Carplet	Freshwater, marine	DD	✓	
29	Fishes	*Pangasius pangasius*	Yellowtail Catfish	Freshwater, Brackish	LC	✓	
30	Fishes	*Pentaprion longimanus*	Longfin Mojarra	Marine, brackish	LC		✓
31	Fishes	*Polynemus paradiseus*	Paradise threadfin	Freshwater, brackish water	NE	✓	
32	Fishes	*Puntius chola*	Swamp Barb	Streams, rivers, canals, beels, haors, ponds and inundated fields, mainly in shallow water	LC		✓
33	Fishes	*Tenualosa ilisha*	Hilsa shad	Freshwater, brackish, marine	NE	✓	
34	Fishes	*Trichogaster pectroralis*	Snakeskin Gourami	Freshwater	NE	✓	✓
35	Fishes	*Xenetondon cancila*	Freshwater Garfish	Freshwater, brackish, marine	DD	✓	
36	Insecta	*Catopsillia* sp.	Migrants	Plain, Garden, cultivated	NE		✓
37	Insecta	*Diplacodes* sp.	Ground skimmer	Plain, Garden, cultivated land	DD	✓	✓
38	Insecta	*Euploea core godartii*	Common Crow	All layers of vegetation, forested areas, treetop	LC	✓	
39	Insecta	*Gandaca harina*	Tree Yellow	Sunny areas with low vegetation	LC	✓	
40	Insecta	*Ischnura heterosticta.*	Common Bluetail	In marshes, weedy ponds and wetlands	LC		✓
41	Insecta	*Junonia Hubner*	Buckeyes	Open, sunny areas with low vegetation, some bare ground	DD	✓	
42	Insecta	*Neurothemis tullia*	Pied paddy skimmer	Marshes, well vegetated ponds, lakes and rice fields	LC		✓
43	Insecta	*Omocestus viridulus*	Common Green Grasshopper	Ground-dwelling insects	NE	✓	

No.		Scientific Name	Common Name	Habitat	IUCN	Wet	Dry
44		*Orthetrum* sp.	Green marsh hawk	Ponds, marsh	LC	✓	✓
45	Insecta	*Rhyithemis phyllis*	Yellow striped flutterer	Found at the open ponds or marshes and swamp forests	LC		✓
46		*Sympetrum* sp.	Red Dragonfly	Near the water habitat for breeding	NE	✓	✓
47	Crustacean	*Litopenaeus setiferus*	White Shrimp	Estuaries, marshes, and coastal areas generally to about 100 feet offshore	NE		✓
48		*Pomacea canaliculata*	Golden Apple Snail	Stretches of water, Lagoons, Ponds, Swamps	LC	✓	✓
49		Unknown	Freshwater mussels	Freshwater Pond	-		✓

NE: Not Evaluate; **DD**: Data deficiency; **LC**: Least Concern, **NT**: Near Threatened

(4) Impacts on Flora

Construction Period: Activities like ground clearance, excavation of soil, cutting down the trees, transporting construction vehicles, transitions the construction machinery and building the stations will lead direct impacts on the habitat of terrestrial plant species. Moreover, the habitat of aquatic plant and mangrove species will be affected by the construction activities passing through Inya Lake and Yangon River and also affected by the construction workers such as cutting down the trees without necessary.

Operation Period: In this phase, there is no significant impact on the flora species.

(5) Impacts on Fauna

Construction period: In this phase, excavation of top soil and land clearances during the construction phase will cause the habitat loss of some snake, rat and insects. If there is no proper control and management during the construction phase, the intensive noise and vibration will affect the habitats and the feeding of birds especially around the Inya Lake. The proposed project will cross over the Hlaing River may have some issues of oil spilling in the river. These issues will affect the aquatic fauna directly. But this Hlaing River is used as the way for big motor boat since many years, the minor oil spill may occur daily. This will lead to the cumulative impact for the aquatic fauna from this river.

Operation period: In this phase, the situations will be settled down due to no more excavation and land clearances activities. But the vibration and noise by the train would disturb the barrowing animals.

(6) Impact Matrix of Species Found in Study Area

Table 5. 48 Sensitivity of Species Found in the Study Area

Categories	NE	DD	LC	NT	VU	EN	CR	EW	EX
Flora	38	1	16	0	1	1	0	0	0
Fauna	6	4	22	1	0	0	0	0	0
Sensitivity	LOW				MEDIUM		HIGH		

NE: Not Evaluate, **DD**: Data deficiency, **LC**: Least Concern, **NT**: Near Threatened, **VU**: Vulnerable, **EN**: Endangered, **CR**: Critically Endangered, **EW**: Extinct in Wild **EX**: Extinct

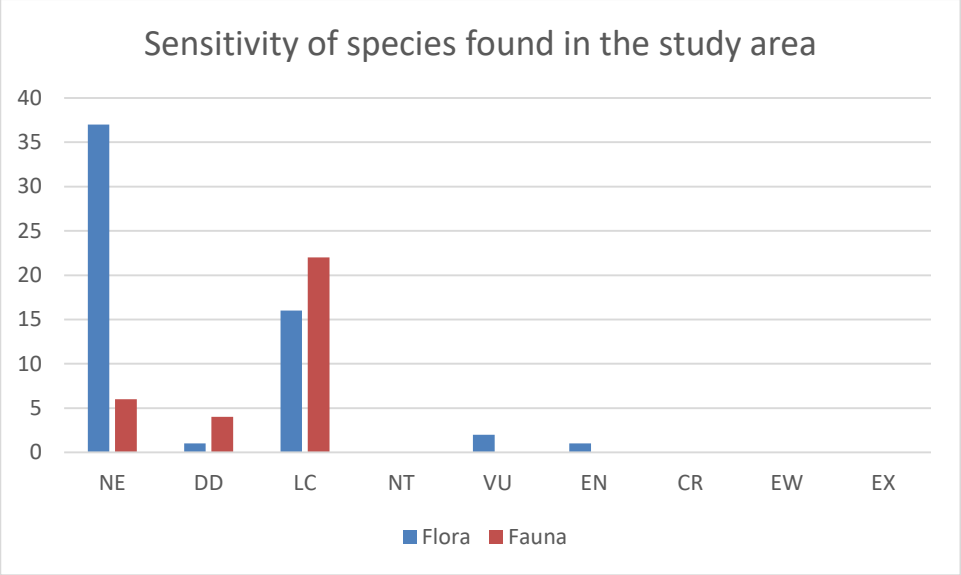


Figure 5. 50 The IUCN Status Graph of the Flora and Fauna Recorded from the Proposed Project Area

(7) Mitigation Measures for Flora

Construction period: Avoid the cutting down of IUCN red list species especially endangered and vulnerable species as much as possible, transplantation in another spacious area and refrain the trees are the best way. Besides, if there are any mature trees that are hollow or rotting in the construction zone, they won't survive being transplanted. The best option in this case is simply to remove the trees. The construction workers need some awareness program like the value and how ecosystem is important.

Operation Period: Monitoring by on-site ecologist regularly according to the management plans.

(8) Mitigation Measures for Fauna

Construction and Operation Period: Before the land clearance activities and excavation the soil there should be take care of the kill of burrowing animals. The maintenance of the top soils during construction and replace them after construction. If the ponds or ditches are filled during construction, the re-creation of ponds or ditches in suitable places after construction is also important for the fishes, crustaceans, amphibians and insects. There should be enough awareness training concerning with the waste disposing and the important of healthy ecology for the worker is also important.

5.4.2 Benthos Survey

(1) Methodology

Sample collections were carried out at a total of 5 points in both dry and wet seasons on November 10th, 2018 and April 7th, 2019 respectively (Table 5.49, Figure 5.51). At each site, 20 x 20 cm quadrat was placed and the substrate was dug to a depth of a few centimeters. For the qualitative analysis, samples were collected by randomly through the benthic area of each point. Moreover, samples of quantitative data were obtained by using standard quadrat. For the data precision, there are at least 3-5 quadrats of sampling sites were established in each point. Obtained sediment samples were placed on the sieve (0.5 mm mash size) and wash with water and collected by using forceps and preserved with 5% formalin for further analysis. Identification was conducted by using compound microscope (Olympus).

After all organisms have been recorded, assign each type of organism an abundance (frequency) code as follows: R (Rare) = 1 to 9 organisms found in the sample C (Common) = 10 to 99 organisms found in the sample D (Dominant) = 100 or more organisms found in the sample Record the code next to the actual count on the data sheet.

There is a possibility that discovering insects and other organisms that are not listed on the Pollution Tolerance Index (e.g., adult dragonflies, water striders, water bugs). They are not counted in the PTI. These organisms are not as useful as indicators of water quality because they are less dependent on local stream conditions for habitat requirements.

For the diversity index, Shannon-Wiener Index (H') was used by the following;

$H' = - \Sigma \, pi \log pi$

Where pi is the proportion of importance value of the ith taxon (pi = ni/N, ni is the importance value of ith taxon and N is the importance value of all the taxa).

Table 5. 49 Locations of Study Site

	Point 1	Point 2	Point 3	Point 4	Point 5
Latitude	16°51'3.47"N	16°51'20.05"N	16°51'12.88"N	16°50'58.82"N	16°51'9.80"N
Longitude	96° 5'55.38"E	96° 6'1.43"E	96° 8'16.63"E	96° 8'24.07"E	96° 9'54.33"E



Figure 5. 51 Benthos Survey points

(2) Results and Discussion

A total number of 28 macroinvertebrates were recorded along the YUMRT line in dry and wet season. According to the survey results, 20 macroinvertebrates belonging to 18 families from 15 orders in dry season and 18 macroinvertebrates belonging to 17 families from 12 orders in wet season. Among them, 10 macroinvertebrates were found in both seasons.

Dry Season Survey

A total of 20 macroinvertebrates were collected, representing 18 families from 15 orders. Of these, 8 were Arthropoda, 5 were Annelida and 7 were Mollusca (Table 5.50). Among them, most of the species were observed rarely except Dero sp. which was recorded predominantly. The number of family and species were as highest as in point 1 while the lowest of both were recorded in point 5 (Figure 5.51).

Small invertebrates are functionally important in many terrestrial and aquatic ecosystems (Wilson 1992, Freckman et al. 1997, Palmer et al. 1997, Postel and Carpenter 1997). The presence of benthic macro-invertebrates can tell us a lot about the health of a stream because each organism varies in its ability to tolerate pollution. Mayfly larvae, for example, are very sensitive to pollution and can only survive in clean water. Rat-tailed maggots, on the other hand, are relatively unaffected by pollution and can tolerate highly degraded waterways.

The abundance of macro-invertebrates was not too varied ranging from 207 to 239 m-2, except point 3 show the very high number of 17443 m-2 (Table 3). This point is stream area and located in very close to the household area. According to the result of present survey, this area can be assigned as some polluted area because the highest numbers of Oligochaete were found, although, the genus of Eiseniella are associated with soft bottom streams, but they are not as pollution tolerant as other oligochaetes. Furthermore, current threats of Juga plicifera are not well known, but the river systems in which occur are badly degraded. Toxicity tests show that copper is more toxic to *J. plicifera* than nickel (Nebeker et al. 1986). In the present study, this species was only found in point-2.

Table 5. 50 Systematic Classification List of Macroinvertebrates

S/N	Phylum	Class	Order	Family	Genus and Species/Common name	Frequency
1	Arthropoda	Crustacean	Decapoda	Grapsidae	*Paragrapsus gaimardii*	R
2		Insecta	Odonata	Coenagrionidae	Damselfly larvae	-
3				Gomphidae	*Ophiogomphus cecilia* (Fourcroy 1785)Larvae	R
4			Hemiptera	Mesoveliidae	*Mesovelia mulsanti*	-
5				Naucoridae	Creeping water bug	-
6			Coleoptera	Dytiscidae	*Dytiscus marginalis*	-
7			Diptera	Culicidae	Mosquito larvae	-
8				Tupulidae	True fly larvae	R
9	Annelida	Polychaeta	Phyllodocida	Syllidae	*Syllid* sp.	R
10			Errantia	Nereidae	*Nereis* sp.1	C
11					*Nereis* sp.2	-
12		Clitella	Haplotaxida	Naididae	*Dero* sp.	D
13		Oligochaeta	Haplotaxida	Lumbricidae	*Eiseniella tetraedra*	R
14	Mollusca	Gastropoda	Basommatophora	Planorbidae	*Gyraulus convexiusculus*	R
15			Stylommaatophora	Succineidae	*Succinea putris* (Linnaeus 1758	R
16			Architaenioglossa	Ampullariidae	*Pomacea lineata* (Spix 1827)	R
17					*Pomacea paludosa* (Say 1829)	R
18			Littorinimorpha	Hydrobiidae	*Floridobia floridana* (Frauenfeld 1863)	R
19			Hygrophila	Physidae	*Physella gyrina* (Say 1821)	R
20			Sorbeoconcha	Semisulcospiridae	*Juga plicifera* (Lea 1838)	R

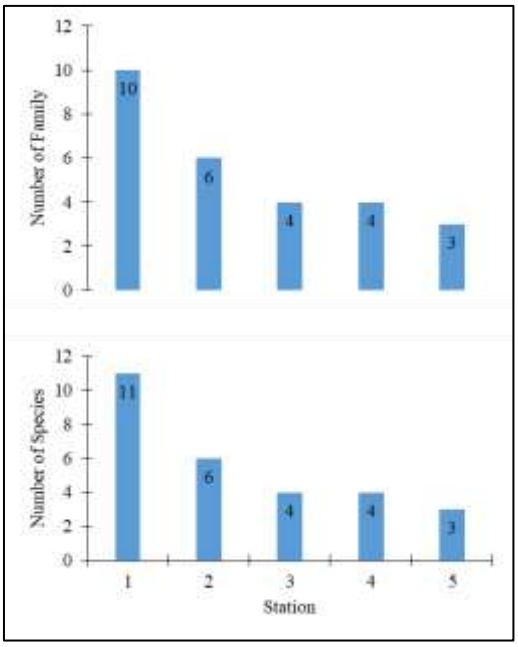


Figure 5. 52 Point wise variation of Family (above) and species (below)

Table 5. 51 Quantitative account on macroinvertebrates of the study areas

Point	1	2	3	4	5
No. of organism (m^2)	233	239	207	233	17,443

Not only the substrate but also the river bank is changed by turbulent flow and deposition. In the habitat type of river, the macro-invertebrate communities were dominated by Oligochaeta which belong to the tolerant taxa that could somewhat endure water pollution. The investigation results indicated that the river bed under the bridge is consistently added to by silt deposits. Insect species such as Ephemeroptera, Plecoptera, and Trichoptera were the most vulnerable to adverse changes of the river bank. Few insect species can reproduce in such a degraded ecosystem without vegetation except Chironomidae and Diptera Yu et al. 2016. These insect species were not detected in the present study. However, order; Diptera of 2 species mosquito larvae and true fly larvae were discovered in the lake habitat areas.

The difference of species diversity between the normal sites and the river (under-bridge) sites is significant mainly because of the absence of insects at under-bridge sites. Conversely, the relationship of abundance and biomass between under-bridge sites and lake sites demonstrated that the tolerant species Oligochaetes were barely affected by such habitat degradation.

Ghosh et al. 2015 mentioned that low diversity indices, like the Shannon-Wiener Index, demonstrated clearly that the selected lake is polluted and has high anthropogenic activity which has rendered the lake bad to poor health status especially during monsoon season. Otherwise, a large H' value indicates greater diversity, as influenced by a greater number and/or a more equitable distribution of taxon. In the present study, the Shannon-Wiener index values at each site were 0.12 point 1, 0.14 point 2, 0.14 at point 3, 0.16 point 4 and 0.14 point 5 respectively (Table 5.52).

According to the outputs of potential impacts matrix, there is no significant impact for before and after construction period was estimated for the proposed project areas (Table 5.53). However, there are some minor impacts on biodiversity of proposed sites such as temporary habitat loss on site e.g. land taken up by construction equipment, water pollution from accidental spillages, thawing chemicals, runoff and road spray can lead to adverse changes in aquatic biodiversity as can changes in sediment.

Table 5. 52 Species composition, Diversity indices and Pollution tolerance indices of macro-invertebrate

S/N	Genus and Species	Point				
		1	2	3	4	5
1	*Paragrapsus gaimardii*	+	+			
2	Damselfly larvae		+	+		
3	*Ophiogomphus cecilia*				+	
4	*Mesovelia mulsanti*			+		
5	Creeping water bug			+		
6	*Dytiscus marginalis*			+		
7	Mosquito larvae			+		

S/N	Genus and Species	Point				
		1	2	3	4	5
8	True fly larvae			+		+
9	*Syllid* sp.		+			
10	*Nereis* sp.1	+	+			
11	*Nereis* sp.2					+
12	*Dero* sp.				+	+
13	*Eiseniella tetraedra*			+	+	
14	*Gyraulus convexiusculus*			+		
15	*Succinea putris*			+	+	
16	*Pomacea lineata*			+		
17	*Pomacea paludosa*	+			+	
18	*Floridobia floridana*			+		
19	*Physella gyrina*					+
20	*Juga plicifera*				+	
	Total	3	4	11	6	4
Diversity Index (H')		0.12	0.14	0.14	0.16	0.14
PTI		4	3	17	17	12

Group 1: Intolerant to pollution
Group 2: Moderately Intolerant to pollution
Group 3: Fairly Tolerant to pollution
Group 4: Very Tolerant to pollution
Excellent >23
Good 17 to 22
Fair 11 to 16
Poor 0 to 10

Table 5. 53 Primary Source and Potential Impacts of Proposed Project Areas

Source	Impacts	Matrix
Air quality	High levels of NOx can have an effect on vegetation, including leaf damage and reduced growth. It can make indirect effect on macroinvertebrates communities.	2
Land take	Land take or changes in land usage may impact existing habitats and species, depending on mitigation measures.	1
Noise	Any increase in noise levels has the potential to impact on noise-sensitive species in the vicinity of the site.	2
Traffic	Noise or land take related to increased traffic or the construction of access roads may impact upon existing habitats and species, depending on mitigation measures.	2
Soils and hydrogeology	Any deterioration in soils or changes in hydrogeology may impact upon existing habitats and species.	1
Water quality	Any deterioration in water quality may impact upon water- dependent species and habitats.	1

Minor impact (1); An impact that causes noticeable changes in the character of the environment without affecting its sensitivities, e.g. a planned or unplanned discharge that could result in exceedances of an environmental quality guideline in the immediate vicinity of the release point, but that would not be expected to have significant environmental or health effects (ecosystem functions are not affected).

Moderate impact (2); An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends, e.g. a discharge or incident resulting in potential effects on natural ecosystems in the vicinity of the release point or incident; ongoing effects on people in the vicinity of a site due to impacts such as noise, odour or traffic.

Significant impact (3); An impact that, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.

Wet Season Survey

A total of 18 macroinvertebrates belonging to 12 orders and 17 families were recorded from the four points (Table 5.54). Among them, 7 species were comprised under Arthopoda, 3 species were Annelida and 8 species were Mollusca. Point 3 has the highest species occurrence with a value of 14 species, followed 7 species of macroinvertebrates were detected in Point 4. On the other hand, the lowest species occurrences were found in Point 5 (only 1 species) and Point 2 (2 species).

At Point 3, most of the species were observed rarely but some species are common to dominant. Most species are commonly found in Point 4 but few species are rarely observed. Although species diversity was lowest, the number of its quantities was highest among five points. Likewise, there are two species of benthos were recorded in Point 2 but their abundance were common.

Biomphalaria pfeifferi, this snail is a medically important pest because of transferring the disease schistosomiasis. This species is resistant to low oxygen levels. Melanoides tuberculata is known to carry certain parasites which can be dangerous to humans. Scirtids can be common in high quality forested streams, but they can also be common in tree-covered urban ponds. Their presence may therefore reflect more about the abundance of leaf litter than any aspects of water quality.

Table 5. 54 Classified list of macroinvertebrates

S/N	Phylum	Class	Order	Family	Genus and Species/Common name	Frequency
1	Arthropoda	Crustacean	Decapoda	Grapsidae	*Paragrapsus gaimardii*	C
2		Insecta	Odonata	Libellulidae	Skimmers larvae	C
3			Hemiptera	Naucoridae	Creeping water bug	R
4			Coleoptera	Dytiscidae	*Dytiscus marginalis*	R
5				Scirtidae	Beetles larvae	D
6			Diptera	Chironomoidae	True fly larvae	R
7				Stratiomyidae	*Odontomyia* sp.	R
8	Annelida	Polychaeta	Errantia	Nereidae	*Nereis* sp.	C
9		Clitella	Haplotaxida	Naididae	*Dero* sp.	D
10		Oligochaeta		Lumbricidae	*Eiseniella tetraedra*	D
11	Mollusca	Gastropoda	Basommatophora	Planorboidea	*Biomphalaria pfeifferi* (Krauss 1848)	C
12				Planorbidae	*Gyraulus convexiusculus*	C
13			Stylommaatophora	Succineidae	*Succinea putris* (Linnaeus 1758	R
14			Architaenioglossa	Ampullariidae	*Pomacea lineata* (Spix 1827)	C
15					*Pomacea paludosa* (Say 1829)	R
16			Littorinimorpha	Hydrobiidae	*Floridobia floridana* (Frauenfeld 1863)	C
17			Sorbeoconcha	Semisulcospiridae	*Juga plicifera* (Lea 1838)	C
18				Thiaridae	*Melanoides tuberculata* (Müller, 1774)	C

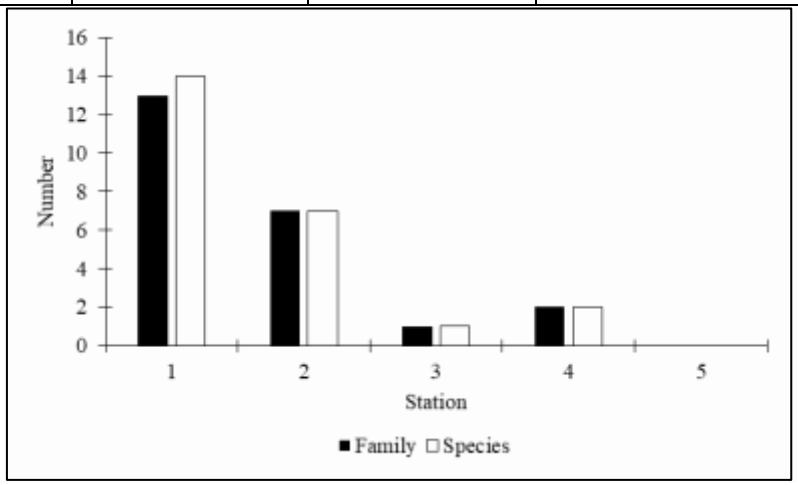


Figure 5. 53 Point-wise variations of family and species of macroinvertebrates

Table 5. 55Quantitative account on macroinvertebrates of the study areas

Point	1	2	3	4	5
No. of organism (m^2)	0	1	579	357	6,875

According to the quantitative analysis, the highest number of organisms were detected in Point 5; 88% (6875 organism/m-2) (Table 5.55) whereas the lowest number of organisms were found in Point 2; 0% (1 organism/m-2). However, the highest diversity of benthos were

found in Lake ecosystem (Point 3; 14 sp. and 4; 7 sp.) (Table 5.56). Because these ecosystems play an important role for their life cycle, especially for insects. In the riverine ecosystem (Points 1; 0 sp. and 2; 2 sp. and), the diversity of species were lowest as well as quantities were also lowest compared to the lake ecosystems because the substrates of riverine are dynamic and lotic ecosystems.

Most studies advocating the use of macroinvertebrates in biomonitoring have focused on stream habitats (Hering et al., 2004; Resh and Jackson, 1993). Among the communities that are considered bioindicators of water quality, the most commonly used are the benthic macroinvertebrates (Bonada et al., 2006) because the structure of the benthic communities in an aquatic ecosystem reflects its ecological conditions, including habitat heterogeneity (Heino et al., 2003) and water quality (Soldner et al., 2004). ALL macroinvertebrates have an important role in the trophic structure of aquatic ecosystems, feeding on living or decomposing organic matter and serving as food for other invertebrates and vertebrates (Moulton et al., 2010).

Table 5. 56 The species distribution, Pollution Tolerance Indices and diversity indices of macroinvertebrates

Sr.	Genus and Species	Points				
		1	2	3	4	5
1	*Paragrapsus gaimardii*	-	+	-	-	-
2	Skimmers larvae	-	-	+	+	-
3	Creeping water bug	-	-	+	-	-
4	*Dytiscus marginalis*	-	-	+	-	-
5	Beetles larvae	-	-	+	-	-
6	True fly larvae	-	-	+	+	-
7	*Odontomyia* sp.	-	-	+	-	-
8	*Nereis* sp.	-	+	-	-	-
9	*Dero* sp.	-	-	+	+	-
10	*Eiseniella tetraedra*	-	-	+	-	+
11	*Biomphalaria pfeifferi* (Krauss 1848)	-	-	+	-	-
12	*Gyraulus convexiusculus*	-	-	+	-	-
13	*Succinea putris* (Linnaeus 1758	-	-	-	+	-
14	*Pomacea lineata* (Spix 1827)	-	-	+	+	-
15	*Pomacea paludosa* (Say 1829)	-	-	+	-	-
16	*Floridobia floridana* (Frauenfeld 1863)	-	-	+	+	-
17	*Juga plicifera* (Lea 1838)	-	-	-	+	-
18	*Melanoides tuberculata* (O. F. Müller, 1774)	-	-	+	-	-
	Total					
Diversity Index (H')		0.00	0.11	0.11	0.16	0.07
PTI		0	0	32	17	1

Group 1: Intolerant to pollution
Group 2: Moderately Intolerant to pollution
Group 3: Fairly Tolerant to pollution
Group 4: Very Tolerant to pollution
Excellent = >23
Good 17 to 22
Fair 11 to 16
Poor 0 to 10

There are five functional trophic groups, defined by their feeding strategy as collector-gatherers, predators, collector-filterers, shredders, and scrapers (Merritt and Cummins 1996; Cummins et al., 2005). According to Tomanova et al., 2006, the collector- gatherers are the

dominant trophic group in tropical streams because of the abundance of resources produced by the rapid degradation of allochthonous organic matter. In the present study, 3 species of collector-gatherers viz., Beetles larvae, Odontomyia sp. and Eiseniella tetraedra were recorded. Moreover, one species of shredder (Paragrapsus gaimardii) and 2 species of predators (Skimmers larvae, Dytiscus marginalis) were also detected.

At Point 3, some species are very tolerant to pollution such as True fly larvae: most chironomid larvae (True fly) are tolerant to environmental degradation and characteristic of lentic and lotic ecosystems, being able to tolerate low levels of dissolved oxygen (Junqueira and Campos, 1998), Dero sp., Eseniella tetraedra, Biomphalaria pfeifferi and Gyraulus convexiusculus. This mean they could be found in polluted environment. On the other hand, some species are very sensitive to moderately tolerant to pollution such as Skimmers larvae, Dytiscus marginalis, Beetles larvae, Pomacea lineata, P. paludosa, Floridobia floridana and Melanoides tuberculate. According to the Pollution Tolerance Indices (PTI), Point 3 shows the excellent conditions environmentally, although the individual of true fly larvae were dominant (Table 5.56).

The environmental conditions of Point 4 also has the good condition because it has 17 PTI value with 2 pollution tolerant species and, 5 species are intolerant to moderately tolerant in environmental conditions.

The deterioration of environmental condition occurred in Point 5 because its PTI value was only 1. The major impact could be attributed to the poor management in household waste. Although the PTI values of Points 1 and 2 were very low the environmental condition could much better than other points because the Points are located in riverine environment.

According to the results of potential impacts matrix, there is no significant impact for before and after construction period was estimated for the proposed project areas (Table 5.57). However, there are some minor impacts on biodiversity of proposed sites such as temporary habitat loss on site e.g. land taken up by construction equipment, water pollution from accidental spillages, thawing chemicals, runoff and road spray can lead to adverse changes in aquatic biodiversity as can changes in sediment.

Table 5. 57 Primary source and potential impacts of proposed project areas

Source	Impacts	Matrix
Air quality	High levels of NOx can have an effect on vegetation, including leaf damage and reduced growth. It can make indirect effect on macro-invertebrates communities.	2
Land take	Land take or changes in land usage may impact existing habitats and species, depending on mitigation measures.	1
Noise	Any increase in noise levels has the potential to impact on noise- sensitive species in the vicinity of the site.	2
Traffic	Noise or land take related to increased traffic or the construction of access roads may impact upon existing habitats and species, depending on mitigation measures.	2
Soils and hydrogeology	Any deterioration in soils or changes in hydrogeology may impact upon existing habitats and species.	1
Water quality	Any deterioration in water quality may impact upon water- dependent species and habitats.	1

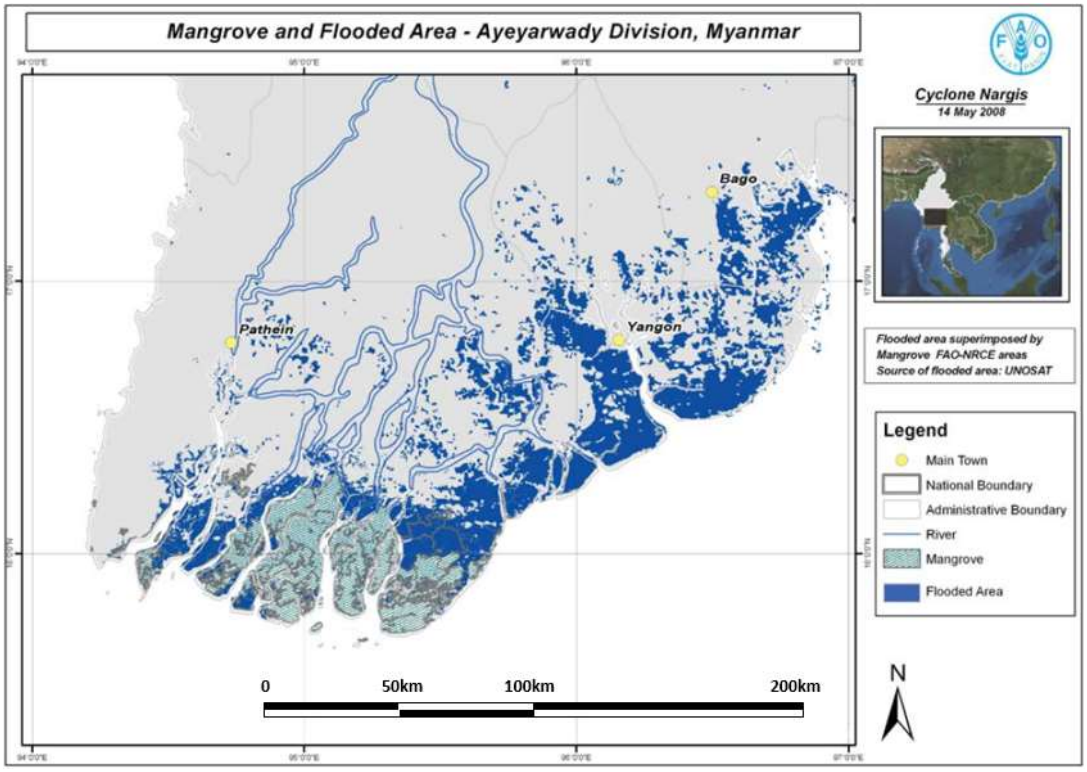
Minor impact (1); An impact that causes noticeable changes in the character of the environment without affecting its sensitivities, e.g. a planned or unplanned discharge that could result in exceedances of an environmental quality guideline in the immediate vicinity of the release point, but that would not be expected to have significant environmental or health effects (ecosystem functions are not affected).

Moderate impact (2); An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends, e.g. a discharge or incident resulting in potential effects on natural ecosystems in the vicinity of the release point or incident; ongoing effects on people in the vicinity of a site due to impacts such as noise, traffic.

Significant impact (3); An impact that, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.

5.4.3 Mangrove

Regarding distribution of mangrove, it is widely distributed in the Ayeyarwady region. On the other hand, it is not distributed around Yangon region as shown in Figure 5.53.



Reference: Digital Agricultural Atlas of the Union of Myanmar, The Union of Myanmar, Ministry of Agriculture and Irrigation, United Nations Development Programme, Food and Agriculture Organization of the United Nations

Figure 5. 54 Distribution Map of Mangrove Forest in Yangon and Ayeyarwady

5.4.4 Tree counting

As of April 2019, over 1,500 trees, not included in the government area shown as below table, may be logged or transplanted due to the construction of YUMRT. Especially in Hlaing Tharyar Township, it is estimated that approx. 1,200 trees will be affected.

Table 5. 58 Estimated number of logged trees along the YUMRT alignment

No.	Township	Public area		Private area	Government area	Total (Provisional)
		North Side	South Side			
1	South Okkalapa	23	-	20	Unknown	48
2	Yankin	35	12	3		50
3	Hlaing	96	93	3		192
4	Mayangone	18	21	0		59
5	Hlaing Tharyar	417	755	10		1191
Total		589	881	36		1,506

Reference: JICA study team

5.5 Description of Project-Affected Persons

5.5.1 Census Survey

(1) Survey Coverage

A census survey on those PAPs was carried out by JICA Study Team from May to July, 2019. The LARAP survey aimed to cover all possible PAHs from the Project. Efforts were made to inform the survey schedule to Ward GAD to inform PAHs in advance and the survey team visited at least twice if absent. Even with those attempts, 11.7% of the PAHs could not be covered in this survey as shown in Table 5.59. Therefore, the survey results presented in the following sections are the information of PAHs and PAPs covered in the survey.

Table 5. 59 Survey Coverage (Unit: PAH)

Township	Total PAHs	PAHs un-surveyed
Hlaing Tharyar	1,007	86
Hlaing	77	25
Mayangon	59	21
Yankin	11	1
South Okkalappa	11	3
Total	1,165	136

Reference: JICA study team

In Detail Design stage, the boundaries of affected area will be clearly demarcated and identified on the ground. If there were additional affected area and affected people due to the changes of the alignment, a supplementary survey will be conducted, and the survey result will be updated.

(2) Project Affected Household and Project Affected People

Total PAHs and PAPs from the project are 1,165 PAHs and 4,873 PAPs, respectively. Township wise, majority of PAHs are in Haing Tharyar Township totaling 1,007 PAHs. Among PAHs, 67 PAHs will be considered as non-displaced PAHs whose part of the land and/or income source will be affected by the project but do not have to change the location of their houses. On the other hand, 1,165 PAHs are considered as displaced PAHs whose structure and the combination of structure, land and income sources will be affected by the project.

Table 5. 60 Type of Loss by PAHs and Total PAPs

Township	PAHs			PAPs
	Non-Displaced	Displaced	Total	Total
Hlaing Tharyar	67	940	1,007	4,129
Hlaing	18	59	77	349
Mayangon	24	35	59	293
Yankin	7	4	11	51
South Okkalappa	4	7	11	51
Total	67	1,045	1,165	4,873

Note: The figures exclude remaining PAHs
Source: JICA Study Team

(3) Household Size

According to Population and Housing Census 2014, mean household size in Yangon is 5.61. PAHs of this Project shows similar figure which is 5.59 and PAHs having more than 5 members in the family consists of 33.7% of total surveyed PAHs.

Table 5. 61 Household Size (Unit: PAH)

Township	1	2	3	4	5	6	7+
Hlaing Tharyar	19	124	234	247	133	80	82
Hlaing	3	5	9	14	9	6	10
Mayangon	4	3	3	6	6	3	10
Yankin	0	3	1	1	2	0	3
South Okkalappa	1	1	3	1	0	2	1
Total	27	136	250	269	150	91	106

Note: The figures exclude remaining PAHs
Source: JICA Study Team

(4) Ethnic Group

The Myanmar government officially recognize 135 distinct ethnic groups. Major national ethnic groups are: Bamar, Chin, Kachin, Kayin, Kayah, Mon, Rakhaine and Shan. Among PAHs, 94% are Bamar and some are from other ethnic groups and a few Chinese and Singaporean.

Table 5. 62 Profile of Ethnic Group (Unit: PAH)

Township	Bamar	Chin	Kachin	Kayin	Kayah	Mon	Rakhaine	Shan	Others
Hlaing Tharyar	868	1	0	29	0	2	13	1	8
Hlaing	51	0	0	1	0	0	1	3	0
Mayangone	28	0	0	0	0	0	1	3	2
Yankin	10	0	0	0	0	0	0	0	0
South Okkalappa	9	0	0	0	0	0	0	0	0
Total	966	1	0	30	0	2	15	7	10

Note: The figures exclude remaining PAHs
Source: JICA Study Team

(5) Language

Almost all PAHs speak Bamar language. Others speaks Barmer language and Shan, Rakhaine, Mon Kayin, English and Chinese.

Table 5. 63 Profile of Language (Unit: PAH)

Township	Bamar	Chin	Kachin	Kayin	Kayah	Mon	Rakhaine	Shan	Others
Hlaing Tharyar	918	0	0	1	0	1	1	0	1
Hlaing	55	0	0	0	0	0	0	1	0
Mayangon	32	0	0	0	0	0	0	1	1
Yankin	10	0	0	0	0	0	0	0	0
South Okkalappa	9	0	0	0	0	0	0	0	0
Total	1,024	0	0	1	0	1	1	2	2

Note: The figures exclude remaining PAHs
Source: JICA Study Team

(6) Religion

The religious belief of almost all surveyed PAHs are Buddhism. Other religions include Christian, Muslim, and Hindu. No PAHs maintain special cultural and social traditions outside of the mainstream.

Table 5. 64 Profile of Religion (Unit: PAH)

Township	Buddhism	Christian	Muslim	Hindu	Others
Hlaing Tharyar	908	7	4	3	0
Hlaing	55	0	1	0	0
Mayangon	30	2	1	0	0
Yankin	10	0	0	0	0
South Okkalappa	9	0	0	0	0
Total	1,012	9	6	3	0

Note: The figures exclude remaining PAHs
Source: JICA Study Team

5.5.2 Loss of Inventory Survey

(1) Loss of Land

The total affected area from the project is 15.6 acre, of which 5.0 acre is private land and 10.6 acre is government land. Affected private land is composed of freehold land, grant land and licensed land, 4.0 acre, 0.5 acre and 0.5 acre, respectively. The majority of affected private land is located in Mayangon Township.

Table 5. 65 Affected Land by Land Type (Unit: Acre)

Township	Private			Government	Total
	Freehold	Grant	License		
Hlaing Tharyar	-	-	-	1.5	1.5
Hlaing	1.5	-	-	3.5	5.0

Mayangon	2.0	0.5	0.5	5.0	8.0
Yankin	0.5	-	-	0.5	1.0
South Okkalappa	-	-	-	0.1	0.1
Total	4.0	0.5	0.5	10.6	15.6

Source: JICA Study Team (Data provided from YCDC)

(2) Loss of Structures

Among project affected structures, 626 Project Affected Units (PAUs) are the residential use followed by the mixed use of residential and commercial and the commercial use, 242 PAUs and 124 PAUs, respectively, which are summarized in Table 5.66 and Table5.67 indicates PAUs by type of structure. 921 units are wooded and bamboo structures most of which are in Hlaing Tharyar Township. 45 units are RC/SRC structures which are mainly located in Hlaing and Mayangon Township. Examples of different type of structures are shown in Figure 5.55.

Table 5. 66 Project Affected Structures by Type of Use (Unit: PAU)

Township	Residential	Commercial	Mix	Government	Others	Total
Hlaing Tharyar	605	79	224	1	2	911
Hlaing	3	15	9	17	0	44
Mayangon	16	23	4	3	1	47
Yankin	2	1	2	0	0	5
South Okkalappa	0	6	3	0	0	9
Total	626	124	242	21	3	1,016

Note: The figures exclude remaining PAHs
Source: JICA Study Team

Table 5. 67 Project Affected Structures by Type of Structure (Unit: PAU)

Township	RC/SRC	Brick Nogging	Wood/ Bamboo	Others	Total
Hlaing Tharyar	1	0	905	3	909
Hlaing	28	6	3	2	39
Mayangon	15	11	4	2	32
Yankin	0	1	6	1	8
South Okkalappa	1	3	3	1	8
Total	45	21	921	9	996

Note: The figures exclude remaining PAHs
Source: JICA Study Team



RC Structure



Brick Nogging Structure



Wooden Structure

Source: JICA Study Team

Figure 5. 55 Type of Structures

(3) Loss of Common Property Resources

Total likely affected common properties are 10 units, which include religious halls, government dormitories, water pump, and public toilets.

Table 5. 68 Affected Common Property

Township	Unit	Remark
Hlaing Tharyar	3	Water pump, Gate, Public toilet
Hlaing	2	Religious hall, Industrial unit
Mayangon	5	Guard Office, Religious Hall, Water pump
Yankin	0	-
South Okkalappa	0	-
Total	10	-

Source: JICA Study Team

(4) Loss of Livelihood

Since the project does not have impact on agriculture land, there are no livelihood loss from the land-based economy. The impact on economic activities along the Hlaing River was confirmed by Focus Group Discussions (FGDs) with boat operators and fishermen. Based on the result, it is also considered that the impact will be negligible that can be managed by the mitigation measures included in the Environmental Management Plan.

On the other hand, there are some PAHs making a living from the project affected structures, namely: apartment owner and business operator of the commercial buildings and shops. Those PAHs will lose income generating opportunities during the resettlement and transition period until they can restart their business. The compensation policy will cover those losses.

CHAPTER 6 ASSESSMENT OF ENVIRONMENTAL IMPACT

Generally speaking, transportation infrastructure should be used semi-permanently with repeated periodic inspection and maintenance due to highly public facility. Therefore, this section describes the potential environmental and social impacts expected to take place during pre-construction, construction, operation, decommission and demolition phase of the project. The phase of closure and post-closure shall be omitted due to above mentioned reasons. Additionally, Assessments of Environmental Impact including Evaluation Matrix and Reason for Construction of Railway Bridge and Instalment of transmission line were prepared separately because the two construction works have different environmental impacts compared with main construction work. Predictions of the impacts were conducted based on the results of scoping, analysis of the project components and the baseline data including field survey results.

While there is essentially no project without negative impact, most of the impacts expected to be generated from the project are considered to be limited in scale, confined to the project area, and hence manageable. This is due to the nature of the project (new construction), the social and natural environmental conditions in and around the project area (e.g. absence of protected areas and endangered or rare species). As a result, no impact has been evaluated to be significantly detrimental (i.e. 'A-') in the impact assessment except resettlement and poverty on the pre-construction stage shown in Tables.

Some of the key negative impacts expected by the project include: generation of noise and vibration; and deterioration of air and water quality. Effective and practical countermeasures must be adopted against each of these impacts. For example, consultation meetings should be held with all stakeholders and yet with the PAPs in particular in a timely and accessible manner to alleviate the stress caused by resettlement, construction works should be avoided at night time as much as possible to reduce the level of nuisance caused by the construction works, construction methods should be adopted and equipment used in a way that minimizes the risk of generating air pollution and increasing noise and vibration levels, and proper water treatment facilities (e.g. floating equipment) must be installed to avoid water contamination from occurring at depots (refer to Chapter 6 for a more detailed description of the countermeasures proposed to be adopted against each impact).

Result of the environmental and social impact assessment is shown in Table 6.5 to 6.8 along with the results of the assessment made earlier at the scoping stage to allow comparisons to be made. It should be noted that the evaluation has been made based on the premise that no countermeasure would be put in place.

Table 6. 1 Environmental and Social Impact for Railway

	No	Impact Activities / Impacted Item	Comprehensive evaluation	Pre-construction phase or construction phase									Operation phase			
				Land acquisition and loss of inventory including the object related to demolition of existing buildings	Modification of land use plan and Management of each construction activity based on the construction rule	Construction waste	Tree logging	Cutting and filling soil and digging with land modification	Operation of construction heavy machine and Dump trucks	Construction of viaducts, railway tracks, stations, a rolling stock yard, relocation and under installation of high –voltage line	Traffic control in and around construction site	In flow of construction participant and establishment of base camp	Reduction of Through-traffic volume due to development of YUMRT And speeding up of passage velocity	Operation of YUMRT	Existence of viaducts, railway tracks, stations, a rolling stock yard.	Increasing of number of settlers
Pollution	1	Air pollution	**B-/B+**	D	D	D	D	D	**B-**	D	**B-**	D	**B+**	D	D	D
	2	Water pollution	**B-/B-**	D	D	**B-**	D	**B-**	D	**B-**	D	**B-**	D	D	**B-**	**B-**
	3	Waste	**B-/B-**	**B-**	D	**B-**	**B-**	**B-**	D	D	D	**B-**	D	D	**B-**	**B-**
	4	Soil contamination	**B-/B-**	D	D	**B-**	D	**B-**	D	D	D	D	D	D	**B-**	D
	5	Noise and vibration	**B-/B±**	D	D	D	D	D	**B-**	**B-**	**B-**	D	**B+**	**B-**	**B-**	D
	6	Ground subsidence	**B-/D**	D	D	D	D	**B-**	D	D	D	D	D	D	D	D
	7	Offensive odor	**B-/B-**	D	D	D	D	D	D	D	D	**B-**	D	D	**B-**	D
	8	Bottom sediment	**D/D**	D	D	D	D	D	D	D	D	D	D	D	D	D
Natural Environment	9	Protected area	**D/D**	D	D	D	D	D	D	D	D	D	D	D	D	D
	10	Ecosystem	**B-/B-**	D	D	**B-**	**B-**	**B-**	D	**B-**	D	D	D	**B-**	**B-**	D
	11	Hydrology	**B-/D**	D	D	D	D	**B-**	D	D	D	D	D	D	D	D
	12	Geology and Topography	**B-/D**	D	D	D	D	**B-**	D	**B-**	D	D	D	D	D	D
Social Environment	13	Land acquisition/ Resettlement	**A-/D**	**A-**	D	D	D	D	D	D	D	D	D	D	D	D
	14	Poverty	**A-/B+**	**A-**	D	D	D	D	D	**B+**	D	D	D	**B+**	**B+**	D
	15	Indigenous and ethnic people	**B-/D**	**B-**	D	D	D	D	D	D	D	D	D	D	D	D
	16	Local economy such as employment and livelihood, etc.	**B-/B+**	**B-**	D	D	D	D	D	**B+**	D	**B+**	**C**	**B+**	**B+**	D
	17	Land use and utilization of local resources	**B-/B-**	**B-**	**B-**	D	D	**B-**	D	**B-**	D	D	D	D	**B-**	D
	18	Water use and its rights	**B-/D**	D	D	D	D	D	D	**B-**	D	D	D	D	D	D
	19	Existing social infrastructure and services	**B-/B+**	**B-**	D	D	D	D	D	**B-**	**B-**	D	**B+**	**B+**	D	D
	20	Social institutions such as social infrastructure and local decision-making institutions	**B-/B+**	D	D	D	D	D	D	**B-**	D	D	D	**B+**	**B+**	D
	21	Maldistribution of benefit and damage	**B-/B-**	D	D	D	D	D	D	**B-**	**B-**	**B-**	D	D	D	**B-**
	22	Local conflict of interest	**B-/B-**	**B-**	D	D	D	D	D	**B-**	D	**B-**	D	**B-**	D	D
	23	Cultural heritage	**D/D**	D	D	D	D	D	D	D	D	D	D	D	D	D
	24	Landscape	**B-/B-**	D	D	D	D	D	D	**B-**	D	D	D	D	**B-**	D
	25	Gender	**B-/D**	D	D	D	D	D	D	D	D	**B-**	D	**B-**	**B-**	D
	26	Children's rights	**B-/D**	D	D	D	D	D	D	D	D	**B-**	D	D	D	D
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-/B-**	D	D	D	D	D	D	D	D	**B-**	D	D	D	**B-**
	28	Labor environment including labor safety	**B-/B-**	D	D	D	D	**B-**	D	D	D	**B-**	D	**B-**	**B-**	D
Others	29	Accidents	**B-/B-**	D	D	D	D	D	**B-**	D	**B-**	D	**B-**	**B-**	D	D
	30	Cross-border impact and climate change	**B-/B-**	D	D	D	D	D	**B-**	D	D	D	D	**B-**	D	D

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 6. 2 Environmental and Social Impact for Receiving Substation

	No	Impact Activities / Impacted Item	Comprehensive evaluation	Pre-construction phase or construction phase									Operation phase	
				Land acquisition and loss of inventory including the object related to demolition of existing buildings	Modification of land use plan and Management of each construction activity based on the construction rule	Construction waste	Tree logging	Cutting and filling soil and digging with land modification	Operation of construction heavy machine and Dump trucks	Construction of Substation	Traffic control in and around construction site	In flow of construction participant and establishment of base camp	Operation of Receiving Substation	Existence of Receiving Substation
Pollution	1	Air pollution	**B-/D**	D	D	D	D	D	**B-**	D	**B-**	D	D	D
	2	Water pollution	**B-/D**	D	D	**B-**	D	**B-**	D	**B-**	D	**B-**	D	D
	3	Waste	**B-/D**	D	D	**B-**	**B-**	**B-**	D	**B-**	D	**B-**	D	D
	4	Soil contamination	**B-/B-**	D	D	**B-**	D	**B-**	**B-**	D	D	D	**B-**	D
	5	Noise and vibration	**B-/B-**	D	D	D	D	D	**B-**	**B-**	**B-**	D	**B-**	D
	6	Ground subsidence	**B-/D**	D	D	D	D	**B-**	**B-**	**B-**	D	D	D	D
	7	Offensive odor	**B-/D**	D	D	D	D	D	D	D	D	**B-**	D	D
	8	Bottom sediment	**B-/D**	D	D	D	D	**B-**	D	D	D	D	D	D
Natural Environment	9	Protected area	**D/D**	D	D	D	D	D	D	D	D	D	D	D
	10	Ecosystem	**B-/B-**	D	D	D	**B-**	**B-**	D	D	D	D	D	**B-**
	11	Hydrology	**D/D**	D	D	D	D	D	D	D	D	D	D	D
	12	Geology and Topography	**D/D**	D	D	D	D	D	D	D	D	D	D	D
Social Environment	13	Land acquisition/ Resettlement	**D/D**	D	D	D	D	D	D	D	D	D	D	D
	14	Poverty	**D/D**	D	D	D	D	D	D	D	D	D	D	D
	15	Indigenous and ethnic people	**D/D**	D	D	D	D	D	D	D	D	D	D	D
	16	Local economy such as employment and livelihood, etc.	**B±/D**	**B-**	D	D	D	D	D	**B+**	D	**B+**	D	D
	17	Land use and utilization of local resources	**B-/D**	D	**B-**	D	D	D	D	D	D	D	D	D
	18	Water use and its rights	**B-/D**	D	D	D	D	D	D	D	D	**B-**	D	D
	19	Existing social infrastructure and services	**B-/D**	D	D	D	D	D	D	D	D	D	D	D
	20	Social institutions such as social infrastructure and local decision-making institutions	**D/D**	D	D	D	D	D	D	D	D	D	D	D
	21	Maldistribution of benefit and damage	**B-/D**	D	**B-**	D	D	D	D	D	D	D	D	D
	22	Local conflict of interest	**B-/D**	D	D	D	D	D	D	D	D	**B-**	D	D
	23	Cultural heritage	**D/D**	D	D	D	D	D	D	D	D	D	D	D
	24	Landscape	**D/D**	D	D	D	D	D	D	D	D	D	D	D
	25	Gender	**B-/D**	D	D	D	D	D	D	D	D	**B-**	D	D
	26	Children's rights	**D/D**	D	D	D	D	D	D	D	D	D	D	D
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-/D**	D	D	D	D	D	D	D	D	**B-**	D	D
	28	Labor environment including labor safety	**B-/B-**	D	D	D	D	**B-**	**B-**	**B-**	D	**B-**	**B-**	D
Others	29	Accidents	**B-/D**	D	D	D	D	D	**B-**	**B-**	**B-**	D	**D**	D
	30	Cross-border impact and climate change	**D/D**	D	D	D	D	D	D	D	D	D	D	D

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 6. 3 Environmental and Social Impact for Transmission Line

	No	Impact Activities / Impacted Item	Comprehensive evaluation	Pre-construction phase or construction phase								Operation phase	
				Land acquisition and loss of inventory including the object related to demolition of existing buildings	Modification of Land Use and Management of each construction activity based on the construction rule	Construction waste	Tree logging	Cutting and filling soil and digging with land modification	Operation of construction heavy machine and Dump trucks and Transportation and Installation of transmission pipe line	Traffic control in and around construction site	In flow of construction participant and establishment of base camp	Operation and Maintenance of Transmission Line	Existence of Transmission line
Pollution	1	Air pollution	**B-/D**	D	D	D	D	D	**B-**	**B-**	D	D	D
	2	Water pollution	**B-/D**	D	D	B-	D	**B-**	D	D	D	D	D
	3	Waste	**B-/D**	D	D	**B-**	**B-**	**B-**	D	D	**B-**	D	D
	4	Soil contamination	**B-/D**	D	D	**B-**	D	D	**B-**	D	D	D	D
	5	Noise and vibration	**B-/D**	D	D	D	D	D	**B-**	**B-**	D	D	D
	6	Ground subsidence	**D/D**	D	D	D	D	D	D	D	D	D	D
	7	Offensive odor	**B-/D**	D	D	D	D	D	**B-**	D	D	D	D
	8	Bottom sediment	**B-/D**	D	D	D	D	**B-**	D	D	D	D	D
Natural Environment	9	Protected area	**D/D**	D	D	D	D	D	D	D	D	D	D
	10	Ecosystem	**D/D**	D	D	D	D	D	D	D	D	D	D
	11	Hydrology	**D/D**	D	D	D	D	D	D	D	D	D	D
	12	Geology and Topography	**D/D**	D	D	D	D	D	D	D	D	D	D
Social Environment	13	Land acquisition/ Resettlement	**D/D**	D	D	D	D	D	D	D	D	D	D
	14	Poverty	**B-/D**	D	D	D	D	D	**B-**	D	D	D	D
	15	Indigenous and ethnic people	**D/D**	D	D	D	D	D	D	D	D	D	D
	16	Local economy such as employment and livelihood, etc.	**B±/D**	D	D	D	D	D	B-	D	**B+**	D	D
	17	Land use and utilization of local resources	**B-/D**	D	D	D	D	**B-**	D	D	D	D	D
	18	Water use and its rights	**B-/D**	D	D	D	D	D	**B-**	D	D	D	D
	19	Existing social infrastructure and services	**B-/D**	D	D	D	D	D	**B-**	D	D	**B+**	D
	20	Social institutions such as social infrastructure and local decision-making institutions	**D/D**	D	D	D	D	D	D	D	D	D	D
	21	Maldistribution of benefit and damage	**B-/D**	D	D	D	D	**B-**	**B-**	D	D	D	D
	22	Local conflict of interest	**B-/D**	D	D	D	D	**B-**	**B-**	D	D	D	D
	23	Cultural heritage	**D/D**	D	D	D	D	D	D	D	D	D	D
	24	Landscape	**B-/D**	D	D	D	D	D	**B-**	D	D	D	D
	25	Gender	**B-/D**	D	D	D	D	D	D	D	**B-**	D	D
	26	Children's rights	**B-/D**	D	D	D	D	D	D	D	**B-**	D	D
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-/D**	D	D	D	D	D	D	D	**B-**	D	D
	28	Labor environment including labor safety	**B-/D**	D	D	D	D	**B-**	**B-**	D	**B-**	D	D
Others	29	Accidents	**B-/D**	D	D	D	D	**B-**	**B-**	**B-**	D	D	D
	30	Cross-border impact and climate change	**D/D**	D	D	D	D	D	D	D	D	D	D

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 6. 4 Environmental and Social Impact for New Bayint Naung Bridge

	No	Impact Activities / Impacted Item	Comprehensive evaluation	Pre-construction phase or construction phase									Operation phase		
				Land acquisition and loss of inventory including the object related to demolition of existing buildings	Modification of land use plan and Management of each construction activity based on the construction rule	Construction waste	Tree logging	Cutting and filling soil and digging with land modification	Operation of construction heavy machine and Dump trucks	Construction of the bridge	Traffic control in and around construction site	In flow of construction participant and establishment of base camp	Reduction of Through-traffic volume due to development of YUMRT And speed in gup of passage velocity	Operation of YUMRT	Existence of viaducts and bridge
Pollution	1	Air pollution	**B-/B+**	D	D	**D**	D	D	**B-**	D	**B-**	D	**B+**	D	D
	2	Water pollution	**B-/D**	D	D	**B-**	D	**B-**	**B-**	**B-**	D	**B-**	D	D	D
	3	Waste	**B-/D**	D	D	**B-**	**B-**	**B-**	D	D	D	**B-**	D	D	D
	4	Soil contamination	**B-/D**	D	D	**B-**	D	**B-**	**B-**	D	D	D	D	D	D
	5	Noise and vibration	**B-/B±**	D	D	D	D	**B-**	**B-**	**B-**	**B-**	D	**B+**	**B-**	**B-**
	6	Ground subsidence	**B-/B-**	D	D	D	D	**B-**	D	**B-**	D	D	D	**B-**	**B-**
	7	Offensive odor	**B-/D**	D	D	D	D	D	D	D	D	**B-**	D	D	D
	8	Bottom sediment	**B-/D**	D	D	**B-**	D	**C**	**B-**	**B-**	D	**B-**	D	D	D
Natural Environment	9	Protected area	**D/D**	D	D	D	D	D	D	D	D	D	D	D	D
	10	Ecosystem	**B-/B-**	D	D	D	**B-**	**B-**	D	**B-**	D	D	D	**B-**	**C**
	11	Hydrology	**B-/B-**	D	D	D	D	D	D	**B-**	D	D	D	D	**B-**
	12	Geology and Topography	**B-/B-**	D	D	D	D	**B-**	D	**B-**	D	D	D	D	**B-**
Social Environment	13	Land acquisition/ Resettlement	**B-/D**	**B-**	D	D	D	D	D	D	D	D	D	D	D
	14	Poverty	**B-/D**	**B-**	D	D	D	D	D	D	D	D	D	D	D
	15	Indigenous and ethnic people	**D/D**	D	D	D	D	D	D	D	D	D	D	D	D
	16	Local economy such as employment and livelihood, etc.	**B±/B-**	**B-**	D	D	D	D	D	**B+**	D	**B+**	D	D	**B-**
	17	Land use and utilization of local resources	**B-/D**	**B-**	**B-**	D	D	**B-**	D	**B-**	D	D	D	D	D
	18	Water use and its rights	**B-/B-**	D	D	D	D	D	D	**B-**	D	D	D	D	**B-**
	19	Existing social infrastructure and services	**B-/B+**	**B-**	D	D	D	**B-**	D	**B-**	**B-**	D	D	**B+**	**B+**
	20	Social institutions such as social infrastructure and local decision-making institutions	**D/D**	D	D	D	D	D	D	D	D	D	D	D	D
	21	Maldistribution of benefit and damage	**B-/B-**	**B-**	D	D	D	D	D	**B-**	**B-**	**B-**	D	**B-**	D
	22	Local conflict of interest	**B-/D**	**B-**	D	D	D	D	D	**B-**	D	**B-**	D	D	D
	23	Cultural heritage	**D/D**	D	D	D	D	D	D	D	D	D	D	D	D
	24	Landscape	**B-/D**	D	D	D	D	D	D	**B-**	D	D	D	D	D
	25	Gender	**B-/D**	D	D	D	D	D	D	**D**	D	**B-**	D	D	D
	26	Children's rights	**B-/D**	D	D	D	D	D	D	D	D	**B-**	D	D	D
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-/D**	D	D	D	D	D	D	D	D	**B-**	D	D	D
	28	Labor environment including labor safety	**B-/D**	D	D	D	D	**B-**	**B-**	D	D	**B-**	D	D	D
Others	29	Accidents	**B-/D**	D	D	D	D	D	**B-**	**B-**	**B-**	D	D	D	D
	30	Cross-border impact and climate change	**D/B+**	D	D	D	**D**	**D**	**D**	D	D	D	**B+**	D	D

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 6. 5 Results of Assessment for Railway (Reason for the Evaluation)

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction/ Construction	Operation	
Pollution	1	Air pollution	**B-**	**B+**	**Construction:** Emission gas (NOx, SOx) and dust (PM) will have a temporary negative impact on the air quality by construction heavy machines, dump trucks and traffic congestion due to traffic control. **Operation:** Positive impact will be offered by reduction of traffic volume along YUMRT.
	2	Water pollution	**B-**	**B-**	**Construction:** - Turbid water will be generated at lakes and ponds along YUMRT alignment due to civil and excavation works. - Turbid water will be generated at a proposed site for rolling stock yard due to soil filling works. - There is a possibility of being discharged organic waste water at an installed base camp site. - Negative impact for water quality will be occurred if construction waste is left for a long time illegally. **Operation:** There is a possibility of being discharged organic waste water from toilet installed every station and the rolling stock yard.
	3	Waste	**B-**	**B-**	**Construction:** - General waste and excreta will be generated from base camp site. - It is predicted that construction waste such as soil and deforestation trees are generated. **Operation:** General waste and excreta will be generated from every station, rolling stock yard and by increasing number of settlers.
	4	Soil contamination	**B-**	**B-**	**Construction:** - Excavated soil at the construction site may be contaminated due to oil leakage. - Negative impact for soil will be occurred if construction waste is left for a long time illegally. **Operation:** It is possible that soil contamination is generated at proposed rolling stock yard due to oil leaks of heavy machine and dump track, rolling stock coating, and waste dumping from residents.
	5	Noise and vibration	**B-**	**B±**	**Construction:** Noise and vibration will be generated by construction heavy machines, dump trucks, concrete placing work and traffic congestion due to traffic control. **Operation:** YUMRT can reduce traffic noise and vibration depending on traffic volume reduction, but YUMRT issues additional noise and vibration by itself.
	6	Ground subsidence	**B-**	**D**	**Construction:** Construction activities which have negative impact to underground water such as large-scale digging and water pumping are not scheduled in this project. But there is still a possibility of ground subsidence in case of soft foundation under elevated section. **Operation:** There is no significant impact.
	7	Offensive odor	**B-**	**B-**	**Construction:** Offensive odor may be issued depending on the volume of general waste etc. from basecamp sites. **Operation:** Offensive odor may be issued depending on the volume of general waste etc. from every station, rolling stock yard etc.
	8	Bottom sediment	D	D	**Construction:** Construction activities which have negative impact to bottom sediment are not scheduled in this project. **Operation:** Operation activities which have negative impact to bottom sediment are not scheduled in this project.
Natural Environment	9	Protected area	D	D	**Construction and Operation:** There is no protected area along E-W line's alignment.
	10	Ecosystem	**B-**	**B-**	**Construction:** - There is a negative impact for ecosystem through deforestation trees due to construction of viaduct and rolling stock yard. - It is a possible that turbid water will occur along and around E-W line's alignment. - Negative impact for ecosystem will be offered through construction of rolling stock yard. **Operation:** There is a negative impact on main species that have their feeding area around a bridge construction site due to YUMRT's running on the bridge with noise and vibration.
	11	Hydrology	**B-**	D	**Construction:** Negative impact for hydrology will be occurred depend on the amount and location of cutting and filling soil and digging. **Operation:** There is no activity which has negative impacts.
	12	Geology and Topography	**B-**	D	**Construction and Operation:** There is no specified and valuable geology and topography in and around the alignment. However, there is a possibility of soil erosion and slope collapse at a rolling stock yard constructed by filling soil.
Social Environment	13	Land acquisition/ Resettlement	**A-**	D	**Pre-construction:** It is predicted that there are large-sized land acquisition and resettlement along E-W's alignment. **Operation:** There is no land acquisition and resettlement on the operation phase.
	14	Poverty	**A-**	**B+**	**Pre-construction:** The impact on poverty is evaluated based on characteristics of local society around the construction sites. **Operation:** There is no land acquisition and resettlement on the operation phase. -It may also have positive impacts on local economy because YUMRT can save time for travelling.
	15	Indigenous and ethnic people	**B-**	D	**Pre-construction:** Existence of Indigenous and ethnic people including religious minority is confirmed by Census survey. Livelihood recovery support considering impact on them and their racial characteristic will be implemented provided that they exist. **Operation:** There is no impact on Indigenous and ethnic people due to no land acquisition or resettlement on the operation phase.
	16	Local economy such	**B-**	**B+**	**Pre-construction:**

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction/ Construction	Operation	
		as employment and livelihood, etc.			- It is possible that a negative impact for livelihood of PAPs is generated depending on land acquisition and resettlement. - There is a positive impact on illegal dwellers living in Hlaing Tharyar economically as employment opportunity by YUMRT construction and as commercial opportunity for construction workers. **Operation:** -There is no land acquisition and resettlement on the operation phase. - A positive impact for local economy will be generated such as time saving for traveling to Central of Yangon and alleviation of traffic congestion.
	17	Land use and utilization of local resources	**B-**	**B-**	**Pre-construction and Construction:** There may be a negative impact as land acquisition for agricultural land in proposed rolling stock area. **Operation:** There is no land acquisition and resettlement on the operation phase. But it is possible that a negative impact is generated as disordered development and rough-and-tumbled utilization of local resources around E-W alignment and stations.
	18	Water use and its rights	**B-**	D	**Construction:** A negative impact on well water quality for drinking may be issued depending on the construction activities and land acquisitions. **Operation:** - There is no impact on water use because of no land acquisition on the operation phase. - There is no additional impact on water use and its rights because Irrigation facilities and drinking water facilities such as waterworks and wells located in the project area including viaduct, station building and rolling stock yard can be transferred as necessary.
	19	Existing social infrastructure and services	**B-**	**B+**	**Pre-construction and Construction:** - A negative impact on sensitive facilities such as school, hospital and community center may be occurred depending on land acquisition and traffic control. - There may be a possibility of electrical power cut around the alignment when relocation and under installation of high –voltage line is conducted. **Operation:** Improvement of accessibility by installing YUMRT stations is expected, by which there is a possibility of positive impact on use of social infrastructure such as school, hospital etc.
	20	Social institutions such as social infrastructure and local decision - making institutions	**B-**	**B+**	**Construction:** It is possible that community severance is occurred depending on installing construction regulated area **Operation:** Positive impact will be offered by reduction of traffic volume along YUMRT
Social Environment	21	Maldistribution of benefit and damage	**B-**	**B-**	**Construction:** Depending on the construction area, there may be maldistribution of benefit and damage such as prohibition of road crossing and setting of detour route**.** **Operation:** Increasing number of settlers can be issued.
	22	Local conflict of interest	**B-**	**B-**	**Construction:** Local residents and municipalities may demand that construction contractor should supply employment opportunities equally as construction workers**.** -Some conflict may be occurred between locals and construction workers. -There may be some complains from nearby residents due to noise and vibration. **Operation:** There may be some complains from nearby residents due to noise and vibration.
	23	Cultural Heritage	D	D	**Pre-construction and Construction:** It is predicted that there is no impact on religious and historical buildings such as pagoda under the current proposed alignment. But confirm the existence of influence again at the time of linear determination. Existence of the impact should be confirmed to be sure after finalizing the alignment. **Operation:** There is no impact on religious and historical buildings because of non- additional land acquisition on the operation phase. But Existence of vibration impact by YUMRT operation should be confirmed.
	24	Landscape	**B-**	**B-**	**Construction and Operation:** - There is no landscape conservation area designated by law and regulation in the vicinity of the railway bridge and the elevated section. - The everyday landscape in the vicinity of the project area will change due to elevated structure, station buildings and relocation and under installation of high –voltage line.
	25	Gender	**B-**	**B-**	**Construction:** There may be a gender gap regarding wage, salary and treatment as construction workers. **Operation:** Employment opportunities for women will be limited with respect to YUMRT operation. In addition, It is possible that female passengers give up getting on a train because of being afraid of congestion in the train during commuting time.
	26	Children's right	**B-**	D	**Construction:** Children's compulsory education rights may be hindered because of customary child labor in the communities along the YUMRT alignment. **Operation:** There is no impact on children's right by YUMRT operation.
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	**B-**	**Construction:** Infectious diseases such as HIV/AIDS, etc. may be spread by inflow of construction workers. Additionally, land use changes by soil cutting and soil filling may create new habitats for mosquitoes that can mediate dengue fever. **Operation:** There is a possibility that STD and other infectious diseases spread by increasing of number of settlers and travelers after YUMRT operation.
	28	Labor environment	**B-**	**B-**	**Construction:** It is necessary to improve labor environment for construction workers in accordance

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction/ Construction	Operation	
		including labor safety			with related laws and regulations. **Operation:** - There is no big change in labor environment for local residents by YUMRT operation. - The appropriate labor environment for YUMRT staffs needs to be secured in accordance with related laws and regulations.
Others	29	Accidents	**B-**	**B-**	**Construction:** Since construction related vehicles use arterial roads on E-W line, there is a possibility of increasing traffic accidents. **Operation:** It is estimated that the risk of traffic accidents will increase due to speeding up of passing vehicles.
	30	Cross-border impact and climate change	**B-**	**B-**	**Construction:** Greenhouse gas emissions will increase by reducing the absorbed amount of greenhouse gas by cutting street trees along the alignment, operation of construction heavy machinery and construction of structures. **Operation:** Since the traffic volume along E-W line will decrease due to YUMRT operation, reduction of greenhouse gases can be expected in the project area. On the other hand, it is also predicted that additional greenhouse gasses is generated depending on the quantity of consumed electricity by YUMRT operation.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 6. 6 Results of Assessment for Receiving Substation (Reason for the Evaluation)

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
Pollution	1	Air pollution	**B-**	D	**Construction:** Air pollution such as exhaust fumes from earthmoving equipment as well as construction vehicle associated with Haling Tharyar substation and west university substation construction is anticipated **Operation:** No activity that will cause air pollution is expected.
	2	Water pollution	**B-**	D	**Construction:** - Temporary water pollution due to concrete mixing, aggregate collection and excavation is expected. In addition, temporally water pollution from contractor employ's camp/ office is expected. - Negative impact for water quality will be occurred if construction waste is left for a long time illegally. **Operation:** No activity that will cause water is expected.
	3	Waste	**B-**	D	**Construction:** Construction waste soil will be generated. **Operation:** No activity that will cause waste is expected
	4	Soil contamination	**B-**	**B-**	**Construction:** - Excavated soil at the construction site may be contaminated. - Negative impact for soil will be occurred if construction waste is left for a long time illegally. **Operation:** Inappropriate management of transformer will cause oil leakage. Consequently, it will contaminate soil.
	5	Noise and vibration	**B-**	**B-**	**Construction:** Noise and vibration resulting from construction activities is expected. **Operation:** Noise from the substation will affect residents around substation area.
	6	Ground subsidence	**B-**	D	**Construction and Operation:** Construction activities which have negative impact to underground water such as large-scale digging and water pumping are not scheduled in this project. **Operation:** No activity that will cause ground subsidence is expected.
	7	Offensive odor	**B-**	D	**Construction:** Offensive odor may be issued depending on the volume of general waste etc. from basecamp sites. **Operation:** No activity that will cause offensive odor is expected.
	8	Bottom sediment	**B-**	D	**Construction:** Excavated soil at the construction site may be contaminated. **Operation:** Operation activities which have negative impact to bottom sediment are not scheduled in this project.
Natural Environment	9	Protected area	D	D	**Construction and Operation:** There is no protected area within the project area.
	10	Ecosystem	**B-**	**B-**	**Construction:** There is a negative impact for ecosystem through deforestation trees due to construction of receiving substation. **Operation:** Some impacts on existing habitats will be expected due to substation operation with noise. It is necessary to confirm with the biodiversity survey team if the habitat of endangered species is located within the project area.
	11	Hydrology	D	D	**Construction and Operation:** No activity that will cause hydrology is expected.
	12	Geology and Topography	D	D	**Construction and Operation:** There is no specified and valuable geology and topography in and around the substation.
Environme	13	Land acquisition/ Resettlement	D	D	**Pre-construction and operation:** There is no land acquisition and resettlement on the pre-construction and operation phase because the palaces constructed substation are government land.
	14	Poverty	D	D	**Pre-construction:** There is no land acquisition and resettlement on the construction phase. **Operation:** There is no land acquisition and resettlement on the operation phase.

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
	15	Indigenous and ethnic people	D	D	**Pre-construction:** There is no impact on Indigenous and ethnic people due to no land acquisition or resettlement on the construction phase. **Operation:** There is no impact on Indigenous and ethnic people due to no land acquisition or resettlement on the operation phase.
	16	Local economy such as employment and livelihood, etc.	**B±**	D	**Pre-construction:** - It is possible that a negative impact for livelihood of PAPs is generated depending on land acquisition and resettlement. - Positive impact such as creation of local employment is predicted. **Operation:** No activity that will affect local economy such as employment and livelihood, etc.
	17	Land use and utilization of local resources	**B-**	D	**Pre-construction and Construction:** There may be a modification of land use and management. **Operation:** No activity that will affect land use and utilization of local resources.
	18	Water use and its rights	**B-**	D	**Construction:** A negative impact on well water quality for drinking may be issued depending on the construction activities and land acquisitions. **Operation:** There is no impact on water use and its rights.
	19	Existing social infrastructure and services	**B-**	D	**Pre-construction and Construction:** - A negative impact on sensitive facilities such as school, hospital and community center may be occurred depending on land acquisition and traffic control. - There may be a possibility of electrical power cut around the alignment when relocated. **Operation:** There is no impact on Existing social infrastructure and services.
	20	Social institutions such as social infrastructure and local decision - making institutions	D	D	**Construction:** There is no impact on Social institutions such as social infrastructure and local decision - making institutions. **Operation:** There is no community severance because E-W line is constructed by elevated structures for all sections.
Social Environment	21	Maldistribution of benefit and damage	**B-**	D	**Construction:** Depending on the construction area, there may be maldistribution of benefit and damage. **Operation:** It is predicted that there is no maldistribution of benefit and damage.
	22	Local conflict of interest	**B-**	D	**Construction:** There may be conflicts between local residences and construction workers. **Operation:** No activity that will affect local conflict of interest.
	23	Cultural Heritage	D	D	**Pre-construction, Construction and Operation:** It is predicted that there is no impact on religious and historical buildings such as pagoda under the current proposed area. There is no impact on religious and historical buildings because of non- additional land acquisition on the operation phase.
	24	Landscape	D	D	**Construction and Operation:** - The scenery will not be changed due to low rise facility. - No activity that will affect landscape is expected.
	25	Gender	**B-**	D	**Construction:** There may be a gender gap regarding wage, salary and treatment as construction workers. **Operation:** There is no impact in gender.
	26	Children's right	D	D	**Construction:** The project will not cause any adverse impact on children's rights. **Operation:** There is no impact on children's right by substation operation.
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	**Construction:** Infectious diseases such as HIV/AIDS, etc. may be spread by inflow of construction workers. **Operation:** No notable impact is expected.
	28	Labor environment including labor safety	**B-**	**B-**	**Construction:** Inappropriate management of working environment will rise the rick of accident and disease. **Operation:** The appropriate labor environment for substation staffs needs to be secured in accordance with related laws and regulations.
Others	29	Accidents	**B-**	D	**Construction:** There is a possibility of increasing traffic accidents because the effect of construction vehicles. **Operation:** Electric shock hazards will be expected due to improper management of ROW clearing or luck of information provided to public.
	30	Cross-border impact and climate change	D	D	**Construction and Operation:** Gas emission from construction vehicles is not significant. No activities that will affect global warming are expected.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 6. 7 Results of Assessment for Transmission line (Reason for the Evaluation)

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
Pollution	1	Air pollution	**B-**	D	**Construction:** Air pollution such as dust and exhaust fumes from earthmoving equipment and vehicles and dust emission from site clearance is anticipated. **Operation:** No notable impact is expected.
	2	Water pollution	**B-**	D	**Construction:** - Temporary water pollution due to excavation work near water bodies is expected. In addition, temporally water pollution from contractor employ's camp is expected.

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
					- Negative impact for water quality will be occurred if construction waste is left for a long time illegally. **Operation:** No notable impact is expected.
	3	Waste	**B-**	D	**Construction:** Generation of soil, sand and domestic waste will be generated. **Operation:** No activity that will cause waste is expected
	4	Soil contamination	**B-**	D	**Construction:** - Temporary soil contamination due to oil leakage that may be caused from using fuel for heavy machines and vehicles. However, the amount of oil use is limited and impact is considered to be insignificant. - Negative impact for soil will be occurred if construction waste is left for a long time illegally. **Operation:** No notable impact is expected.
	5	Noise and vibration	**B-**	D	**Construction:** Noise and vibration will be generated by construction heavy machines, dump trucks, and traffic congestion due to traffic control. **Operation:** No notable impact is expected.
	6	Ground subsidence	D	D	**Construction and Operation:** There is no significant impact.
	7	Offensive odor	**B-**	D	**Construction:** Offensive odor may be generated around the construction site due to excavation, drugging of mud in the drainage channels or from the camp sites during construction. **Operation:** No notable impact is expected.
	8	Bottom sediment	**B-**	D	**Construction**: There are some temporary impacts on bottom sediment of water bodies through the transmission line. **Operation:** operation activities which have negative impact to bottom sediment are not scheduled in this project.
Natural Environment	9	Protected area	D	D	**Construction and Operation:** There is no protected area within the project area.
	10	Ecosystem	D	D	**Construction and Operation:** No notable impact is expected.
	11	Hydrology	D	D	**Construction and Operation:** No activity that will cause hydrology is expected.
	12	Geology and Topography	D	D	**Construction and Operation:** There is no specified and valuable geology and topography in and around the substation.
Social Environment	13	Land acquisition/ Resettlement	D	D	**Pre-construction, Construction and Operation:** There is no land acquisition and resettlement on the pre- construction and operation phase because the palaces constructed substation are government land.
	14	Poverty	**B-**	D	**Pre-construction:** There will be some interruption to residents because of excavation and backfilling works the construction phase. **Operation:** There is no land acquisition and resettlement on the operation phase.
	15	Indigenous and ethnic people	D	D	**Pre-construction and Operation:** There is no impact on Indigenous and ethnic people due to no land acquisition or resettlement during the operation phase.
	16	Local economy such as employment and livelihood, etc.	**B+**	D	**Pre-construction:** - Positive impact such as creation of local employment is predicted. - Negative impact such as temporary closing of shops of local people along the construction of transmission line. **Operation:** No activity that will affect local economy such as employment and livelihood, etc.
	17	Land use and utilization of local resources	**B-**	D	**Pre-construction and Construction:** - There may be temporary land use because of excavation and backfilling works along the transmission line. **Operation:** No activity that will affect land use and utilization of local resources.
	18	Water use and its rights	**B-**	D	**Construction:** A negative impact on well water quality for domestic water may be issued depending on the construction activities. **Operation:** There is no impact on water use and its rights.
	19	Existing social infrastructure and services	**B-**	D	**Pre-construction and Construction:** - A negative impact on sensitive facilities such as existing roads, schools, hospital and community center will be temporarily affected due to excavation and earthmoving works. **Operation:** There is no significant impact.
	20	Social institutions such as social infrastructure and local decision - making institutions	D	D	**Construction and Operation:** There is no community severance because E-W line is constructed by elevated structures for all sections.
Social Environment	21	Maldistribution of benefit and damage	**B-**	D	**Construction:** Depending on the construction area, there may be maldistribution of benefit and damage such as prohibition of road crossing and shops closing temporarily. **Operation:** It is predicted that there is no maldistribution of benefit and damage after construction phase.
	22	Local conflict of interest	**B-**	D	**Construction:** Local residents and municipalities may complaint concerned with excavation and stockpiling temporarily. **Operation:** Existence of the impact should be confirmed.
	23	Cultural Heritage	D	D	**Pre-construction and Construction and Operation:** No cultural heritage has been identified along the transmission line.
	24	Landscape	**B-**	D	**Construction and Operation:** There is temporary landscape conservation in construction site along the transmission line.
	25	Gender			**Construction:** There can be a gender gap regarding wage, salary and treatment among workers.

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
			B-	D	**Operation:** It is predicted that there is no impact on gender.
	26	Children's right	**B-**	D	**Construction:** There is a possibility that children's compulsory education rights may be hindered because of customary child labor in the communities along the transmission line. **Operation:** No notable impact is expected.
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	**Construction:** Due to an inflow of construction workers Infectious diseases such as HIV/AIDS, etc. may spread although at a limited scale. **Operation:** No notable impact is expected.
	28	Labor environment including labor safety	**B-**	D	**Construction:** It is necessary to implement safe labor environment for construction workers in accordance with related laws and regulations. **Operation:** There is no impact on labor environment including safety after construction phase.
Others	29	Accidents	**B-**	D	Construction: Accidents are expected to be relatively minor because construction is relatively small in scale construction machines and excavation is limited. **Operation:** There is no impact after construction phase.
	30	Cross-border impact and climate change	D	D	**Construction and Operation:** There is no impacts on cross- border impact and climate change due to the implementing the transmission line.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 6. 8 Results of Assessment for New Bayint Naung Bridge (Reason for the Evaluation)

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
Pollution	1	Air pollution	**B-**	**B+**	**Construction:** Emission gas (NOx, SOx) and dust (SPM) will have a temporary negative impact on the air quality by construction heavy machines, dump trucks and traffic congestion due to traffic control. **Operation:** Positive impact will be offered by reduction of traffic volume along YUMRT.
	2	Water pollution	**B-**	D	**Construction:** - Turbid water will be generated at a bridge construction site on the Hlaing River and at lakes due to civil and excavation works. -Turbid water will be generated at a proposed site for rolling stock yard due to soil filling works. - There is a possibility of being discharged organic waste water at an installed base camp site. - Negative impact for water quality will be occurred if construction waste is left for a long time illegally. **Operation:** No notable impact is expected.
	3	Waste	**B-**	D	**Construction:** - General waste and excreta will be generated from base camp site. - It is predicted that construction waste such as soil and deforestation trees are generated. **Operation:** No notable impact is expected.
	4	Soil contamination	**B-**	D	**Construction:** - Excavated soil at the construction site may be contaminated. - Leakage of oil from heavy machine and dump track may contaminate soil. - Negative impact for soil will be occurred if construction waste is left for a long time illegally. **Operation:** No notable impact is expected.
	5	Noise and vibration	**B-**	**B±**	**Construction:** Noise and vibration from excavation works, construction heavy machines, dump trucks, concrete placing work and traffic congestion due to traffic control may be generated. **Operation:** YUMRT can reduce traffic noise and vibration depending on traffic volume reduction, but YUMRT issues additional noise and vibration by itself.
	6	Ground subsidence	**B-**	**B-**	**Construction and Operation:** Construction activities which have negative impact to underground water such as large-scale digging and water pumping are not scheduled in this project. But there is still a possibility of ground subsidence in case of soft foundation under elevated section.
	7	Offensive odor	**B-**	D	**Construction:** Offensive odor may be issued depending on the volume of general waste etc. from basecamp sites. **Operation:** It is predicted that there is no impact on offensive odor
	8	Bottom sediment	**B-**	D	**Construction:** - Excavated soil at the construction site may be contaminated. - It is possible that bottom sediment in Hlaing River is contaminated under construction of bridge piers. **Operation:** Operation activities which have negative impact to bottom sediment are not scheduled in this project.
Natural Environment	9	Protected area	D	D	**Construction and Operation:** There is no protected area along proposed bridge area.
	10	Ecosystem	**B-**	**B-**	**Construction:** - There is a negative impact for ecosystem through deforestation trees due to construction of bridge. - There may be a negative impact on aquatic ecosystem due to excavation works and discharge of waste from railway bridge construction. **Operation:** There is a negative impact on main species that have their feeding area around a bridge construction site due to YUMRT's running on the bridge with noise and vibration.

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
	11	Hydrology	**B-**	**B-**	**Construction and Operation:** It is possible that river flow condition is modified due to construction and existence of railway bridge.
	12	Geology and Topography	**B-**	**B-**	**Construction and Operation:** There is no specified and valuable geology and topography in and around the alignment. However, There is a possibility of soil erosion and slope collapse at constructed by cutting and filling soil.
Social Environment	13	Land acquisition/ Resettlement	**B-**	D	**Pre-construction:** It is predicted that there are some land acquisition and resettlement along the bridge area. **Operation:** There is no land acquisition and resettlement on the operation phase.
	14	Poverty	**B-**	D	**Pre-construction:** The impact on poverty is evaluated based on characteristics of local society around the construction sites. **Operation:** There is no land acquisition and resettlement on the operation phase.
	15	Indigenous and ethnic people	D	D	**Construction and Operation:** There is no impact on Indigenous and ethnic people due to no land acquisition or resettlement on the operation phase.
	16	Local economy such as employment and livelihood, etc.	**B±**	**B-**	**Pre-construction:** - It is possible that a negative impact for livelihood of PAPs is generated depending on land acquisition and resettlement. - There may be a negative impact on livelihood of fishery operators and other relevant person because of bridge construction in Hlaing River. - There is a positive impact on illegal dwellers living in Hlaing Tharyar economically as employment opportunity by YUMRT construction and as commercial opportunity for construction workers. **Operation:** -There is no land acquisition and resettlement on the operation phase. But a negative impact for livelihood of fishery operators and other relevant person may be issued because it is possible that their fishery area becomes narrow due to existence of constructed bridge.
	17	Land use and utilization of local resources	**B-**	D	**Pre-construction and Construction:** - There may be a negative impact as land acquisition for agricultural land in proposed railway bridge area. - A negative impact for utilization of local resources may be occurred due to a bridge construction in Hlaing River. **Operation:** There is no land acquisition and resettlement on the operation phase.
	18	Water use and its rights	**B-**	**B-**	**Construction:** A negative impact on well water quality for drinking may be issued depending on the construction activities and land acquisitions. Route of water vehicles (eg. fishery boats and ships) passing may change due to construction of bridge. **Operation:** - There may be a negative impact on fishery right due to the existence of bridge piers in Hlaing River.
	19	Existing social infrastructure and services	**B-**	**B+**	**Pre-construction and Construction:** - A negative impact on sensitive facilities such as school, hospital and community center may be occurred depending on traffic control. **Operation:** Positive impact on traffic volume reduction may occur by operation of YUMRT is expected.
	20	Social institutions such as social infrastructure and local decision - making institutions	D	D	**Construction and Operation:** There is no community severance along railway bridge area.
Social Environment	21	Maldistribution of benefit and damage	**B-**	**B-**	**Construction and Operation:** Depending on the construction area, there may be maldistribution of benefit and damage such as relocation of fishing area and hindering of their economy due to bridge construction.
	22	Local conflict of interest	**B-**	D	**Construction:** Local residents may complaint about entering construction workers and safety of their neighborhood. **Operation:** There is no possible impact on local conflict of interest by operation.
	23	Cultural Heritage	D	D	**Construction and Operation:** There is no impact on religious and historical buildings around proposed bridge area.
	24	Landscape	**B-**	D	**Construction and Operation:** - There is no landscape conservation area designated by law and regulation in the vicinity of the railway bridge. - The everyday landscape in the vicinity of the project area will change due to bridge construction.
	25	Gender	**B-**	D	**Construction: T**here can be a gender gap regarding wage, salary and treatment as construction workers. **Operation:** There is no possible impact on gender by operation.
	26	Children's right	**B-**	D	**Construction:** There is a possibility that children's compulsory education rights may be hindered because of customary child labor in the communities along the bridge. **Operation:** There is no impact on children's right by YUMRT operation.
	27	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	**Construction:** Infectious diseases such as HIV/AIDS, etc. may be spread by inflow of construction workers. Additionally, Land use changes by soil cutting and soil filling may create new habitats for mosquitoes that can mediate dengue fever. **Operation:** There is a possibility that STD and other infectious diseases spread by increasing of

Category	№	Impact Item (JICA Item)	Evaluation		Reason for evaluation
			Pre-Construction Construction	Operation	
					number of settlers and travelers after YUMRT operation.
	28	Labor environment including labor safety	**B-**	D	**Construction:** It is necessary to improve labor environment for construction workers in accordance with related laws and regulations. **Operation:** - There is no big change in labor environment for local residents by YUMRT operation. -The appropriate labor environment for YUMRT staffs needs to be secured in accordance with related laws and regulations**.**
Others	29	Accidents	**B-**	D	**Construction:** Since construction related vehicles use arterial roads, there is a possibility of increasing traffic accidents. **Operation:** There is no accidents during operation of YUMRT.
	30	Cross-border impact and climate change	D	**B+**	**Construction:** Gas emission from construction vehicles is not significant. No activities that will affect global warming are expected. **Operation:** The traffic volume along YUMRT will decrease due to YUMRT operation.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

CHAPTER 7 ENVIRONMENTAL MANAGEMENT PLAN AND MONITORING PLAN

7.1 Environmental Management System

Mitigation measures need to be put in place before, during and after the project against each of the negative impacts expected to take place. As important as such mitigation measures are monitoring activities to check if the entities responsible for taking such mitigation actions (i.e. contractor and MR) have indeed been carrying out the necessary activities and if such activities have led to the outcome they had been expected to deliver.

The chapters that follow will explain the mitigation measures planned to be adopted in the project and the way in which the social and natural environment in concern will be monitored. Mitigation measures will be carried out predominantly by the contractor during construction under the supervision of MR and its representative (i.e. consultant). After construction in the operation stage, such measures will be carried out by MR.

State of the environment on the other hand, will be monitored by the contractor during construction and the result of such monitoring activities will be submitted to MR and the consultant on a monthly basis. These monitoring reports will then be submitted to ECD by MR biannually in accordance with Article 108 of the EIA Procedure (2015). Similarly, MR will carry out necessary monitoring in the operation stage, sometimes with support from an environmental consultant, and submit to ECD its results in accordance with the environmental monitoring plan presented in Table7.5 to 7.7 below.

7.2 Environmental Mitigation Measures

This chapter presents the proposed measures to avoid, reduce or compensate for the potential adverse impacts (i.e. those impacts that had been judged to bring about significant negative impact (A-) or negative impact (B-) in Table 5.1 above). A summary of the environmental mitigation measures of the project, cost and implementation structure are presented in Table 7.1 to 7.4.

Table 7. 1 Mitigation Measures against Project Impacts for Railway

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
Pollution					
1.	Air pollution	**B-**	**B+**	• Regular preventive maintenance service of construction equipment and machinery will strictly comply with and will require conducting daily routine equipment and machinery check-ups to ensure that there are in the optimum working conditions. • The proper work schedules should be considered not to concentrate the construction equipment at a certain point for long time. • To reduce the dust, the periodical water spray should be taken. • If the residents and pedestrians complain about the dust and gas, the consultant of the supervision and contractors should reconsider the construction technique. • When the air pollution levels exceeds significantly the environmental standards, the regulation on fuel quality, importing old cars and emission gas control should be prepared on necessity.	• No mitigation measure is required.
2.	Water pollution	**B-**	**B-**	• Concrete poring and road surfacing will be closely supervised to prevent spillage.	• Promotion on awareness on water conservation and

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
				• Temporary sanitation facilities such as portable (mobile) toilets and garbage bins will be provided by the contractors to ensure that the domestic wastes to be generated by the construction personals are properly handled and not thrown into the drainage to prevent further pollution. • Washing the construction tools along the waters will be prohibited to prevent water pollution • In construction works near water bodies, turbid waste water shall be disposed at designated sites.	reducing water usage. • Promoting urinals and wash basins with automatic sensors.
3.	Waste	**B-**	**B-**	• Waste generated from the construction and camp sites should be disposed according to the instructions of YCDC. • Treatment is required if the soil contain poisonous substance prior to reuse and dumping. • Generated waste could be sold to others depending upon the suitability.	• YCDC should provide the proper numbers of garbage bins in every station for YUMRT users. • The waste in the operation stage should be properly collected and disposed or recycled in compliance with the respective rules.
4.	Soil contamination	**B-**	**B-**	• Spoil soil shall be disposed at designated dumping site. • Soil quality testing should be performed • Proper oil disposal measure should be implemented so that there will be no leakage occurs • Refueling place should be constructed with concrete floor to prevent leakage • Batteries containing liquid inside shall be kept on the impervious place.	• Soil pollution only may occur in the depot site due to the oil leakage so care should be taken so that the spillage will not be taken place. • Proper oil disposal measure should be implemented so that there will be no leakage occurs
5.	Noise and vibration	**B-**	**B±**	• Noise suppressors such as mufflers will be installed whenever deemed necessary to maintain the noise generated by various heavy equipment and other construction machinery within permissible limits. • Temporary noise barriers such as corrugated metal sheets will be installed around the construction sites to maintain noise level within permissible level if necessary. • High noise generating construction activities will be scheduled during daytime only (7:00 – 22:00) to avoid noise disturbance to adjust residential and commercial areas, and other noise-sensitive areas. • To identify impact on the surrounding buildings, the vibration level and condition of the buildings should be monitored. • If the local people complain about noise and vibration, the consultant of the supervision and contractors should reconsider the construction technique. • If the noise level reaches a significant level such as exceeding the environmental standards, the mitigation measures on noise control should be conducted.	• Installation of noise shield on the viaduct section. • At the station platform, paging and bell signaling volume shall be adjust to the lowest level where it will not detract from their function. • Noise monitoring shall continue during the operation phase to determine and install suitable noise reduction measures (e.g. unobtrusive noise barriers on the edge of the station) • Insulator/ anti-vibration devices will be installed under the rails thereby reducing noise and vibration. • The proper countermeasures to reduce noise and vibration such as slow speed in curve sections, installation of sound barrier and adoption of expansion and contraction joint should be included in the plan and design.
6.	Ground subsidence	**B-**	D	• In the detail design stage, the detailed geological surveys should be carried out. The proper structure design and construction technique should be considered on the basis of the survey results.	• The ground subsidence should be monitored regularly.
7.	Offensive odor	**B-**	**B-**	• Regular cleaning of the general waste from camp sites.	• Regular cleaning of the general waste from stations and rolling stock yard
8.	Bottom sediment	D	D	• Take care when working near the water body • Spoil soil shall be disposed at designated dumping site • Soil quality testing should be performed	• No mitigation measure is required
Natural Environment					
9.	Protected area	D	D	• No mitigation measure is required	• No mitigation measure is required
10.	Ecosystem	**B-**	**B-**	• Compensatory planting of shrubbery species to the limited area under the elevated structures should be considered as necessary. • Afforestation should be planted with collaboration of forest department.	• Insulator/ anti-vibration devices will be installed along the bridge to reduce the impact on the aquatic

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
				• In construction works at the excavation site, the turbid water should be monitored and controlled as necessary.	ecosystem • The proper countermeasures to reduce noise and vibration such as slow speed in curve sections, installation of sound barrier and adoption of expansion and contraction joint should be included in the plan and design.
11.	Hydrology	**B-**	D	• In the detailed design stage, the detailed hydrological surveys should be conducted. The proper structure design and construction technique should be considered on the basis of the survey results.	• No mitigation measure is required.
12.	Geology and topography	**B-**	D	• In the detail design stage, the detailed geological and geotechnical surveys should be carried out. The proper structure design and construction technique should be considered on the basis of the survey results.	• The possibilities of soil erosion and slope collapse should be monitored regularly.
Social Environment					
13.	Land acquisition/ Resettlement	**A-**	D	• Conduct census survey and local stakeholder meeting • Prepare RAP involving the following measures o PAPs must be acknowledged as an eligible for compensation o Identify the eligibility of non-titled people at the census survey intended to PAPs and ensure the compensation and support o Refer the previous/on-going projects by other donors, determine the requirement for social vulnerability and compensate to them o Resettlement site must be prepared when PAPs need it • Livelihood recovery support should be provided considering impact on PAPs.	• No mitigation measure is required.
14.	Poverty	**A-**	**B+**	• Define the displaced persons and criteria for determining their eligibility for compensation • Record the detail list of property losses due to the project implementation for determining the compensation amount	• No mitigation measure is required.
15.	Indigenous and ethnic people	**B-**	D	• Conduct stakeholder meeting • Livelihood recovery support should be provided considering impact on their racial characteristic	• No mitigation measure is required.
16.	Local economy such as employment and livelihood, etc.	**B-**	**B+**	• Prepare RAP involving the following measure o Measure to restore PAPs livelihood must be secured	• No mitigation measure is required.
17.	Land use and utilization of local resources	**B-**	**B-**	• Proper design should be prepared to minimize the impact on land use • Restore the construction and labor camp to the previous land use condition after completion of the construction if possible, if not restore to the better land use condition • Prepare and plan to make sure there will be no misuse of local resources during the construction process.	• Prepare and plan to make sure there will be no disordered development and rough-and-tumbled utilization of local resources around E-W alignment and stations.
18.	Water use and its right	**B-**	D	• Water quality should be monitored especially ground water to ensure its quality for drinking and other usage. • If the water quality deems to be declined, appropriate water treatment measures should be implemented.	• No mitigation measure is required.
19.	Existing social infrastructure and services	**B-**	**B+**	• Make sure to provide easy access to sensitive facilities such as hospital, school, etc. during the construction period and if required, measures such as detour route should be set up based on the traffic congestion condition • Social service utilities such as power, water, drainage and communication line will be diverted before starting the construction activity • Make sure that people will get the utility connection after the relocation of the facilities	• No mitigation measure is required
20.	Local institutions such as social infrastructure and local decision-making institutions	**B-**	**B+**	• Make sure to provide easy access to sensitive facilities such as hospital, school, etc. during the construction period and if required, measures such as detour route should be set up based on the traffic congestion condition	• No mitigation measure is required
21.	Maldistribution of benefit and damage	**B-**	**B-**	• Establish external monitoring committee by the third party	• Establish external monitoring committee by the third party
22.	Local conflict of interest	**B-**	**B-**	• Give employment opportunities to local residents and municipalities on priority basis.	• Establish external monitoring committee by the third party
23.	Cultural	D	D	• No impact on cultural and historical sites is predicted along the	• Existence of vibration impact

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
	heritage			proposed alignment. However, existence of impact and its influence should be confirmed at the time of linear determination and after finalizing the alignment to ensure there will be no impact on religious and historical buildings	on the surrounding religious and historical buildings should be assessed • If the vibration exceeds the standard limit, vibration reduction measures should be implemented.
24.	Landscape	**B-**	**B-**	• Design on facilities which will harmonize with the surrounding landscape • All structure will be designed according to the National Building Code • Conduct construction works in a manner that there will be minimal disturbance to the original landscape.	• To reduce the visual impact caused by the changing of the original landscape, compensatory planting of shrubbery spices to the limited area under the elevated structures should be considered as necessary
25.	Gender	**B-**	**B-**	• Affected female headed household should include additional subsistence and relocation assistance, opportunity for skill training and income restoration, employment opportunity in civil work. • Feminine gender will be invited and join local stakeholder as well as male gender • Interview to feminine gender while in census survey will be considered	• Keep provision separate female ticket counter in the station • Keep provision of designated seat for female in the train
26.	Children's right	**B-**	D	• Secure the accessibility to go to school/hospital when select resettlement places • Child labor recruitment should be prohibited in the construction site	• No mitigation measure is required
27.	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	**B-**	• In order to prevent spreading of infectious diseases such as HIV/ AIDS, awareness training to workers shall be provided. • Local public health center will conduct health education to new settlers • Periodic health check-up program will conduct.	• Local public health center will conduct health education to new settlers • Periodic awareness program should be conducted • Periodic health check-up program will conduct.
28.	Labor environment including labor safety	**B-**	**B-**	• Construction personnel will be provided with the necessary safety gears such as protective hard hat and safety belt. • First aid stations supervised by the safety health officer of the contractor will be located within the construction site office. • Arrange safety training to the worker periodically.	• Proper safety instrument should keep in the station as well as office building • Arrange safety training to the worker periodically.
Others					
29.	Accidents	**B-**	**B-**	• A sound traffic management and detour plans duly approved by the concerned governmental agency will strictly implemented to minimize traffic congestions and accidents • Traffic enforcers will be designated along these areas to assist in directing traffic flow • Parking time of construction equipment such as dump track and agitator car along the major thorough fare will be limited, especially during peak hours to minimize traffic congestions	• A sound traffic management plan duly approved by the concerned governmental agency will strictly implemented to minimize traffic accidents • Appropriate vehicle speed detection system should be set up along the E-W alignment
30.	Cross-border impact and climate change	**B-**	**B-**	• When the air pollution levels exceeds significantly the environmental standards, the regulation on fuel quality, importing old cars and emission gas control should be prepared on necessity. • Planting of shrubbery spices to the limited area under the elevated structures should be considered as necessary to reduce the emission of greenhouse gases.	• Planting of shrubbery spices to the limited area under the elevated structures should be considered as necessary to reduce the emission of greenhouse gases.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 7. 2 Mitigation Measures against Project Impacts for Receiving Substation

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
Pollution					
1.	Air pollution	**B-**	D	• Apply preventive maintenance system, optimizing construction schedule to minimize time that vehicles are in construction time, apply dust control measures such as water spraying on the unpaved load, etc.	• No mitigation measure is required.
2.	Water	**B-**	D	• Apply sediment traps, silt traps, develop fuel handling procedure,	• No mitigation measure is

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
	pollution			proper sewage system, etc.	required.
3.	Waste	**B-**	D	• Waste generated from the construction should be disposed according to the instructions of YCDC. • Treatment is required if the soil contain poisonous substance prior to reuse and dumping. • Generated waste could be sold to others depending upon the suitability.	• No mitigation measure is required.
4.	Soil contamination	**B-**	**B-**	• Spoil soil shall be disposed at designated dumping site. • Proper oil disposal measure should be implemented so that there will be no leakage occurs	• Proper oil disposal measure should be implemented so that there will be no leakage occurs.
5.	Noise and vibration	**B-**	**B-**	• Kept distance from the residential area when operating noise emitting equipment, apply periodical inspection of the equipment, limit night work, etc.	• Noise monitoring shall continue during the operation phase to determine and install suitable noise reduction measures (e.g. unobtrusive noise barriers on the edge of the substation)
6.	Ground subsidence	**B-**	D	• In the detail design stage, the detailed geological surveys should be carried out. The proper structure design and construction technique should be considered on the basis of the survey results.	• No mitigation measure is required.
7.	Offensive odor	**B-**	D	• Regular cleaning of the general waste from camp sites.	• No mitigation measure is required
8.	Bottom sediment	**B-**	D	• Take care when working near the water body • Spoil soil shall be disposed at designated dumping site • Soil quality testing should be performed • Proper oil disposal measure should be implemented so that there will be no leakage occurs • Refueling place should be constructed with concrete floor to prevent leakage	• No mitigation measure is required
Natural Environment					
9.	Protected area	D	D	• No mitigation measure is required	• No mitigation measure is required
10.	Ecosystem	**B-**	**B-**	• Compensatory planting of shrubbery species to the limited area under construction should be considered as necessary. • In construction works at the excavation site, the turbid water should be monitored and controlled as necessary.	• Insulator/ anti-vibration devices will be installed around the substations to reduce the impact on the ecosystem
11.	Hydrology	D	D	• No mitigation measure is required.	• No mitigation measure is required.
12.	Geology and topography	D	D	• No mitigation measure is required.	• No mitigation measure is required.
Social Environment					
13.	Land acquisition/ Resettlement	D	D	• No mitigation measure is required.	• No mitigation measure is required.
14.	Poverty	D	D	• No mitigation measure is required.	• No mitigation measure is required.
15.	Indigenous and ethnic people	D	D	• No mitigation measure is required.	• No mitigation measure is required.
16.	Local economy such as employment and livelihood, etc.	**B±**	D	The project is expected to create a significant level of employment opportunities for local people and others	• No mitigation measure is required
17.	Land use and utilization of local resources	**B-**	D	• Prepare and plan to make sure there will be no misuse of local resources during the construction process.	• No mitigation measure is required
18.	Water use and its right	**B-**	D	• Water quality should be monitored especially ground water to ensure its quality for drinking and other usage. • If the water quality deems to be declined, appropriate water treatment measures should be implemented.	• No mitigation measure is required
19.	Existing social infrastructure and services	**B-**	D	• Apply appropriate logistics system for transportation with heavy load, establishing of road maintenance crews for immediate repair, provision of detours and road safety precaution.	• No mitigation measure is required
20.	Local institutions such as social infrastructure	D	**D**	• No mitigation measure is required	• No mitigation measure is required

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
	and local decision-making institutions				
21.	Maldistribution of benefit and damage	**B-**	D	• Establish external monitoring committee by the third party	• No mitigation measure is required
22.	Local conflict of interest	**B-**	D	• Establish external monitoring committee by the third party	• No mitigation measure is required
23.	Cultural heritage	**D**	D	• No mitigation measure is required.	• No mitigation measure is required.
24.	Landscape	**D**	D	• No mitigation measure is required.	• No mitigation measure is required.
25.	Gender	**B-**	D	• Feminine gender will be invited and join local stakeholder as well as male gender	• No mitigation measure is required.
26.	Children's right	**D**	D	• Child labor recruitment should be prohibited in the construction site	• No mitigation measure is required
27.	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	In order to prevent spreading of infectious diseases such as HIV/AIDS, awareness training shall be provided to construction workers.	No mitigation measure is required
28.	Labor environment including labor safety	**B-**	**B-**	• Construction personnel will be provided with the necessary safety gears such as protective hard hat and safety belt. • First aid stations supervised by the safety health officer of the contractor will be located within the construction site office. • Arrange safety training to the worker periodically.	• Apply safe working practice.
Others					
29.	Accidents	**B-**	**D**	• A sound traffic management and detour plans duly approved by the concerned governmental agency will strictly implemented to minimize traffic congestions and accidents • Traffic enforcers will be designated along these areas to assist in directing traffic flow • Parking time of construction equipment such as dump track and agitator car along the major thorough fare will be limited, especially during peak hours to minimize traffic congestions	• No mitigation measure is required
30.	Cross-border impact and climate change	D	D	• No mitigation measure is required	No mitigation measure is required

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 7. 3 Mitigation Measures against Project Impacts for Transmission Line

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
Pollution					
1.	Air pollution	**B-**	D	• Regular preventive maintenance service of construction equipment and machinery will strictly comply with and will require conducting daily routine equipment and machinery check-ups to ensure that there are in the optimum working conditions. • The proper work schedules should be considered not to concentrate the construction equipment at a certain point for long time. • Water should be frequently sprayed on the ground at construction site, as appropriate, near residential areas.	• No mitigation measure is required.
2.	Water pollution	**B-**	D	• Temporary sanitation facilities such as portable (mobile) toilets and garbage bins will be provided by the contractors to ensure that the domestic wastes to be generated by the construction personals are properly handled and not thrown into the drainage to prevent further pollution. • Washing the construction tools along the waters will be prohibited to prevent water pollution. • In construction works near water bodies, turbid waste water shall be disposed at designated sites.	• No mitigation measure is required.
3.	Waste	**B-**	D	• Waste generated from the construction must be disposed only after considering reducing, reusing and recycling in accordance with the instructions from YCDC. • Generated waste such as excavated soil could be reuse depending upon the suitability.	• No mitigation measure is required.
4.	Soil	**B-**	D	• All wastes including oil and grease shall be disposed at designated	• No mitigation measure is

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
	contaminatio n			dumping site. • Proper fuel storage measure should be implemented so that there will be no leakage occurs. • To control temporary soil contamination, sanitation facilities and garbage bins must be provided in base camps.	required.
5.	Noise and vibration	**B-**	D	• Temporary noise barriers such as corrugated metal sheets will be installed around the sites to keep within permissible noise level. • High noise generating earthmoving activities will be scheduled during daytime only (7:00 – 22:00) to avoid noise disturbance to adjust residential and commercial areas, and other noise-sensitive areas.	• No mitigation measure is required.
6.	Ground subsidence	D	D	• No mitigation measure is required.	• No mitigation measure is required.
7.	Offensive odor	**B-**	D	• The level of offensive odor should be monitored regularly. • Regular cleaning of the general waste from camp sites.	• No mitigation measure is required.
8.	Bottom sediment	**B-**	D	• Spoil soil shall be disposed at designated dumping site.	• No mitigation measure is required
Natural Environment					
9.	Protected area	D	D	• No mitigation measure is required	• No mitigation measure is required
10.	Ecosystem	D	D	• No mitigation measure is required.	• No mitigation measure is required.
11.	Hydrology	D	D	• No mitigation measure is required.	• No mitigation measure is required.
12.	Geology and topography	D	D	• No mitigation measure is required.	• No mitigation measure is required.
Social Environment					
13.	Land acquisition/ Resettlement	D	D	• No mitigation measure is required.	• No mitigation measure is required.
14.	Poverty	**B-**	D	• Provide temporary small bridges in regular way of local people when excavation works are conducted.	• No mitigation measure is required.
15.	Indigenous and ethnic people	D	D	• No mitigation measure is required.	• No mitigation measure is required.
16.	Local economy such as employment and livelihood, etc.	**B+/-**	D	• Provide temporary small bridges in regular way of local people when excavation works are conducted.	• No mitigation measure is required.
17.	Land use and utilization of local resources	**B-**	D	• Prepare and plan to make sure there will be no misuse of local resources during the construction phase.	• No mitigation measure is required.
18.	Water use and its right	**B-**	D	• Make sure not to damage the usual water supply system of local people. • Water quality should be monitored especially ground water to ensure its quality for drinking and other usage.	• No mitigation measure is required.
19.	Existing social infrastructure and services	**B-**	D	• Content and schedule of construction works shall be made public prior to construction. • Education shall be provided to construction workers and staff in charge of public complaints and communications should be designated.	• No mitigation measure is required
20.	Local institutions such as social infrastructure and local decision-making institutions	D	D	• No mitigation measure is required	• No mitigation measure is required
21.	Maldistribution of benefit and damage	**B-**	D	• Establish external monitoring committee by the third party	• No mitigation measure is required.
22.	Local conflict of interest	**B-**	D	• Content and schedule of construction works shall be made public prior to construction. • Education shall be provided to construction workers and staff in charge of public complaints and communications should be designated.	• No mitigation measure is required.
23.	Cultural heritage	D	D	• No mitigation measure is required.	• No mitigation measure is required.
24.	Landscape	**B-**	D	• Construction safety net must be provided around the excavation and earthmoving works.	• No mitigation measure is required.
25.	Gender	**B-**	D	• Feminine gender will be invited and join local stakeholder as well as male gender	• No mitigation measure is required.
26.	Children's	**B-**	D	• Child labor recruitment should be prohibited in the construction site	• No mitigation measure is

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
	right				required
27.	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	• In order to prevent spreading of infectious diseases such as HIV/ AIDS, awareness training to workers shall be provided.	• No mitigation measure is required.
28.	Labor environment including labor safety	**B-**	D	• Construction personnel will be provided with the necessary safety gears such as protective hard hat and safety belt. • First aid stations supervised by the safety health officer of the contractor will be located within the construction site office. • Emergency vehicles will be on stand-by within the construction site • Arrange safety training to the worker periodically.	• No mitigation measure is required.
Others					
29.	Accidents	**B-**	D	• A sound traffic management and detour plans duly approved by the concerned governmental agency will strictly implemented to minimize traffic congestions and accidents • Traffic enforcers will be designated along these areas to assist in directing traffic flow • Parking time of construction equipment such as dump track and agitator car along the major thorough fare will be limited, especially during peak hours to minimize traffic congestions	• No mitigation measure is required.
30.	Cross-border impact and climate change	D	D	• No mitigation measure is required.	• No mitigation measure is required.

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

Table 7. 4 Mitigation Measures against Project Impacts for New Bayint Naung Bridge

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
Pollution					
1.	Air pollution	**B-**	**B+**	• Regular preventive maintenance service of construction equipment and machinery will strictly comply with and will require conducting daily routine equipment and machinery check-ups to ensure that there are in the optimum working conditions. • The proper work schedules should be considered not to concentrate the construction equipment at a certain point for long time. • To reduce the dust, the periodical water spray should be taken. • If the residents and pedestrians complain about the dust and gas, the consultant of the supervision and contractors should reconsider the construction technique. • When the air pollution levels exceeds significantly the environmental standards, the regulation on fuel quality, importing old cars and emission gas control should be prepared on necessity.	• No mitigation measure is required.
2.	Water pollution	**B-**	**D**	• Concrete poring and road surfacing will be closely supervised to prevent spillage. • Temporary sanitation facilities such as portable (mobile) toilets and garbage bins will be provided by the contractors to ensure that the domestic wastes to be generated by the construction personals are properly handled and not thrown into the drainage to prevent further pollution. • Washing the construction tools along the waters will be prohibited to prevent water pollution. • In construction works near water bodies, turbid waste water shall be disposed at designated sites.	• No mitigation measure is required.
3.	Waste	**B-**	D	• Waste generated from the construction should be disposed according to the instructions of YCDC. • Treatment is required if the soil contain poisonous substance prior to reuse and dumping. • Generated waste could be sold to others depending upon the suitability.	• No mitigation measure is required
4.	Soil contamination	**B-**	D	• Spoil soil shall be disposed at designated dumping site. • Soil quality testing should be performed • Proper oil disposal measure should be implemented so that there will be no leakage occurs • Refueling place should be constructed with concrete floor to prevent leakage • Batteries containing liquid inside shall be kept on the impervious	• Soil pollution only may occur in the depot site due to the oil leakage so care should be taken so that the spillage will not be taken place. • Proper oil disposal measure

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
				place.	should be implemented so that there will be no leakage occurs
5.	Noise and vibration	**B-**	**B±**	• Noise suppressors such as mufflers will be installed whenever deemed necessary to maintain the noise generated by various heavy equipment and other construction machinery within permissible limits. • Temporary noise barriers such as corrugated metal sheets will be installed around the construction sites to maintain noise level within permissible level if necessary. • High noise generating construction activities will be scheduled during daytime only (7:00 – 22:00) to avoid noise disturbance to adjust residential and commercial areas, and other noise-sensitive areas. • To identify impact on the surrounding buildings, the vibration level and condition of the buildings should be monitored. • If the local people complain about noise and vibration, the consultant of the supervision and contractors should reconsider the construction technique. • If the noise level reaches a significant level such as exceeding the environmental standards, the mitigation measures on noise control should be conducted.	• Installation of noise shield on the viaduct section. • Noise monitoring shall continue during the operation phase to determine and install suitable noise reduction measures (e.g. unobtrusive noise barriers on the edge of the station) • Insulator/ anti-vibration devices will be installed under the rails thereby reducing noise and vibration.
6.	Ground subsidence	**B-**	**B-**	• In the detail design stage, the detailed geological surveys should be carried out. The proper structure design and construction technique should be considered on the basis of the survey results.	• The ground subsidence should be monitored regularly.
7.	Offensive odor	**B-**	D	• Regular cleaning of the general waste from camp sites.	• No mitigation measure is required
8.	Bottom sediment	**B-**	D	• Take care when working near the water body • Spoil soil shall be disposed at designated dumping site • Soil quality testing should be performed	• No mitigation measure is required
Natural Environment					
9.	Protected area	D	D	• No mitigation measure is required	• No mitigation measure is required
10.	Ecosystem	**B-**	**B-**	• Compensatory planting of shrubbery species to the limited area under the elevated structures should be considered as necessary. • Afforestation should be planted with collaboration of forest department. • In construction works at the excavation site, the turbid water should be monitored and controlled as necessary.	• Insulator/ anti-vibration devices will be installed along the bridge to reduce the impact on the aquatic ecosystem
11.	Hydrology	**B-**	**B-**	• In the detailed design stage, the detailed hydrological surveys should be conducted. The proper structure design and construction technique should be considered on the basis of the survey results. • Detail hydrological study is required to determine the effect of the construction of Railway Bridge and embankment on river flow pattern.	• Detail hydrological study is required to determine the effect on river flow condition due to the existence of Railway Bridge and embankment.
12.	Geology and topography	**B-**	**B-**	• In the detail design stage, the detailed geological and geotechnical surveys should be carried out. The proper structure design and construction technique should be considered on the basis of the survey results.	• The possibilities of soil erosion and slope collapse should be monitored regularly.
Social Environment					
13.	Land acquisition/ Resettlement	**B-**	D	• Conduct census survey and local stakeholder meeting • Prepare RAP involving the following measures • PAPs must be acknowledged as an eligible for compensation • Identify the eligibility of non-titled people at the census survey intended to PAPs and ensure the compensation and support • Refer the previous/on-going projects by other donors, determine the requirement for social vulnerability and compensate to them • Resettlement site must be prepared when PAPs need it • Livelihood recovery support should be provided considering impact on PAPs.	• No mitigation measure is required.
14.	Poverty	**B-**	D	• Define the displaced persons and criteria for determining their eligibility for compensation • Record the detail list of property losses due to the project implementation for determining the compensation amount	• No mitigation measure is required.
15.	Indigenous and ethnic people	D	D	• No mitigation measure is required.	• No mitigation measure is required.
16.	Local economy such as	**B±**	**B+**	• Prepare RAP involving the following measure • Measure to restore PAPs livelihood must be secured	• Livelihood support should be provided to fishery operators

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
	employment and livelihood, etc.			• Enhance the orderly development especially in Hlaing Tharyar area to create new employment and give such employment to PAPs on priority basis.	and other relevant person considering impact on their livelihood.
17.	Land use and utilization of local resources	**B-**	D	• Proper design should be prepared to minimize the impact on land use • Restore the construction and labor camp to the previous land use condition after completion of the construction if possible, if not restore to the better land use condition • Prepare and plan to make sure there will be no misuse of local resources during the construction process.	• Prepare and plan to make sure there will be no disordered development and rough-and-tumbled utilization of local resources around E-W alignment and stations.
18.	Water use and its right	**B-**	**B-**	• Water quality should be monitored especially ground water to ensure its quality for drinking and other usage. • If the water quality deems to be declined, appropriate water treatment measures should be implemented.	• Consult with respective government authorities about the fishery right along the bridge piers in Hlaing river to ensure there will be no impact on the livelihood of fishery operators
19.	Existing social infrastructure and services	**B-**	**B+**	• Make sure to provide easy access to sensitive facilities such as hospital, school, etc. during the construction period and if required, measures such as detour route should be set up based on the traffic congestion condition • Social service utilities such as power, water, drainage and communication line will be diverted before starting the construction activity • Make sure that people will get the utility connection after the relocation of the facilities	• No mitigation measure is required
20.	Local institutions such as social infrastructure and local decision-making institutions	D	D	• No mitigation measure is required	• No mitigation measure is required
21.	Maldistribution of benefit and damage	**B-**	**B-**	• Establish external monitoring committee by the third party	• Establish external monitoring committee by the third party
22.	Local conflict of interest	**B-**	D	• Give employment opportunities to local residents and municipalities on priority basis.	• No mitigation measure is required
23.	Cultural heritage	D	D	• No impact on cultural and historical sites is predicted along the proposed alignment. However, existence of impact and its influence should be confirmed at the time of linear determination and after finalizing the alignment to ensure there will be no impact on religious and historical buildings	• Existence of vibration impact on the surrounding religious and historical buildings should be assessed • If the vibration exceeds the standard limit, vibration reduction measures should be implemented.
24.	Landscape	**B-**	D	• Design on facilities which will harmonize with the surrounding landscape • All structure will be designed according to the National Building Code • Conduct construction works in a manner that there will be minimal disturbance to the original landscape.	• To reduce the visual impact caused by the changing of the original landscape, compensatory planting of shrubbery spices to the limited area under the elevated structures should be considered as necessary
25.	Gender	**B-**	D	• Affected female headed household should include additional subsistence and relocation assistance, opportunity for skill training and income restoration, employment opportunity in civil work. • Feminine gender will be invited and join local stakeholder as well as male gender • Interview to feminine gender while in census survey will be considered	• No mitigation measure is required
26.	Children's right	**B-**	D	• Secure the accessibility to go to school/hospital when select resettlement places • Child labor recruitment should be prohibited in the construction site	• No mitigation measure is required
27.	Health (Infectious diseases such as HIV/AIDS, etc.)	**B-**	D	• In order to prevent spreading of infectious diseases such as HIV/ AIDS, awareness training to workers shall be provided. • Local public health center will conduct health education to new settlers • Periodic health check-up program will conduct.	• No mitigation measure is required
28.	Labor environment including	**B-**	D	• Construction personnel will be provided with the necessary safety gears such as protective hard hat and safety belt. • First aid stations supervised by the safety health officer of the	• No mitigation measure is required

No	Items of Impacts	Magnitude of adverse Impact		Mitigation Measures	
		Before/ during Construction Stage	Operation Stage	Before/ during Construction Stage	Operation Stage
	labor safety			contractor will be located within the construction site office. • Emergency vehicles will be on stand-by within the construction site • Arrange safety training to the worker periodically.	
Others					
29.	Accidents	**B-**	D	• A sound traffic management and detour plans duly approved by the concerned governmental agency will strictly implemented to minimize traffic congestions and accidents • Traffic enforcers will be designated along these areas to assist in directing traffic flow • Parking time of construction equipment such as dump track and agitator car along the major thorough fare will be limited, especially during peak hours to minimize traffic congestions	• A sound traffic management plan duly approved by the concerned governmental agency will strictly implemented to minimize traffic accidents • Appropriate vehicle speed detection system should be set up along the E-W alignment
30.	Cross-border impact and climate change	D	**B+**	• No mitigation measure is required	• No mitigation measure is required

A+/-: Significant positive/negative impact is expected
B+/-: Positive/Negative impact is expected to some extent
C+/-: Extent of positive/negative impact is unknown
D: No impact is expected

7.3 Environmental Monitoring Plan

As stated in Article 108 of the EIA Procedure (2015), MR, as the project proponent, is required to submit in the implementation stage environmental monitoring reports to MONREC in a way that is described in the EMP yet no less frequently than every six months. According to Article 109 of the legislation, the monitoring reports shall include: 'a) documentation of compliance with all conditions; b) progress made to date on implementation of the EMP against the submitted implementation schedule; c) difficulties encountered in implementing the EMP and recommendations for remedying those difficulties and steps proposed to prevent or avoid similar future difficulties; d) number and type of non-compliance with the EMP and proposed remedial measures and timelines for completion of remediation; e) accidents or incidents relating to the occupational and community health and safety, and the environment; and f) monitoring data of environmental parameters and conditions as committed in the EMP or otherwise required'. MR plans to submit the environmental monitoring reports in a way that is in line with this obligation.

In addition, MR, in accordance with Article 110 of the EIA Procedure (2015), plans to make the monitoring report submitted to MONREC publicly available at the following places within ten days after completing the report: a) major stations (i.e. Hlaing Thayar, Hlaing, Ma Yan Gone, Yankin and South Okkalapa); b) E Guard Office; and on MR's website. A summary of the environmental monitoring plan, cost and implementation structure proposed to be carried out in the project are presented in the following tables.

Table 7. 5 Environmental Monitoring Plan for Railway

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
Planning Stage								
1	Involuntary Resettlement	Refer to attached LARAP						
2	Poverty	Refer to attached LARAP						
Construction Stage								
1	Air Pollution	NO2, SO2, PM10, PM2.5, ozone and micro climate (i.e. temperature, humidity, wind speed and direction and so on for reference)	One weekday for 24 consecutive hours per location	Twelve locations along the project alignment	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 24,000** (USD 1,000 * 12 points * 2 times)
2	Water Pollution (Surface water)	BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform, total nitrogen, total phosphorus, total organic carbon and TSS	Sampling and measurement using field equipment and laboratory analyses	Twelve locations along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 12,000** (USD 500 * 12points * 2 times)
3	Water Pollution (Ground water)	pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	Sampling and measurement using field equipment and laboratory analyses	Six locations along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 48,000 (USD 400*6 points*2 times)**
4	Waste Disposal	- Volume of waste including soil, vegetation, existing railway structures and garbage - Voices and complaints from the local community	- Confirmation of records of waste generated - Confirmation of voices and complaints - Visual observation	Construction site and labor camps along the project alignment	Quarterly and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
5	Soil Contamination	- Soil condition - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Construction site and surrounding area of project alignment	Quarterly and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
6	Noise and Vibration	- LAeq (noise) - LV10 (vibration)	One weekday for 24 consecutive hours per location	Twelve locations along the project alignment	Biannually	Environmental consultant hired by MR	Yangon Region Government	**USD 12,000** (USD 500 * 12points * 2 times)
7	Offensive Odors	- Volume of waste and night soil including sludge, vegetation and	- Confirmation of voices and complaints - Visual observation	Construction site and labor camps along the project	monthly and when complaints are heard in this	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
		garbage - Voices and complaints from the PAPs		alignment	regard			
8	Ecosystem	Habitat and estimated number of trees cut and other natural vegetation cleared	Biodiversity surveying using field equipment	Project-affected area	Whenever works that involve vegetation clearance take place	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
9	Hydrology	River water flow	Visual observation	Rivers and creeks where bridge construction work takes place	Whenever bridge construction works take place	Contractor under supervision of consultant	Yangon Region Government	Cost should be included in the construction cost.
10	Topography and Geology	Extent and necessity of cutting and filling	Visual observation	Project-affected area	Whenever works that involve cutting and filling take place	Contractor under supervision of consultant	Yangon Region Government	Cost should be included in the construction cost.
11	Involuntary Resettlement	Refer to attached LARAP						
12	Water Usage	- Water saving efforts and activities - Voices and complaints from the local community	- Visual observation - Confirmation of voices and complaints	Construction site and labor camps	Whenever works that involve water use take place	Contractor under supervision of consultant	Yangon Region Government	Cost should be included in the construction cost.
13	Existing Social Infrastructure and Services	Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Project-affected area	When complaints are heard in this regard	Contractor under supervision of consultant	Yangon Region Government	Cost should be included in the construction cost.
14	Infectious Diseases such as HIV/AIDS	- Number of infected cases - Voices and complaints from the local community	- Confirmation of health check list of workers (and preferably of local community) - Confirmation of voices and complaints	Construction site and surrounding area	Monthly and when complaints are heard in this regard	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
15	Labor Environment	- Number of cases that suffered from heat strokes and other occupational health problems - Voices and complaints from the workers	- Confirmation of health check list of workers - Confirmation of voices and complaints	Construction site and labor camps	Monthly	Contractor under supervision of consultant	Yangon Region Government	Cost should be included in the construction cost.
16	Accidents	Number of accidents	Confirmation of records of	Construction site	Monthly	Contractor	Yangon	Cost should be

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
			accidents			under supervision of consultant	Region Government	included in the construction cost.
17	Cross Boundary Impacts, Cumulative Impacts and Climate Change	Air quality	Refer to '1. Air Pollution' above.				Yangon Region Government	
Operation Stage								
1	Air Pollution	- Air quality (e.g. dust level) - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Five locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the O&M cost.
2	Water Pollution (Surface water)	BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform, total nitrogen, total phosphorus, total organic carbon and TSS	Sampling and measurement using field equipment and laboratory analyses	Twelve locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years (*once during dry season and once during rainy season) and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	**USD 24,000** (USD 1,000 * 12 points * 2 times)
3	Water Pollution (Ground water)	pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	Sampling and measurement using field equipment and laboratory analyses	Six locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years (*once during dry season and once during rainy season) and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	**USD 4,800** (USD 400 * 6 points * 2 times)
4	Waste Disposal	- Volume of waste including existing railway structures, oil and garbage - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Depot sites (i.e. Hlaing Thayar) and stations	Quarterly for the first two years and when complaints are heard in this regard	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the O&M cost.
5	Soil Contamination	- Soil condition - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Construction site and surrounding area	Quarterly for the first two years and when complaints are heard in this	MR with support from MOTC and Yangon Region	Yangon Region Government	Cost should be included in the O&M cost.

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
					regard	Government		
6	Noise and Vibration	- Noise and vibration level - Voices and complaints from the local community	- Confirmation of voices and complaints - Observation	Thirty one locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the O&M cost.
7	Water Usage	- Water saving efforts and activities - Voices and complaints from the local community	- Visual observation - Confirmation of voices and complaints	Depot sites (i.e. Hlaing Tharyar) and stations	Quarterly for the first two years and when complaints are heard in this regard	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the O&M cost.
8	Accidents	Number of accidents	Confirmation of records of accidents	Along the YUMRT alignment	Monthly	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Costs should be included in the O&M cost.
9	Cross Boundary Impacts, Cumulative Impacts and Climate Change	Water quality	Refer to '2. Water Pollution' above.					

P: Planning Stage, Co: Construction Stage, O: Operation Stage

Source: JICA Study Team

Table 7. 6 Environmental Monitoring Plan for Transmission Line and Substation

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
Planning Stage								
1	Involuntary Resettlement	Refer to attached LARAP						
2	Poverty	Refer to attached LARAP						
Construction Stage								
1	Air Pollution	NO2, SO2, PM10, PM2.5, ozone and micro climate (i.e. temperature, humidity, wind speed and direction and so on for reference)	One weekday for 24 consecutive hours per location	Four locations along the transmission alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 8,000** (USD 1,000 * 4 points * 2 times)
2	Water Pollution (Surface water)	BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform,	Sampling and measurement using field equipment and laboratory analyses	One location along the project alignment (*same	Biannually (*once during dry season and once during	Environmental consultant hired by MR	Yangon Region Government	**USD 1,000** (USD 500 * 1points * 2 times)

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
		total nitrogen, total phosphorus, total organic carbon and TSS		places as baseline survey in principle)	rainy season)			
3	Water Pollution (Ground water)	pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	Sampling and measurement using field equipment and laboratory analyses	Four locations along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 32,00 (USD 400*4 points*2 times)**
4	Noise and Vibration	- LAeq (noise) - LV10 (vibration)	- One weekday for 24 consecutive hours per location	Four locations along the project alignment	Biannually	Environmental consultant hired by MR	Yangon Region Government	**USD 4,000** (USD 500 * 4 points * 2 times)
5	Waste Disposal	- Volume of waste including excavated soil, oil and garbage - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Along the transmission line	During construction activities taking place	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost
6	Ecosystem	- Habitat and estimated number of trees cut and other natural vegetation cleared	- Biodiversity surveying using field equipment	Project-affected area	Whenever works that involve vegetation clearance take place	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
7	Hydrology	-Water flow	Visual observation	Rivers and creeks where bridge construction work takes place	Whenever transmission line construction works take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
8	Topography and Geology	Extent and necessity of cutting and filling	Visual observation	Project-affected area	Whenever works that involve cutting and filling take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
9	Water Usage	- Water saving efforts and activities Voices and complaints from the local community	- Visual observation Confirmation of voices and complaints	Construction site and labor camps	Whenever works that involve water use take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
10	Existing Social Infrastructure and Services	Voices and complaints from the local community	- Confirmation of voices and complaints Visual observation	Project-affected area	When complaints are heard in this regard	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
11	Infectious Diseases such as HIV/AIDS	- Number of infected cases - Voices and complaints from the local community	- Confirmation of health check list of workers (and preferably of local community) - Confirmation of voices and complaints	Construction site and surrounding area	Monthly and when complaints are heard in this regard	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
12	Labour Environment	- Number of cases that suffered from heat strokes and other occupational health problems - Voices and complaints from the workers	- Confirmation of health check list of workers - Confirmation of voices and complaints	Construction site and labor camps	Monthly	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
13	Accidents	Number of accidents	- Confirmation of records of accidents	Construction site	Monthly	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
14	Cross Boundary Impacts, Cumulative Impacts and Climate Change	- Air quality	- Refer to '1. Air Pollution' above.				Yangon Region Government	
Operation Stage								
1	Air Pollution	- NO2, SO2, PM10, PM2.5, ozone and micro climate (i.e. temperature, humidity, wind speed and direction and so on for reference)	- One weekday for 24 consecutive hours per location	Four locations along the transmission alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 8,000** (USD 1,000 * 4 points * 2 times)
2	Water Pollution (Surface water)	- BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform, total nitrogen, total phosphorus, total	- Sampling and measurement using field equipment and laboratory analyses	One location along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 1,000** (USD 500 * 1points * 2 times)

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
		organic carbon and TSS						
3	Water Pollution (Ground water)	- pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	- Sampling and measurement using field equipment and laboratory analyses	Four locations along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 32,00 (USD 400*4 points*2 times)**
4	Waste Disposal	- Volume of waste including existing railway structures, oil and garbage - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Depot sites (i.e. Hlaing Thayar) and stations	Quarterly for the first two years and when complaints are heard in this regard	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the O&M cost.
5	Noise and Vibration	- LAeq (noise) - LV10 (vibration)	- One weekday for 24 consecutive hours per location	Four locations along the project alignment	Biannually	Environmental consultant hired by MR	Yangon Region Government	**USD 4,000** (USD 500 * 4 points * 2 times)
6	Accidents	- Number of accidents	- Confirmation of records of accidents	Along the YUMRT alignment	Monthly	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Costs should be included in the O&M cost.
7	Local conflict of interests	- Voices and complaints from the local community	- Confirmation of voices and complaints	Along the transmission line (During maintenance)	During Maintenance	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
8	Cross Boundary Impacts, Cumulative Impacts and Climate Change	- Water quality	- Refer to '2. Water Pollution' above.					

Table 7. 7 Environmental Monitoring Plan for Bridge

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
Planning Stage								
1	Involuntary Resettlement	Refer to attached LARAP						
2	Poverty	Refer to attached LARAP						
Construction Stage								
1	Air Pollution	NO2, SO2, PM10, PM2.5,	One weekday for 24	Two locations along	Biannually (*once	Environmental	Yangon	**USD 4,000**

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
		ozone and micro climate (i.e. temperature, humidity, wind speed and direction and so on for reference)	consecutive hours per location	the project alignment	during dry season and once during rainy season)	consultant hired by MR	Region Government	(USD 1,000 * 2 points * 2 times)
2	Water Pollution (Surface water)	BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform, total nitrogen, total phosphorus, total organic carbon and TSS	Sampling and measurement using field equipment and laboratory analyses	Eight locations along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 8,000** (USD 500 * 8points * 2 times)
3	Water Pollution (Ground water)	pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	Sampling and measurement using field equipment and laboratory analyses	Two locations along the project alignment (*same places as baseline survey in principle)	Biannually (*once during dry season and once during rainy season)	Environmental consultant hired by MR	Yangon Region Government	**USD 16,00 (USD 400*2 points*2 times)**
4	Waste Disposal	- Volume of waste including soil, vegetation, existing railway structures and garbage - Voices and complaints from the local community	- Confirmation of records of waste generated - Confirmation of voices and complaints - Visual observation	Construction site and labor camps along the project alignment	Quarterly and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
5	Soil Contamination	- Soil condition - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Construction site and surrounding area of project alignment	Quarterly and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
6	Noise and Vibration	- LAeq (noise) - LV10 (vibration)	One weekday for 24 consecutive hours per location	Two locations along the project alignment	Biannually	Environmental consultant hired by MR	Yangon Region Government	**USD 2,000** (USD 500 * 2points * 2 times)
7	Offensive Odors	- Volume of waste and night soil including sludge, vegetation and garbage - Voices and complaints from the PAPs	- Confirmation of voices and complaints - Visual observation	Construction site and labor camps along the project alignment	monthly and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.
8	Ecosystem	Habitat and estimated number of trees cut and other natural vegetation cleared	Biodiversity surveying using field equipment	Project-affected area	Whenever works that involve vegetation clearance take	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the construction cost.

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
					place			
9	Hydrology	River water flow	Visual observation	Rivers and creeks where bridge construction work takes place	Whenever bridge construction works take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
10	Topography and Geology	Extent and necessity of cutting and filling	Visual observation	Project-affected area	Whenever works that involve cutting and filling take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
11	Involuntary Resettlement	Refer to attached LARAP						
12	Water Usage	- Water saving efforts and activities - Voices and complaints from the local community	- Visual observation - Confirmation of voices and complaints	Construction site and labor camps	Whenever works that involve water use take place	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
13	Existing Social Infrastructure and Services	Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Project-affected area	When complaints are heard in this regard	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
14	Infectious Diseases such as HIV/AIDS	- Number of infected cases - Voices and complaints from the local community	- Confirmation of health check list of workers (and preferably of local community) - Confirmation of voices and complaints	Construction site and surrounding area	Monthly and when complaints are heard in this regard	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
15	Labour Environment	- Number of cases that suffered from heat strokes and other occupational health problems - Voices and complaints from the workers	- Confirmation of health check list of workers - Confirmation of voices and complaints	Construction site and labor camps	Monthly	Contractor with support from consultant, MR, MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the construction cost.
16	Accidents	Number of accidents	Confirmation of records of	Construction site	Monthly	Contractor with	Yangon	Cost should be

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
			accidents			support from consultant, MR, MOTC and Yangon Region Government	Region Government	included in the construction cost.
17	Cross Boundary Impacts, Cumulative Impacts and Climate Change	Air quality	Refer to '1. Air Pollution' above.				Yangon Region Government	
Operation Stage								
1	Air Pollution	- Air quality (e.g. dust level) - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Two locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the O&M cost.
2	Water Pollution (Surface water)	BOD, COD, DO, oil & grease, pH, turbidity, temperature, total coliform, total nitrogen, total phosphorus, total organic carbon and TSS	Sampling and measurement using field equipment and laboratory analyses	Eight locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years (*once during dry season and once during rainy season) and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	**USD 16,000** (USD 1,000 * 8 points * 2 times)
3	Water Pollution (Ground water)	pH, Total Dissolved Solid (TDS), Arsenic (As), Iron (Fe), Manganese (Mn), Chloride	Sampling and measurement using field equipment and laboratory analyses	Two locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years (*once during dry season and once during rainy season) and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	**USD 1,600** (USD 400 * 2points * 2 times)
4	Waste Disposal	- Volume of waste including existing railway structures, oil and garbage - Voices and complaints from the local community	- Confirmation of voices and complaints - Visual observation	Depot sites (i.e. Hlaing Thayar) and stations	Quarterly for the first two years and when complaints are heard in this regard	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the O&M cost.
5	Soil Contamination	- Soil condition	- Confirmation of voices and complaints	Construction site and surrounding	Quarterly for the first two years and	Environmental consultant hired	Yangon Region	Cost should be included in the

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
		- Voices and complaints from the local community	- Visual observation	area	when complaints are heard in this regard	by MR	Government	O&M cost.
6	Noise and Vibration	- Noise and vibration level - Voices and complaints from the local community	- Confirmation of voices and complaints - Observation	Thirty one locations along the project alignment (*same places as baseline survey in principle)	Biannually for the first two years	Environmental consultant hired by MR	Yangon Region Government	Cost should be included in the O&M cost.
7	Water Usage	- Water saving efforts and activities - Voices and complaints from the local community	- Visual observation - Confirmation of voices and complaints	Depot sites (i.e. Hlaing Tharyar) and stations	Quarterly for the first two years and when complaints are heard in this regard	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Cost should be included in the O&M cost.
8	Accidents	Number of accidents	Confirmation of records of accidents	Along the YUMRT alignment	Monthly	MR with support from MOTC and Yangon Region Government	Yangon Region Government	Costs should be included in the O&M cost.
9	Cross Boundary Impacts, Cumulative Impacts and Climate Change	Water quality	Refer to '2. Water Pollution' above.					

7.4 Emergency Preparedness and Response Plan

This plan includes preparedness and response for emergency cases which can be faced during construction and operation phases of YUMRT. An unforeseen event which has a potential to cause impacts on environment such as earthquake, flooding, fire, oil spillage and road accidents is regarded as the emergency situation.

At the very first situation, the equipment facilities which are necessary for emergency situations should have been identified and made a list. The list and the necessary items for sudden event must be available on site.

Some of the required equipment is shown below.

(1) First aid supplies
(2) Fire pumps and extinguishers
(3) Alarming System (Flashing Light or Voice)
(4) Contact Numbers (nearby hospitals, fire stations, etc.)
(5) Signs for emergency situation (existing way, emergency exit)

All workers must receive the first aid training as part of their induction. Some workers are also needed to receive in more advanced training to handle the emergency events. The training records should be also kept systematically and the first aid team should be grouped in case of emergency events. There must be clear information about the roles and responsibilities such as implementing ERP or communicating the emergency contact lists. First aid personnel should have following certified qualifications.

(1) Be reliable
(2) Be competent and familiar with the Emergency Response Plan and first aid equipment on site.
(3) Have current certified first aid qualifications.
(4) Undertake the initial management of injuries and illness.
(5) Record details of first aid given, and
(6) Remain calm in the emergency situation.

The plan will be continually and regularly monitored and reviewed by the responsible person during the construction and operation phases to ensure it is applicable in any situations and even effective for after the occurrence of any accidents.

7.4.1 Emergency Response Plan for Earthquakes

Yangon City is situated in Earthquake Zone II and is considered to be situated in earthquake prone areas. According to the earthquake incidents, from 2006 to 2014 earthquake events occurred in Yangon can be classified as slight as the scale of the magnitude ranges from 3.0 to 4.4. Owners and residents along the YUMRT alignment and passengers must have awareness concerned with earthquake, not only the physical and emotional impact but also the economic impact of the loss productivity in their workplace.

The main purpose of this plan is to minimize the impacts which could be caused by the natural hazards not only by the earthquakes but also by the heavy rain or flooding, to promote safety for passengers, workers and communities and to assist the speedy recovery. Planning should be informed to all the workers and even public awareness is necessary for nearby communities. The response plan also should be monitored regularly for continuous improvement.

The dangers associated with earthquakes are

(1) Collapsing structures and falling objects (glass, ceiling)
(2) Serious injuries
(3) Fire
(4) Fallen power lines
(5) Broken water pipe lines

The trains should be suspended while the earthquake is happening. After the shaking stops, the trains should be stopped at nearest stations. The emergency response plans should be posted even in the trains and at the stations. The responsible person should reassure the passengers to calm down.

After earthquakes, the responsible person should be prepared for the aftershocks and make a quick check for injuries or trapped people. If it is necessary, provide the emergency first aid. The electrical switches and oil storage should be checked to avoid explosion.

7.4.2 Emergency Response Plan for Fire

The plan must be applicable in both construction and operation phases. The firefighting training should be provided to workers and regular instruction and practice are also necessary for continuous improvement. The sufficient amount of the extinguishers and firefighting system for the site by following the instructions, techniques and guidelines in concern with the fire emergency matters of Myanmar Fire Services Department should be installed. Fire action signs and emergency signs should be posted at site and concerned areas. The emergency contact numbers of Myanmar Fire Services Department should be posted in places where staves and relevant people can read it and become familiar with its contents. The smoking at the working site should be strongly prohibited and the warning signs for electric shock should be posted at concerned places to avoid any emergency situations.

Voice or emergency light alarm system, fire hose reels, manual portable extinguishers and sprinklers, temperature and gas sensors should be installed and the instructions of the routine to be followed are required to be cleared. The existing ways, emergency exits and fire evacuation places are also needed to be prepared at working site since the construction phase.

7.5 Health and Safety Plan

The occupational health and safety plan (OHS) and the community health and safety plan (CHS) is necessary to be implemented during construction and operation phases of YUMRT.

It is aiming to provide the safe and sound working environment not only for workers on site but also for the community including passengers.

7.5.1 Occupational Health and Safety Plan (OHS)

The plan will include the following sectors.

(1) Health Care Services for Employees
(2) Personal Protective Equipment
(3) Safe working at site

(1) Health Care Services for Employees

- Premedical checkup for employees should be provided at the time of employment.
- Annual checkup for all workers who are exposed to dusts and hazardous materials should have been performed.
- The first aid facilities should be provided at the working sites and each YUMRT stations.
- First aid training for all employees is necessary.
- Respiratory hazards like dusts produced due to drilling, transportation and stockpiling operations should be monitored regularly.
- Physical injuries may be occurred during the construction, operation phases and maintenance activities.

(2) Personal Protective Equipment

- Excavators, dumpers, dozers and other automated equipment that require an operator should be equipped with air-conditioned, dust proof and sound proof cabs.
- Provide personal breathing protection such as masks should be provided.
- Workers who have to be exposed to excessive noise levels during construction and operation phases should be provided the appropriate PPE.
- Workers who have to handle the hazardous materials should be provided the related PPE.

(3) Safe working at site

The possible hazard that can be occurred at construction and operation phases is accidents. This can also be mitigated by following the safety procedures to prevent accidents.

- There should be a proper schedule for construction time.
- Specific warning devices and signs such as flashing light should be provided at the site for workers.
- Specific training should be implemented for workers who have to handle the hazardous materials or equipment.
- First aid personnel should have current certified first aid qualifications.
- Emergency Alarm system should be installed.
- Proper security system must be provided for all workers.

7.5.2 Community Health and Safety Plan (CHS)

Community health and safety plan should be applicable in all phases.

- Put signage at noisy areas in working site.
- Noisy mechanics should be placed in enclosures or there should be a schedule for construction.
- Warning signs should be installed to avoid the accidents with electricity.
- Exposure to dusts should be controlled by spraying water along the working site.
- Sign posts for traffic should be erected at essential places such as schools.
- There should be speed limits for vehicles used for construction.
- Regular inspection and maintenance of the rail lines and facilities to ensure track stability and integrity should be performed.
- Oil spill prevention and control and emergency preparedness and response plan based on analysis of hazards, including the nature, consequences and probability of accidents should be prepared.
- Dissemination of emergency preparedness and response information to the potentially affected communities (e.g.; emergency notification system and evacuation procedure) should be done.
- Local education regarding the dangers of trespassing to community should have performed.
- Stations should be designed to ensure the authorized route is safe, clearly indicated and easy to use.
- Platform screen doors should be installed at the stations for overall passengers' safety consideration.
- Emergency Detrainment Ramp, Emergency Communication Button, Emergency Stop Button on Escalator and Emergency Telephone should be provided.

7.5.3 Electrical Hazards

Since the project is including construction for transmission lines, substation, there might be emergency situations concerned with electric. Many workers are unaware of the potential electrical hazards present in their work environment, which makes them more vulnerable to the dangers of electrocution.

The following tips are possible solutions to reduce or eliminate the risk of injury associated with electrical work for all phases.

- Overhead power lines should be maintained a minimum distance of 10 feet from nearby equipment.
- Nothing is stored under overhead power lines.
- Safety barriers and signs must be installed to warm nearby electrical workers.
- Only qualified person must fix the damaged electrical tools and equipment.
- Cracks, cuts or abrasions on cables, wires and cords should be checked thoroughly.

- The correct wires suitable for the operation and the electrical load to work on should be used.
- Non-conductive wood or fiberglass ladders should be used when working near power lines.
- Excavation and digging near the underground cable lines should be carried out carefully.
- If it is possible, cable locating devices should be used.

7.6 Grievance Redress Mechanism

Complaints and conflicts may arise during construction, land acquisition and compensation process. These complaints and conflicts can be of many kinds. It could be:

I. EIA

- Unexpected natural and social adverse impacts by the project construction activities

II. Land Acquisition and Compensation

- Errors in the identification of people and property affected by the project;
- Disagreement on land, either between the affected person and the expropriation agency, or between two neighbors;
- Conflict over the ownership of a property between two affected persons;
- Disagreement over the assessment of property;
- Family problems (estates, divorces) that raise disputes between heirs or members of the same family regarding a property, parts of a property or other property;

Disagreements about resettlement measures, location of a resettlement site, and type of compensation or habitat proposed, characteristics of the parcel, quality of the new areas of use, etc.

The aim of the Grievance Redress Mechanisms (GRM) is to ensure that grievances and concerns raised by PAPs or other people within the communities can be effectively dealt with in a timely and satisfactory manner. Given the potential for quick and effective resolution on the ground, utilizing local dispute mechanisms as a first step in line with current traditional practices makes the mechanism more effective. Normally, a grievance redress mechanism is developed to ensure that:

- All complaints related to natural and social impacts by the project, resettlement, compensation and others assistances are appropriately dealt with;
- It can be easily access by those who have complaints related to resettlement and other assistance; and
- Adequate measures are taken to resolve the issues rose.

Grievance related to any aspect of the project or sub-project shall be handled through a consultative manner appropriately, easily and speedily. The Grievance Redress Committee (GRC) is suited as the main entity that takes care of the issues. The composition of the GRC includes the following members:

- Representatives from PMU;

- Representatives from Yangon City Development Committee;
- Ward Tract administrator / Representatives from the relevant community;
- Township GAD;
- Ministry of Natural Resources and Environmental Conservation;
- Other relevant organization, if any.

The GRC members are mainly composed of relevant officials at township level. However, depending on the type of the complaint or the situation, the GRC may also ask representatives of the relevant organization to take part in the procedure of grievance resolution, such as state/ regional government, contractor and consultants.

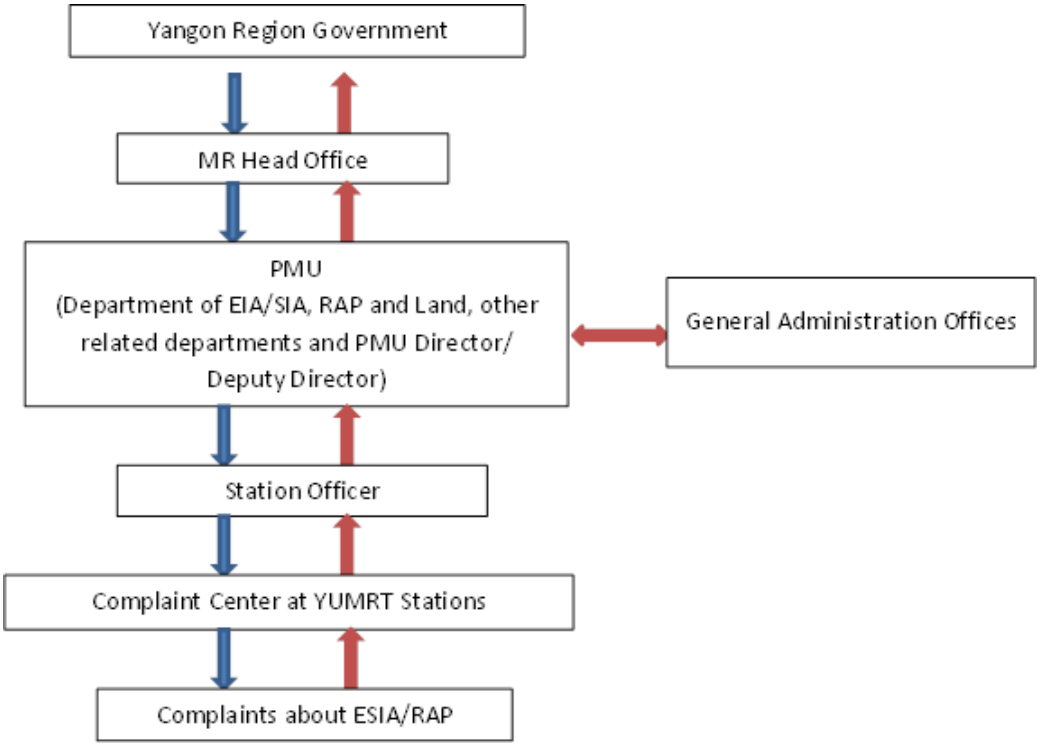


Figure 7. 1 During PMU's Operation

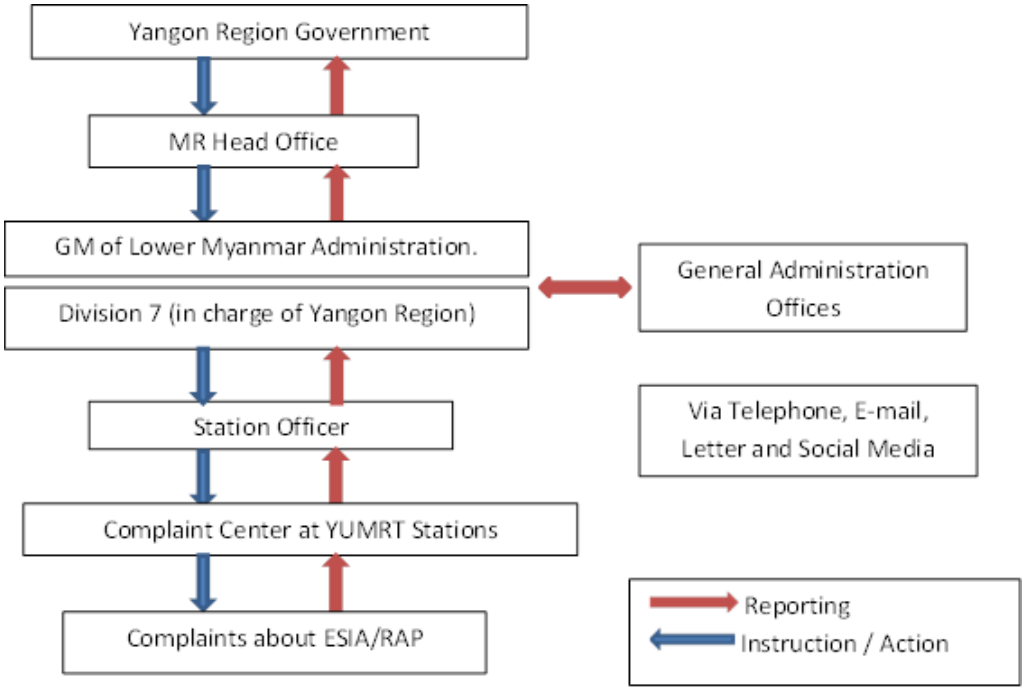


Figure 7. 2 After PMU's Operation

7.7 Traffic Management Plan

The controlled movement of traffic and pedestrians in the project is essential to the correct running of the site. Traffic movement controls around the site and lifting and materials storage must be maintained to support a safe working environment. The following instructions must be implemented.

- Site entrance/exit must be controlled by security gateman in security hut which will be in voice contact with site reception and management at the construction site.
- All drivers have to register upon entering and leaving the site and will be given by verbal instruction to take the correct access onto the site.
- All vehicles such as delivery vehicles, excavators, dump trucks, forklifts, cranes must be cooperated and coordinated by main contractor and sub-contractors to whom the vehicles belong.
- Site speed limit not exceeding 10 mph must be enforced at all times.
- All persons operating vehicles and heavy machines must have their current License.
- All heavy machines and lifting equipment have to be fitted with an audible reversing alarm and all dumpers must be worn to fit safety belt by the operator.
- All site roads where possible must be wide enough to enable vehicles to pass and where not possible appropriate signage must be provided.
- Signage and caution sign must be provided at junctions to indicate direction of traffic flow and priority.
- Designated parking area must be provided for all vehicles requiring to park on site.

- The pedestrian route to the site should be via a dedicated walkway and crossing point the site compound and pedestrian traffic signs must be provided to alert all drivers especially at junctions.
- Personal Protective Equipment (PPE) must be provided to all drivers and workers and appropriate warning signage for PPE must be displayed at site entrances.
- External lighting must be provided to the site office, construction compound, and access route when the site is in operation and reflective traffic signs must be provided to the priority places.

7.8 Roles and Responsibilities of Key Players in Environmental Management

Carrying out environmental management for the project involves a number of participants each with different mandates, responsibilities and interests. In particular, Yangon Regional Government, MR supported by MOTC, has the primary responsibility to ensure that the people and the natural environment are adequately protected from the negative impacts that are generated from the project and that they adequately and rightfully benefit from the positive impacts. The following section describes the key players and their roles and responsibilities in environmental management under the project.

(1) Yangon Regional Government

As the project proponent and leading executing body of the project, regional government carries overall responsibility for managing and protecting the social and natural environment to the extent that the project may have an effect. It may directly or through a representative (e.g. consultant) carry out activities that help meeting this goal. To be specific, regional government will form a project management unit (PMU) for the subject project so that all necessary considerations and decisions related to the project, be it technical, financial, administrative or environmental, can be made swiftly. One unit of the PMU is assigned with the task of environmental management as explained in more detail below.

(2) MOTC

As the supervising body of MR, MOTC will support MR in, inter alia, implementing the EMP especially in matters related to involuntary resettlement and other social issues that require cooperation with the regional government and other concerned government bodies. It is ultimately MOTC that confirms the amount of compensation to be provided to the PAPs and decides whether MR can spend the budget for the said purpose. It is therefore important that MR communicates and works closely with MOTC to earn their understanding.

(3) PMU

PMU will be established as a joint organization or a state/semi-governmental firm by YRG and MOTC on the detail design stage. However, the structures of organization, operation, personnel etc. have not been determined at the moment. Therefore, a YUMRT project team

should be established composed by the representatives from YRG, MOTC and MR focusing on forming of PMU.

(4) Engineer (Consultant)

The consultant will supervise the contactor in implementing environmental mitigation measures and monitoring. If any issue is identified, the consultant will consult with MR and, upon their consent, give instructions to the contractor to take appropriate countermeasures to improve the state of the environment against adverse impacts. The consultant will conduct environmental inspections of the construction work and report the results to MR. The consultant will also support MR in preparing an environmental monitoring report to MONREC and JICA respectively, as required by the EIA Procedure (2015) and JICA Environmental Guidelines.

(5) Contractor

A contractor will be selected by MR through a tendering process to carry out construction. Contractor is the major executing body for environmental management and protection in the construction stage. It will carry out such work under the instruction of MR often through the engineer/consultant. It is the contractor's obligation to strictly follow the EMP including environmental monitoring as stipulated in this report. It must also report promptly to MR through the engineer about the state of the environment and about any other issues that may arise in the construction stage that relate to environmental and social considerations.

(6) Line Agencies

The local government (e.g. Mandalay and Bago Region Governments, GAD officers and officers from DALMS) and ECD will cooperate and/or oversee the environmental management activities and those related to public consultation, provision of compensation and other supports to the PAPs, grievance redress and conflict resolution. A close cooperation with the local authorities such as Mandalay City Development Committee, Naypyidaw City Development Committee, in addition to GAD, is also important in dealing with and solving site-specific concerns or other complaints from the local community such as those related to waste management.

(7) Project-affected Persons

PAPs, the local community and other stakeholders will be affected by the project positively and/or negatively. The PAPs do not have a responsibility for environmental management in general. However, they are expected to show willingness to understand the project and how it may affect them and to actively participate in the public consultation process by expressing freely and honestly their views and opinions.

CHAPTER 8 PUBLIC CONSULTATION AND DISCLOSURE

8.1 Requirements under the EIA Procedure (2015)

With regards to public consultation and disclosure, Article 61 and 65 of the EIA Procedure (2015) requires project proponents to:

a. *timely disclose all relevant information about the proposed project and its likely adverse impacts to the public and civil society through local and national media, the website(s) of the project or project proponent, at public places such as libraries and community halls, and on sign boards at the project site visible to the public, and provide appropriate and timely explanations in press conferences and media interviews;*
b. *arrange consultation meeting at national, regional, state, Nay Pyi Taw Union Territory and local levels, with PAPs, authorities, community based organizations and civil society; and*
c. *not later than fifteen (15) days after submission of the EIA Report to the Department, disclose the EIA Report to civil society, PAPs, local communities and other concerned stakeholders: (i) by means of national media (i.e. newspapers); (ii) the website(s) of the Project or Project Proponent; (iii) at public meeting places (e.g. libraries, community halls); and (iv) at the offices of the Project Proponent*

Accordingly, information on the project was made public in the following four stages under this project:

1. Information disclosure on the project upon commencement of the EIA
2. Stakeholder meeting at the scoping stage
3. Stakeholder meeting upon preparation of the EIA report (draft)
4. Disclosure of the EIA report after submission to ECD/MONREC

In addition, consultations were held separately from the above mentioned processes targeting specifically those that are expected to be directly affected by the project, namely, those that need to relocate their houses or structures as a result of the project. Each of the activities related to public consultation and disclosure is described in the following sections.

8.2 Information Disclosure on the Project upon Commencement of the EIA

Information about the project was disclosed to the LARAPs and other stakeholders in accordance with the EIA Procedure (2015) and JICA Environmental Guidelines at an early stage of the EIA study. Chief Minister of Yangon Region proclaimed Cut-off Date (COD) which includes project description, information of proposed project affected unit (PAU) and information of project proponent on May 6th, 2019 in National Newspaper; Myanma Alinn and Kyay Mone. COD announcement letter is described in **Appendix 12.**

8.3 Stakeholder Meeting at the Scoping Stage

8.3.1 Purpose

Stakeholder meetings were held in the scoping stage in order to:

a) raise stakeholders' awareness and understanding towards the project including its necessity and possible positive/negative impacts;
b) ensure stakeholders understand what kind of survey is planned to be carried out under the EIA study and for what purposes; and
c) collect and adequately reflect the views and concerns of the stakeholders to the EIA study

8.3.2 Methodology

Stakeholder meetings were held in three places at the scoping stage in June, 2019. MR, in consultation with the EIA consultant, selected the venues taking into account the following conditions:

(1) geographical location and distribution in mind the geographical coverage of the project (i.e. 350 km);
(2) administrative boundaries under which the locations fall;
(3) accessibility of the local people;
(4) capacity and availability of the venues

An announcement of the meetings was made on two different newspapers (i.e. *The Mirror and Myanmar Alin*). In addition, MR made an invitation using invitation cards to national, regional, state, Nay Pyi Taw Union Territory and to the ward level community leaders located along the project area.

8.3.3 Outline of the Stakeholder Meetings

The stakeholder meetings attracted a wide range of stakeholders including the local people, relevant government organizations including ECD/MONREC, Yangon Regional Government, MR and the media. An outline of the stakeholder meetings held at the scoping stage is presented below. A more detailed description of each meeting is shown in **Appendix 8.**

Table 8. 1 Summary of the Stakeholder Meetings at the Scoping Stage

No.	Date and Time	Township	Summary
1	9:00 to 12:00, June 1st, Saturday 2019	Hlaing Tharyar	Participants: a total of 1456 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
2	9:00 to 12:00, June 8th, Saturday 2019	Hlaing/ Mayangone	Participants: a total of 347 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
3	13:00 to 16:00, June 8th, Saturday 2019	Yankin/ South Okkalapa	Participants: a total of 183 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.

Source: JICA Study Team

The stakeholder meetings were held according to the following agenda:

6) Opening remarks;
7) Presentation on the proposed project;
8) Presentation on issues related to environmental and social considerations;
9) Question and answers; and
10) Closing remarks

According to the agenda above, MR introduced the project to the floor by explaining: the purpose of the stakeholder meeting; project objective and proponent; project location; project component; project schedule; and contact person using a power point presentation attached in **Appendix 9**.

The EIA consultant then explained: the process of EIA; environmental type of the project; environmental baseline condition; initial impact evaluation; and terms of reference of the EIA survey.

MR and the EIA consultant received questions and opinions from the participants and gave answers.

8.4 Stakeholder Meeting upon Preparation of the EIA Report (draft)

8.4.1 Purpose

Information of the project was similarly disclosed to the public during preparation of the draft EIA report in order to:

a) raise PAPs' and other stakeholders' awareness and understanding towards the project including its necessity and possible positive/negative impacts;
b) allow PAPs and other stakeholders to be informed about the way in which the EIA was carried out as well as the result and conclusion of it; and
c) allow all stakeholders to have the opportunity to express their views and opinions so that they could be reflected to the final project design and implementation

8.4.2 Methodology

Stakeholder meetings were held at this stage in January, 2020 at five places. The venues used at the scoping stage were reviewed and finalized by MR in consultation with the EIA consultant. Announcement of the meetings were made in the same way as at the scoping stage.

8.4.3 Outline of the Stakeholder Meetings

Stakeholder meetings at the draft EIA report preparation stage were held with participation of local people, relevant government organizations including regional governments, private companies and the media. An outline of the meetings is presented below. Detailed records are shown in **Appendix 10**.

Table 8. 2 Summary of the Stakeholder Meetings at the Draft EIA Reporting Stage

No.	Date and Time	Township	Summary
1	8:00 to 11:00, January 12nd, Sunday 2020	Mayangone	Participants: a total of 77 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
2	14:00 to 17:00, January 12nd, Sunday 2020	Htantabin	Participants: a total of 137 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
3	14:00 to 17:00, January 13th, Monday 2020	Yankin/ South Okkalapa	Participants: a total of 134 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
4	8:00 to 11:00, January 14th, Tuesday 2020	Hlaing Tharyar	Participants: a total of 922 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.
5	14:00 to 17:00, January 14th, Sunday 2020	Hlaing	Participants: a total of 113 persons including local residents, news media, government officials, Parliament Representatives, NGO/ INGOs, Private company, Interested parties etc.

Source: JICA Study Team

The agenda of the stakeholder meeting was no different from the scoping stage (i.e. opening remarks; presentation on the proposed project; presentation on issues related to environmental and social considerations; presentation on issues related to land acquisition and resettlement action plan (LARAP); questions and answers; and closing remarks). According to this agenda, MR introduced the project to the floor by explaining: the objective of the stakeholder meeting; project objective; project location; project component; project schedule; and project proponent, contact person and EIA consultant using a power point presentation attached in **Appendix 11**.

Then the ESIA consultant explained: the EIA process; environmental type of the project; environmental baseline condition; terms of reference of the EIA survey; results of the EIA survey; environmental impact assessment; mitigation measures; and monitoring plan. In the question and answers session, MR and the EIA consultant gave an answer to each question raised from the floor which ranged from: environmental impact; project alternative; land acquisition and resettlement; mitigation measures; project period; and project components.

8.5 Disclosure of the EIA Report after Submission to ECD/MONREC

In accordance with EIA procedure 2015, timely disclosure of all relevant information and its likely adverse negative impacts mentioned in the EIA report for YUMRT Project should be executed to the public and civil society through local and national media, the websites of the Project or Project Proponent, at public places such as libraries and community halls, and on sign boards at the Project site visible to the public.

CHAPTER 9 CONCLUSION AND RECOMMENDATIONS

The YUMRT aims to alleviate traffic congestion and provide a fast, convenient and reliable public transportation for the population of the Yangon City in Myanmar. The YUMRT will provide between Hlaing Thayar and Parami of the EW Line. The YUMRT is indispensable, and if those investments are made, 60% of mechanized trips could be by public transport in 2035.

This EIA study has been carried out by E Guard Environmental Services Company Limited under the supervision of JICA Study Team and in compliance with, among others, the EIA Procedure (2015) and JICA Environmental Guidelines (2010). Baseline data has been collected, as part of the EIA study, through air and water quality measurements and lab analyses, and noise and vibration measurements, all in strict compliance with the EQEG. In addition, socio-economic and ecosystem surveys were carried out along the project area.

The most significant issue during the construction stage of the project will be traffic congestion due to road diversions, closures and lane reductions. The duration of the congestion at any one location could be anything from a few months to three or four years. The most affected road is Parami Road. It is important that the existing number of lanes on the major roads be maintained as far as possible and sufficient warning signs are provided at all locations. Detailed traffic management plans are now being prepared by the Project Proponent for every construction site – which would detail out all the necessary precautions needed to minimize congestion.

The main concerns during the operations of the YUMRT Line are noise and vibrations. Noise levels at bends and at the approach to stations may even be higher. To prevent from noise pollution, noise barriers are needed to be installed. During the construction phase, nighttime works should be avoided as much as possible. Construction methods should be adapted to those which can control noise and vibration. Vibration may be of concern at the underground sections of the YUMRT Line. Several types of vibration-reduction measures will be adopted for the YUMRT Line – among others floating slab tract, direct fixation devices and under base plates.

Land acquisition and relocation of people and businesses are the main impacts during the pre-construction stage. Detail explanation is mentioned in the attached LARAP.

Information on the project including that on the EIA was proactively made available to the public throughout the study. Stakeholder meetings were held in three places during scoping stage (i.e. June 2019) and in five places upon preparation of the draft EIA report (i.e. January 2020) in bringing in close to 3,300 participants in total.

In order to maximize the benefits of the Project and to minimize its economic costs, it is crucial that the identified mitigation measures are implemented effectively and the construction process be monitored diligently. Practical mitigation measures and monitoring plan have been proposed by JICA Study Team and MR has agreed to put them in place to

effectively reduce such impacts. In doing so, MR should continue working closely with organizations such as MOTC, MOEE and Yangon Region Government (YRG) and YCDC and steadily move forward together with the public and the PAPs.

APPENDICES

Appendix 1 Socio-economic Survey Form (Myanmar version)

ရန်ကုန်မြို့ပြလူထု ရထားပို့ဆောင်ရေးစီမံကိန်း

(Yangon Urban Mass Rapid Transit Construction Project- YUMRT) ၏

မြေသိမ်းဆည်းရေးနှင့် ပြန်လည်နေရာချထားရေးအစီအစဉ်၏ စစ်တမ်းကောက်ယူမှု မေးခွန်းလွှာ

ဤစစ်တမ်းကောက်ယူမှု မေးခွန်းလွှာသည် ဂျပန်နိုင်ငံ အပြည်ပြည်ဆိုင်ရာ ပူပေါင်းဆောင်ရွက်ရေး အေဂျင်စီ (JICA) မှ အကောင်အထည်ဖော်ဆောင်ရွက်သည့် ရန်ကုန်မြို့ပြ လူထု ရထားပို့ဆောင်ရေး စီမံကိန်း၏ မြေသိမ်းဆည်းရေးနှင့် ပြန်လည်နေရာချထားရေး အစီအစဉ်အတွက် ကောက်ယူသည့် မေးခွန်းလွှာ ဖြစ်ပါသည်။ ၎င်းမေးခွန်းလွှာတွင် စီမံကိန်းကြောင့် ထိခိုက်ခံရသော လူများ၊ ထိခိုက်ခံရသော ပိုင်ဆိုင်မှုများနှင့် အခြားသောဆုံးရှုံးမှုများ၊ ဝင်ငွေနှင့် လူနေမှုဘဝကို ထိခိုက်စေသော အသေးစိတ် အချက်အလက်များကို ၎င်းတို့၏ နေအိမ်များသို့သွားရောက် မေးမြန်းထားခြင်းဖြစ်ပါသည်။

စစ်တမ်းကောက်ယူမှု မေးခွန်းလွှာတွင် အပိုင်း (၃) ပိုင်းပါဝင်ပါသည်။

(က) စစ်တမ်းကောက်ယူမှု မှတ်တမ်း
(ခ) သန်းခေါင်စာရင်း ကောက်ယူမှုမှတ်တမ်း (ထိခိုက်ခံရသော လူနှင့် လူနေမှုဘဝ)
(ဂ) ဆုံးရှုံးနစ်နာမှုကောက်ယူသည့်မှတ်တမ်း (မြေယာဆုံးရှုံးမှု/ ယှနစ်များနှင့် ဆုံးရှုံးမှုများ)

(က) စစ်တမ်းကောက်ယူမှုမှတ်တမ်း

၁။	စစ်တမ်းကောက်ယူမှု နံပါတ်	
၂။	စစ်တမ်းကောက်ယူသည့် နေ့ စွဲ	
၃။	စစ်တမ်းကောက်ယူသူ၏ အမည်	
၄။	စစ်တမ်းကိုစစ်ဆေးသည့်သူ	
၅။	စီမံကိန်းကြောင့်ထိခိုက်ခံရသည့် လူ၊ ပုဂ္ဂိုလ်	
၆။	စီမံကိန်းကြောင့် ထိခိုက်ခံရသည့် လူ၊ ပုဂ္ဂိုလ်၏ ဆက်သွယ်ရန်လိပ်စာ	
၇။	တည်နေရာ (မြို့ နယ်၊ ကျေးရွာ၊ ရပ်ကွက်)	
၈။	ထိခိုက်ခံရသည့်အမျိုးအစား (က) မြေယာ (ခ) အဆောက်အဦး (ဂ) ဝင်ငွေအရင်းအမြစ် *အရင်းအမြစ်အမျိုးမျိုး	

(ခ) ထိခိုက်ခံရသောလူ၊ ပုဂ္ဂိုလ် ဆန်းစစ်လေ့လာခြင်း

၁။ အိမ်ထောင်စီး၏ သတင်းအချက်အလက်များ			အဖြေ
၁။	အမည်		
၂။	အမျိုးသား/မှတ်ပုံတင်အမှတ်		

၁။ အိမ်ထောင်ဦးစီး၏ သတင်းအချက်အလက်များ			အဖြေ
၃။	အသက်	(က) ၅ နှစ်အောက်၊ (ခ) ၆- ၁၇ နှစ်၊ (ဂ) ၁၈-၆၀ နှစ်၊ (ဃ) ၆၁ နှစ် နှင့် အထက်	
၄။	လိင်	(က) ယောကျ်ား၊ (ခ) မိန်းမ	
၅။	ကိုးကွယ်သည့်ဘာသာ	(က) ဗုဒ္ဓ၊ (ခ) ခရစ်ယာန်၊ (ဂ) မွတ်စလင်၊ (ဃ) အခြား (_____)	
၆။	လူမျိုး	(က) ဗမာ၊ (ခ) ရှမ်း၊ (ဂ) ကရင်၊ (ဃ) ရခိုင်၊ (င) မွန်၊ (စ) ကချင်၊ (ဆ) အခြား (_____)	
၇။။	နေ့စဉ်အသုံးပြုသော ဘာသာစကား	(က) မြန်မာ၊ (ခ) ရှမ်း၊ (ဂ) ကယား။ (ဃ) ကချင်၊ (င) ချင်း၊ (စ) မွန်၊ (ဆ) အခြား (_____)	
၈။	မူလနေထိုင်သည့်နေရာ	တည်နေရာ	
၉။	နေထိုင်သည့်အချိန်ကာလ	နှစ်	
၁၀။	ပညာရေး	(က) ဘုန်းတော်ကြီးသင် ပညာရေး၊ (ခ) မူလတန်း၊ (ဂ) အလယ်တန်း၊ (ဃ) အထက်တန်း။ (င) တက္ကသိုလ်၊ (စ) ဘွဲ့ ရ၊ (ဆ) အခြား (_____)	
၁၁။	အလုပ်အကိုင်	(က) မိုခို၊ (ခ) ကျောင်းသား၊ (ဂ) ဈေးဆိုင်ပိုင်ရှင်၊ (ဃ) ပုံကျဈေးသည်၊ (င) ကျွမ်းကျင်အလုပ်သမား။ (စ) နေ့စား (ဆ) လယ်သမား။ (ဇ) မွေးမြူရေး၊ (ဈ) တံငါသည်၊ (ည) အစိုးရ ဝန်ထမ်း၊ (ဋ) ကိုယ်ပိုင် ကုမ္ပဏီ၊ (ဌ) အလုပ်လက်မဲ့၊ (ဍ) အခြား (___ ___)	
၁၂။	မိသားစုဝင်အရေအတွက်	(------) ယောက်	
၁၃။	အဓိကဝင်ငွေ အရင်းအမြစ်	(က) မိုခို၊ (ခ) ကျောင်းသား၊ (ဂ) ဈေးဆိုင်ပိုင်ရှင်၊ (ဃ) ပုံကျဈေးသည်၊ (င) ကျွမ်းကျင်အလုပ်သမား။ (စ) နေ့စား, (ဆ) လယ်သမား။ (ဇ) မွေးမြူရေး၊ (ဈ) တံငါသည်၊ (ည) အစိုးရဝန်ထမ်း၊ (ဋ) ကိုယ်ပိုင်ကုမ္ပဏီ၊ (ဌ) အလုပ်လက်မဲ့၊ (ဍ) အခြား (_____)	
၁၄။	အခြားဝင်ငွေအရင်းအမြစ်		
၁၅။	အဓိကအလုပ်		

၁။ အိမ်ထောင်ဦးစီး၏ သတင်းအချက်အလက်များ			အဖြေ
	လုပ်ကိုင်သည့်နေရာ		
၁၆။	အလုပ်သို့ သွားလာသည့်ပုံစံ	(က) လမ်းလျှောက်, (ခ) စက်ဘီး၊ (ဂ) မော်တော်ဆိုင်ကယ်၊ (ဃ) အလုပ်ရှင်မှ ထောက်ပံ့ပေးသည့် အများသုံးယာဉ် (စ) ဖယ်ရီကား။ (ဆ) အငှါးယာဉ်၊ (ဇ) အခြား (_____)	
၁၇။	လစဉ်ဝင်ငွေ	.....ကျပ်	
၁၈။	လစဉ်ကုန်ကျငွေ	.....ကျပ်	
၁၉။	ဆင်းရဲနွမ်းပါးမှု အခြေအနေ	(က) အမျိုးသမီး အိမ်ထောင်ဦးစီး၊ (ခ) မုဆိုးမ၊ (ဂ) သက်ကြီး အိမ်ထောင်ဦးစီး။ (ဃ) မသန်စွမ်းသော အိမ်ထောင်ဦးစီး။ (င) အခြား (_____)	

၂။ အိမ်ထောင်စု အချက်အလက်များ					
မိသားစုဝင်	အိမ်ထောင်ဦးစီး နှင့်တော်စပ်ပုံ	အသက်	လိင်	ပညာအရည်အချင်း	အလုပ်အကိုင်
မိသားစုဝင် ၁					
မိသားစုဝင် ၂					
မိသားစုဝင် ၃					
မိသားစုဝင် ၄					
မိသားစုဝင် ၅					
မိသားစုဝင် ၆					
မိသားစုဝင် ၇					

***အိမ်ထောင်ဦးစီးနှင့်တော်စပ်ပုံ**

(က) အိမ်ထောင်ဦးစီး (ခ) ဇနီး/ ခင်ပွန်း (ဂ) သား/ သမီး (ဃ) သမက်/ ချွေးမ (င) အခြားဆွေမျိုးတော်စပ်ပုံ (စ) အခြား

*** အခြားသော အချက်များကို ယခင် အပေါ်ရှိ ၁။ အိမ်ထောင်ဦးစီး၏ သတင်းအချက်အလက်များ ရှိ ကုဒ်နံပါတ်များအတိုင်း ထည့်သွင်းအသုံးပြုပါရန်။**

၃။ နေထိုင်မှုအခြေအနေ			အဖြေ
၁။	လျှပ်စစ်မီး	(က) လျှပ်စစ်မီး မရရှိပါ၊ (ခ) လျှပ်စစ်မီး (မျှဝေသုံးစွဲ)၊ (ဂ) ကိုယ်ပိုင်မီးစက်၊ (ဃ) အစိုးရလျှပ်စစ်မီး၊ (င) အခြား (.....)	
၂။	ရေရရှိမှု	(က) ရေမရရှိပါ၊ (ခ) မိုးရေ၊ (ဂ) စည်ပင်သာယာမှ	

		ထောက်ပံ့သည့်ရေ၊ (ဃ) ရေတွင်း၊ (င) ကိုယ်ပိုင်ရေစက် (စ) အခြား.....	
၃။	အိမ်သာအမျိုးအစား	(က) အိမ်သာမရှိပါ၊ (ခ) ရေလောင်းအိမ်သာ၊ (ဂ) ယင်လုံအိမ်သာ၊ (ဃ) မျှဝေသုံးစွဲ	
၄။	ဖုန်းအမျိုးအစား	(က) အထိုင်ဖုန်း၊ (ခ) မိုဘိုင်းဖုန်း၊ (ဂ) မရှိပါ။	
၅။	အမှိုက်စုဆောင်းခြင်း	(က) ရှိ၊ (ခ) မရှိ	

၄။ လူမှုရေးဆိုင်ရာ ဝန်ဆောင်မှုများ			**အမြဲ**
၁။	ပညာရေး (စာသင်ကျောင်း)	(က) ကောင်း၊ (ခ) သင့်၊ (ဂ) ညံ့	
၂။	ကျန်းမာရေးဆိုင်ရာ ဝန်ဆောင်မှု (ဆေးရုံ၊ ဆေးပေးခန်း)	(က) ကောင်း၊ (ခ) သင့်၊ (ဂ) ညံ့	
၃။	သယ်ယူပို့ ဆောင်ရေး	(က) ကောင်း၊ (ခ) သင့်၊ (ဂ) ညံ့	
၄။	ဆင်းရဲနွမ်းပါးမှုလျော့ချရေး အစီအစဉ်	(က) ရှိ (_____), (ခ) မရှိ	

(ဂ) ထိခိုက်ခံရသောအဆောက်အဦး/ ယူနစ်များ

၅။ ထိခိုက်ခံရသော မြေယာ			**အမြဲ**
၁။	မြေယာအမျိုးအစား	(က) ဘိုးဘွားပိုင်မြေ၊ (ခ) အစိုးရထံမှ ငှားရမ်းထားသောမြေ၊ (ဂ) စိုက်ပျိုးမြေ၊ (ဃ) မြေလွတ်မြေရိုင်း၊ (င) ဘုန်းကြီးကျောင်း ပိုင်မြေ၊ (စ) အခြား (_____)	
၂။	အသုံးပြုသည့် ရည်ရွယ်ချက်	(က) လူနေအဆောက်အအုံ၊ (ခ) စီးပွားရေး၊ (ဂ) အစိုးရ၊ (ဃ) စိုက်ပျိုးရေး၊ (စ) အခြား (_____)	
၃။	တရားဝင် ပိုင်ဆိုင်မှု အထောက်အထား	(က) ပိုင်ရှင်၊ (ခ) မြေငှါးပိုင်ဆိုင်သူ၊ (ဂ) ငှားရမ်းနေထိုင်သူ၊ (ဃ) တရားဝင်ဘက်ကဒ်ဖြင့် နေထိုင်သူ၊ (င) တရားဝင်ဘက်ကဒ်မပါဘဲ နေထိုင်သူ	
၄။	တရားဝင်စာရွက်တမ်း	(က) အထောက်အထား ခိုင်လုံမှုရှိ၊ (ခ) အထောက်အထား ခိုင်လုံမှုမရှိ *စာရွက်စာတမ်း အထောက်အထားအား ဓါတ်ပုံရိုက်ရန်။	
၅။	ငှားရမ်းနေထိုင်ခ	(က) အိမ်ငှား၊ (ခ) အငှားချသူ ပမာဏ (ကျပ်)	
၆။	ငွေပေးချေမှု	(က) လစဉ်၊ (ခ) နှစ်စဉ်၊ (ဂ) အခြား_____	
၇။	အသုံးပြုသည့်ကာလကြာချိန်	.....နှစ်	

၈။	မြေဧရိယာ ပမာဏ	အရှည် အကျယ်	
၉။	ထိခိုက်ခံသည့် ပမာဏ	(က) ၁၀၀%၊ (ခ) ၇၅%၊ (ဂ) ၅၀%၊ (ဃ) ၂၅%၊ (င) ၂၅%အောက်	
၁၀။	ဦးစားပေးလိုလားမှု	(က) ထိခိုက်ခံရသောဧရိယာ အတွက်ပဲ လျော်ကြေးပေးရန်၊ (ခ) ဧရိယာတစ်ခုလုံးအတွက် လျော်ကြေးပေးရန်၊	

၆။ ထိခိုက်ခံရသည့် အဆောက်အဦ			အဖြေ
၁။	အသုံးပြုသည့်ရည်ရွယ်ချက်	(က) အိမ်၊ (ခ) တိုက်ခန်း၊ (ဂ) ဈေးဆိုင်၊ (ဃ) ကုန်စုံဆိုင်၊ (င) အဖွဲ့အစည်းပိုင် အဆောက်အဦး၊ (စ) ဘာသာရေးဆိုင်ရာ အဆောက်အဦး၊ (ဆ) အခြား (_____)	
၂။	ပိုင်ဆိုင်မှုအထောက်အထား	(က) ပိုင်ရှင်၊ (ခ) မြေငှါးပိုင်ဆိုင်သူ၊ (ဂ) ငှားရမ်းနေထိုင်သူ၊ (ဃ) တရားဝင်ဘက်ကဒ်ဖြင့် နေထိုင်သူ၊ (င) တရားဝင်ဘက်ကဒ်မပါဘဲ နေထိုင်သူ၊	
၃။	ငှားရမ်းနေထိုင်ခ	(က) အိမ်ငှား၊ (ခ) အငှားချသူ ပမာဏ (ကျပ်)	
၄။	ငွေပေးချေမှု	(က) လစဉ်၊ (ခ) နှစ်စဉ်၊ (ဂ) အခြား_____	
၅။	ဆောက်လုပ်သည့်ခုနှစ်	နှစ်	
၆။	နေထိုင်သည့်နှစ်	နှစ်	
၇။	အဆောက်အဦးပုံစံ (၁) အမိုး (၂) ဘောင် (၃) နံရံ	 (က) ဝါး/ အရွက်/ မိုးကာဖျင်၊ (ခ) သွပ်၊ (ဂ) အုတ် (က) ဝါး၊ (ခ) သစ်သား၊ (ဂ) အုတ် (က) ဝါး၊ (ခ) သစ်သား၊ (ဂ) အုတ် (ဃ) ကွန်ကရစ်	
၈။	အဆောက်အဦးအရွယ်အစား	အရှည်(ပေ) အကျယ်(ပေ)	
၉။	ထိခိုက်ခံရသည့် ပမာဏ	(က) ၁၀၀%၊ (ခ) ၇၅%၊ (ဂ) ၅၀%၊ (ဃ) ၂၅%၊ (င) ၂၅%အောက်	
၁၀။	ဦးစားပေးလိုလားမှု	(က) ထိခိုက်ခံရသောဧရိယာ အတွက်ပဲ လျော်ကြေးပေးရန်၊ (ခ) ဧရိယာတစ်ခုလုံးအတွက် လျော်ကြေးပေးရန်၊	
၁၁။	လျော်ကြေးပေးသည့်နည်းလမ်း	(က) ကိုယ်တိုင်ပြောင်းရွှေ့ခြင်း၊ (ခ) ပြန်လည်နေရာချထားပေးသည့်နေရာ၊ (ဂ) အခြား	

YMD နှင့် Google Map ကို အသုံးပြု၍ ရရှိသော မြေယာ နယ်နိမိတ်နှင့် အဆောက်အဦ၏ တည်နေရာပြပုံ
ထိခိုက်ခံရသည့် အဆောက်အဦ၏ ဓာတ်ပုံ

ဂ။ သစ်ပင်/ သီးနှံ					
စဉ်	သစ်ပင်/ သီးနှံအမည်	သစ်ပင် အရေအတွက်	သီးနှံ (ဧက)	သီးနှံ ထွက်နှုန်း	ရောင်းရငွေ ပမာဏ .....ကျပ်
၁။					
၂။					
၃။					
၄။					
၅။					

ဃ။ မိသားစုပိုင် ပစ္စည်းဥစ္စာ			အဖြေ
၁။	အခြားနေရာရှိ ပိုင်ဆိုင်မှုများ	(က) မြေယာ၊ (ခ) အိမ်၊ (ဂ) မရှိ	
၂။	မိသားစုပိုင် ပစ္စည်းဥစ္စာ အရေအတွက်	(က) စက်ဘီး၊ (ခ) မော်တော်ဆိုင်ကယ်၊ (ဂ) ကား၊ (ဃ) လှေ၊ (င) အခြား (_____)	
၃။	တိရစ္ဆာန် အရေအတွက်	(က) ကြက်၊ (ခ) ဝက်၊ (ဂ) ဘဲ၊ (ဃ) ဆိတ်၊ (င) အခြား (_____)	

Appendix 2 Socio-economic Survey Form (English version)

Questionnaire Form of
LARAP Survey for
Yangon Urban Mass Rapid Transit Construction Project (YUMRT)

This questionnaire is used for the Land Acquisition and Resettlement Action Plan (LARAP) Survey for **Yangon Urban Mass Rapid Transit Construction Project (YUMRT)** funded by Japan International Cooperation Agency (JICA), in which the detailed information about the affected people, affected properties and other losses, income and livelihood of those affected people are to be collected in their houses.

This questionnaire has following three sections:

(A) Survey Record
(B) Census Survey *(Affected People / Livelihood)*
(C) Loss of Inventory (LOI) Survey *(Affected Land / Units and the Losses)*
(D) Perception, Assistance Needs

(A) Survey Record

1	Survey Sr. Number	
2	Survey Date	
3	Enumerator	
4	Inspector	
5	Name of PAP	
6	Contact of PAP	
7	Location (Township, Ward, Village)	
8	Survey Block Number (from YCDC List)	
9	Affected Item (1) Land, (2) Structure, (3) Income source *multiple	

(B) Analysis on Affected People

1. Information on Household Head			**Answer**
1	Name	-	
2	Type of Identity Card	(1) Citizenship Card (pink), (2) Associate Citizenship Card (blue), (3) Naturalised Citizenship Card (green), (4) National Registration Card (three-fold card, green for	

		men, pink for women), (5) Temporary Registration Card (white), (6) No Card, (7) Other (_____)	
3	Identity Card Number		
4	Age	(1) below 5 (2) 6 to 17, (3) 18 to 60, (4) above 61 Note: Please write down actual age also apart from choosing the option	
5	Sex	(1) Male, (2) Female	
6	Religion	(1) Buddhism, (2) Christian, (3) Muslim, (4) Other (_____)	
7	Ethnic Group	(1) Bamar, (2) Shan, (3) Kayin, (4) Rakhine, (5) Mon, (6) Kachin, (7) Other (_____)	
8	Language used in daily communication	(1) Burmese, (2) Shan, (3) Karen, (4) Kachin, (5) Chin, (6) Mon, (7) Other (_____)	
9	Origin Area	Location	
10	Duration of living	In years	
11	Education	(1) Monastery Education, (2) Primary School, (3) Middle School, (4) High School, (5) University, (6) Graduate School, (7) Other (_____)	
12	Occupation	(1) Total Dependent, (2) Student, (3) Shop Owner, (4) Stall Owner/ Vendor, (5) Skilled Labour, (6) Casual Labour, (7) Farmer, (8) Livestock, (9) Fishery, (10) Gov. Staff, (11) Private company, (12) Unemployed, (13) Other (_____)	
13	No. of Family members	In number	
14	Primary income source	(1) Total Dependent, (2) Student, (3) Shop Owner, (4) Stall Owner/ Vendor, (5) Skilled Labour, (6) Casual Labour, (7) Farmer, (8) Livestock, (9) Fishery, (10) Gov. Staff, (11) Private company, (12) Unemployed, (13) Other (_____)	
15	Secondary income source		
16	Work place of primary income source	(1) At Home, (2) Within village, (3) Outside village, within township, (4) Outside township (5) Other (_____)	
17	Work place of secondary income source		

18	Commuting mode to the work place	(1) Walk, (2) Bicycle, (3) Motorbike, (4) Bus provided by an employer, (5) Ferry bus, (6) Taxi, (7) Others (_____)	
19	Monthly income	In Kyat	
20	Monthly expenditure	In Kyat	
21	Vulnerability Status	(1) Women HH, (2) HH with Widow, (3) HH with Elders with no immediate support member, (4) HH with physically challenged member, (5) Other (_____)	

2. Information on Household Structure					
Member	Relation to Household Head	Age	Sex	Education	Occupation
M 1					
M 2					
M 3					
M 4					
M 5					
M 6					
M 7					

*Relating to Household Head: (1) HH Head (2) Spouse (3) Son/Daughter and those in law (4) Other Relatives (5) Others

*For others, please use the same code as 1. Information on Household Head

3. Access to infrastructure			**Answer**
1	Electricity	(1) No Electricity, (2) Shared Electricity, (3) Own Generator, (4) Gov. Electricity, (5) Other (_____)	
2	Water supply	(1) No Water, (2) Rain water, (3) municipal water supply, (4) Tube well, (5) Private water vendor, (6) Other (_____)	
3	Toilet/Sewage	(1) No (open defecation), (2) Shared Toilet (3) Fly Proof Latrine, (4 Public Toilet (5) Flush Toilet (6) Other (_____)	
4	Telephone	(1) Fixed, (2) Mobile, (3) No	
5	Waste collection	(1) Yes, (2) No	
6	Waste collection	(1) YCDC dust bin, (2) Designated place,	

	method	(3) Bell- ring system, (4) Burning, (5) Others (_____)	
7	Waste collection times (YCDC)	(1) Once per week, (2) Twice per week, (3) Once per month, (4) Twice per month, (5) Others (_____)	

4. Access to social service			**Answer**
1	Education (School)	(1) Good, (2) Fair, (3) Poor	
2	Healthcare service (Clinic, Hospital)	(1) Good, (2) Fair, (3) Poor	
3	Transportation	(1) Good, (2) Fair, (3) Poor	
4	Poverty alleviation programme	(1) Yes (_____), (2) No	

(C) Survey on Affected Land / Units

5. Affected Land			**Answer**
0	Location	GPS Coordinates	
1	Type of Land	(1) Freehold, (2) Grant, (3) Agriculture, (4) Vacant, Fallow and Virgin, (5) Monastery, (6) Other (_____)	
2	Purpose of use	(1) Residential, (2) Commercial, (3) Government, (4) Agricultural, (5) Other (_____)	
3	Legal Status	(1) Owner, (2) Lease holder, (3) Rented, (4) Illegal w/ smart card, (card no _____) (5) Illegal w/o smart card	
4	Legal Documents	(1) With Certificate, (2) Without Certificate *Please take photo of the Certificate for verification	
5	Lease/Rental Fee	(1) Lease, (2) Rental Amount (Kyat)	
6	Payment	(1) monthly, (2) yearly, (3) Other (_____)	
7	Period of use	In years	
8	Remaining lease/rental period	In years	
9	Size of Land	Length Width	
10	Affected Area	(1) 100%, (2) 75%, (3) 50%, (4) 25%, (5) Less than	

		25%	
11	Preference	(1) Compensation for only affected area, (2) Compensation for whole area = Relocation	

6. Affected Units			Answer
0	Location	GPS Coordinates	
1	Purpose of use	(1) House, (2) Apartment, (3) Shop, (4) Stall, (5) Community owned building, (6) Religious building, (7) Other (_____)	
2	Legal status	(1) Owner, (2) Lease holder, (3) Rented, (4) Illegal w/ smart card, (5) Illegal w/o smart card	
3	Lease/Rental Fee	(1) Lease, (2) Rental Amount (Kyat)	
4	Payment	(1) monthly, (2) yearly, (3) Other_____	
5	Year of Construction	In years	
6	Year of Occupancy	In years	
7	Remaining Lease/Rental period	In years	
8	Material of Structure	(1) Bamboo house with GI Roofing, (2) Bamboo house with Thatch Roofing, (3) Timber house with GI Roofing, (4) Timber house with Thatch Roofing, (5) Brick Nogging with GI Roofing, (6) RC/SRC, (7) Other, specify (_____)	
9	Size of the Unit	Length (ft) Width (ft)	
10	Affected Area	(1) 100%, (2) 75%, (3) 50%, (4) 25%, (5) Less than 25%	
11	Compensation Preference	(1) Compensation for only affected part, (2) Compensation for whole part = relocation	
12	Who should demolish the house?	(1) Demolish by myself (keep the materials), (2) Demolish by the government, (3) Other, specify (_____)	
13	Compensation Method	(1) Self relocation = Cash compensation, (2) Resettlement site, (3) Unknown, (4) Others (_____)	
14	If you are asked to relocate, what is your	(1) Set back in the own land, (2) Own land in other area, (3) Set back from the YUMRT ROW,	

	preferred site?	(4) In the same village, (5) In the same township, (6) Others (_____)	

Photo of Affected Structure

7. Trees and Crops					
No.	Name of Trees and Crops	Numbers (Trees)	In Acre (Crops)	Yield (Crops)	Farm gate Price (Kyat)
1					
2					
3					
4					
5					

8. Household Assets			**Answer**
1	Ownership in other place	(1) Land, (2) House, (3) No	
2	No. of HH Assets	(1) Bicycle (No._____), (2) Motorbike (No._____), (3) Car (No._____), (4) Boat (No._____), (5) Others (_____)	
3	No. of Livestock animals	(1) Chicken (No._____), (2) Pig (No._____), (3) Duck (No._____),	

		(4) Goat (No._____), (5) Others (_____)	

(D) Perception, Assistance Needs

9. Perception and Assistance			Answer
1	Have you attended the Public Consultation?	(1) Yes, (2) No	
2	Are you supportive of the Project?	(1) Yes, (2) No (Why? _____), (3) Depends on the condition, (4) No Idea	
3	What kind of assistance do you prefer for income restoration?	(1) Job referral/placement, (2) Skill development training, (3) Access to financial institution, (4) One-time payment, (5) Other (_____)	

Appendix 3 Results of Water Quality Analysis (Dry Season)



ISO TECH LABORATORY

WTL/RE/001

W/E319 6/6

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: GW - 1

Location: Hlaing Thar Ya

Date and Time of collection: 21.3.2019

Date and Time of arrival at Laboratory: 21.3.2019

Date and Time of commencing examination: 22.3.2019

Date and Time of completing: 24.3.2019

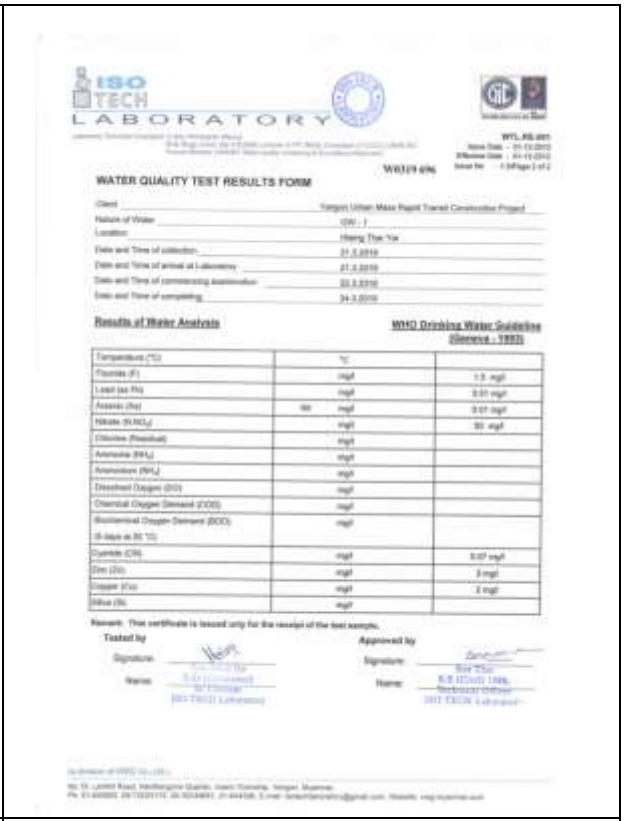
Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.2		6.5 - 9.2
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	400 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese	0.2	mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Kyaw Thura Oo, Lab Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Soe Thiri, B.E (Civil), Technical Officer, ISO TECH Laboratory



ISO TECH LABORATORY

WTL/RE/001

W/E319 6/6

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: GW - 1

Location: Hlaing Thar Ya

Date and Time of collection: 21.3.2019

Date and Time of arrival at Laboratory: 21.3.2019

Date and Time of commencing examination: 22.3.2019

Date and Time of completing: 24.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_4)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Kyaw Thura Oo, Lab Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Soe Thiri, B.E (Civil), Technical Officer, ISO TECH Laboratory



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000304/18
Date: 28/03/2019
Page 1 of 1

Sample Described as : Ground Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 21 March 2019
Sample Brought By : Client
Sample Marking : GW-1
Sample Location : Hlaing Tharyar Station
Analysed Date : 21 March 2019
Lab Code No : 101/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 C Dried at 180 °C	50	mg/L	8048
2	Chloride	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-Cl- B Argentometric Method	1	mg/L	2361.45
3	Iron	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012 3500-Fe B	0.01	mg/L	0.035

End of Report

NOA (Myanmar) Limited
(Nu Nu Yi)
Manager



guard

Operation Department: Environmental Quality Baseline Sampling Survey Field Notes

E Guard-OD-EQ-F-10 Version: 01

Approved by MD On Date: 12/11/2018 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: Aung Moe Oo
Location: Hlaing Thar Ya
Lat. & Long: 16°57'48.5"N 96°08'39.6"E
Weather: Sunny

Date: 21.3.19
Time: 11:30 AM
Instrument: Multi
Sample/Location ID:
GPS Waypoint no: GW1
Temperature: 36°C
Time: 11:30 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (micro/cm)	Electrical Conductivity: TDS (g/l)	Electrical Conductivity: Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP (mV)	Flow Rate (m/sec)	Depth (m)	Remarks
1.	7.2	8.03	5.22	4.4	3.46	22.5	140		25 ft.	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques, Accurate field measurement, Transportation, Treat, Preparation
- Monitoring Schedule, Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles, If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Thiri Thu Khaing

EFFECTIVE DATE: 01/01/2019



ISO TECH LABORATORY

WTL-RE-001

WE019 697

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	DW - 2
Location	Dagon - Ayar Bus Station
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

Results of Water Analysis

		WHO Drinking Water Guideline (Geneva - 1993)
pH	8.6	6.5 - 8.5
Colour (True)	TCU	<5 TCU
Turbidity	NTU	5 NTU
Conductivity	micro S/cm	
Total Hardness	mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness	mg/l as $CaCO_3$	
Magnesium Hardness	mg/l as $CaCO_3$	
Total Alkalinity	mg/l as $CaCO_3$	
Phenolphthalein Alkalinity	mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)	mg/l as $CaCO_3$	
Bicarbonate (HCO_3)	mg/l as $CaCO_3$	
Iron	mg/l	0.3 mg/l
Chloride (as Cl)	mg/l	250 mg/l
Sodium Chloride (as NaCl)	mg/l	
Sulphate (as SO_4)	mg/l	500 mg/l
Total Solids	mg/l	1500 mg/l
Suspended Solids	mg/l	
Dissolved Solids	mg/l	1000 mg/l
Manganese	0.8 mg/l	0.05 mg/l
Phosphate	mg/l	
Phenolphthalein Acidity	mg/l	
Methyl Orange Acidity	mg/l	
Salinity	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name — Position — Company

Approved by — Signature — Name — Position — Company

ISO TECH LABORATORY

WTL-RE-001

WE019 697

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: DW - 2
Location: Dagon - Ayar Bus Station
Date and Time of collection: 21.3.2019
Date and Time of arrival at Laboratory: 21.3.2019
Date and Time of commencing examination: 22.3.2019
Date and Time of completing: 24.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate (NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name — Position — Company

Approved by — Signature — Name — Position — Company



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 3900394/19
Date: 29/03/2019
Page 1 of 1

Sample Described as	Ground Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	21 March 2019
Sample Brought By	Client
Sample Marking	DW-2
Sample Location	Dagon Ayar Bus Station
Analysed Date	21 March 2019
Lab Code No	102119

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 2540-C Dried at 180 °C	50	mg/L	3881
2	Chloride	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 4500-Cl- B Argentometric Method	1	mg/L	1423.05
3	Iron	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012,3500-Fe B	0.01	mg/L	66.17

End of Report

SGS (Myanmar) Limited

Ma Ni Yi
Manager

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 3900394/19
Date: 29/03/2019
Page 1 of 1

Sample Described as : Ground Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 21 March 2019
Sample Brought By : Client
Sample Marking : DW-2
Sample Location : Dagon Ayar Bus Station
Analysed Date : 21 March 2019
Lab Code No : 102119

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 2540-C Dried at 180 °C	50	mg/L	3881
2	Chloride	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 4500-Cl- B Argentometric Method	1	mg/L	1423.05
3	Iron	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012,3500-Fe B	0.01	mg/L	66.17

End of Report

SGS (Myanmar) Limited

Ma Ni Yi
Manager



guard

Operation Department	E-Guard-OD-EQ-F-18 Version :01	Approved by MD Date: 12/1/2018 Page 8 of 11
Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: U Aung Moe Oo	Date: 21.3.19
Location: [illegible]	Time: 9:30 a.m.
Lat. & Long.: [illegible]	Instrument: HQR, TDS
Weather: Sunny	Sample/Location ID: DW2
	GPS Waypoint no:
	Temperature: 26.5° C.
	Time: 9:30 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (mS/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP (mV)	Flow Rate (m/sec)	Depth (m)	Remarks
2.6-DW	4.48	9.89	2.5	6.21	4.5	98		26.5°C		

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination. Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use; Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by

Daw Khin Than Lwin

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EFFECTIVE DATE: 01/01/2018



ISO TECH LABORATORY

WYL-RD-001

W0319 698

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	GW - 3
Location	Intersection Point of BOC and Tawlay
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

pH	6.7		6.8 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese	2.3	mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: The certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: — Lab Technician, ISO TECH Laboratory

Approved by — Signature: — Name: — B.E (Chemical), Technical Officer, ISO TECH Laboratory

(a division of WWD Co.,Ltd.)

No.18, Lanthit Road, Hanthayawa Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-644560, 09-73231175, 09-421033861, 01-644558, E-mail: isotechlaboratory@gmail.com, Website: wwg-myanmar.com



ISO TECH LABORATORY

WYL-RD-001

W0319 698

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	GW - 3
Location	Intersection Point of BOC and Tawlay
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate (NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: The certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: — Lab Technician, ISO TECH Laboratory

Approved by — Signature: — Name: — B.E (Civil), Technical Officer, ISO TECH Laboratory

(a division of WWD Co.,Ltd.)

No.18, Lanthit Road, Hanthayawa Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-644560, 09-73231175, 09-421033861, 01-644558, E-mail: isotechlaboratory@gmail.com, Website: wwg-myanmar.com



SGS

ANALYSIS REPORT — ORIGINAL

Job Ref: 2000394/19
Date: 29/03/2019
Page 1 of 1

Sample Described as	:	**Ground Water**
Client Name	:	**Yangon Urban Mass Rapid Transit Construction Project**
Sample Received Date	:	21. March. 2019
Sample Brought By	:	Client
Sample Marking	:	GW-3
Sample Location	:	Intersection point of BOC and Tawn Tay
Analysed Date	:	21. March. 2019
Lab Code No	:	103/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 2540 C Dried at 180 °C	50	mg/L	3768
2	Chloride	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 4500-Cl- B Argentometric Method	1	mg/L	1402.60
3	Iron	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,3500-Fe B	0.01	mg/L	0.393

End of Report

SGS (Myanmar) Limited
(Dr. Nu Yi)
Manager



guard

Operation Department	E Guard-OD-EQ-F-18 Version 01	Approved by MD On Date: 12/1/2018 Page 5 of 11
Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: U Maung Aung	**Date:** 21.3.19
Location: Intersection of BOC and Tawlay	**Time:** 10:15 AM
Lat. & Long.: 16°48'03.8"N 96°09'18.8"E	**Instrument:** HORIBA
Weather: Sunny	**Sample/Location ID:** GW3
	GPS Waypoint no:
	Temperature: 31.47
	Time: 10:15 am.

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (ms/cm)	Electrical Conductivity: TDS (g/l)	Electrical Conductivity: Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP (mV)	Flow Rate (m³/sec)	Depth (m)	Remarks
1	6.79	4.79	2.06	2.5	5.98	6.2	340		900	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques, Accurate field measurement, Transportation, Time, Preparation
- Monitoring Schedule, Review previous field sheets, Equipment checklist, Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use. Adequate for volume required.

Notes

Checked by:

Daw Thin Thin Nwe

EFFECTIVE DATE: 01/01/2019

Copy Document



ISO TECH LABORATORY

WTL-RE-001

W/0319 699

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	GW - 4
Location	Mee Khwat Market
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

pH	6.8		6.5 - 8.2
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl_2)		mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese	3.0	mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature / Name

Approved by — Signature / Name

ISO TECH LABORATORY

WTL-RE-001

W/0319 699

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	GW - 4
Location	Mee Khwat Market
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	M	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature / Name

Approved by — Signature / Name



SGS

ANALYSIS REPORT

ORIGIN AL

Job Ref: 2003286/19
Date: 28/03/2019
Page 1 of 1

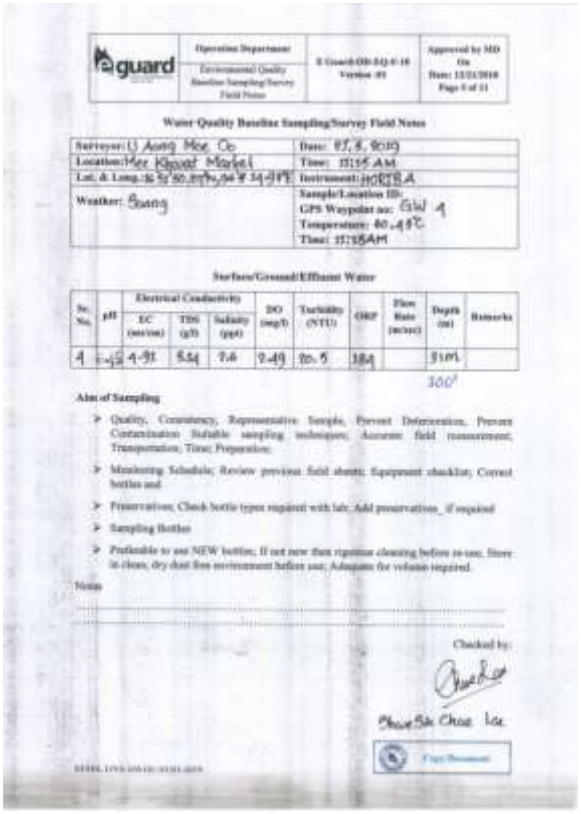
Sample Described as	Ground Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	21 March 2019
Sample Brought By	Client
Sample Marking	GW-4
Sample Location	Mee Khwant Market
Analysed Date	23 March 2019
Lab Code No.	104 /19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540-C Dried at 180 °C	10	mg/L	3740
2	Chloride	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-Cl- B Argentometric Method	1	mg/L	1577.53
3	Iron	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,3500-Fe B	0.01	mg/L	0.019

End of Report

SGS (Myanmar) Limited

Ohn Nu Yin
Manager



guard

Operation Department	E-Guard-OD-EQ-F-10 Version -01	Approved by MD On Date: 13/11/2018 Page 8 of 11
Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: U Aung Moe Oo	Date: 07.8.2019
Location: Mee Khwat Market	Time: 10:15 AM
Lat. & Long.: N 16°50.894'/96°9'34.019"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID: GPS Waypoint no: GW 1 Temperature: 30.4°C Time: 10:15AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (ms/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
1	6.45	4.91	5.54	2.6	2.49	20.5	184		3.05	

300'

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives_if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Phone Sin Chan Lin



ISO TECH LABORATORY

WTL-RE-001

W0319 788

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	GW - 5
Location	Na Wa Day Intersection Point (Na Wa Day Housing)
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	6.9		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese	1.2	mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature / Name: Daw Hnin Thi, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature / Name: Daw Thi, B.E (Civil) 1998, Technical Officer, ISO TECH Laboratory

(A Division of WKG Co. Ltd.)
No.19, Lanthit Road, Kanthayarzan Quarter, Kokeo Township, Yangon, Myanmar.
Ph: 01-640800, 09-73120175, 09-420339891, 01-644538, E-mail: isotechlaboratory@gmail.com, Website: wkg-myanmar.com

ISO TECH LABORATORY

WTL-RE-001

W0319 789

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	GW - 5
Location	Na Wa Day Intersection Point (Na Wa Day Housing)
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (T)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) 5 days at 20 °C		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature / Name: Daw Hnin Thi, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature / Name: Daw Thi, B.E (Civil) 1998, Technical Officer, ISO TECH Laboratory

(A Division of WKG Co. Ltd.)
No.19, Lanthit Road, Kanthayarzan Quarter, Kokeo Township, Yangon, Myanmar.
Ph: 01-640800, 09-73120175, 09-420339891, 01-644538, E-mail: isotechlaboratory@gmail.com, Website: wkg-myanmar.com



SGS

ANALYSIS REPORT — ORIGINAL

Job Ref: 2000394/19
Date: 29/03/2019
Page 1 of 1

Sample Described as	:	Ground Water
Client Name	:	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	:	21. March. 2019
Sample Brought By	:	Client
Sample Marking	:	GW-5
Sample Location	:	Na Wa Day Housing
Analysed Date	:	21. March. 2019
Lab Code No.	:	105/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed, 2012, 2540 C (Dried at 180 °C)	50	mg/L	337
2	Chloride	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed, 2012, 4500-Cl- B (Argentometric Method)	1	mg/L	106.33
3	Iron	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed, 2012,3500-Fe B	0.01	mg/L	0.336

End of Report

SGS (Myanmar) Limited
(Ko Ko Yi)
Manager

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

SGS Myanmar Limited



guard

Operation Department	E-Guard-OH-EQ-F-19 Version 01	Approved by MD On Date: 12/3/2018 Page 1 of 11
Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: U Aung Min Oo	Date: 21.3.2019
Location: Na Wa Day Housing	Time: 12:30 PM
Lat. & Long.: 16°45'05.6"N, 96°09'49.1"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID: GW-5
	GPS Waypoint no:
	Temperature: 32.62°C
	Time: 12:30 PM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (mS/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
5.	6.48	0.615	0.308	0.3	3.44	2.8	91		2.8 m	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Contact bottles seal
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles, If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:
Thwe Zin Cho Lo

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EFFECTIVE DATE: 01/01/2018



ISO TECH LABORATORY

WTL-RE-001

WB319 781

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	GW - 6
Location	FMI
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

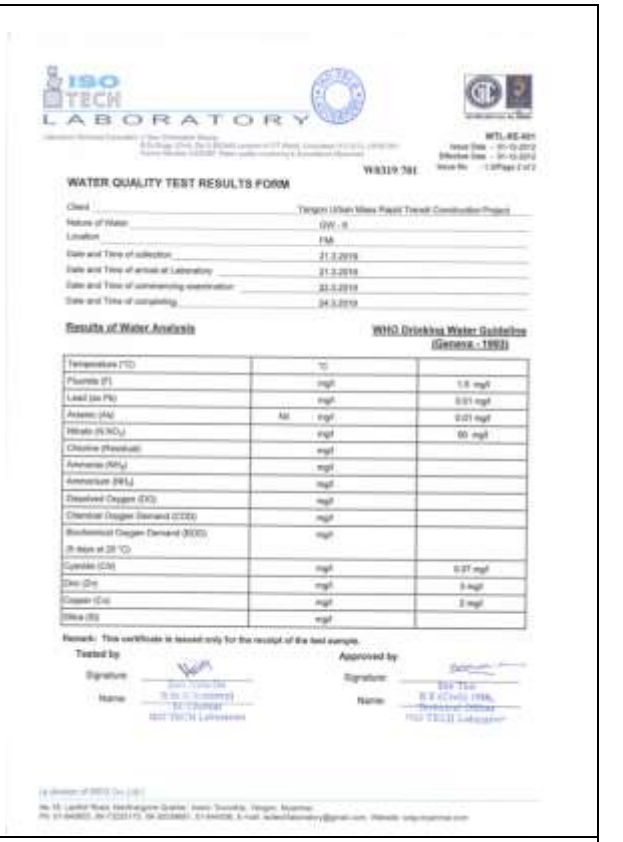
Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	9.6		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	200 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1500 mg/l
Manganese	2.3	mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: ZAW TOO TU — Name: U Zaw Too Tu — Technical Officer — ISO TECH Laboratory

Approved by — Signature: ZAW TUN — Name: U Zaw Tun — Technical Officer — ISO TECH Laboratory



ISO TECH LABORATORY

WTL-RE-001

WB319 781

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	GW - 6
Location	FMI
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (TC)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: U Zaw Too Tu — Technical Officer — ISO TECH Laboratory

Approved by — Signature: — Name: U Zaw Tun — Technical Officer — ISO TECH Laboratory



SGS

ANALYSIS REPORT ORIGINAL

Job Ref: 2000394/19
Date: 29/03/2019
Page 1 of 1

Sample Described as	Ground Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	21. March. 2019
Sample Brought By	Client
Sample Marking	GW-6
Sample Location	FMI
Analysed Date	21. March. 2019
Lab Code No	190 /19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 2540-C Dried at180 °C	50	mg/L	347
2	Chloride	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 4500-Cl- B Argentometric Method	1	mg/L	134.71
3	Iron	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,3500-Fe B	0.01	mg/L	0.183

End of Report

SGS (Myanmar) Limited
(Na Ni Yi)
Manager



guard

Operation Department — Environmental Quality Baseline Sampling/Survey Field Notes — E-Guard-OD-EQ-F-10 Version :01 — Approved by MD On Date: 12/1/2018 Page 1 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: D Aung Moe Oo	Date: 21.3.2019
Location: FMI	Time: 1445 PM
Lat. & Long.: 16°51'0.7"N, 96°5'0.9"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID: GW6
	GPS Waypoint no:
	Temperature: 31.93°C (89.48°F)
	Time: 3:55pm

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (mS/cm)	Electrical Conductivity TDS (g/l)	Electrical Conductivity Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
6	6.65	0.636	0.394	0.3	4.88	0	98		61m. 900'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques, Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles, If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required.

Notes:

Checked by:

Htwe Shi Chae Lee

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EFFECTIVE DATE: 01/01/2018

ISO TECH LABORATORY

WTL-RE-001

W8319 782

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	GW - T
Location	Ba Yint Naung Pwal Yoan (Thot Mon Pa Lar Zar), (Yan Kin Monastery)
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

Results of Water Analysis

		WHO Drinking Water Guideline (Geneva - 1993)
pH	6.8	6.5 - 9.2
Colour (True)	TCU	15 TCU
Turbidity	NTU	5 NTU
Conductivity	micro S/cm	
Total Hardness	mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness	mg/l as $CaCO_3$	
Magnesium Hardness	mg/l as $CaCO_3$	
Total Alkalinity	mg/l as $CaCO_3$	
Phenolphthalein Alkalinity	mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)	mg/l as $CaCO_3$	
Bicarbonate (HCO_3)	mg/l as $CaCO_3$	
Iron	mg/l	0.3 mg/l
Chloride (as Cl)	mg/l	250 mg/l
Sodium chloride (as NaCl)	mg/l	
Sulphate (as SO_4)	mg/l	400 mg/l
Total Solids	mg/l	1500 mg/l
Suspended Solids	mg/l	
Dissolved Solids	mg/l	1500 mg/l
Manganese	1.6 mg/l	0.05 mg/l
Phosphate	mg/l	
Phenolphthalein Acidity	mg/l	
Methyl Orange Acidity	mg/l	
Salinity	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Kyi Htay Oo
Role (Chemistry)
Dr. Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Htay Htay Thet
B.E (Civil) (Hon)
Technical Officer
ISO TECH Laboratory

(A division of MKD Co. Ltd.)
No.19, Lanthit Road, Hanthagone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-644800, 09-73233179, 09-420338881, 01-644338, E-mail: isotechlaboratory@gmail.com, Website: mkg-myanmar.com

ISO TECH LABORATORY

WTL-RE-001

W8319 782

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: GW - T
Location: Ba Yint Naung Pwal Yoan (Thot Mon Pa Lar Zar), (Yan Kin Monastery)
Date and Time of collection: 21.3.2019
Date and Time of arrival at Laboratory: 21.3.2019
Date and Time of commencing examination: 22.3.2019
Date and Time of completing: 24.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Kyi Htay Oo
Role (Chemistry)
Dr. Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Htay Htay Thet
B.E (Civil) (Hon)
Technical Officer
ISO TECH Laboratory

(A division of MKD Co. Ltd.)
No.19, Lanthit Road, Hanthagone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-644800, 09-73233179, 09-420338881, 01-644338, E-mail: isotechlaboratory@gmail.com, Website: mkg-myanmar.com

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 3000394/19
Date: 29/03/2019
Page 1 of 1

Sample Described as : Ground Water
Client Name : Yangon Urbar Mass Rapid Transit Construction Project
Sample Received Date : 21 March 2019
Sample Brought By : Client
Sample Marking : GW-7
Sample Location : Yan Kin Monastery
Analysed Date : 21 March 2019
Lab Code No. : 107 /19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solids	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 2540-C Dried at180 °C	50	mg/L	916
2	Chloride	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 4500-Cl- B Argentometric Method	1	mg/L	230.70
3	Iron	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012 3500-Fe B	0.01	mg/L	0.200

---------- End of Report ----------

NGS (Myanmar) Limited
(Ma Ma Yi)
Manager

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	Operation Department	X-Guard-GH-EQ-F-28 Version :01	Approved by MD On Date: 2/15/2019 Page 5 of 11
X-guard	Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: KTH, MMH	Date: 21.3.2019
Location: Yan Kin Monastery	Time: 9:30:08 PM
Lat. & Long.: 16°54'M 96°06'24.05"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID: GPS Waypoint no: GW(7) Temperature: 34.9°C Time: 9:30:08 PM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (ms/cm)	Electrical Conductivity TDS (g/l)	Electrical Conductivity Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
7	6.81	1.72	0.798	0.9	6.58	0.0	140		0.7m	

9:00:10

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives_ if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Htay Htay Thet
Chief Lab

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EFFECTIVE DATE: 02/16/2019



ISO TECH LABORATORY

WTL-RE-001

W1319 863

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: GW (Point - 8)

Location: Pariami Road and Inwin Road

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 27.3.2019

Date and Time of completing: 29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	8.23		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium Chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1000 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese	Nil	mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Zaw Naing Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Soe Thet, B.E (Civil), Technical Officer, ISO TECH Laboratory



ISO TECH LABORATORY

WTL-RE-001

W1319 863

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: GW (Point - 8)

Location: Pariami Road and Inwin Road

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 27.3.2019

Date and Time of completing: 29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (Tc)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate (N-NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_4)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O_3)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Zaw Naing Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Soe Thet, B.E (Civil), Technical Officer, ISO TECH Laboratory



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 200330/19

Date: 09/04/2019

Page 1 of 1

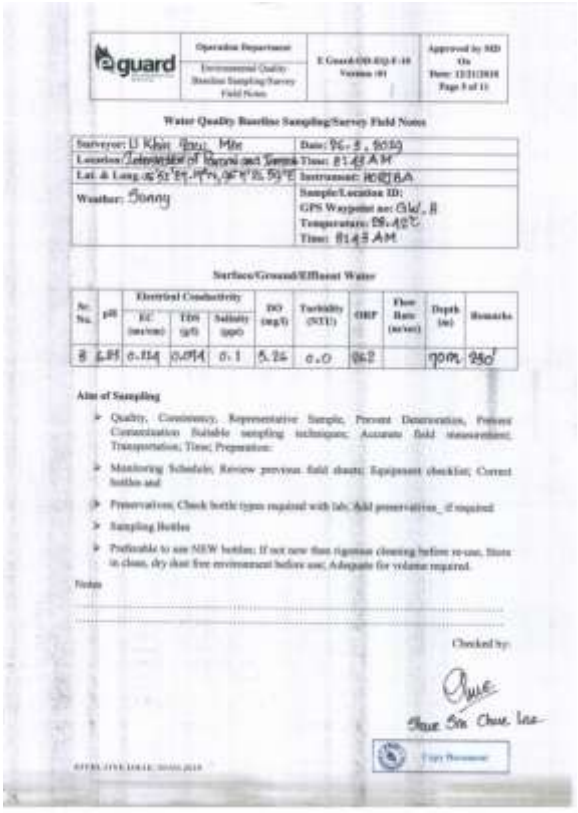
Sample Described as	:	Surface Water	
Client Name	:	Yangon Urban Mass Rapid Transit Construction Project	
Sample Received Date	:	26. March. 2019	
Sample Brought By	:	Client	
Sample Marking	:	GW-8	
Sample Location	:	Pariami Road and Inn Sein Road	
Analysed Date	:	26. March. 2019	
Lab Code No.	:	123/19	

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540-C Dried at180 °C	60	Mg/L	99.0
2	Chloride	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-Cl- B Argentometric Method	1	mg/L	12.47
3	Iron	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,3500-Fe B	0.01	mg/L	0.028

End of Report

SGS (Myanmar) Limited

Director



guard

Operation Department	E Guard-OD-EQ-F-10 Version 01	Approved by MD On Date: 12/11/2018 Page 5 of 11
Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: U Khin Maung Myo	Date: 26.3.2019
Location: Intersection of Pariami and Sanma	Time: 8:45 AM
Lat. & Long.: 16°51'49.4"N, 96°11'25.5"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID: GPS Waypoint no: GW. 8 Temperature: 28.4°C Time: 8:45 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (ms/cm)	Electrical Conductivity: TDS (g/l)	Electrical Conductivity: Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m³/sec)	Depth (m)	Remarks
8	6.85	0.114	0.074	0.1	5.26	0.0	86.2		70m	250'

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Thaw Zin Chaw, Intern

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EFFECTIVE DATE: 30/03/2018

ISO TECH LABORATORY

WTL-RE-001

W/0819 285

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 1)
Location	West Yangon University
Date and Time of collection	8.8.2019
Date and Time of arrival at Laboratory	8.8.2019
Date and Time of commencing examination	9.8.2019
Date and Time of completing	11.8.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

pH	8.1		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	400 mg/l
Total Solids		mg/l	1500 mg/l
Total Suspended Solids		mg/l	
Total Dissolved Solids		mg/l	1000 mg/l
Manganese	0.04	mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name: Daw Wint Yin, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature — Name: Daw Thin, B.Sc (Chemistry), ISO TECH Laboratory

(a division of WISO Co. Ltd.)
No.18, Lanthit Road, Nanthagone Quarter, Insein Township, Yangon, Myanmar.
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ISO TECH LABORATORY

WTL-RE-001

W/0819 285

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: Ground Water (Point - 1)
Location: West Yangon University
Date and Time of collection: 8.8.2019
Date and Time of arrival at Laboratory: 8.8.2019
Date and Time of commencing examination: 9.8.2019
Date and Time of completing: 11.8.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate (N-NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	5 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name: Daw Wint Yin, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature — Name: Daw Thin, B.Sc (Chemistry), ISO TECH Laboratory

SGS

ORIGINAL

ANALYSIS REPORT

Job Ref : 2000510/2019
Date : 15/08/2019
Page : 1 of 1

Sample Described as	: Ground Water
Client Name	: Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	: 09 August 2019
Sample Brought By	: Client
Sample Marking	: GW-1
Sample Location	: West University
Analysed Date	: 09 Aug 2019
Lab Code No	: 057119

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA 2540C & ASTM D5907-13 (Test wt. 103-105°C)	50	mg/L	510
2	Chloride	Standard methods for the examination of water & waste water APHA 4500-Cl B & ASTM D512-12 (Test wt. 4500-Cl- B Argentometric Method)	1	mg/L	242.03
3	Iron	Standard methods for the examination of water & waste water APHA 3500-Fe B & ASTM D1068-15 (Test wt. 3111 B)	0.01	mg/L	0.268

End of Report

(Nu Nu Yi)
Manager

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guard	Operation Department Environmental Quality Baseline Sampling Survey Field Notes	E Guard-OD-EQ-F-10 Version :01	Approved by MD On Date: 12/21/2018 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: [illegible]	Date: 8.8.2019
Location: West Yangon University	Time: 9:30 AM
Lat. & Long: [illegible]	Instrument: HORIBA
Weather: Cloudy	Sample/Location ID: GPS Waypoint no: GW-1 Temperature: 27.9°C Time: 9:08 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (mS/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
1	8.13	1.11	0.721	0.6	4.86	0.0	350		150'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques, Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

EFFECTIVE DATE: 01/01/2019

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ISO TECH LABORATORY

WTL-RE-001

W0819 286

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 2)
Location	Htan Tapin Police Station
Date and Time of collection	8.8.2019
Date and Time of arrival at Laboratory	8.8.2019
Date and Time of commencing examination	8.8.2019
Date and Time of completing	11.8.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

pH	8.0		6.8 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	200 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Total Suspended Solids		mg/l	
Total Dissolved Solids		mg/l	1000 mg/l
Manganese	1.0	mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Zaw Htet Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Soe Thin, B.E (Civil) 1996, Technical Officer, ISO TECH Laboratory

(a division of WES Co. Ltd.)
No. 14, Lanthit Road, Kanthayarna Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-640855, 09-73231171, 09-892098891, 01-644556, E-mail: isotechlaboratory@gmail.com, Website: iwq-myanmar.com



ISO TECH LABORATORY

WTL-RE-001

W0819 286

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 2)
Location	Htan Tapin Police Station
Date and Time of collection	8.8.2019
Date and Time of arrival at Laboratory	8.8.2019
Date and Time of commencing examination	8.8.2019
Date and Time of completing	11.8.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate (N NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Zaw Htet Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Soe Thin, B.E (Civil) 1996, Technical Officer, ISO TECH Laboratory

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ANALYSIS REPORT

Job Ref : 3200015/2019
Date : 15/08/2019
Page : 1 of 1

Sample Described as	Ground Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	08 August 2019
Sample Brought By	Client
Sample Marking	GW - 2
Sample Location	Htan Ta Pin Police Station
Analysed Date	08 August 2019
Lab Code No	285/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA 2540B & WEF 23rd ed. 2017, 2540-C-2540-E/SL-C	50	mg/L	61.33
2	Chloride	Standard methods for the examination of water & waste water APHA 4500B & WEF 23rd ed. 2012, 4500-Cl- B Argentometric Method	1	mg/L	9.74
3	Iron	Standard methods for the examination of water & waste water APHA 3500-Fe B WEF 23rd ed. 2012, 3500-Fe B	0.01	mg/L	1.309

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Manager

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guard

Operation Department — Environmental Quality Baseline Sampling/Survey Field Notes

E-Guard-OD-EQ-F-10 Version: 01

Approved by MD On Date: 15/11/2018 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: (1) Sin Min Htet	Date: 8.8.2019
Location: Htan Ta Pin Police Station	Time: 07.45 AM
Lat. & Long. 16°55'34.4"N 96°08'08.8"E	Instrument: HORIBA
Weather: Cloudy	Sample/Location ID: GW-2
	GPS Waypoint no: GW-2
	Temperature: 27.6°C
	Time: 9:49 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (ms/cm)	Electrical Conductivity: TDS (g/l)	Electrical Conductivity: Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
2 - GW	6.08	0.248	0.2	0.1	5.1	14.1			30.110'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination, Suitable sampling techniques, Accurate field measurement, Transportation, Time, Preparation.
- Monitoring Schedule; Review previous field sheets, Equipment checklist, Correct bottles and
- Preservatives; Check bottle types required with lab. Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles, If use new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use, Adequate for volume required.

Notes

Checked by:

EFFECTIVE DATE: 01/01/2019

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ISO TECH LABORATORY

WTL-RE-001

W8819 287

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point -3)
Location	B.E.H.S - No.8, Hlaing Thar Yar Township
Date and Time of collection	8.8.2019
Date and Time of arrival at Laboratory	8.8.2019
Date and Time of commencing examination	8.8.2019
Date and Time of completing	11.8.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

pH	6.7		6.8 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Total Suspended Solids		mg/l	
Total Dissolved Solids		mg/l	1000 mg/l
Manganese	0.01	mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature / Name: Daw Thida Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature / Name: Mo Thin, B.E (Civil) 1998, Technical Officer, ISO TECH Laboratory

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ISO TECH LABORATORY

WTL-RE-001

W8819 287

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point -3)
Location	B.E.H.S - No.8, Hlaing Thar Yar Township
Date and Time of collection	8.8.2019
Date and Time of arrival at Laboratory	8.8.2019
Date and Time of commencing examination	8.8.2019
Date and Time of completing	11.8.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature / Name: Daw Thida Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature / Name: Mo Thin, B.E (Civil) 1998, Technical Officer, ISO TECH Laboratory

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ANALYSIS REPORT ORIGINAL

Job Ref: 20000193319
Date: 15/08/2019
Page: 1 of 1

Sample Described as	Ground Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	08 August 2019
Sample Brought By	Client
Sample Marking	GW - 3
Sample Location	B.E.H.S (8) Hlaing Tharyar
Analysed Date	09 August 2019
Lab Code No.	28819

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA/AWWA & WEF 22nd ed. 2012, 2540 C (Dried at 180 °C)	50	mg/L	257.67
2	Chloride	Standard methods for the examination of water & waste water APHA/AWWA & WEF 22nd ed. 2012, 4500-Cl- B (Argentometric Method)	1	mg/L	1302.01
3	Iron	Standard methods for the examination of water & waste water APHA/AWWA & WEF 22nd ed. 2012 3500-Fe B	0.01	mg/L	<0.01

End of Report

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guard

Operation Department: Environmental Quality (Baseline Sampling Survey) Field Notes

E-Guard-ESN-EQ-F-16 Version /01

Approved by MD On Date: 12/2/2018 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor(s): Ms Mu Mu	Date: 8.8.2019
Location: B.E.H.S (8) Hlaing Thar Yar	Time: 09:45 AM
Lat. & Long: 16°51'0.61"N 96°7'43.94"E	Instrument: HORIBA
Weather: Cloudy	Sample/Location ID: Ground Water_3
	GPS Waypoint no:
	Temperature: 29.0°C
	Time: 03:45AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (ms/cm)	Electrical Conductivity: TDS (g/l)	Electrical Conductivity: Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
1.	7.08	0.410	0.269	0.25	3.34	28.4	348		(400.380)	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination, Suitable sampling techniques Accurate field measurement, Transportation, Time, Preparation
- Monitoring Schedule, Review previous field sheets, Equipment checklist, Correct bottles and
- Preservatives, Check bottle types required with lab, Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles, If not new then rigorous cleaning before re-use, Store in clean, dry-dust free environment before use, Adequate for volume required.

Notes

Checked by

Khaing Su Khaing

EFFECTIVE DATE: 8/10/2019

ISO TECH LABORATORY

WTL-RE-001

W0819 288

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: Ground Water (Point -4)

Location: Yadanar Thiri Myaw Oo Monastery, Hlaing Thar Yar Township

Date and Time of collection: 8.8.2019

Date and Time of arrival at Laboratory: 8.8.2019

Date and Time of commencing examination: 9.8.2019

Date and Time of completing: 11.8.2019

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
pH	6.9		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	400 mg/l
Total Solids		mg/l	1500 mg/l
Total Suspended Solids		mg/l	
Total Dissolved Solids		mg/l	1000 mg/l
Manganese	1.2	mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Myo Oo
B.Sc (Chemistry)
Sr. Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thiri
B.E (Civil) 1998
Technical Officer
ISO TECH Laboratory

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ISO TECH LABORATORY

WTL-RE-001

W0819 288

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: Ground Water (Point -4)

Location: Yadanar Thiri Myaw Oo Monastery, Hlaing Thar Yar Township

Date and Time of collection: 8.8.2019

Date and Time of arrival at Laboratory: 8.8.2019

Date and Time of commencing examination: 9.8.2019

Date and Time of completing: 11.8.2019

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	0.01	mg/l	0.01 mg/l
Nitrate (N/NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Myo Oo
B.Sc (Chemistry)
Sr. Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thiri
B.E (Civil) 1998
Technical Officer
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ANALYSIS REPORT

ORIGINAL

Job Ref : 20005110319
Date : 10/08/2019
Page : 1 of 1

Sample Described as : Ground Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 08 August 2019
Sample Brought By : Client
Sample Marking : GW - 4
Sample Location : Yadanar Thiri Myaw Oo Monastery
Analysed Date : 09 August 2019
Lab Code No. : 290/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA [illegible]	50	mg/L	106
2	Chloride	Standard methods for the examination of water & waste water APHA [illegible]	1	mg/L	3.00
3	Iron	Standard methods for the examination of water & waste water APHA [illegible]	0.01	mg/L	<0.01

End of Report

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Manager

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guard	Operation Department Environmental Quality Baseline Sampling/Survey Field Notes	E-Guard-OD-EQ-F-10 Version :01	Approved by MD On Date: 12/21/2018 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: U Zaw Min Htet	Date: 8.8.2019
Location: Yadanar Thiri Myaw Oo Monastery	Time: 10:50 PM
Lat. & Long: 16°50'46.9"N 96°04'39.3"E	Instrument: HORIBA
Weather: Cloudy	Sample/Location ID: GPS Waypoint no: EQ-01-S Temperature: Ground Water-4 Time: 10:50 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (ms/cm)	Electrical Conductivity: TDS (g/l)	Electrical Conductivity: Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP (mV)	Flow Rate (m/sec)	Depth (m)	Remarks
4	8.01	1.96	0.908	0.8	4.5	12.5	98	100.110		

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques, Accurate field measurement, Transportation, Time, Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use. Adequate for volume required.

Notes

Checked by:

EFFECTIVE DATE: 01/01/2019

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ISO TECH LABORATORY

WTL-RE-001

W0319 6/6

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 1

Location: Hlaing Thar Yar

Date and Time of collection: 21.3.2019

Date and Time of arrival at Laboratory: 21.3.2019

Date and Time of commencing examination: 22.3.2019

Date and Time of completing: 24.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.0		6.8 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	208	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium Chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Htoo Oo
B.Sc (Chemistry)
Jr. Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Soe Thu
B.E (Civil) (Hons)
Technical Officer
ISO TECH Laboratory

ISO TECH LABORATORY

WTL-RE-001

W0319 6/6

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 1

Location: Hlaing Thar Yar

Date and Time of collection: 21.3.2019

Date and Time of arrival at Laboratory: 21.3.2019

Date and Time of commencing examination: 22.3.2019

Date and Time of completing: 24.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	28.6	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	3.8	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Htoo Oo
B.Sc (Chemistry)
Jr. Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Soe Thu
B.E (Civil) (Hons)
Technical Officer
ISO TECH Laboratory



ISO TECH LABORATORY

WTL-RE-001

W0319 6/6

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 1

Location: Hlaing Thar Yar

Date and Time of collection: 21.3.2019

Date and Time of arrival at Laboratory: 21.3.2019

Date and Time of commencing examination: 21.3.2019

Date and Time of completing: 22.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	12	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	0	CFU/100ml	Not detected
pH	7.0		6.8 - 8.5
Turbidity	208	NTU	5 NTU
Colour (True)	125	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes.

: This certificate is issued only for the receipt of the test sample.

: < - Less than

Tested by

Signature:

Name: Zaw Htoo Oo
B.Sc (Chemistry)
Jr. Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Soe Thu
B.E (Civil) (Hons)
Technical Officer
ISO TECH Laboratory



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 3000394/19
Date: 26/03/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 21 March 2019
Sample Brought By : Client
Sample Marking : SW-1
Sample Location : Hlaing Tharyar Station
Analysed Date : 21 March 2019
Lab Code No. : 089/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012) 2540 D.Dried at 103-105 °C	20	mg/L	<20
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012) 4500-N_{org} B.Macro Kjeldahl Method	1	mg/L	1-12
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012)4500-P E.Ascorbic Acid Method	0.01	mg/L	0.049
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012) 5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012) 5210 D & Instruction Manual BOD-System Oxidirect (Lovibond)	3	mg/L	31
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012)5220 D Closed Reflux, Colorimetric Method	10	mg/L	97

End of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (SM 5310 B)	16.80	9.54	0.50
SAMPLE CONDITION:					
WATER'S COLOUR/TURBID			YELLOWISH BROWN	YELLOWISH BROWN	
SEDIMENT			MORE	MORE	

Remark : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23 RD EDITION, 2017

RESULT 1 : ON 1 (SAMPLE TAKEN STATION)

RESULT 2 : ON 2 (DISCHARGE BOX STATION)

Pyant S.

(INVESTMENT DETERMINATION)
LABORATORY SUPERVISOR

APRIL 12, 2019

* DO NOT COPY PARTIAL OF THIS ANALYSIS REPORT WITHOUT OFFICIAL APPROVAL.
* REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.

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guard	Operation Department	E-Guard-OD-EQ-F-14 Version :01	Approved by MD On Date: 12/21/2018 Page 9 of 11
	Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: Aung Min Oo	Date: 21.3.2019
Location: Thamaing Tsp/Yangon	Time: 9:00 AM
Lat. & Long.: 16°52'45.35"N, 96°11'46.98"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID:
	GPS Waypoint no: SW 1
	Temperature: 30.2°C
	Time: 9:00 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (mS/cm)	Electrical Conductivity TDS (g/l)	Electrical Conductivity Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
1.	7.34	0.416	0.201	0.4	2.08	62	328		2.5m	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store to clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Shwe Sin Chat Lae

ISO TECH LABORATORY

WTL-RE-001
Issue Date – 01.12.2012
Effective Date – 01.12.2012
Issue No. – 1.0/Page 1 of 2

W0319 (01)

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	SW - 1
Location	Dagon - Ayar Bus Station
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.4		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	90	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as ($CaCO_3$)
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature
Name
Kyi Thar Oo
B.Sc (Chemistry)
Sr. Chemist
ISO TECH Laboratory

Approved by
Signature
Name
Soe Thar
B.E (Civil) (1998)
Technical Officer
ISO TECH Laboratory

(A division of WEG Co., Ltd.)

No.19, Landlot Road, Hlaingthayagone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-640923, 09-73233175, 09-253129987, 01-643008, E-mail: isotechlaboratory@gmail.com, Website: www.myanmar.com

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ISO TECH LABORATORY

WTL-RE-001
Issue Date – 01.12.2012
Effective Date – 01.12.2012
Issue No. – 1.0/Page 2 of 2

W0319 (02)

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	SW - 2
Location	Dagon - Ayar Bus Station
Date and Time of collection	21.3.2019
Date and Time of arrival at Laboratory	21.3.2019
Date and Time of commencing examination	22.3.2019
Date and Time of completing	24.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	29.8	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	4.0	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	5 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature
Name
Kyi Thar Oo
B.Sc (Chemistry)
Sr. Chemist
ISO TECH Laboratory

Approved by
Signature
Name
Soe Thar
B.E (Civil) (1998)
Technical Officer
ISO TECH Laboratory

(A division of WEG Co., Ltd.)

No.19, Landlot Road, Hlaingthayagone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-640923, 09-73233175, 09-253129987, 01-643008, E-mail: isotechlaboratory@gmail.com, Website: www.myanmar.com



ISO TECH LABORATORY

WTL-RE-001

580319 077

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client : Yangon Urban Mass Rapid Transit Construction Project

Nature of Water : SW - 2

Location : Dagon - Ayar Bus Station

Date and Time of collection : 21.3.2019

Date and Time of arrival at Laboratory : 21.3.2019

Date and Time of commencing examination : 21.3.2019

Date and Time of completing : 22.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	10	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	2	CFU/100ml	Not detected
pH	7.4		6.5 - 8.5
Turbidity	66	NTU	5 NTU
Colour (True)	40	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.

: This certificate is issued only for the receipt of the test sample.

: + = Less than

Tested by

Signature :

Name :

Approved by

Signature :

Name :



SGS

ANALYSIS REPORT ORIGINAL

Job Ref: 3000284/19
Date: 29/03/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 21. March. 2019
Sample Brought By : Client
Sample Marking : SW-2
Sample Location : Dagon Ayar Bus Station
Analysed Date : 21. March. 2019
Lab Code No. : 056/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 2340-D Dried at 103-105 °C	20	mg/L	<20
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 4500-N_{org}.B Macro Kjeldahl Method	1	mg/L	<1
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,4500-P E.Ascorbic Acid Method	0.01	mg/L	0.035
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5520 B	3	mg/L	7.9
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 5210 D & Winkler's Manual BOD-System Oxidized (Undiluted)	2	mg/L	20
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	56

End of Report

SGS (Myanmar) Limited

(Ma Ni Yi)
Manager



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME	YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	E-GUARD ENVIRONMENTAL SERVICES CO., LTD.		
ADDRESS	NO.11, KOTHAYI AVENUE ROAD, YANGON (RANGOON)		
CONTACT INFORMATION	TEL : +675-720170 e-mail : (Tue@guardservices.com		
SAMPLING SOURCE	-		
SAMPLE TYPE	SURFACE WATER	RECEIVED DATE	APRIL 1, 2019
SAMPLING DATE	MARCH 21, 2019	ANALYTICAL DATE	APRIL 1-12, 2019
SAMPLING TIME	-	REPORT NO.	(UEA-0381)
SAMPLING METHOD	-	WORK NO.	(EEA-0242)
SAMPLING BY	CUSTOMER	ANALYSIS NO.	T1941(1)-0001, T1941(1)-0002
ANALYZED BY	MISS KANLAYANEE YOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1 (SAMPLE NO. T1941(1)-0001)	RESULT 2 (SAMPLE NO. T1941(1)-0002)	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (SM 5310 B)	16.61	8.54	0.30
SAMPLE CONDITION (WATER'S COLOUR/FLAVOR/ SEDIMENT)			NO ABNORMAL WATER	NO ABNORMAL WATER	

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 21 TH EDITION, 2017

RT1(L) 1 : ON 1 (THANE THAYAR STATION)

RT1(L) 1 : ON 1 (OKKON KYAR BAN STATION)

Pyant S.

(MR.PYANT SUTTAWATWONG)
LABORATORY SUPERVISOR

APRIL 12, 2019

* DO NOT COPY PARTIAL OF THIS ANALYSES REPORT WITHOUT OFFICIAL APPROVAL.
* REPORTED ANALYSES REFERS TO SUBMITTED SAMPLE ONLY.



guard	Operation Department: Environmental Quality Baseline Sampling/Survey Field Notes	E Guard-OD-EQ-F-10 Version :01	Approved by MD On Date: 12/11/2018 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: Aung Htet Oo	Date: 21. 3. 2019
Location: Sakura Gardens	Time: 9:57:54 AM
Lat. & Long. 16° 44.574'N, 96° 9.098'E	Instrument: Horiba
Weather: Sunny	Sample/Location ID: SW/2
	GPS Waypoint no:
	Temperature: 30.9°C
	Time: 9:57:54 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (mS/cm)	Electrical Conductivity: TDS (g/l)	Electrical Conductivity: Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP mV	Flow Rate (m³/sec)	Depth (m)	Remarks
2.	7.43	0.885	0.28	0.2	5.06	0.7	237		2.5m.	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation.
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives_ if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use; Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Khar Sin Chue Lee

EFFECTIVE DATE: 01.01.2019

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ISO TECH LABORATORY

WTL-RE-001

W8319 (01)

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 3

Location: Intersection Point of BOC and Twantay

Date and Time of collection: 21.3.2019

Date and Time of arrival at Laboratory: 21.3.2019

Date and Time of commencing examination: 22.3.2019

Date and Time of completing: 24.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

pH	7.1		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	198	NTU	5 NTU
Conductivity		micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1000 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Daw Mala Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Daw Thu, B.Sc (Chem) (Hons), Technical Officer, ISO TECH Laboratory

ISO TECH LABORATORY

WTL-RE-001

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 4

Location: Intersection Point of BOC and Twantay

Date and Time of collection: 21.3.2019

Date and Time of arrival at Laboratory: 21.3.2019

Date and Time of commencing examination: 22.3.2019

Date and Time of completing: 24.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	26.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	Nil	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Daw Mala Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Daw Thu, B.Sc (Chem) (Hons), Technical Officer, ISO TECH Laboratory



ISO TECH LABORATORY

WTL-RE-001

S80319 (03)

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 3

Location: Intersection Point of BOC and Twantay

Date and Time of collection: 21.3.2019

Date and Time of arrival at Laboratory: 21.3.2019

Date and Time of commencing examination: 21.3.2019

Date and Time of completing: 22.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Total Coliform Count	100	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	40	CFU/100ml	Not detected
pH	7.1		6.5 - 8.5
Turbidity	198	NTU	5 NTU
Colour (True)	60	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.

: This certificate is issued only for the receipt of the test sample.

: \- Less than

Tested by — Signature: — Name: Daw Mala Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Daw Thu, B.Sc (Chem) (Hons), Technical Officer, ISO TECH Laboratory



SGS

ANALYSIS REPORT ORIGINAL

Job Ref: 2000394/19
Date: 29/03/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 21 March 2019
Sample Brought By : Client
Sample Marking : SW-3
Sample Location : Inglesection Point of BOC & Twan Tay
Analysed Date : 21 March 2019
Lab Code No : 001119

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed.,2012, 2540-D Dried at 103-105 °C	20	mg/L	148.67
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 4500-N_{org}.B Macro Kjeldahl Method	1	mg/L	19
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,4500-P.E Ascorbic Acid Method	0.01	mg/L	0.781
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 5210 D & Instrution Manual BOD System Oxidirect (Lovibond)	2	mg/L	60
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	157

End of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

SGS (Myanmar) Limited | Block 3, 4, 5, Level 1, Myanma Industrial Development Complex, No. 3, Kaba Aye Pagoda Road, Bahan Township, Yangon, Myanmar | t (95-1) 230 3660 / 230 3661 | f (95-1) 230 3662 | www.sgs.com.mm

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	:		
ADDRESS	:		
CONTACT INFORMATION	:		
SAMPLING SOURCE	:		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: APRIL 3, 2019
SAMPLING DATE	: MARCH 21, 2019	ANALYTICAL DATE	: APRIL 3 TO, 2019
SAMPLING TIME	: -	REPORT NO.	:
SAMPLING METHOD	: -	WORK NO.	:
SAMPLING BY	:	ANALYSIS NO.	:
ANALYZED BY	:		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1	RESULT 2	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L				
SAMPLE CONDITION					

APRIL 11, 2019

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* REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.

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guard

Operation Department	E Guard-OD-EQ-F-10 Version :01	Approved by MD On Date: 12/11/2018 Page 7 of 11
Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: U Wunna Tun	Date: 21.2.2019
Location: BOC #4 gas station	Time: 10:05 : AM
Lat. & Long: 16°50'46.9"N 96°9'20.4"E	Instrument: Horiba
Weather: Sunny	Sample/Location ID: SW3
	GPS Waypoint no:
	Temperature: 29.5° C
	Time: 10:05 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (micro)	Electrical Conductivity TDS (g/l)	Electrical Conductivity Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
3.	6.9	8.01	1.59	1	1.06	86	216		7'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Steve Sin Chan Lin

EFFECTIVE DATE: 01/01/2019

ISO TECH LABORATORY

WTL/RE-001

W0319 693

WATER QUALITY TEST RESULTS FORM

Client : Yangon Urban Mass Rapid Transit Construction Project
Nature of Water : SW - 4
Location : Mee Khwat Market
Date and Time of collection : 21.3.2019
Date and Time of arrival at Laboratory : 21.3.2019
Date and Time of commencing examination : 22.3.2019
Date and Time of completing : 24.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.3		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	130	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature :
Name :

Approved by
Signature :
Name :

(A division of WED Co.,Ltd.)

No.10, Lanthit Road, Nanthagone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-646833, 09-73231173, 09-502288821, 01-644306, E-mail: isotechlaboratory@gmail.com, Website: wtg.insein.net

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ISO TECH LABORATORY

WTL/RE-001

W0319 693

WATER QUALITY TEST RESULTS FORM

Client : Yangon Urban Mass Rapid Transit Construction Project
Nature of Water : SW - 4
Location : Mee Khwat Market
Date and Time of collection : 21.3.2019
Date and Time of arrival at Laboratory : 21.3.2019
Date and Time of commencing examination : 22.3.2019
Date and Time of completing : 24.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	25.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_4)		mg/l	
Ammonium (NH_3)		mg/l	
Dissolved Oxygen (DO)	98	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature :
Name :

Approved by
Signature :
Name :

(A division of WED Co.,Ltd.)

No.10, Lanthit Road, Nanthagone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-646833, 09-73231173, 09-502288821, 01-644306, E-mail: isotechlaboratory@gmail.com, Website: wtg.insein.net



ISO TECH LABORATORY

WTL-RE-001

MB319-079

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client : Yangon Urban Mass Rapid Transit Construction Project

Nature of Water : SW - 4

Location : Mee Khwat Market

Date and Time of collection : 21.3.2019

Date and Time of arrival at Laboratory : 21.3.2019

Date and Time of commencing examination : 21.3.2019

Date and Time of completing : 22.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	80	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	30	CFU/100ml	Not detected
pH	7.5		6.5 - 8.5
Turbidity	130	NTU	5 NTU
Colour (True)	60	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes.

: This certificate is issued only for the receipt of the test sample.

: * - Less than

Tested by — Signature: — Name: — ISO TECH Laboratory

Approved by — Signature: — Name: — ISO TECH Laboratory

(a division of MEE Co.,Ltd.)

No. 19, Lan(K) Road, Mahabayone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-649803, 09-73103774, 09-5533967, 01-644408, E-mail: isotechlaboratory@gmail.com, Website: engr.myanmar.com



SGS

ANALYSIS REPORT ORIGINAL

Job Ref: 2000394/19
Date: 29/03/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 21. March .2019
Sample Brought By : Client
Sample Marking : SW-4
Sample Location : Mee Khwant Market
Analysed Date : 21. March .2019
Lab Code No. : 096/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 2540.D.Dried at 103-105 °C	20	mg/L	95.00
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012 ,4500-N_{org}.B.Macro Kjeldahl Method	1	mg/L	20.50
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,4500-P.E.Ascorbic Acid Method	0.01	mg/L	0.022
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 5210.D & Instruction Manual BOD System Oxidtech (Lovibond)	2	mg/L	44
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,5220.D.Closed Reflux, Colorimetric Method	10	mg/L	170

End of Report

SGS (Myanmar) Limited

(Ko Ko Yi)
Manager



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME	YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME			
ADDRESS			
CONTACT INFORMATION			
SAMPLING SOURCE			
SAMPLE TYPE	SURFACE WATER	RECEIVED DATE	APRIL 3, 2019
SAMPLING DATE	MARCH 21, 2019	ANALYTICAL DATE	APRIL 8-12, 2019
SAMPLING TIME	-	REPORT NO.	
SAMPLING METHOD	-	WORK NO.	
SAMPLING BY	CUSTOMER	ANALYSIS NO.	
ANALYZED BY	MISS MAKAYAMEE WYNNA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1 (SW4/SW4-MIX)	RESULT 2 (SW4/SW4-MIX)	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (SM 5310.B)	20.00	20.00	0.05
SAMPLE CONDITION					
ODOUR			ACCEPTABLE	ACCEPTABLE	

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 21 ST EDITION, 2017

RESULT 1 : SW-1 (DISTRIBUTION POINT OF BOC AND TRAM ROAD)

RESULT 2 : SW-4 (MEE KHWAT MARKET)

Signature
(MRS. MYINT MYINT KHAING)
LABORATORY SUPERVISOR

APRIL 12, 2019

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* REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.



eguard

Operation Department	E Guard-OD-EQ-F-06 Version 001	Approved by MD On Date: 12/11/2018 Page 1 of 11
Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: U Wunna Tayza	Date: 27.3.2019
Location: Mee Lwint Market	Time: 10:43 AM
Lat. & Long: 16°56.80"N, 96°31'10.06"E	Instrument: WQC1 EA
Weather: Sunny	Sample/Location ID: GPS Waypoint no: Bul A Temperature: Time: 10:40 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (ms/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
4	7.08	4.24	2.95	3.4	2.4	98	342		6'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques, Accurate field measurement, Transportation, Time Preparation.
- Monitoring Schedule; Review previous field sheets, Equipment checklist; Correct bottles and
- Preservatives(Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Thant Sin Chue Lae



ISO TECH LABORATORY

WTL-RE-001

W8319 694

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 5

Location: Na Wa Day Intersection Point (Na Wa Day Housing)

Date and Time of collection: 21.3.2019

Date and Time of arrival at Laboratory: 21.3.2019

Date and Time of commencing examination: 22.3.2019

Date and Time of completing: 24.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	8.8		6.8 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	210	NTU	5 NTU
Conductivity		micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Soe Thet Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Soe Thet, B.E (Civil) (Hon), Technical Officer, ISO TECH Laboratory

ISO TECH LABORATORY

WTL-RE-001

W8319 694

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 5

Location: Na Wa Day Intersection Point (Na Wa Day Housing)

Date and Time of collection: 21.3.2019

Date and Time of arrival at Laboratory: 21.3.2019

Date and Time of commencing examination: 22.3.2019

Date and Time of completing: 24.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	28.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	Nil	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Soe Thet Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Soe Thet, B.E (Civil) (Hon), Technical Officer, ISO TECH Laboratory



ISO TECH LABORATORY

WTL-RE-001

W8319 699

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 5

Location: Na Wa Day Intersection Point (Na Wa Day Housing)

Date and Time of collection: 21.3.2019

Date and Time of arrival at Laboratory: 21.3.2019

Date and Time of commencing examination: 21.3.2019

Date and Time of completing: 22.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	00	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	00	CFU/100ml	Not detected
pH	8.8		6.5 - 8.5
Turbidity	210	NTU	5 NTU
Colour (True)	80	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.

: This certificate is issued only for the receipt of the test sample.

: < - Less than

Tested by — Signature: — Name: Soe Thet Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: Soe Thet, B.E (Civil) (Hon), Technical Officer, ISO TECH Laboratory



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2003704/19
Date: 29/03/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 21 March 2019
Sample Brought By : Client
Sample Marking : SW-5
Sample Location : Na Wa Day Housing
Analysed Date : 21 March 2019
Lab Code No. : 089/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 2540-D Dried at 103-105 °C	20	mg/L	84.00
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 4500-N_{org} B Macro Kjeldahl Method	1	mg/L	35.20
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,4500-P E Ascorbic Acid Method	0.01	mg/L	1.267
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,5520B	5	mg/L	6.8
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 5210 D & Indication Manual BOD System Oxidirect (Lovibond)	2	mg/L	64
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	230

End of Report

SGS (Myanmar) Limited

(Ko Ko Yi)
Manager

United Analyst and Engineering Consultant Co., Ltd

ANALYSIS REPORT

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L		40.09	30.79	0.05
SAMPLE CONDITION					
WATER'S COLOUR/TURBID			Yellowish Brown	Yellowish Brown	
ODOUR/SMELL			Musty	Musty	

Pyae S.

APRIL 11, 2019

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* REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.

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guard

	Operation Department		Approved by MD On
	Environmental Quality Baseline Sampling/Survey Field Notes	E-Guard-HR-EQ-F-10 Version :01	Date: 12/1/2018 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: [illegible] Aung Min Oo	Date: 21.8.2019
Location: Ah Lel Yay Housing	Time: 11:45 AM
Lat. & Long: 16°57'42.7"N, 96°4'8.8"E	Instrument: Horiba
Weather: Sunny	Sample/Location ID: SW5
	GPS Waypoint no:
	Temperature: (33.3°C)
	Time: 11.45 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (mS/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
5	6.91	0.52	1.14	1.4	1.9	310	226		3'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles. If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Copy Document

EFFECTIVE DATE: 01/01/2019

ISO TECH LABORATORY

WTL-RE-001

W8319 695

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 5
Location: PAR
Date and Time of collection: 21.3.2019
Date and Time of arrival at Laboratory: 21.3.2019
Date and Time of commencing examination: 22.3.2019
Date and Time of completing: 24.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

pH	7.1		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	220	NTU	5 NTU
Conductivity		Micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	400 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Daw Mya Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: U Kyaw Thu, B.E (Civil) 1996, Technical Officer, ISO TECH Laboratory

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ISO TECH LABORATORY

WTL-RE-001

W8319 695

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 5
Location: PAR
Date and Time of collection: 21.3.2019
Date and Time of arrival at Laboratory: 21.3.2019
Date and Time of commencing examination: 22.3.2019
Date and Time of completing: 24.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	25.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	Nil	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 05 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Daw Mya Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature: — Name: U Kyaw Thu, B.E (Civil) 1996, Technical Officer, ISO TECH Laboratory



ISO TECH LABORATORY

WTL-RE-201
Issue Date : 01-1-2016
Effective Date : 01-1-2016
Issue No. : 1 (Page 1 of 1)

MB319-001

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client : Yangon Urban Mass Rapid Transit Construction Project
Nature of Water : SW - 6
Location : PMI
Date and Time of collection : 21.3.2019
Date and Time of arrival at Laboratory : 21.3.2019
Date and Time of commencing examination : 21.3.2019
Date and Time of completing : 22.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	90	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	10	CFU/100ml	Not detected
pH	7.1		6.5 - 8.5
Turbidity	220	NTU	5 NTU
Colour (True)	80	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.
: This certificate is issued only for the receipt of the test sample.
: f = Less than

Tested by
Signature :
Name :

Approved by
Signature :
Name :



SGS

ANALYSIS REPORT ORIGINAL

Job Ref: E00394/19
Date: 26/03/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 21. March. 2019
Sample Brought By : Client
Sample Marking : SW-9
Sample Location : PMI
Analysed Date : 21. March. 2019
Lab Code No. : 100/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540-D Dried at 103-105 °C	20	mg/L	68.67
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-N_{org} B Macro Kjeldahl Method	1	mg/L	<1
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	mg/L	<0.01
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 D & Instruction Manual BOD-Sensis Oxidmet (Lovibond)	2	mg/L	31
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	254

End of Report

SGS (Myanmar) Limited
(Ms Nu Yi)
Manager



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME : YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION
CUSTOMER NAME : C.GUARD ENVIRONMENTAL SERVICES CO., LTD
ADDRESS : NO.11, LANMADAW AVENUE ROAD, YANGON (Industrial)
CONTACT INFORMATION : TEL : 0979 7555 (7) E-mail : 22cue@gmail.com
SAMPLING SOURCE :
SAMPLE TYPE : SURFACE WATER
SAMPLING DATE : MARCH 13, 2019
SAMPLING TIME :
SAMPLING METHOD :
SAMPLING BY : CLIENT'S PERSONNEL
ANALYZED BY : TEST LABORATORY STAFF
RECEIVED DATE : APRIL 2, 2019
ANALYTICAL DATE : APRIL 2-10, 2019
REPORT NO. : [illegible]
WORK NO. : [illegible]
ANALYSIS NO. : T19013-001 / T19013-002

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1 T19013-001	RESULT 2 T19013-002	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/l	HIGH TEMPERATURE COMBUSTION METHOD, 5310B	43.51	32.19	0.05
SAMPLE CONDITION			Acceptable	Acceptable	

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 21 TH EDITION, 2005
RESULT 1 : SW-3 (NA 400 200' BUILDING)
RESULT 2 : SW-4 (PMI)

Pyae S.
(PYAE PHYOE SUTTHAMLIN(MSC))
LABORATORY SUPERVISOR
APRIL 12, 2019

* DO NOT COPY PARTIAL OF THIS ANALYSIS REPORT WITHOUT OFFICIAL APPROVAL.
* REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.



C.guard	Operation Department Environmental Quality Baseline Sampling Survey Field Notes	E-Guard-OD-EQ-F-10 Version /01	Approved by MD On Date: 12/11/2018 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: U Aung Moe Oo	Date: 21.3.2019
Location: PMI	Time: 1:30 PM
Lat. & Long.: 16°51'16.45"N, 96°5'[illegible]E	Instrument: Horiba
Weather: Sunny	Sample/Location ID: SW6 GPS Waypoint no: Temperature: 29.45 Time: 1:30 PM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (ms/cm)	Electrical Conductivity: TDS (g/l)	Electrical Conductivity: Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
6	6.8	2.96	1.97	1.4	2.03	25.8	139		2.5	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques Accurate field measurement; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use; Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by

Shwe Sin Chan Lee

Copy Document

EFFECTIVE DATE: 01/01/2019



ISO TECH LABORATORY

WTL-RE-001

W0319 849

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 7

Location: Hlaing Small Creek (Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 27.3.2019

Date and Time of completing: 29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.8		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	2200	NTU	5 NTU
Conductivity		micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	200 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

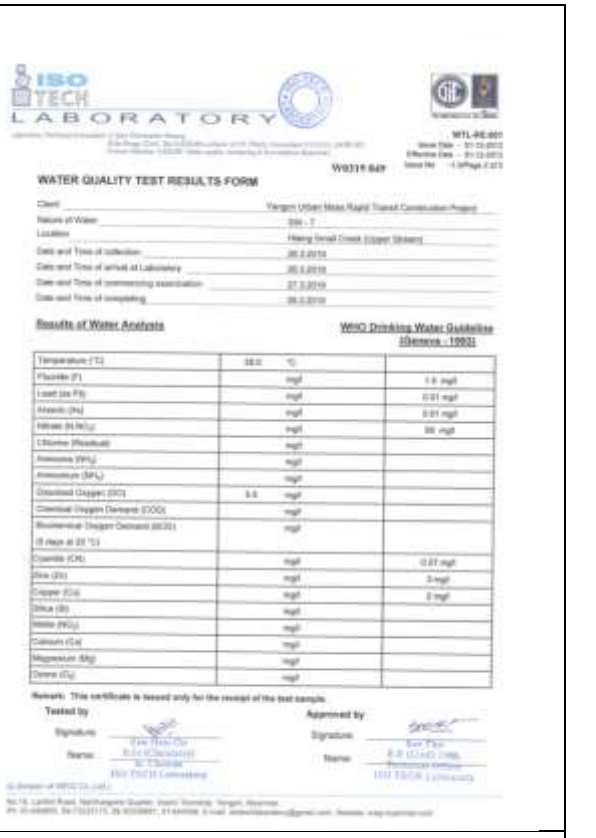
Signature:

Name: Zaw Wunk Oo
B.Sc (Chemistry)
Sr. Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Kyaw Thu
B.E (Civil) 1998,
Technical Officer
ISO TECH Laboratory



ISO TECH LABORATORY

WTL-RE-001

W0319 849

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 7

Location: Hlaing Small Creek (Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 27.3.2019

Date and Time of completing: 29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	28.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4^+)		mg/l	
Dissolved Oxygen (DO)	5.6	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Mercury (Hg_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O_3)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name: Zaw Wunk Oo
B.Sc (Chemistry)
Sr. Chemist
ISO TECH Laboratory

Approved by

Signature:

Name: Kyaw Thu
B.E (Civil) 1998,
Technical Officer
ISO TECH Laboratory



ISO TECH LABORATORY

WTL-RE-001

SE319 849

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 7

Location: Hlaing Small Creek (Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 26.3.2019

Date and Time of completing: 27.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	90	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	30	CFU/100ml	Not detected
pH	7.8		6.5 - 8.5
Turbidity	2200	NTU	5 NTU
Colour (True)	300	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes.

- This certificate is issued only for the receipt of the test sample.
- = Less than

Tested by

Signature:

Name:

Approved by

Signature:

Name: Kyaw Thu
B.E (Civil) 1998,
Technical Officer
ISO TECH Laboratory



SGS

ANALYSIS REPORT ORIGINAL

Job Ref: 2090396/19
Date: 09/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 26 March 2019
Sample Brought By : Client
Sample Marking : SW-7
Sample Location : Hlaing Small Creek Upper Stream
Analysed Date : 26 March 2019
Lab Code No. : 109/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 2540 D Dried at 103-105 °C	20	mg/L	1127
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 4500 N_{org} B Macro Kjeldahl Method	1	mg/L	3.24
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,4500-P E Ascorbic Acid Method	0.01	mg/L	0.209
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 5210 D & Instruction Manual 5OD.System Oxidirect (Lovibond)	2	mg/L	23
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,5220 D, Closed Reflux, Colorimetric Method	10	mg/L	85.0

End of Report

SGS (Myanmar) Limited

Manager

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME			
CUSTOMER NAME			
ADDRESS			
CONTACT INFORMATION			
SAMPLING SOURCE			
SAMPLE TYPE		RECEIVED DATE	
SAMPLING DATE		ANALYTICAL DATE	
SAMPLING TIME		REPORT NO.	
SAMPLING METHOD		WORK NO.	
SAMPLING BY		ANALYSED NO.	
ANALYSED BY			

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		DETECTION LIMIT
TOTAL INORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (SM 5310)	3.87	3.28	0.05
SAMPLE CONDITION					
WATER COLOUR/TURBID			Incolourless/ None	Incolourless/ None	
ODOUR/OIL					

(a) : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23 RD EDITION, 2017

RESULT 1 : ONLY 2 SAMPLE SMALL CODES UPPER STREAMS

RESULT 2 : ONLY 6 SAMPLE SMALL CODES UPPER STREAMS

Byput S.

APRIL 22, 2019

• DO NOT COPY PARTIAL OF THIS ANALYSIS REPORT WITHOUT OFFICIAL APPROVAL.
• REPORTED ANALYSES REFERS TO SUBMITTED SAMPLE ONLY.

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guard

Operation Department
Environmental Quality Baseline Sampling/Survey Field Notes

E-Guard-ISD-EQ-F-16 Version (01)

Approved by YSD On Date: 2/07/2019 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: KZM, WWZ	Date: 25.3.2019
Location: Under Bo Gyi Aung Bridge	Time: 10:05 PM
Lat. & Long: 16°51'28.32"N 96°9'48.48"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID:
	GPS Waypoint no: SWCB 3 (Up Stream (UM))
	Temperature: 30.3°C
	Time: 10:05 PM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (ms/cm)	Electrical Conductivity TDS (g/l)	Electrical Conductivity Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
1.	8.05	7.34	4.83	4.4	4.04	0.0	90		15	

Aim of Sampling

- Quality; Consistency; Representative Sample; Prevent Deterioration; Prevent Contamination: Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation.
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, rinse in clean, dry dust free environment before use; Adequate for volume required.

Notes:

Checked by:

Saw San Chue Lae

ISO TECH LABORATORY

WTL/NE-001
Issue Date : 01-10-2012
Effective Date : 01-10-2013
Issue No : 1.0/Page 1 of 2

W0319 (EN)

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	SW - 9
Location	Hlaing Small Creek (Upper Stream)
Date and Time of collection	26.3.2019
Date and Time of arrival at Laboratory	26.3.2019
Date and Time of commencing examination	27.3.2019
Date and Time of completing	29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.0		6.8 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	3	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name:

Approved by
Signature:
Name:

(a Division of WEQ Co.,Ltd.)

No. 61, Lanthit Road, Nanthaguone Quarter, Insein Township, Yangon, Myanmar
Ph. 01-644923, 09-73251715, 09-5013661, 01-644936, E-mail: isotechlaboratory@gmail.com, Website: wwg-myanmar.com

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ISO TECH LABORATORY

WTL/NE-001
Issue Date : 01-10-2012
Effective Date : 01-10-2013
Issue No : 1.0/Page 2 of 2

W0319 (EN)

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 9
Location: Hlaing Small Creek (Upper Stream)
Date and Time of collection: 26.3.2019
Date and Time of arrival at Laboratory: 26.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 29.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	30.3	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	6.2	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O_3)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name:

Approved by
Signature:
Name:

(a Division of WEQ Co.,Ltd.)

No. 61, Lanthit Road, Nanthaguone Quarter, Insein Township, Yangon, Myanmar
Ph. 01-644923, 09-73251715, 09-5013661, 01-644936, E-mail: isotechlaboratory@gmail.com, Website: wwg-myanmar.com



ISO TECH LABORATORY

WTL-ISO-001

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 6

Location: Hlaing Small Creek (Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 26.3.2019

Date and Time of completing: 27.3.2019

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	3	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	Not detected (<1)	CFU/100ml	Not detected
pH	7.9		6.5 - 8.5
Turbidity	3	NTU	5 NTU
Colour (True)	50	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes.

: This certificate is issued only for the receipt of the test sample.

: < - Less than

Tested by

Signature:

Name:

Approved by

Signature:

Name:

SGS

ANALYSIS REPORT ORIGINAL

Job Ref: 3006396118
Date: 09/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 26, March ,2019
Sample Brought By : Client
Sample Marking : SW-6
Sample Location : Hlaing Small Creek Upper Stream
Analysed Date : 28, March ,2019
Lab Code No : 119/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012, 2540-D Dried at 103-105 °C	20	mg/L	2058
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 4500-N_{org}.B.Macro Kjeldahl Method	1	mg/L	3.36
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	mg/L	0.465
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012, 5210 D & Instruction Manual BOD System Oxitherm (Lovibond)	2	mg/L	20
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	184

End of Report



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1	RESULT 2	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (SM 5310B)	1.67	1.33	0.50
SAMPLE CONDITION					

Gopal S.



guard

Operation Department: Environmental Quality Baseline Sampling/Survey Field Notes

E-Guard-OD-EQ-F-10 Version.01

Approved by SD Date: 2/10/2019 Page 9 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: KZM, WWZ

Location: Upstream Bo Set Naung Bridge

Lat. & Long: 16°47'50.56"N 96°06'54.36"E

Weather: Sunny

Date: 26.3.2019

Time: 12:30 PM

Instrument: HORIBA

Sample/Location ID:

GPS Waypoint no: SW-6 (Up Stream (5m.))

Temperature: 34.0°C

Time: 19:30 PM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (micro)	Electrical Conductivity: TDS (g/l)	Electrical Conductivity: Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
6.	8.4	765	4.05	4.4	5.64	0.0	80		1.98	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques: Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule: Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives_ if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required

Notes

Checked by:

Khaw Sin Chee Lee



ISO TECH LABORATORY

WTL-RE-001

W1019 851

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 9

Location: Hlaing Small Creek (Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 27.3.2019

Date and Time of completing: 29.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

pH	7.8		6.8 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	3400	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	200 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: — ISO TECH Laboratory

Approved by — Signature: — Name: — ISO TECH Laboratory

(a division of WEO Co.,Ltd.)
No.18, Lanthit Road, Kanthayaone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-644800, 09-73233175, 09-5035861, 01-644808, E-mail: isotechlaboratory@gmail.com, Website: wtg-myanmar.com

ISO TECH LABORATORY

WTL-RE-001

W1019 851

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 9

Location: Hlaing Small Creek (Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 27.3.2019

Date and Time of completing: 29.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	26.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	5.6	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	5 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O_3)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: — ISO TECH Laboratory

Approved by — Signature: — Name: — ISO TECH Laboratory

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ISO TECH LABORATORY

WTL-RE-001

S0319 169

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 9

Location: Hlaing Small Creek (Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 26.3.2019

Date and Time of completing: 27.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Total Coliform Count	110	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	40	CFU/100ml	Not detected
pH	7.8		6.8 - 8.5
Turbidity	3400	NTU	5 NTU
Colour (True)	400	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes.

: This certificate is issued only for the receipt of the test sample.

: < - Less than

Tested by — Signature: — Name: — ISO TECH Laboratory

Approved by — Signature: — Name: — ISO TECH Laboratory

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ANALYSIS REPORT

ORIGINAL

Job Ref: 2000396/19
Date: 09/04/2019
Page 1 of 1

Sample Described as : **Surface Water**
Client Name : **Yangon Urban Mass Rapid Transit Construction Project**
Sample Received Date : 28 March 2019
Sample Brought By : Client
Sample Marking : SW-9
Sample Location : Hlaing Small Creek Upper Stream
Analysed Date : 28 March 2019
Lab Code No : 11/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 2540 D Dried at 103-105 °C	20	mg/L	2000
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 4500-N_{org} B Macro Kjeldahl Method	1	mg/L	3.80
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	mg/L	0.081
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 5210 D & Instruction Manual BOD System Oxidirect (Levibond)	3	mg/L	12
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	100

End of Report

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United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: S GUARD ENVIRONMENTAL SERVICES CO., LTD.		
ADDRESS	: NO.11, AIRPORT JUNBLE ROAD, YANGON, MYANMAR		
CONTACT INFORMATION	: TEL : +979 7003170 e-mail : (Tue@guardservice.com		
SAMPLING SOURCE	:		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: APRIL 9, 2019
SAMPLING DATE	: MARCH 28, 2019	ANALYTICAL DATE	: APRIL 9-12, 2019
SAMPLING TIME	: -	REPORT NO.	: [illegible]
SAMPLING METHOD	: -	WORK NO.	: 2019-[illegible]
SAMPLING BY	: CUSTOMER	ANALYSIS NO.	: Y19A[illegible]
ANALYZED BY	: MISS BANUSHREE VITTAL		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 3	RESULT 4	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (SM 5310 B)	2.27	3.43	0.50
SAMPLE CONDITION			YELLOWISH BROWN	YELLOWISH BROWN	

pH : [illegible]
RESULT 1 : [illegible]
RESULT 2 : [illegible]

Pyae T.

(MRS PYAINT SITTANALTWORD)
LABORATORY SUPERVISOR

APRIL 12, 2019

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* REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.

1/1

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guard

Operation Department
Environmental Quality Baseline Sampling/Survey Field Notes

S Guard-OH-EQ-F-10
Version .01

Approved by MH Ho
Date: 1/10/2019
Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: [illegible]	Date: 26.3.2019
Location: Under Bridge Nearg Bottle	Time: 09:30
Lat. & Long: [illegible]	Instrument: WATERRA
Weather: Sunny	Sample/Location ID:
	GPS Waypoint no: [illegible] Up Stream (1 m.)
	Temperature: 30.2°C
	Time: 19:30

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (ms/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
9	8.0	9.94	4.96	4.8	4.98	0.0	450		1.5	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Thaw Zin Chue Lay

ISO TECH LABORATORY

WTL-RE-041
Issue Date : 01-12-2012
Effective Date : 01-12-2012
Issue No. : 1 (4Page 1 of 2)

W8319 852

WATER QUALITY TEST RESULTS FORM

Client : Yangon Urban Mass Rapid Transit Construction Project
Nature of Water : SW - 10
Location : Hlaing Small Creek (Upper Stream)
Date and Time of collection : 26.3.2019
Date and Time of arrival at Laboratory : 26.3.2019
Date and Time of commencing examination : 27.3.2019
Date and Time of completing : 29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.7		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	9285	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature :
Name : Soe Thu Tun
B.Sc (Chemistry)
Sr Chemist
ISO TECH Laboratory

Approved by
Signature :
Name : Soe Thu
B.E (Civil) (1996)
Technical Officer
ISO TECH Laboratory

a division of WEG Co. Ltd.

No. 18, Lanthit Road, Hlaingkangone Quarter, Insein Township, Yangon, Myanmar
Ph: 01-6456572, 09-73233175, 09-30318881, 01-644438, E-mail: isotechlaboratory@gmail.com, Website: wegmyanmar.com

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ISO TECH LABORATORY

WTL-RE-041
Issue Date : 01-12-2012
Effective Date : 01-12-2012
Issue No. : 1 (4Page 2 of 2)

W8319 852

WATER QUALITY TEST RESULTS FORM

Client : Yangon Urban Mass Rapid Transit Construction Project
Nature of Water : SW - 10
Location : Hlaing Small Creek (Upper Stream)
Date and Time of collection : 26.3.2019
Date and Time of arrival at Laboratory : 26.3.2019
Date and Time of commencing examination : 27.3.2019
Date and Time of completing : 29.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	29.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	5.8	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Chorine (Cl_2)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature :
Name : Soe Thu Tun
B.Sc (Chemistry)
Sr Chemist
ISO TECH Laboratory

Approved by
Signature :
Name : Soe Thu
B.E (Civil) (1996)
Technical Officer
ISO TECH Laboratory

a division of WEG Co. Ltd.

No. 18, Lanthit Road, Hlaingkangone Quarter, Insein Township, Yangon, Myanmar
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ISO TECH LABORATORY

WTL-RE-021

M0319 101

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 10

Location: Hlaing Small Creek Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 26.3.2019

Date and Time of completing: 27.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	500	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	40	CFU/100ml	Not detected
pH	7.7		6.5 - 8.5
Turbidity	5000	NTU	5 NTU
Colour (True)	200	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.

: This certificate is issued only for the receipt of the test sample.

: * - Less than

Tested by

Signature:

Name: Daw Khin Ohn
B.Sc (Chemistry)
Technologist
ISO TECH Laboratory

Approved by

Signature:

Name: Daw Thin
B.E (Civil) 1996,
Professional Engineer
ISO TECH Laboratory

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 3000386/19
Date: 09/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 26 March 2019
Sample Brought By : Client
Sample Marking : SW-10
Sample Location : Hlaing Small Creek Upper Stream
Analysed Date : 26 March 2019
Lab Code No. : 110719

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 2540-D Dried at 103-105 °C	20	mg/L	2910
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 4500-N_{org} B.Macro Kjeldahl Method	1	mg/L	5.39
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012,4500-P E.Ascorbic Acid Method	0.01	mg/L	0.456
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 5210 D & Instruction Manual BOD System Costtech (Lovibond)	2	mg/L	56
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	152

End of Report

United Analyst and Engineering Consultants Co., Ltd.

ANALYSIS REPORT

PROJECT NAME	YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME			
ADDRESS			
CONTACT INFORMATION			
SAMPLING SOURCE			
SAMPLE TYPE	SURFACE WATER	RECEIVED DATE	APRIL 4, 2019
SAMPLING DATE	MARCH 26, 2019	ANALYTICAL DATE	APRIL 4-12, 2019
SAMPLING TIME		REPORT NO.	
SAMPLING METHOD		WORK NO.	
SAMPLING BY	CUSTOMER	ANALYSIS NO.	
ANALYZED BY			

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1	RESULT 2	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (SM 5310)	3.27	3.32	0.50
SAMPLE CONDITION					
APPEARANCE			No colour and odour	No colour and odour	

SM STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 21ST EDITION, 2011

RESULT 1 : ONLY 5 KAONG SMALL CREEK UPPER STREAM

RESULT 2 : ONLY 10 KAONG SMALL CREEK UPPER STREAM (5 KAONG SMALL CREEK UPPER STREAM)

Report 3.

(MRS PYAINT SOTHANA THUNG)
LABORATORY SUPERVISOR

APRIL 12, 2019

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1/1

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guard	Operation Department Environmental Quality Baseline Sampling/Survey Field Notes	E-Guard-OD-EQ-F-10 Version :01	Approved by MD On Date: 2/03/2019 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: WPA, SWMP	Date: 26.3.2019
Location: Under 6a Dat Nawa Bridge	Time: 09.51
Lat. & Long.: 16°51'00.64"N & 96°12.47"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID: GPS Waypoint no: SW(10) Up Stream (5m) Temperature: 30.5°C Time: 10:45

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (ms/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
10	6.46	7.45	4.34	4.1	5.45	0.0	352		15'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Shwe Sin Chan Lar

Copy Document

EFFECTIVE DATE: 02/10/2019



ISO TECH LABORATORY

WTL-RE-001

W1319 853

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 11
Location: Hlaing Small Creek (Down Stream)
Date and Time of collection: 26.3.2019
Date and Time of arrival at Laboratory: 26.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 29.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

pH	7.7		6.8 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	2080	NTU	5 NTU
Conductivity		micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: — Approved by — Signature: — Name:

No. 19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-640603, 09-7320170, 09-5123841, 01-644108, E-mail: isotechlaboratory@gmail.com, Website: wwg-myanmar.com



ISO TECH LABORATORY

WTL-RE-001

W1319 853

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 11
Location: Hlaing Small Creek (Down Stream)
Date and Time of collection: 26.3.2019
Date and Time of arrival at Laboratory: 26.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 29.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)	29.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	6.6	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	5 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O_3)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: — Approved by — Signature: — Name:

No. 19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-640603, 09-7320170, 09-5123841, 01-644108, E-mail: isotechlaboratory@gmail.com, Website: wwg-myanmar.com

ISO TECH LABORATORY

WTL-RE-001

S00319 163

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 11
Location: Hlaing Small Creek (Down Stream)
Date and Time of collection: 26.3.2019
Date and Time of arrival at Laboratory: 26.3.2019
Date and Time of commencing examination: 26.3.2019
Date and Time of completing: 27.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	80	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	20	CFU/100ml	Not detected
pH	7.7		6.8 - 8.5
Turbidity	2080	NTU	5 NTU
Colour (True)	200	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes.
: This certificate is issued only for the receipt of the test sample.
< : Less than

Tested by — Signature: — Name: — Approved by — Signature: — Name:

No. 19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-640603, 09-7320170, 09-5123841, 01-644108, E-mail: isotechlaboratory@gmail.com, Website: wwg-myanmar.com



SGS

ANALYSIS REPORT ORIGINAL

Job Ref: 0000390/19
Date: 05/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 26. March. 2019
Sample Brought By : Client
Sample Marking : SW-11
Sample Location : Hlaing Small Creek Down Stream
Analysed Date : 28. March. 2019
Lab Code No : 113/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012, 2540 D Dried at 103-105 °C	20	mg/L	900
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012, 4500-N_{org} B Macro Kjeldahl Method	1	mg/L	1.00
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	mg/L	0.350
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012, 5210 D & Instruction Manual BOD-System Oxitop (Lovibond)	3	mg/L	69
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012,5220D Closed Reflux, Colorimetric Method	15	mg/L	134

End of Report

M2N (Myanmar) Limited
Authorized Signatory
Khin Mar Yin
Manager

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United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME	YANGON URBAN RAILWAYS TRANSIT CONSTRUCTION		
CUSTOMER NAME	E GUARD ENVIRONMENTAL SERVICE CO., LTD		
ADDRESS	NO.11, AIRPORT AVENUE, NORTH YANKIN, YANGON		
CONTACT INFORMATION	TEL : 9751755179 e-mail :		
SAMPLING SOURCE	-		
SAMPLE TYPE	SURFACE WATER	RECEIVED DATE	: APRIL 4, 2019
SAMPLING DATE	: MARCH 28, 2019	ANALYTICAL DATE	: APRIL 4-12, 2019
SAMPLING TIME	-	REPORT NO.	: 0319-0289(B)
SAMPLING METHOD	-	WORK NO.	: 0319-0203(A)
SAMPLING BY	CUSTOMER	ANALYSES NO.	: 7184(0319-0003) - 7184(0319-0006)
ANALYSES BY	MISS HANNA KHINE TOTHU		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1 (7184(0319-0003))	RESULT 2 (7184(0319-0006))	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (SM 5310 B)	1.01	0.97	0.05
SAMPLE CONDITION (NO TASTE OR ODOUR)			No unusual appearance	No unusual appearance	

(SM) : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23 RD EDITION, 2017.

RESULT 1 : (W-11 (A) (A)) SMALL CREEK DOWN STREAM)

RESULT 2 : (W-11 (A) (A)) SMALL CREEK DOWN STREAM)

APRIL 12, 2019

* DO NOT COPY PARTIAL OF THIS ANALYSES REPORT WITHOUT OFFICIAL APPROVAL.
* REPORTED ANALYSES REFERS TO SUBMITTED SAMPLE ONLY.

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eguard	Operation Department: Environmental Quality Baseline Sampling/Survey Field Sheets	E Guard-OD-GQ-F-10 Version #1	Approved by MD On Date: 2/10/2019 Page 5 of 13

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: U Zaw Win	Date: 28.3.2019
Location: Under the Kaytumadi Bridge	Time: 11.05 AM
Lat. & Long.: 16°51'32.90"N, 96°8'40.40"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID: Down Stream GPS Waypoint no: Down Stream Temperature: 29.0°C Time: 11:50 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (ms/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
17.	7.07	11.2	0.08	0.4	5.91	0.0	015		1.5'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives, Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Thuk Gyi Aye Lae

Copy Document

EFFECTIVE DATE: 01/10/2019

ISO TECH LABORATORY

WTL/RE-001
Issue Date : 01-12-2015
Effective Date : 01-12-2015
Issue No : 1.0/Page 1 of 2

W0319 854

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 02
Location: Hlaing Small Creek (Down Stream)
Date and Time of collection: 28.3.2019
Date and Time of arrival at Laboratory: 28.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.7		6.5 - 9.5
Colour (True)		TCU	15 TCU
Turbidity	2000	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Htay Htay Oo
B.Sc (Chemistry)
IHI TECH Laboratory

Approved by
Signature:
Name: Htay Htay
B.E (Civil) 1996
Technical Officer
IHI TECH Laboratory

(a division of WTG Co., Ltd.)

No. 12, Lashit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar
Ph: 01-644808, 09-73229179, 09-420048621, 01-644808, E-mail: ihitechlaboratory@gmail.com, Website: ihitechmyanmar.com

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ISO TECH LABORATORY

WTL/RE-001
Issue Date : 01-12-2015
Effective Date : 01-12-2015
Issue No : 1.0/Page 2 of 2

W0319 854

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 02
Location: Hlaing Small Creek (Down Stream)
Date and Time of collection: 28.3.2019
Date and Time of arrival at Laboratory: 28.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 29.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	28.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	5.8	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O_3)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Htay Htay Oo
B.Sc (Chemistry)
IHI TECH Laboratory

Approved by
Signature:
Name: Htay Htay
B.E (Civil) 1996
Technical Officer
IHI TECH Laboratory

(a division of WTG Co., Ltd.)

No. 12, Lashit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar
Ph: 01-644808, 09-73229179, 09-420048621, 01-644808, E-mail: ihitechlaboratory@gmail.com, Website: ihitechmyanmar.com



ISO TECH LABORATORY

MTL/RE-021

MS19 183

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 12

Location: Hlaing Sinah Creek (Down Stream)

Date and Time of collection: 26.2.2019

Date and Time of arrival at Laboratory: 26.2.2019

Date and Time of commencing examination: 26.2.2019

Date and Time of completing: 27.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Total Coliform Count	80	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	20	CFU/100ml	Not detected
pH	7.7		6.5 - 8.5
Turbidity	2800	NTU	5 NTU
Colour (True)	220	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes.

: This certificate is issued only for the receipt of the test sample.

: < - Less than

Tested by

Signature:

Name:

Approved by

Signature:

Name:

ISO TECH Laboratory



SGS

ANALYSIS REPORT ORIGINAL

Job Ref: 2000200115
Date: 09/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 26, March, 2019
Sample Brought By : Client
Sample Marking : SW-12
Sample Location : Hlaing Sinah Creek Down Stream
Analysed Date : 26, March, 2019
Lab Code No : 114/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012, 2540 D Dried at 103-105 °C	20	mg/L	1600
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012, 4500-N_{org} B Macro-Kjeldahl Method	1	mg/L	5.36
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012 4500-P E Ascorbic Acid Method	0.01	mg/L	0.203
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012,5520B	5	mg/L	7.50
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012, 5210 D & Instruction Manual BOD System Oxidirect (Lovibond)	2	mg/L	60
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	184

End of Report

SGS (Myanmar) Limited

Manager

United Analyst and Engineering Consultant Co., Ltd.

ANALYSES REPORT

PROJECT NAME : YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION
CUSTOMER NAME : E-GUARD ENVIRONMENTAL SERVICES CO., LTD.
ADDRESS : NO.(11), AIRPORT AVENUE ROAD, YANGON (MYANMAR)
CONTACT INFORMATION : TEL : (+95) 1861215 e-mail : (hsue@e-guardservices.com)
SAMPLING SOURCE : -
SAMPLE TYPE : SURFACE WATER
SAMPLING DATE : MARCH 26, 2019
SAMPLING TIME : -
SAMPLING METHOD : -
SAMPLING BY : CUSTOMER
ANALYZED BY : PGS ANALYANCE TOTAL
RECEIVED DATE : APRIL 4, 2019
ANALYTICAL DATE : APRIL 4-11, 2019
REPORT NO. : 2019-0366
WORK NO. : 2019-0023/4
ANALYSIS NO. : T19N0331-0002 - T19N0331-0004

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1 (19N0331-0002)	RESULT 2 (19N0331-0004)	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	5310 C TEMPERATURE CONDITION METHOD (2ND EDITION)	3.01	3.67	0.05
SAMPLE CONDITION (WATER COLOUR/TURBID/ SEDIMENT)			YELLOWISH BROWN	YELLOWISH BROWN	

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 21ST EDITION, 2017.

RESULT 1 : SW-11 (HLAING SMALL CREEK DOWN STREAM)
RESULT 2 : SW-12 (HLAING SMALL CREEK DOWN STREAM)

APRIL 22, 2019

• DO NOT COPY PARTIAL OF THIS ANALYSED REPORT WITHOUT SPECIAL APPROVAL.
• REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.



E-guard

Operation Department	E Guard-OD-EQ-F-10 Version -01	Approved by MD On Date: 2/5/2019 Page 5 of 11
Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: [illegible]	Date: [illegible]
Location: Under 30 Yat Hlaing Bridge	Time: 11.44 AM
Lat. & Long: [illegible]	Instrument: HORIBA
Weather: Cloudy	Sample/Location ID: Down Stream. GPS Waypoint no: [illegible] Temperature: 30.5°C Time: 11.54 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (ms/cm)	Electrical Conductivity TDS (g/l)	Electrical Conductivity Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
1.	7.98	0.8	0.68	0.1	4.34	0.0	108		1.57	

Aim of Sampling

- Quality, Consistency, Representative Samples, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation.
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferably to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Hsue Sin Chee Ltd.

Copy Document

EFFECTIVE DATE: 02/10/2018

ISO TECH LABORATORY

WTL-RE-001

W0319 055

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 13
Location: Hlaing Small Creek (Down Stream)
Date and Time of collection: 26.3.2019
Date and Time of arrival at Laboratory: 26.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 28.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

pH	7.9		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	9900	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl_2)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1000 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: [illegible] — B.Sc (Chemistry) — Dr. Chemist — ISO TECH Laboratory

Approved by — Signature: — Name: [illegible] — B.E (Civil) 1986 — Technical Officer — ISO TECH Laboratory

(A Division of WETO Co. Ltd.)

No. 19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-[illegible], 09-[illegible], 01-[illegible], E-mail: [illegible], Website: [illegible]

ISO TECH LABORATORY

WTL-RE-001

W0319 055

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 13
Location: Hlaing Small Creek (Down Stream)
Date and Time of collection: 26.3.2019
Date and Time of arrive at Laboratory: 26.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 28.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)	35.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	8.0	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O_3)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: [illegible] — B.Sc (Chemistry) — Dr. Chemist — ISO TECH Laboratory

Approved by — Signature: — Name: [illegible] — B.E (Civil) 1986 — Technical Officer — ISO TECH Laboratory

(A Division of WETO Co. Ltd.)

No. 19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-[illegible], 09-[illegible], 01-[illegible], E-mail: [illegible], Website: [illegible]

ISO TECH LABORATORY

WTL-RE-001

M0319 104

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 13
Location: Hlaing Small Creek (Down Stream)
Date and Time of collection: 26.3.2019
Date and Time of arrival at Laboratory: 26.3.2019
Date and Time of commencing examination: 26.3.2019
Date and Time of completing: 27.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	120	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	40	CFU/100ml	Not detected
pH	7.9		6.5 - 8.5
Turbidity	9900	NTU	5 NTU
Colour (True)	350	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.
: This certificate is issued only for the receipt of the test sample.
: = Less than

Tested by — Signature: — Name: [illegible] — B.Sc (Chemistry) — Dr. Chemist — ISO TECH Laboratory

Approved by — Signature: — Name: [illegible] — B.E (Civil) 1986 — Technical Officer — ISO TECH Laboratory

(A Division of WETO Co. Ltd.)

No. 19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-[illegible], 09-[illegible], 01-[illegible], E-mail: [illegible], Website: [illegible]

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2300205/19
Date: 05/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 26. March .2019
Sample Brought By : Client
Sample Marking : SW-13
Sample Location : Hlaing Small Creek Down Stream
Analysed Date : 28. March .2019
Lab Code No: : 119/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 2540 D Dried at 103-105 °C	50	mg/L	2150
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 4500-N_{org} B Macro Kjeldahl Method	1	mg/L	2.60
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	mg/L	0.809
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5520B	5	mg/L	7.60
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 5210 D & Instruction Manual BOD System Oxidirect (Lovibond)	2	mg/L	37
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	119

End of Report

[illegible]

[illegible]

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME	: YANGON URBAN AREA RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	:		
ADDRESS	:		
CONTACT INFORMATION	:		
SAMPLING SOURCE	:		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: APRIL 4, 2019
SAMPLING DATE	: MARCH 28, 2019	ANALYTICAL DATE	: APRIL 4-12, 2019
SAMPLING TIME	: -	REPORT NO.	:
SAMPLING METHOD	: -	WORK NO.	:
SAMPLING BY	: CUSTOMER	ANALYSIS NO.	:
ANALYZED BY	:		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		DETECTION LIMIT
			1	2	
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (APHA 5310 B)	3.09	2.70	0.50
SAMPLE CONDITION:					
WATER'S COLOUR/FLAVOR			NO UNUSUAL ODOUR	NO UNUSUAL ODOUR	
ODOUREET					

NOTE: STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23 RD EDITION, 2017.

RESULT 1 : 3.09 (+/-0.26) MG/L CRUDE DOMS (TRIGGER)

RESULT 2 : 2.70 (+/-0.23) MG/L CRUDE DOMS (TRIGGER)

LABORATORY SUPERVISOR

APRIL 12, 2019

* DO NOT COPY PARTIAL OF THIS ANALYSIS REPORT WITHOUT OFFICIAL APPROVAL.
* REPORTED ANALYSES REFERS TO SUBMITTED SAMPLE ONLY.

	Operation Department	E-Guard-HS-EQ-F-30 Version 101	Approved by SHE On: Date: 2/15/2019 Page 9 of 15
e-guard	Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: WHZ, KZH	Date: 22.3.2019
Location: Dala Bridge	Time: 12.50
Lat. & Long.: 16°47'6.96"N, 96°6'10.40"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID: Down Stream. GPS Waypoint no: Bkd (18)_DS Temperature: 31.8°C Time: 13:50

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (ms/cm)	Electrical Conductivity TDS (g/l)	Electrical Conductivity Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
38.	8.28	6.89	4.54	3.8	4.91	0.0	88		1.1	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives_ if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

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Checked by:

Thaw Sin Chan Lee

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EFFECTIVE DATE: 02/16/2019

ISO TECH LABORATORY

WTL-RD-001
Issue Date : 01-12-2012
Effective Date : 01-12-2012
Issue No : 1.0/Page 1 of 2

W0319 856

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	SW - 14
Location	Hlaing Small Creek (Down Stream)
Date and Time of collection	20.3.2019
Date and Time of arrival at Laboratory	20.3.2019
Date and Time of commencing examination	27.3.2019
Date and Time of completing	29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.0		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	6400	NTU	5 NTU
Conductivity		micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $(CaCO_3)$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium Chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name:

Approved by
Signature:
Name:

(a division of WEQ Co.,Ltd.)

No.16, Lanthit Road, Hanthagone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-644800, 09-73231175, 09-5035881, 01-644808, E-mail: isotechlaboratory@gmail.com, Website: wsq-myanmar.com

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ISO TECH LABORATORY

WTL-RD-001
Issue Date : 01-12-2012
Effective Date : 01-12-2012
Issue No : 1.0/Page 2 of 2

W0319 856

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 14
Location: Hlaing Small Creek (Down Stream)
Date and Time of collection: 20.3.2019
Date and Time of arrival at Laboratory: 20.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 29.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	28.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N_2NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	5.5	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name:

Approved by
Signature:
Name:

(a division of WEQ Co.,Ltd.)

No.16, Lanthit Road, Hanthagone Quarter, Insein Township, Yangon, Myanmar.

ISO TECH LABORATORY

WTL/RE/481

500319 (a)

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 14

Location: Hlaing Small Creek (Down Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 26.3.2019

Date and Time of completing: 27.3.2019

Results of Water Analysis — **WHO Drinking Water Guidelines (Geneva - 1993)**

Total Coliform Count	110	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	40	CFU/100ml	Not detected
pH	7.9		6.5 - 8.5
Turbidity	3400	NTU	5 NTU
Colour (True)	400	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes

: This certificate is issued only for the receipt of the test sample.

: + - Less than

Tested by — Signature / Name / ISO TECH Laboratory

Approved by — Signature / Name / ISO TECH Laboratory

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000359/19
Date: 09/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 26 March 2019
Sample Brought By : Client
Sample Marking : SW-14
Sample Location : Hlaing Small Creek Down Stream
Analysed Date : 26 March 2019
Lab Code No. : 119/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012, 2540-D Dried at 103-105 °C	20	mg/L	2727
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012, 4500-N_{org}.B Macro-Kjeldahl Method	1	mg/L	5.39
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	mg/L	0.372
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012,5520B	5	mg/L	7.73
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012, 5210 D & Ametrodm Manual BOD System Oxidmet (Lovibond)	2	mg/L	50
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	103

End of Report

SGS (Myanmar) Limited
(Ko Ko Yi)
Manager

UAE

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME	YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	[illegible]		
ADDRESS	[illegible]		
CONTACT INFORMATION	[illegible]		
SAMPLING SOURCE	-		
SAMPLE TYPE	SURFACE WATER	RECEIVED DATE	APRIL 4, 2019
SAMPLING DATE	MARCH 26, 2019	ANALYTICAL DATE	APRIL 4-12, 2019
SAMPLING TIME	-	REPORT NO.	[illegible]
SAMPLING METHOD	-	WORK NO.	[illegible]
SAMPLING BY	CUSTOMER	ANALYSIS NO.	[illegible]
ANALYZED BY	[illegible]		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1	RESULT 2	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD,1998	3.09	3.16	0.50
SAMPLE CONDITION: WATER'S COLOUR/CLARITY/ SEDIMENT			no colour/ clear	no colour/ clear	

(a) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22ND EDITION, 2012

RESULT 1 : SW-14 (HLAING SMALL CREEK DOWN STREAM)

RESULT 2 : SW-14 (HLAING SMALL CREEK DOWN STREAM)

Signed

(MRS.) PYAE SITHAR (UTHAMA PHONG)
LABORATORY SUPERVISOR

APRIL 12, 2019

* DO NOT COPY PARTIAL OF THIS ANALYSIS REPORT WITHOUT OFFICIAL APPROVAL.
* REPORTED ANALYSES REFERS TO SUBMITTED SAMPLE ONLY.

	Operation Department: Environmental Quality Baseline Sampling/Survey Field Notes	E Guard-OD-EQ-F-10 Version -01	Approved by MD On Date: 2/10/2019 Page 5 of 33

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: [illegible]	Date: 26.3.2019
Location: Under Bridge	Time: 14.00
Lat. & Long: [illegible]	Instrument: [illegible]
Weather: Sunny	Sample/Location ID: Small Stream
	GPS Waypoint no: SW(14)-Sm
	Temperature: 40C
	Time: 13.08

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (micros)	Electrical Conductivity: TDS (g/l)	Electrical Conductivity: Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
M-	8.26	6.05	3.80	3.3	4.15	0.0	108		75'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Shwe Sin Chan Lay

Copy Document

EFFECTIVE DATE: 02/10/2019



ISO TECH LABORATORY

WTL-RE-001

W0319 057

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 19
Location: Thit Mon Housing (Down Stream)
Date and Time of collection: 20.3.2019
Date and Time of arrival at Laboratory: 20.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.9		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	110	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name:

Approved by
Signature:
Name:

ISO TECH LABORATORY

WTL-RE-001

W0319 057

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 19
Location: Thit Mon Housing (Down Stream)
Date and Time of collection: 20.3.2019
Date and Time of arrival at Laboratory: 20.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	33.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	3.0	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O_3)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name:

Approved by
Signature:
Name:



ISO TECH LABORATORY

WTL-RE-001

W0319 056

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 19
Location: Thit Mon Housing (Down Stream)
Date and Time of collection: 20.3.2019
Date and Time of arrival at Laboratory: 20.3.2019
Date and Time of commencing examination: 20.3.2019
Date and Time of completing: 27.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	80	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	10	CFU/100ml	Not detected
pH	7.9		6.5 - 8.5
Turbidity	110	NTU	5 NTU
Colour (True)	40	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.
: This certificate is issued only for the receipt of the test sample.
: + - Less than

Tested by
Signature:
Name:

Approved by
Signature:
Name:



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 3000300/19
Date: 09/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 28. March. 2019
Sample Brought By : Client
Sample Marking : SW-19
Sample Location : Thit Mon Housing Down Stream
Analysed Date : 28. March. 2019
Lab Code No. : 117/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 2540.D.(Dried at 103-105 °C	10	mg/L	22.0
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 4500-N_{org} B.Macro Kjeldahl Method	1	mg/L	11.2
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,4500-P E.Ascorbic Acid Method	0.01	mg/L	1.141
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 5210 D & Instruction Manual BOD System Oxidirect (Lovibond)	2	mg/L	39
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	80

End of Report

SGS (Myanmar) Limited
Ohn Ko Oo
Manager

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME			
CUSTOMER NAME			
ADDRESS			
CONTACT INFORMATION			
SAMPLING SOURCE			
SAMPLE TYPE		RECEIVED DATE	: APRIL 4, 2019
SAMPLING DATE	: MARCH 26, 2019	ANALYTICAL DATE	: APRIL 4~11, 2019
SAMPLING TIME	:	REPORT NO.	:
SAMPLING METHOD	:	WORK NO.	:
SAMPLING BY	: CUSTOMER.	ANALYSED NO.	:
ANALYSED BY	:		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		DETECTION LIMIT
			1	2	
TOTAL ORGANIC CARBON	mg/L		N.D.	7.00	0.05
SAMPLE CONDITION					
WATER'S COLOUR (TUNED)					
ODOUR/SMELL					

Remark : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23 TH EDITION, 2017

RESULT 1 : ONE (1) TYPE FROM HOUSING DOWN STREAM

RESULT 2 : ONE (1) TYPE FROM HOUSING UPPER STREAM

APRIL 11, 2019

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- REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.

	Operation Department:	E-Guard-OD-EQ-F-18 Version :01	Approved by MD On Date: 2/15/2019 Page 5 of 11
e-guard	Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: KTT, WHZ	Date: 26.3.2019
Location: Tsit Mon. Housing	Time: 9:15 AM
Lat. & Long.: 16°51' 56.59"N, 96°10'51.89"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID: Upper Stream. GPS Waypoint no: GWC15 Temperature: 28.4°C Time: 9:15AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (ms/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
15.	6.76	0.360	0.24	0.2	7.46	52.9	139		5'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservation; Check bottle types required with lab; Add preservatives_if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

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EFFECTIVE DATE: 02/16/2019

ISO TECH LABORATORY

WTL-RE-001

W1319 658

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 15

Location: Tsit Mon Housing (Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 27.3.2019

Date and Time of completing: 29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.4		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	108	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$ +
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: — Lab Technician — MIT TECH Laboratory

Approved by — Signature: — Name: — Laboratory Manager — MIT TECH Laboratory

a division of MIT Co., Ltd.

No.19, Lanthit Road, Nanthegonia Quarter, Insein Township, Yangon, Myanmar.

ISO TECH LABORATORY

WTL-RE-001

W1319 658

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 16

Location: Tsit Mon Housing (Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 27.3.2019

Date and Time of completing: 29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	28.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	3.0	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Chloride (Cl)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: — Lab Technician — MIT TECH Laboratory

Approved by — Signature: — Name: — Laboratory Manager — MIT TECH Laboratory

a division of MIT Co., Ltd.

No.19, Lanthit Road, Nanthegonia Quarter, Insein Township, Yangon, Myanmar.



ISO TECH LABORATORY

WTL-RM-001

MR319 197

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client : Yangon Urban Mass Rapid Transit Construction Project

Nature of Water : SW - 10

Location : Thiri Mon Housing (Upper Stream)

Date and Time of collection : 26.3.2019

Date and Time of arrival at Laboratory : 26.3.2019

Date and Time of commencing examination : 26.3.2019

Date and Time of completing : 27.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Total Coliform Count	40	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	12	CFU/100ml	Not detected
pH	7.4		6.5 - 8.5
Turbidity	128	NTU	5 NTU
Colour (True)	30	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes.

: This certificate is issued only for the receipt of the test sample.

: f. - Less than

Tested by

Signature :

Name :

Approved by

Signature :

Name :



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 3000396/19
Date: 09/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 26 March 2019
Sample Brought By : Client
Sample Marking : SW-10
Sample Location : Thiri Mon Housing Upper Stream
Analysed Date : 26 March 2019
Lab Code No. : 116/19

No.	Test Parameter	Method	LOD	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed, 2012, 2540 D Dried at 103-105 °C	20	mg/L	28.0
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed, 2012, 4500-N_{org} B Micro Kjeldahl Method	1	mg/L	12.68
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed, 2012,4500-P E Ascorbic Acid Method	0.01	mg/L	1.27
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed, 2012,5520B	5	mg/L	6.19
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed, 2012, 5210 D & instruction Manual BOD System Oxidirect (Lovibond)	2	mg/L	5
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed, 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	110

End of Report

SGS (Myanmar) Limited

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME : YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION
CUSTOMER NAME : E-GUARD ENVIRONMENTAL SERVICES CO., LTD.
ADDRESS : NO.(1), AIRPORT AVENUE ROAD, YANGON, MYANMAR
CONTACT INFORMATION : TEL : 4975 332170, e-mail : (Tue@guardservices.com)
SAMPLING SOURCE :
SAMPLE TYPE : SURFACE WATER
SAMPLING DATE : MARCH 26, 2019
SAMPLING TIME :
SAMPLING METHOD :
SAMPLING BY : CUSTOMER
ANALYZED BY : MISS EMILY HSIEH YUTING

RECEIVED DATE : APRIL 4, 2019
ANALYTICAL DATE : APRIL 4 -12, 2019
REPORT NO. : [illegible]
WORK NO. : [illegible]
ANALYSIS NO. : T19M03-0005 - T19M03-0010

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1 (YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION)	RESULT 2 (YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION)	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (SM 5310 B)	14.76	7.65	0.05
SAMPLE CONDITION					
WATER COLOR (PLATINUM-COBALT)			No abnormal appear	No abnormal appear	
ODOR/OIL			No abnormal appear	No abnormal appear	

Note : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23 "EDITION, 2017

RESULT 1 : SW-10 (THIRI MON HOUSING (UPPER STREAM))
RESULT 2 : SW-10 (THIRI MON HOUSING (UPPER STREAM))

Report Signatory

(MR. PYAINT SITTHIWAT THONG)
LABORATORY SUPERVISOR

APRIL 12, 2019

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* REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.



eguard	Operation Department Environmental Quality Baseline Sampling/Survey Field Notes	E Guard-OD-EQ-E-10 Version (0)	Approved by MD On Date: 1/11/2019 Page 9 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: KHLWNE	Date: 26.3.2019
Location: Thiri Mon Housing	Time: 9.40 AM
Lat. & Long: 16°51'40.08"N 96°09'44.2"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID: Up Stream GPS Waypoint no: SW(10) Temperature: 28 deg Time: 9140 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (ms/cm)	Electrical Conductivity TDS (g/l)	Electrical Conductivity Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
1	6.94	490	320	0.2	7.94	69.0	168		5'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives_ (if required)
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

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Checked by:

Shwe Sin Chan Lin

EFFECTIVE DATE: 02/10/2019

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ISO TECH LABORATORY

WTL-RE-001

WE319 859

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 17
Location: Small in Ya Lake
Date and Time of collection: 26.3.2019
Date and Time of arrival at Laboratory: 26.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 28.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

pH	7.1		6.8 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	200	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name:

Approved by
Signature:
Name:

ISO TECH LABORATORY

WTL-RE-001

WE319 859

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 17
Location: Small in Ya Lake
Date and Time of collection: 26.3.2019
Date and Time of arrival at Laboratory: 26.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 28.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	38.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N\text{-}NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	1.6	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Mono (MO_4)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Chrome (Cr_6)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

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Signature:
Name:

Approved by
Signature:
Name:



ISO TECH LABORATORY

WTL-RE-001

WE319 188

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 17
Location: Small in Ya Lake
Date and Time of collection: 26.3.2019
Date and Time of arrival at Laboratory: 26.3.2019
Date and Time of commencing examination: 26.3.2019
Date and Time of completing: 27.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Total Coliform Count	100	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	40	CFU/100ml	Not detected
pH	7.1		6.8 - 8.5
Turbidity	200	NTU	5 NTU
Colour (True)	160	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.
: This certificate is issued only for the receipt of the test sample.
: < - Less than

Tested by
Signature:
Name:

Approved by
Signature:
Name:



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2900398/19
Date: 09/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 26. March. 2019
Sample Brought By : Client
Sample Marking : SW-17
Sample Location : Small Hya Lake
Analysed Date : 28. March. 2019
Lab Code No. : 119/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF,22nd ed, 2012, 2540.D Dried at 103-105 °C	20	mg/L	62.0
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF,22nd ed, 2012, 4500-N_{org}.B.Macro Kjeldahl Method	1	mg/L	4.44
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF,22nd ed, 2012,4500-P.E.Ascorbic Acid Method	0.01	mg/L	0.405
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, 5520.B & WEF,22nd ed, 2012,5520.B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF,22nd ed, 2012, 5210.D & Instruction Manual BOD System Oxitherm (Loviborid)	2	mg/L	5
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF,22nd ed, 2012,5220.D.Closed Reflux, Colorimetric Method	10	mg/L	100

End of Report

SGS (Myanmar) Limited

(Dy.Ms.YI)
Manager

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: S GUARD ENVIRONMENTAL SERVICES CO., LTD.		
ADDRESS	: NO.11, 20/STAFF AVENUE ROAD YANGON MYANMAR		
CONTACT INFORMATION	: TEL : (+979 7655177) e-mail : Cruel@gmail.com		
SAMPLING SOURCE	:		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: APRIL 9, 2019
SAMPLING DATE	: MARCH 26, 2019	ANALYTICAL DATE	: APRIL 9-12, 2019
SAMPLING TIME	: -	REPORT NO.	: 2019-U0851
SAMPLING METHOD	: -	WORK NO.	: 2019-00224
SAMPLING BY	: CUSTOMER	ANALYSIS NO.	: 1104(U)-001(U) ~ 1104(U)-010(U)
ANALYZED BY	: MISS KHIN EVAMO VOTIN		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1 (TANGGYI WELL)	RESULT 2 (TANGGYI WELL)	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (APHA 5310 B)	22.06	7.65	0.50
SAMPLE CONDITION					
ANALYSIS COMMENCED			09:00 AM/09/04/19	09:00 AM/09/04/19	
ANALYSIS COMPLETED			03:00 PM/11/04/19	03:00 PM/11/04/19	

(1) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 21ST EDITION, 2011.

RESULT 1 : DRY LP (SMALL BIN TA LAKE)

RESULT 2 : DRY LB (DAM, BAR TA LAKE)

PROJ ITPART SUTHANUTHORO
LABORATORY SUPERVISOR

APRIL 12, 2019

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* REPORTED ANALYSIS BEFORE TO SUBMITTED SAMPLE ONLY.

1/1

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guard	Operation Department / Environmental Quality Baseline Sampling/Survey Field Notes	E Guard-OD-EQ-F-10 Version :01	Approved by MD On: Date: 1/10/2019 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: W.Z.M / M.M.Z	Date: 26.3.2019
Location: Ring 8 Tan Ta Lake	Time: 8.26 AM
Lat. & Long: 16°50'10.86"N 96°09'20.60"E	Instrument: WQ81x
Weather: Sunny	Sample/Location ID: GPS Waypoint no: 3WC43 Temperature: 29.2°C Time: 8:26 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (micro)	Electrical Conductivity TDS (g/l)	Electrical Conductivity Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
1	6.56	0.028	0.48	0.1	6.34	88.8	290		1.60m	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

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Checked by:

Thaw Zin Oke Lin

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EFFECTIVE DATE: 02/10/2019

ISO TECH LABORATORY

WTL-RE-001
Issue Date : 01-12-2012
Effective Date : 01-12-2012
Issue No : 1.0(Page 1 of 2)

W0319 868

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	SW - W
Location	Main In Ta Lake
Date and Time of collection	26.3.2019
Date and Time of arrival at Laboratory	26.3.2019
Date and Time of commencing examination	27.3.2019
Date and Time of completing	28.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.1		6.6 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	142	NTU	5 NTU
Conductivity		micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1000 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Khin Thin Yu
B.Sc (Chemistry)
Sr. Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Khin Thin Yu
B.E (Civil) (HM)
Technical Officer
ISO TECH Laboratory

(a division of WEG Co.,Ltd.)

No.19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-640892, 09.73231175, 09.50139891, 01-644338, E-mail: isotechlaboratory@gmail.com, Website: wwg-myanmar.com

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ISO TECH LABORATORY

WTL-RE-001
Issue Date : 01-12-2012
Effective Date : 01-12-2012
Issue No : 1.0(Page 2 of 2)

W0319 868

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	SW - W
Location	Main In Ta Lake
Date and Time of collection	26.3.2019
Date and Time of arrival at Laboratory	26.3.2019
Date and Time of commencing examination	27.3.2019
Date and Time of completing	28.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	25.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_4)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	2.2	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O_3)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Khin Thin Yu
B.Sc (Chemistry)
Sr. Chemist
ISO TECH Laboratory

Approved by
Signature:
Name: Khin Thin Yu
B.E (Civil) (HM)
Technical Officer
ISO TECH Laboratory

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No.19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-640892, 09.73231175, 09.50139891, 01-644338, E-mail: isotechlaboratory@gmail.com, Website: wwg-myanmar.com

ISO TECH LABORATORY

WTL-RD-001

MB519 (09)

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 18

Location: Main In Ya Lake

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 26.3.2019

Date and Time of completing: 27.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	80	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	40	CFU/100ml	Not detected
pH	7.1		6.8 - 8.8
Turbidity	140	NTU	5 NTU
Colour (True)	40	TCU	15 TCU
Free Chlorine	50	mg/l	
Total Chlorine	50	mg/l	

Remark : Unsatisfactory for drinking purpose.

: This certificate is issued only for the receipt of the test sample.

: < - Less than

Tested by — Signature: — Name: — INSTECH Laboratory

Approved by — Signature: — Name: — INSTECH Laboratory

(a Division of WES Co. Ltd.)

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2903389/19
Date: 09/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 26, March ,2019
Sample Brought By : Client
Sample Marking : SW-18
Sample Location : Main Inya Lake
Analysed Date : 26, March ,2019
Lab Code No : 125/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 2540.D.Dried at 103-105 °C	10	mg/L	15.0
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 4500-N_{org}.B Macro Kjeldahl Method	1	mg/L	0.30
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,4500-P.E Ascorbic Acid Method	0.01	mg/L	0.270
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 5210 D & Instruction Manual BOD System Oxidirect (Luminox)	2	mg/L	5
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	65.0

End of Report

MSI (Myanmar) Limited

(Dr. Ko Ko)
Manager

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United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME	YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	E-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	NO.11, ZEEPUTT DUBLE ROAD YANGON MYANMAR		
CONTACT INFORMATION	TEL : (+979 7005173) e-mail : (Toe@guardservice.com)		
SAMPLING SOURCES			
SAMPLE TYPE	SURFACE WATER	RECEIVED DATE	APRIL 9, 2019
SAMPLING DATE	MARCH 26, 2019	ANALYTICAL DATE	APRIL 9-12, 2019
SAMPLING TIME	-	REPORT NO.	2019-UE0851
SAMPLING METHOD	-	WORK NO.	2019-WE0234
SAMPLING BY	CUSTOMER	ANALYSIS NO.	1104E(1) 0011, 1104E(1) 0012
ANALYZED BY	PHYO KHALEMAR YOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1 (TANGAMAKHU)	RESULT 2 (TAMWE MAIN)	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (SM 5310 B)	32.00	7.00	0.50
SAMPLE CONDITION (NOT SUITABLE/CLEAN) (SUITABLE/NOT CLEAN)			SUITABLE/CLEAN	SUITABLE/CLEAN	

SM STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 21ST EDITION, 2011.

RESULT 1 : (MU LA (SMALL BAY TO LAKE))

RESULT 2 : (MU LA (SAME BAY TO LAKE))

Pyae S.

PHYO PYAYT SITTHWAI(THORU)
LABORATORY SUPERVISOR

APRIL 12, 2019

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* REPORTED ANALYSES REFERS TO SUBMITTED SAMPLE ONLY.

1/1

	Operation Department	E-Guard-OD-EQ-F-19 Version :01	Approved by MD On Date: 3/4/2019 Page 5 of 11
e-guard	Environmental Quality Baseline Sampling/Survey Field Notes		

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: KZM, WWZ	Date: 26.3.2019
Location: Main Inn Ya Lake	Time: 8.01 AM
Lat. & Long.: 16°51'5.41"N, 96°11'01.08"E	Instrument: HORIBA
Weather: Sunny	Sample/Location ID: GPS Waypoint no: SW (18) Temperature: 28.8°C Time: 8:02 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (ms/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
18.	6.04	.146	.095	0.1	5.44	16.1	196		1m	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement, Transportation, Time; Preparation.
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Daw Sin Chan Lae

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EFFECTIVE DATE: 22/10/2019



ISO TECH LABORATORY

WTL-RE-001

W/0319 861

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 19

Location: Parami Station (Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 27.3.2019

Date and Time of completing: 29.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

pH	7.1		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	1300	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: — Lab Tech (Tu) — B.Sc (Chemistry) — Dr. Chemist — YTCW Laboratory

Approved by — Signature: — Name: — B.E (Civil) 1996 — Technical Officer — YTCW Laboratory

(a division of WEO Co. Ltd.)

No.19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-640803, 09-73231170, 09-31038851, 01-644008, E-mail: isotechlaboratory@gmail.com, Website: wsg-myanmar.com



ISO TECH LABORATORY

WTL-RE-001

W/0319 861

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 19

Location: Parami Station (Upper Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 27.3.2019

Date and Time of completing: 29.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)	29.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N HO_3)		mg/l	50 mg/l
Chloride (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	0.8	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O_3)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: — Lab Tech (Tu) — B.Sc (Chemistry) — Dr. Chemist — YTCW Laboratory

Approved by — Signature: — Name: — B.E (Civil) 1996 — Technical Officer — YTCW Laboratory

(a division of WEO Co. Ltd.)

No.19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-640803, 09-73231170, 09-31038851, 01-644008, E-mail: isotechlaboratory@gmail.com, Website: wsg-myanmar.com

ISO TECH LABORATORY

WTL-RE-001

MB/319 110

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 19

Location: Parami Station (Upper Stream)

Date and Time of collection: 25.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 26.3.2019

Date and Time of completing: 27.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	80	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	10	CFU/10ml	Not detected
pH	7.1		6.5 - 8.5
Turbidity	1300	NTU	5 NTU
Colour (True)	230	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.

: This certificate is issued only for the receipt of the test sample.

: + - Less than

Tested by — Signature: — Name: — Lab Tech (Tu) — B.Sc (Chemistry) — Dr. Chemist — YTCW Laboratory

Approved by — Signature: — Name: — B.E (Civil) 1996 — Technical Officer — YTCW Laboratory

(a division of WEO Co. Ltd.)

No.19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-640803, 09-73231170, 09-31038851, 01-644008, E-mail: isotechlaboratory@gmail.com, Website: wsg-myanmar.com



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000336/19
Date: 09/04/2019
Page 1 of 1

Sample Described as	: Surface Water
Client Name	: Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	: 26. March .2019
Sample Brought By	: Client
Sample Marking	: SW-19
Sample Location	: Parami Station Upper Stream
Analysed Date	: 29. March .2019
Lab Code No	: 121/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 2540-D Dried at 103-105 °C	20	mg/L	197
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 4500-N_{org} B.Macro Kjeldahl Method	1	mg/L	3.00
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,4500-P E.Ascorbic Acid Method	0.01	mg/L	1.004
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012, 5210 D & Instrument Manual BOD System Oxitherd (Lovibond)	2	mg/L	5
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012,5220 D Closed Reflux, Colorimetric Method	40	mg/L	313

End of Report

SGS (Myanmar) Limited

(Dip.Tn.TI)
Manager

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Unless otherwise stated the results shown in this report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD	8.07	8.62	0.50
SAMPLE CONDITION					
WATER COLOUR/TURBID			YELLOWISH BROWN	YELLOWISH BROWN	

Signature
LABORATORY SUPERVISOR

APRIL 11, 2019

* DO NOT COPY PARTIAL OF THIS ANALYSIS REPORT WITHOUT OFFICIAL APPROVAL.
* REPORTED ANALYSIS RANGES TO SUBMITTED SAMPLE ONLY.

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guard	Operation Department: Environmental Quality Baseline Sampling/Survey Field Notes	E-Guard-OD-EQ-F-10 Version: 01	Approved by MD On: Date: 2/5/2019 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: KTM, WMT	Date: 26.3.2019
Location: Parami Station	Time: 6:56 AM
Lat. & Long: 17°5'5.3"N, 96°9'54.54"E	Instrument: HQ40d
Weather: Sunny	Sample/Location ID: Up Stream GPS Waypoint no: (SWC 09) Temperature: 32.5°C Time: 6:56 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity: EC (mS/cm)	Electrical Conductivity: TDS (g/l)	Electrical Conductivity: Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
19.	6.96	0.05	0.00	0.1	5.09	251	238		7.7	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time, Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives _if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

Copy Document

EFFECTIVE DATE: 02/10/2019

ISO TECH LABORATORY

WTL/RE/001
Issue Date : 01-12-2015
Effective Date : 01-12-2015
Issue No : 1.0/Page 1 of 2

W0319 862

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 20
Location: Parami Station (Down Stream)
Date and Time of collection: 26.3.2019
Date and Time of arrival at Laboratory: 26.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 29.3.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	6.9		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	400	NTU	5 NTU
Conductivity		micro S/cm	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1000 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name:

Approved by
Signature:
Name:

ISO TECH LABORATORY

WTL/RE/001
Issue Date : 01-12-2015
Effective Date : 01-12-2015
Issue No : 1.0/Page 2 of 2

W0319 862

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: SW - 20
Location: Parami Station (Down Stream)
Date and Time of collection: 26.3.2019
Date and Time of arrival at Laboratory: 26.3.2019
Date and Time of commencing examination: 27.3.2019
Date and Time of completing: 29.3.2019

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	26.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	5.9	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	5 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	
Nitrite (NO_2)		mg/l	
Calcium (Ca)		mg/l	
Magnesium (Mg)		mg/l	
Ozone (O_3)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name:

Approved by
Signature:
Name:

ISO TECH LABORATORY

WTL/RF/001

M0319 111

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: SW - 20

Location: Parami Station (Down Stream)

Date and Time of collection: 26.3.2019

Date and Time of arrival at Laboratory: 26.3.2019

Date and Time of commencing examination: 26.3.2019

Date and Time of completing: 27.3.2019

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	50	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	10	CFU/100ml	Not detected
pH	6.8		6.8 - 8.8
Turbidity	400	NTU	5 NTU
Colour (True)	120	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes.

- This certificate is issued only for the receipt of the test sample.
- = Less than

Tested by — Signature — Name

Approved by — Signature — Name

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000356/19
Date: 09/04/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 28. March. 2019
Sample Brought By : Client
Sample Marking : SW-20
Sample Location : Parami Station Down Stream
Analysed Date : 28. March. 2019
Lab Code No. : 122/19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 2540 D.Dried at 103-105 °C	20	mg/L	61.5
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 4500-N_{org} B.Macro Kjeldahl Method	1	mg/L	6.16
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,4500-P E.Ascorbic Acid Method	0.01	mg/L	0.035
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5520B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012, 5210 D & evaluation Manual BOD System Oxidirect (Lovibond)	2	mg/L	6
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	mg/L	33.0

End of Report

MDB (Myanmar) Limited
Director
Manager

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT NAME : YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION
CUSTOMER NAME : E-GUARD ENVIRONMENTAL SERVICE CO., LTD
ADDRESS : NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR
CONTACT INFORMATION : TEL : +9577305270, e-mail : ZSue@guardenvironment.com
SAMPLING SOURCE :
SAMPLE TYPE : SURFACE WATER — RECEIVED DATE : APRIL 4, 2019
SAMPLING DATE : MARCH 26, 2019 — ANALYTICAL DATE : APRIL 4 TO 22, 2019
SAMPLING TIME : — REPORT NO. : 0319-0489E
SAMPLING METHOD : — WORK NO. : 0319-0023H
SAMPLED BY : CUSTOMER — ANALYZED NO. : T1A4/22-26/3 - T1A4/22-26/4
ANALYZED BY : MISS NANG KHAING TOPAN

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1 (TW0319-0023-1)	RESULT 2 (TW0319-0023-2)	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD (SW-5310C)	8.02	8.02	0.50
SAMPLE CONDITION (WATER COLOUR/TURBID/SEDIMENT)			YELLOWISH BROWN	YELLOWISH BROWN	

(1) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22 ND EDITION, 2012

RESULT 1 : ON 14 (ONLINE) STATION (APRIL 07/2019)
RESULT 2 : ON 22 (ONLINE) STATION (APRIL 07/2019)

Signature
(MR) KYAW SOTHIRA(TAZAUNG)
LABORATORY SUPERVISOR
APRIL 22, 2019

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* REPORTED ANALYSIS RAISED TO SUBMITTED SAMPLE ONLY.

	Operation Department: Environmental Quality Baseline Sampling/Survey Field Notes	E-Guard-OD-EQ-F-10 Version 101	Approved by MD On Date: 2/4/2019 Page 5 of 11

Water Quality Baseline Sampling/Survey Field Notes

Surveyor: K.Z.M. SWE	Date: 26.3.2019
Location: Parami Station	Time: 2.13 AM
Lat. & Long.: N 16° 51' 6.46" E 96° 9' 38.06"	Instrument: YSI PDA
Weather: Sunny	Sample/Location ID: GPS Waypoint no: SW C20 Down Stream Temperature: 33.4°C Time: 9:19 AM

Surface/Ground/Effluent Water

Sr. No.	pH	Electrical Conductivity EC (mS/cm)	TDS (g/l)	Salinity (ppt)	DO (mg/l)	Turbidity (NTU)	ORP	Flow Rate (m/sec)	Depth (m)	Remarks
20.	6.48	0.221	0.143	0.1	6.54	200	153		5.21	

Aim of Sampling

- Quality, Consistancy, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

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EFFECTIVE DATE: 01/04/2019



ISO TECH LABORATORY

WTL-RE-001

W0819 284

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: Surface Water
Location: Shwe Lin Ban Creek, Down Stream, Hlaing Thar Yar Township
Date and Time of collection: 8.8.2019
Date and Time of arrival at Laboratory: 8.8.2019
Date and Time of commencing examination: 8.8.2019
Date and Time of completing: 11.8.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
pH	8.8		6.8 - 8.8
Colour (True)	80	TCU	15 TCU
Turbidity	148	NTU	5 NTU
Conductivity		micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as Cl)		mg/l	250 mg/l
Sodium chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1500 mg/l
Total Suspended Solids		mg/l	
Total Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Htoo Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thet, B.E (Civil) 1998, Technical Officer, ISO TECH Laboratory

(a division of WEG Co.,Ltd.)
No.19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-645855, 09-73235171, 09-50236851, 01-644596, E-mail: isotechlaboratory@gmail.com, Website: wag-myanmar.com



ISO TECH LABORATORY

WTL-RE-001

W0819 284

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: Surface Water
Location: Shwe Lin Ban Creek, Down Stream, Hlaing Thar Yar Township
Date and Time of collection: 8.8.2019
Date and Time of arrival at Laboratory: 8.8.2019
Date and Time of commencing examination: 8.8.2019
Date and Time of completing: 11.8.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	25.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)	1.4	mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Htoo Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thet, B.E (Civil) 1998, Technical Officer, ISO TECH Laboratory

(a division of WEG Co.,Ltd.)
No.19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-645855, 09-73235171, 09-50236851, 01-644596, E-mail: isotechlaboratory@gmail.com, Website: wag-myanmar.com



ISO TECH LABORATORY

WTL-RE-001

W0819 822

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: Surface Water
Location: Shwe Lin Ban Creek, Down Stream, Hlaing Thar Yar Township
Date and Time of collection: 8.8.2019
Date and Time of arrival at Laboratory: 8.8.2019
Date and Time of commencing examination: 8.8.2019
Date and Time of completing: 8.8.2019

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	30	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	8	CFU/100ml	Not detected
pH	8.8		6.8 - 8.8
Turbidity	148	NTU	5 NTU
Colour (True)	80	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes.

This certificate is issued only for the receipt of the test sample.

* - Less than

Tested by
Signature:
Name: Zaw Htoo Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thet, B.E (Civil) 1998, Technical Officer, ISO TECH Laboratory

(a division of WEG Co.,Ltd.)
No.19, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
Ph: 01-645855, 09-73235171, 09-50236851, 01-644596, E-mail: isotechlaboratory@gmail.com, Website: wag-myanmar.com



SGS

ORIGINAL

ANALYSIS REPORT

Job Ref: 2008140244
Date: 25/08/2019
Page: 1 of 1

Sample Described as: Surface Water
Client Name: Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date: 08 August 2019
Sample Brought By: Client
Sample Marking: SW
Sample Location: Shwe Lin Pan Creek down stream
Analysed Date: 09 Aug 2019
Lab Code No: SW19

No.	Test Parameter	Method	LOQ	Unit	Result
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017, 2540 D Dried at 103-105 °C	10	mg/L	14.53
2	Total Nitrogen (organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017, $4500-NO_3$ B Nitrate Reduction Method	1	mg/L	2.12
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017,4500-P E Ascorbic Acid Method	0.01	mg/L	0.043
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017,5520 B	5	mg/L	<5
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2012, 5210 B 5-Day BOD Test	5	mg/L	<5
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017,5220 D Closed Reflux, Colorimetric Method	10	mg/L	21.6

End of Report

SGS (Myanmar) Limited
(Nu Nu Yi)
Manager

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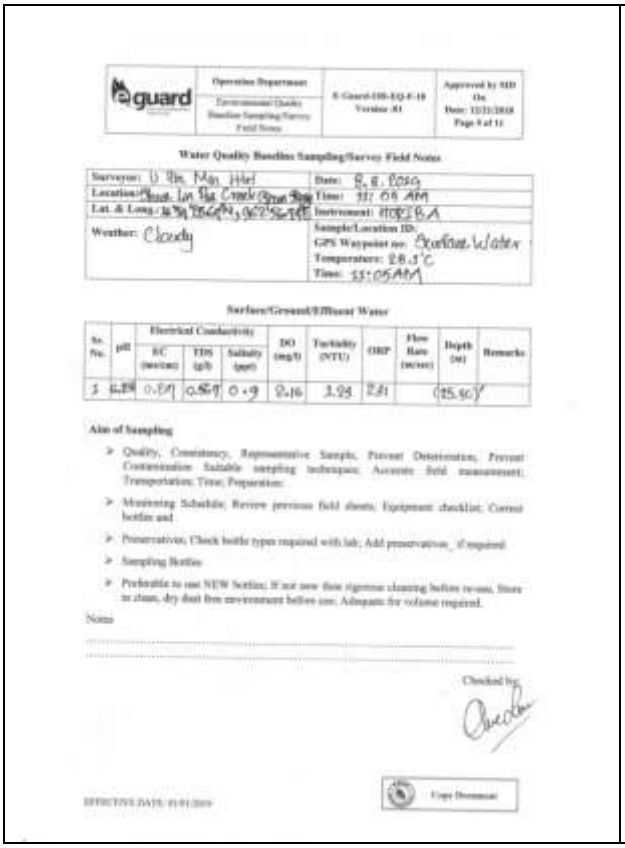


Water Quality Baseline Sampling/Survey Field Notes

Surface/Ground/Effluent Water

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurement; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives, if required.
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT



WATER QUALITY TEST RESULTS FORM



WATER QUALITY TEST RESULTS FORM

Appendix 4 Result of Water Quality Analysis for Wet Season



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2008289/18
Date: 19/10/2018
Page 1 of 1

Sample Described as :	Ground Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	11. October 2018
Sample Brought By	Client
Sample Marking	G-1
Sample Location	Hlaing Thar Yar Railway Station
Analysed Date	11. October 2018
Lab Code No.	178/18

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012, 2540-C Dried at180 ℃	50	4697	mg/L
2	Chloride	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012, 4500-Cl- B Argentometric Method	1	2038	mg/L
3	Iron	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012 3500-Fe B	0.01	2.44	mg/L

End of Report

SGS (Myanmar) Limited
(Na Ni Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY
No.59-C, Nawadar Garden, Yangon-Pathein Road,
Hlaing Thanar Township, Yangon, Republic of the Union of Myanmar
Tel : 01-685276, 685277, 685278, 685279, 685710 Fax : 01-685277

WATER ANALYSIS RESULT

Result Form No.	SWD/ MD / SWDC / 18
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	Hlaing/Thanar Station
Nature of Water	Ground Water - 1
Date of Sample Received	10.10.2018
Tested on	10.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.08	0.0-0.5
Dissolved Oxygen	mg/L	4.2	-

Remark :

Approved By



guard

Operation Department
WQ Quality
Sampling/Survey Field
Note

E Guard-OD-EQ-P-
SS
Version -01

Approved by MD
On
Date: 02/10/2018
Page 1 of 1

Project: YGN - MRT	Date: 05 / 10 / 2018
Client:	Surveyor:
Location: Aqbotwin zone	Time: 10.17 Am
Lat: 16° 52' 44.933" N	Long: 96° 10' 53.518" E
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: GW - 1 GPS Waypoint no: GW - 1 Temperature: 33.0°C Time:
Turbidity by Sushi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

1	6.69	7.90	9.78	4.4	9.13		1000 FT (BNFL)	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Convert bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:



ISO TECH LABORATORY

WTL-RE-001
Issue Date - 01-12-2018
Effective Date - 01-12-2018
Issue No. - 1.0 Page 1 of 2

W1018 251

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 2)
Location	Dagon - Aqar Bus Station
Date and Time of collection	10.10.2018
Date and Time of arrival at Laboratory	10.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	13.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

pH	7.2	6.5 - 8.5
Colour (True)	TCU	15 TCU
Turbidity	NTU	5 NTU
Conductivity	micro Siem	
Total Hardness	mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness	mg/l as $CaCO_3$	
Magnesium Hardness	mg/l as $CaCO_3$	
Total Alkalinity	mg/l as $CaCO_3$	
Phenolphthalein Alkalinity	mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)	mg/l as $CaCO_3$	
Bicarbonate (HCO_3)	mg/l as $CaCO_3$	
Iron	mg/l	0.3 mg/l
Chloride (as Cl_2)	mg/l	250 mg/l
Sodium Chloride (as $NaCl_2$)	mg/l	
Sulphate (as SO_4)	mg/l	500 mg/l
Total Solids	mg/l	1500 mg/l
Suspended Solids	mg/l	
Dissolved Solids	mg/l	1500 mg/l
Manganese	mg/l	0.05 mg/l
Phosphate	mg/l	
Phenolphthalein Acidity	mg/l	
Methyl Orange Acidity	mg/l	
Salinity	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature
Name

Approved by
Signature
Name



ISO TECH LABORATORY

WTL-RD-021
Issue Date : 01.10.2012
Effective Date : 01.10.2012
Issue No. : 1.0/Page 1 of 1

W1608 251

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 2)
Location	Dagon - Aye Bus Station
Date and Time of collection	10.10.2018
Date and Time of arrival at Laboratory	10.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	15.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	ND	mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature
Name
Assistant
ISO TECH Laboratory

Approved by
Signature
Name



SGS

ANALYSIS REPORT ORIGINAL

Job Ref: 2000359/18
Date: 19/10/2018
Page 1 of 1

Sample Described as	Ground Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	11 October 2018
Sample Brought By	Client
Sample Marking	G-2
Sample Location	Dagon Ayaya Nn Way Pyay
Analysed Date	11 October 2018
Lab Code No.	17716

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540-C Dried at 180 °C	50	2708	mg/L
2	Chloride	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-Cl- B Argentometric Method	1	1175	mg/L
3	Iron	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,3500-Fe B	0.01	0.50	mg/L

End of Report

SGS (Myanmar) Limited
(Yu Ye Tu)
Manager

SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY
No.19 (), Nawaday Garden, Yangon (Pathein Road),
Hlaing Thayar Township, Yangon, Republic of the Union of Myanmar
Tel : 01-685570, 685577, 685578, 685710, 685719 Fax : 01-685237

WATER ANALYSIS RESULT

Result Form No	GHU/WD / SWDC / 18
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	[illegible]
Nature of Water	Ground Water - 2
Date of Sample Received	10.10.2018
Tested on	10.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	2.47	0.1~0.5
Dissolved Oxygen	mg/L	4.8	-

Remark :

Approved by

guard

Operation Department — WQ Bowsher, Sampling/Survey Field Sheet — I. Council-ODI-EQ-F-014 Version 01 — Approved by MD On Date: 02/04/2016 Page 2 of 3

Project:	Date: 10/10/2018
Client:	Surveyor:
Location: Dagon Ayaya	Time: 11:40 AM
Lat: 16° 50' 46.932" N	Long: 96° 01' 29.946" E
Evaluation:	Barometer Pressure:
Weather: Cloudy	Sample/Location ID: GPS Waypoint no: GW 2 Temperature: 24.9°C Time: 11:40 AM
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

A	6.42	5.04	5.19	3.71	1.52		18°

Area of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination, Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use; Store in clean, dry dust free environment before use; Adequate for volume required

Notes

Checked by:



ISO TECH LABORATORY

WTL-RE-001

W3618 252

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 3)
Location	Intersection Point Of BOC And Town Tap
Date and Time of collection	10.10.2018
Date and Time of arrival at Laboratory	10.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	10.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

pH	0.7	6.5 - 8.5
Colour (True)	TCU	15 TCU
Turbidity	NTU	5 NTU
Conductivity	micro S/cm	
Total Hardness	mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness	mg/l as $CaCO_3$	
Magnesium Hardness	mg/l as $CaCO_3$	
Total Alkalinity	mg/l as $CaCO_3$	
Phenolphthalein Alkalinity	mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)	mg/l as $CaCO_3$	
Bicarbonate (HCO_3)	mg/l as $CaCO_3$	
Iron	mg/l	0.3 mg/l
Chloride (as Cl_2)	mg/l	200 mg/l
Sodium Chloride (as $NaCl_2$)	mg/l	
Sulphate (as SO_4)	mg/l	500 mg/l
Total Solids	mg/l	1000 mg/l
Suspended Solids	mg/l	
Dissolved Solids	mg/l	1000 mg/l
Manganese	mg/l	0.05 mg/l
Phosphate	mg/l	
Phenolphthalein Acidity	mg/l	
Methyl Orange Acidity	mg/l	
Salinity	pH	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name

Approved by — Signature — Name



ISO TECH LABORATORY

WTL-RE-001

W3618 252

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: Ground Water (Point - 3)
Location: Intersection Point Of BOC And Town Tap
Date and Time of collection: 10.10.2018
Date and Time of arrival at Laboratory: 10.10.2018
Date and Time of commencing examination: 11.10.2018
Date and Time of completing: 10.10.2018

Results of Water Analysis — WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	°C	
Fluoride (F)	mg/l	1.5 mg/l
Lead (as Pb)	mg/l	0.01 mg/l
Arsenic (As)	50 mg/l	0.01 mg/l
Nitrate (N NO_3)	mg/l	50 mg/l
Chlorine (Residual)	mg/l	
Ammonia (NH_3)	mg/l	
Ammonium (NH_4)	mg/l	
Dissolved Oxygen (DO)	mg/l	
Dissolved Oxygen Demand (DOD)	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	mg/l	
Cyanide (CN)	mg/l	0.07 mg/l
Zinc (Zn)	mg/l	3 mg/l
Copper (Cu)	mg/l	3 mg/l
Silica (Si)	mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name

Approved by — Signature — Name



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2008269/18
Date: 19/10/2018
Page 1 of 1

Sample Described as	Ground Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	11. October 2018
Sample Brought By	Client
Sample Marking	D-3
Sample Location	BOC Tomtaw Lab Same
Analysed Date	11. October 2018
Lab Code No.	178/18

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540-C Dried at180 °C	50	2731	mg/L
2	Chloride	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-Cl-B Argentometric Method	1	1318	mg/L
3	Iron	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,3500-Fe B	0.01	0.409	mg/L

End of Report

SGS (Myanmar) Limited
(Nu Nu Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Result Form No.	GMU-WD-1 SWDC / 18
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	BOC (Tomtaw Lab)
Nature of Water	Ground Water - 3
Date of Sample Received	10.10.2018
Tested on	10.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	2.45	0.1-0.5
Dissolved Oxygen	mg/L	4.5	-

Remark :

Approved By

guard

Operator Department: WQ Results Sampling/Survey Field Name

E Guard-GB-EQ-F-008 Version (F)

Approved by MD Qs Date: 02/12/2018 Page 1 of 1

Project: Yangon MRT	Date: 10/10/2018
Client:	Surveyor: U Kaung Tan
Location: BC Tuan Tay Market	Time: 17.09PM
Lat: 16° 58' 18.954" N	Long: 096° 08' 22.453" E
Evaluation:	Barometer Pressure:
Weather: Cloudy	Sample/Location ID: GPS Waypoint no: Skip Temperature: 29.0°C Time:
Turbidity by Sorbi Depth (cm):	
NTU converted from chart:	



Surface/Ground/Effluent Water

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	6.87	4.84	3.11	7.6	2.5		200'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles, If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

ISO TECH LABORATORY

WTL-RE-001 Issue Date : 01-12-2012 Effective Date : 01-12-2012 Issue No. : 1 (Page 1 of 1)

W1018 293



WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 4)
Location	Mee Khwat Market
Date and Time of collection	10.10.2018
Date and Time of arrival at Laboratory	10.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	11.10.2018

Results of Water Analysis — WHO Drinking Water Guideline (Geneva - 1993)

pH	0.0		0.0 - 0.5
Colour (True)		TCU	15 TCU
Turbidity		NTU	0 NTU
Conductivity		micro Siem	
Total Hardness		mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness		mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity		mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)		mg/l as $CaCO_3$	
Bicarbonate (HCO_3)		mg/l as $CaCO_3$	
Iron		mg/l	0.0 mg/l
Chloride (as Cl)		mg/l	200 mg/l
Sodium Chloride (as NaCl)		mg/l	
Sulphate (as SO_4)		mg/l	500 mg/l
Total Solids		mg/l	1000 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate		mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name: Zaw Hein Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature — Name

ISO TECH LABORATORY

WTL-RE-001 Issue Date : 01-12-2012 Effective Date : 01-12-2012 Issue No. : 1 (Page 1 of 1)

W1018 295



WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 4)
Location	Mee Khwat Market
Date and Time of collection	10.10.2018
Date and Time of arrival at Laboratory	10.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	11.10.2018

Results of Water Analysis — WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	50	mg/l	0.01 mg/l
Nitrate (N-NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20°C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name: Zaw Hein Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature — Name

SGS



ANALYSIS REPORT

ORIGINAL

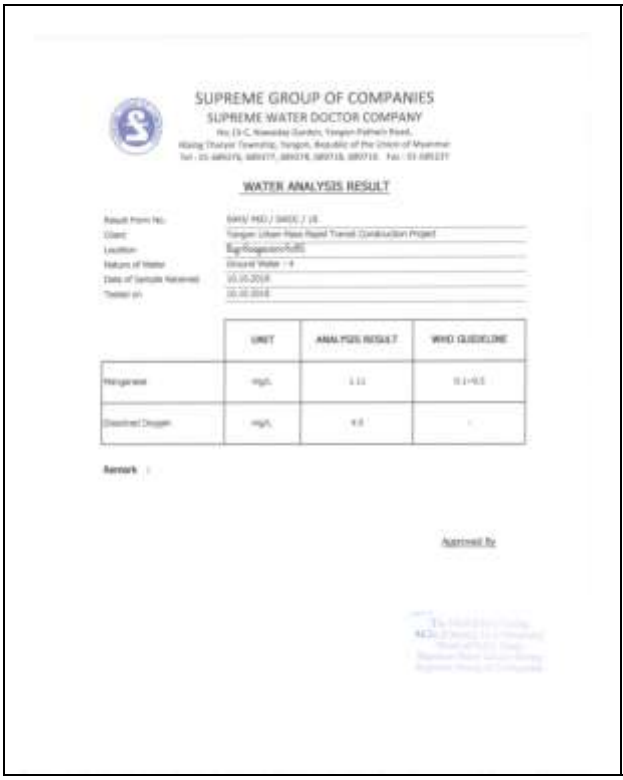
Job Ref: 2000269/18
Date: 19/10/2018
Page 1 of 1

Sample Described as	Ground Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	11. October .2018
Sample Brought By	Client
Sample Marking	D-4
Sample Location	Mee Khwat Zan Hlaw
Analysed Date	11. October .2018
Lab Code No.	170/18

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012, 2540-C Dried at180 °C	50	2502	mg/L
2	Chloride	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012, 4500-Cl-B Argentometric Method	1	1366	mg/L
3	Iron	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed, 2012,3500-Fe B	0.01	1.074	mg/L

End of Report

SGS (Myanmar) Limited
(Ms NE YI)
Manager



SUPREME GROUP OF COMPANIES

SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	1.11	0.1~0.5
Dissolved Oxygen	mg/L	4.8	-

Remark :

Approved By



Aguard

Project: YGN MRT	Date: 10/10/2018
Client:	Surveyor: U Wathy Tun
Location: Mahaut Market	Time: 1151 AM
Lat: 16° 51' 33.959" N	Long: 96° 09' 14.95" E
Evaluation:	Barometer Pressure:
Weather: Cloudy	Sample/Location ID: GW-9 GPS Waypoint no: Temperature: 29°C Time:
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

8.	6.44	4.09	8.01	2.7	5.59	100	

Aim of Sampling

- Quality, Consistency, Representative Sample, Proper Determination, Proper Communication Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use; Store in clean, dry dust free environment before use; Adequate for volume required

Notes

Checked by:



ISO TECH LABORATORY

WTL-RE-001

W1018.304

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 9)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis — WHO Drinking Water Guideline (Geneva - 1993)

pH	6.7	6.5 - 8.5
Colour (True)	TCU	15 TCU
Turbidity	NTU	5 NTU
Conductivity	micro S/cm	
Total Hardness	mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness	mg/l as $CaCO_3$	
Magnesium Hardness	mg/l as $CaCO_3$	
Total Alkalinity	mg/l as $CaCO_3$	
Phenolphthalein Alkalinity	mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)	mg/l as $CaCO_3$	
Bicarbonate (HCO_3)	mg/l as $CaCO_3$	
Iron	mg/l	0.3 mg/l
Chloride (as Cl)	mg/l	250 mg/l
Sodium Chloride (as NaCl)	mg/l	
Sulphate (as SO_4)	mg/l	500 mg/l
Total Solids	mg/l	1500 mg/l
Suspended Solids	mg/l	
Dissolved Solids	mg/l	1000 mg/l
Manganese	mg/l	0.05 mg/l
Phosphate	mg/l	
Phenolphthalein Acidity	mg/l	
Methyl Orange Acidity	mg/l	
Salinity	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name

Approved by — Signature — Name



ISO TECH LABORATORY

WTL-RE-001

W1018.304

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 9)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis — WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chloride (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) 5 days at 20 °C		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silver (Ag)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name

Approved by — Signature — Name



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000271/18
Date: 26/10/2018
Page 1 of 1

Sample Described as : Ground Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 12 October 2018
Sample Brought By : Client
Sample Marking : G-5
Sample Location : Nawaday Intersection Point (Nawaday Housing)
Analysed Date : 15 October 2018

Lab Code No : 193/18

No	Test Parameter	Method	LOQ	Result	Unit
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA AWWA & WEF 22nd ed. 2012, 2540 C (Dried at 180 °C)	10	320	mg/L
2	Chloride	Standard methods for the examination of water & waste water APHA AWWA & WEF 22nd ed. 2012, 4500-Cl- B Argentometric Method	1	118.68	mg/L
3	Iron	Standard methods for the examination of water & waste water APHA AWWA & WEF 22nd ed. 2012,3111C AAS, 3500 AAS, 3113 B	0.01	0.210	mg/L

End of Report

SGS (Myanmar) Limited
(Nu Nu Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Result Form No. : SWD/ RSD / 2000C / 18
Client : Yangon Urban Mass Rapid Transit Construction Project
Location : [illegible]
Nature of Water : Ground Water - G
Date of Sample Received : 11.10.2018
Tested on : 11.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.15	0.1~0.5
Dissolved Oxygen	mg/L	3.7	-

Remark :

Approved By



guard

Operation Department : [illegible]
WQ Section
Sampling Survey Field Data

E-Guard-OD-EQ-F-010 Version-05

Approved by WB Env
Date: 02/4/2018
Page 1 of 1

Project: YUMR - MRT	Date: 11-10-2018
Client:	Surveyor: U Wisum Zaw
Location: [illegible]	Time: 3:08 pm
Lat: 16° 51' 45.30"	Long: 96° 09' 12.05" E
Evaluation:	Barometer Pressure:
Weather:	Sample/Location ID: G5m-Road-S GPS Waypoint no: Temperature: 30°C Time:
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

EAC	0.4640	396	6-9	5-42	3.00

NTU = 0.0 ORP = 180

Aim of Sampling:

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not use thus rigorous cleaning before re-use, Rinse in clean, dry dust free environment before use; Adequate for volume required

Notes

Checked by:



ISO TECH LABORATORY

WTL/WE-001
W1808.365

WATER QUALITY TEST RESULTS FORM

Client : Yangon Urban Mass Rapid Transit Construction Project
Nature of Water : Ground Water (Road - S)
Location : Hlaing Thar Yar Township
Date and Time of collection : 11.10.2018
Date and Time of arrival at Laboratory : 11.10.2018
Date and Time of commencing examination : 12.10.2018
Date and Time of completing : 14.10.2018

Results of Water Analysis		WHO Drinking Water Guideline (Geneva - 1993)
pH	8.4	6.5 - 8.5
Colour (Tcu)	TCU	15 TCU
Turbidity	NTU	5 NTU
Conductivity	micro Siem	
Total Hardness	mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness	mg/l as $CaCO_3$	
Magnesium Hardness	mg/l as $CaCO_3$	
Total Alkalinity	mg/l as $CaCO_3$	
Phenolphthalein Alkalinity	mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)	mg/l as $CaCO_3$	
Bicarbonate (HCO_3)	mg/l as $CaCO_3$	
Iron	mg/l	0.3 mg/l
Chloride (as Cl)	mg/l	250 mg/l
Sodium Chloride (as NaCl)	mg/l	
Sulphate (as SO_4)	mg/l	400 mg/l
Total Solids	mg/l	1500 mg/l
Suspended Solids	mg/l	
Dissolved Solids	mg/l	1000 mg/l
Manganese	mg/l	0.05 mg/l
Phosphate	mg/l	
Phenolphthalein Acidity	mg/l	
Methyl Orange Acidity	mg/l	
Salinity	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

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Approved by
Signature
Name



ISO
LABORATORY

WTL/RE/001

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project
Nature of Water: Ground Water (Pond - 9)
Location: Hlaing Thar Yar Township
Date and Time of collection: 11.10.2018
Date and Time of arrival at Laboratory: 11.10.2018
Date and Time of commencing examination: 12.10.2018
Date and Time of completing: 14.10.2018

Results of Water Analysis

		WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	°C	
Fluoride (F)	mg/l	1.5 mg/l
Lead (as Pb)	mg/l	0.01 mg/l
Arsenic (As)	mg/l	0.01 mg/l
Nitrate ($N-NO_3$)	mg/l	50 mg/l
Chlorine (Residual)	mg/l	
Ammonia (NH_3)	mg/l	
Ammonium (NH_4^+)	mg/l	
Dissolved Oxygen (DO)	mg/l	
Chemical Oxygen Demand (COD)	mg/l	
Biochemical Oxygen Demand (BOD) (3 days at 27 °C)	mg/l	
Cyanide (CN)	mg/l	0.07 mg/l
Zinc (Zn)	mg/l	3 mg/l
Copper (Cu)	mg/l	2 mg/l
Silica (Si)	mg/l	

Remark : This certificate is issued only for the receipt of the test sample.

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Approved by
Signature
Name

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000271/18
Date: 05/10/2018
Page 1 of 1

Sample Described as : Ground Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 12. October. 2018
Sample Brought By : Client
Sample Marking : G-9
Sample Location : FMI Housing
Analysed Date : 15. October. 2018
Lab Code No : 18018

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 C Dried at 180 °C	10	240	mg/L
2	Chloride	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-Cl- B Argentometric Method	1	144.00	mg/L
3	Iron	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,3111 AAS 3500-FeB, 3111 A	0.01	0.065	mg/L

End of Report

SGS (Myanmar) Limited
(Yin Nu Yi)
Manager

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SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY
No.19-C, Nawaday Garden, Yangon-Pathein Road,
Hlaing Thar Yar Township, Yangon, Republic of the Union of Myanmar
Tel: -01-685376, 685377, 685378, 685710, 685711 Fax : 01-685237

WATER ANALYSIS RESULT

Result Form No.
Client: Yangon Urban Mass Rapid Transit Construction Project
Location: FMI
Nature of Water: Ground Water - 9
Date of Sample Received: 12.10.2018
Tested on: 12.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	1.84	0.1~0.5
Dissolved Oxygen	mg/L	3.9	-

Remark :

Approved By



eguard

Operation Department | E-Guard-OD-SO-P-018 Version-01 | Approved by MD On Date: 02/10/2018 Page 1 of 1

Project: YGN MRT	Date: 9.10.2018
Client:	Surveyor: U Nyan Win Htun
Location: FMI - 69.	Time: 2:10 pm.
Lat: 16° 51' 17.619"	Long: 96° 05' 21.652"
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: Grey point-G GPS Waypoint no: Temperature: 35.8°C Time:
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

2.4	6.595	6.955	0-5	9-20		9004

NTU : 66.8 ORP = 247

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination; Suitable sampling technique; Accurate field measurement; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles;
- Preferable to use NEW bottle; If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:



ISO TECH LABORATORY

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 7)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis		WHO Drinking Water Guideline (Geneva - 1993)
pH	8.2	6.8 - 8.5
Colour (True)	TCU	50 TCU
Turbidity	NTU	5 NTU
Conductivity	micro Siem	
Total Hardness	mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness	mg/l as $CaCO_3$	
Magnesium Hardness	mg/l as $CaCO_3$	
Total Alkalinity	mg/l as $CaCO_3$	
Phenolphthalein Alkalinity	mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)	mg/l as $CaCO_3$	
Bicarbonate (HCO_3)	mg/l as $CaCO_3$	
Iron	mg/l	0.3 mg/l
Chloride (as Cl)	mg/l	300 mg/l
Sodium Chloride (as NaCl)	mg/l	
Sulphate (as SO_4)	mg/l	400 mg/l
Total Solids	mg/l	1500 mg/l
Suspended Solids	mg/l	
Dissolved Solids	mg/l	1000 mg/l
Manganese	mg/l	0.05 mg/l
Phosphate	mg/l	
Phenolphthalein Acidity	mg/l	
Methyl Orange Acidity	mg/l	
Calcium	ppm	

Remark : This certificate is issued only for the receipt of the test sample.

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Approved by — Signature / Name



ISO TECH LABORATORY

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Ground Water (Point - 7)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	ND	mg/l	0.01 mg/l
Nitrate (N-NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	5 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark : This certificate is issued only for the receipt of the test sample.

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SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2050271118
Date: 26/10/2018
Page 1 of 1

Sample Described as	Ground Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	12 October 2018
Sample Brought By	Client
Sample Marking	G-7
Sample Location	Thiri Mon Plaza (Yankin Michaelary)
Analysed Date	16 October 2018
Lab Code No	18/016

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Dissolved Solid	Standard methods for the examination of water & waste water, APHA, AWWA & WEF 22nd ed. 2012, 2540.C Dried at 180 °C	20	300	mg/L
2	Chloride	Standard methods for the examination of water & waste water, APHA, AWWA & WEF 22nd ed. 2012, 4500-Cl- B Argentometric Method	1	180.80	mg/L
3	Iron	Standard methods for the examination of water & waste water, APHA, AWWA & WEF 22nd ed. 2012, 3111 Add. 3030 Add. 3010 A	0.01	<0.01	mg/L

End of Report

SGS (Myanmar) Limited
(Tin Ko Ye)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Result From No	ORG/ RSD / SWDC / 18
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	Yan Kin Pagoda(G)
Nature of Water	Ground Water - 7
Date of Sample Received	11.10.2018
Tested on	11.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	1.3	0.1~0.5
Dissolved Oxygen	mg/L	3.7	-

Remark :

Approved By



Project: Yangon MRT

Client:

Location: Yan Kin Monastery

Lat: 16° 51' 35.087"

Evaluation:

Weather: Sunny

Date: 11.10.2018

Surveyor: U Than Zaw

Time: 10:45 A.m.

Long: 96° 06' 25.486"

Barometer Pressure:

Sample/Location ID:

GPS Waypoint no:

Temperature: Bint-67

Time:

Turbidity by Secki Depth (cm):

NTU converted from chart:

Surface/Ground/Effluent Water

	0.45	0.56	0.170	0.5	7.43		2780

Acro/Sampling ODP = 0.2 NTU = 0.0 Temp = 28.4°C

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not use then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:



ISO TECH LABORATORY

WTL-RE-001

Issue Date : 01.10.2013

Effective Date : 01.10.2013

Issue No : 1 of Page 1 of 1

TI 1918.307

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: Ground Water (Point - B)

Location: Hlaing Thar Yar Township

Date and Time of collection: 11.10.2018

Date and Time of arrival at Laboratory: 11.10.2018

Date and Time of commencing examination: 12.10.2018

Date and Time of completing: 14.10.2018

Results of Water Analysis

		WHO Drinking Water Guideline (Geneva - 1993)
pH	6.2	6.5 - 8.5
Colour (True)	TCU	15 TCU
Turbidity	NTU	5 NTU
Conductivity	micro Siem	
Total Hardness	mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness	mg/l as $CaCO_3$	
Magnesium Hardness	mg/l as $CaCO_3$	
Total Alkalinity	mg/l as $CaCO_3$	
Phenolphthalein Alkalinity	mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)	mg/l as $CaCO_3$	
Bicarbonate (HCO_3)	mg/l as $CaCO_3$	
Iron	mg/l	0.3 mg/l
Chloride (as Cl)	mg/l	250 mg/l
Sodium Chloride (as NaCl)	mg/l	
Sulphate (as SO_4)	mg/l	500 mg/l
Total Solids	mg/l	1000 mg/l
Suspended Solids	mg/l	
Dissolved Solids	mg/l	1000 mg/l
Manganese	mg/l	0.05 mg/l
Phosphate	mg/l	
Phenolphthalein Acidity	mg/l	
Methyl Orange Acidity	mg/l	
Salinity	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature

Name

Approved by

Signature

Name



ISO TECH LABORATORY

WTL-RE-001

Issue Date : 01.10.2013

Effective Date : 01.10.2013

Issue No : 1 of Page 2 of 2

TI 1918.307

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: Ground Water (Point - B)

Location: Hlaing Thar Yar Township

Date and Time of collection: 11.10.2018

Date and Time of arrival at Laboratory: 11.10.2018

Date and Time of commencing examination: 12.10.2018

Date and Time of completing: 14.10.2018

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)	Nil	mg/l	0.01 mg/l
Nitrate (NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	3 mg/l
Sulfide (H_2S)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

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Signature

Name

Approved by

Signature

Name



ORIGINAL

SGS

ANALYSIS REPORT

Job Ref: 2000271/18

Date: 26/10/2018

Page 1 of 1

Sample Described as : Ground Water

Client Name : Yangon Urban Mass Rapid Transit Construction Project

Sample Received Date : 12. October. 2018

Sample Brought By : Client

Sample Marking : B-8

Sample Location : Intersection of Parami Road & Insein Road

Analysed Date : 15. October. 2018

Lab Code No : 18018

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Dissolved Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF (2nd ed. 2012) 2540 C Dried at 180 °C	10	80	mg/L
2	Chloride	Standard methods for the examination of water & waste water APHA, AWWA & WEF (2nd ed. 2012) 4500-Cl- B Argentometric Method	1	28.40	mg/L
3	Iron	Standard methods for the examination of water & waste water APHA, AWWA & WEF (2nd ed. 2012) 3111 B, 3500 Fe B, 3111 A	0.01	<0.01	mg/L

End of Report

SGS (Myanmar) Limited

(Ma Mi Yi)

Manager



SUPREME GROUP OF COMPANIES

SUPREME WATER DOCTOR COMPANY

No. 15-C, Alawaddy Garden, Yangon-Pathein Road,
Hlaing Thaiyar Township, Yangon, Republic of the Union of Myanmar
Tel : 01-685076, 685077, 685078, 685719, 685710 Fax : 01-685237

WATER ANALYSIS RESULT

Result Form No.	WSD/ RSD / 0405C / 18
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	[illegible]
Nature of Water	Ground Water - 8
Date of Sample Received	11.10.2018
Tested on	11.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.0	0.1-0.5
Dissolved Oxygen	mg/L	0	-

Remark :

Approved By

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guard



Operation Department | E-Guard-OD-EQ-P-013 Version 03 | Approved by MD On Date 02/04/2014 Page 1 of 1

WQ Monitor Sampling/Survey Field Notes

Project: Yangon MRT	Date: 8-10-2018
Client:	Surveyor: U. Khun Zaw
Location: Downs Road Lowerville	Time: 8:00 Am
Lat: 16°57'30.182"	Long: 96°07'21.621"
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: GPS Waypoint no: Temperature: Time: GW Point 8 Down
Turbidity by Sachi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5.7	0.81	0.098	0.1	4.96		2.00	

NTU = 0.0 ORP = 367 Tem = 26.07

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new than rigorous cleaning before re-use, Store in cities, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:



ISO TECH LABORATORY

WTL-RS-001

W1018 245

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point - 1)
Location	Hlaing Thar Yar Station
Date and Time of collection	10.10.2018
Date and Time of arrival at Laboratory	10.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	11.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)	28.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name: Tun Hsin Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature — Name:



ISO TECH LABORATORY

WTL-RS-001

M1018 003

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point - 1)
Location	Hlaing Thar Yar Station
Date and Time of collection	10.10.2018
Date and Time of arrival at Laboratory	10.10.2018
Date and Time of commencing examination	10.10.2018
Date and Time of completing	11.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	5	CFU/100ml	Not detected
Thermodetected (Recall) Coliform Count	Not detected (+1)	CFU/100ml	Not detected
pH	7.1		6.5 - 8.5
Turbidity	40	NTU	5 NTU
Colour (True)	20	TCU	15 TCU
Free Chlorine	No	mg/l	
Total Chlorine	No	mg/l	

Remark : Unsatisfactory for drinking purposes.

: This certificate is issued only for the receipt of the test sample.

: + - Less than

Tested by — Signature — Name: Tun Hsin Oo, B.Sc (Chemistry), Sr. Chemist, ISO TECH Laboratory

Approved by — Signature — Name:



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2005259/18
Date: 19/10/2018
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 11. October. 2018
Sample Brought By : Client
Sample Marking : S-1
Sample Location : Hlaing Thar Yar Railway Station
Analysed Date : 11. October. 2018

Lab Code No : 171118

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540-D Dried at 103-105 °C	20	36.33	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-N_{org}.B Macro Kjeldahl Method	1	<1	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,4500-P E.Ascorbic Acid Method	0.01	0.004	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 D & Instruction Manual BOD System Oxidirect (Lovibond)	2	5	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	28	mg/L

End of Report

SGS (Myanmar) Limited
(Na Na Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.1	0.1~0.5
Dissolved Oxygen	mg/L	5.2	-

Remark :

Approved By



Unified Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: E-GUARD ENVIRONMENTAL SERVICES CO., LTD.		
ADDRESS	: NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR.		
SAMPLING SOURCE	: HLAING THARYAR RAILWAY STATION		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: OCTOBER 22, 2018
SAMPLING DATE	: OCTOBER 10, 2018	ANALYTICAL DATE	: OCTOBER 23-29, 2018
SAMPLING TIME	: -	REPORT NO.	: 2018-022004
SAMPLING METHOD	: -	WORK NO.	: 2018-007166
SAMPLING BY	: CUSTOMER	ANALYSIS NO.	: T1847000-0001
ANALYZED BY	: MISS KHALAYAMEE YOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L		5.70	0.50
SAMPLE CONDITION				
WATER COLOUR(TCU)			YELLOWISH	
ODOUR			ODOUR	

(a) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22ND EDITION, 2012.

Nilubh Singh
MISS NILAUM SINGH
TECHNICAL MANAGEMENT
NOVEMBER 27, 2018

Piyapat S.
MRS PIYAPAT SUTTAMANOTHAM
LABORATORY SUPERVISOR
NOVEMBER 27, 2018

- AS RECEIVED SAMPLE, AT THE TIME HAS ARRIVED WITHOUT ANY DAMAGE.
- REPORTED ANALYSIS RESULTS TO SUBMITTED SAMPLE ONLY.



e-guard

Operation Department | E-Guard-OD-EQ-F-016 Version :01 | Approved by MD On Date: 02/12/2018 Page 2 of 2

WQ Baseline Sampling/Survey Field Notes

Project: YGN MRT	Date: 10-10-2018
Client:	Surveyor: U Wunna Tun
Location:	Time: 10:45 AM
Lat: 16° 50' 40"+95° N	Long: 96° 00' 06.+95° E
Evaluation:	Barometer Pressure:
Weather: Cloudy	Sample/Location ID: Hlaing Thar Ya Station GPS Waypoint no: Surface water 1 Temperature: 30+5°C Time:
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

2	6.5%	0.14%	0.09%	0.1	9/19		5 mL

0.1ppt (Salinity)

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation.
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:



ISO TECH LABORATORY

WTL-RE-001

W 1018 246

WATER QUALITY TEST RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: Surface Water (Point - 2)

Location: Dagon Ayar - Bus Station

Date and Time of collection: 10.10.2018

Date and Time of arrival at Laboratory: 10.10.2018

Date and Time of commencing examination: 11.10.2018

Date and Time of completing: 13.10.2018

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (T)	23.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) 5 days at 20 °C		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature:

Name:

Approved by

Signature:

Name:



ISO TECH LABORATORY

WTL-RE-001

MD018 004

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client: Yangon Urban Mass Rapid Transit Construction Project

Nature of Water: Surface Water (Point -2)

Location: Dagon Ayar - Bus Station

Date and Time of collection: 10.10.2018

Date and Time of arrival at Laboratory: 10.10.2018

Date and Time of commencing examination: 10.10.2018

Date and Time of completing: 11.10.2018

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Total Coliform Count	4	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	Not detected (<1)	CFU/100ml	Not detected
pH	6.9		6.5 - 8.5
Turbidity	2H	NTU	5 NTU
Colour (True)	10	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.

(This certificate is issued only for the receipt of the test sample.

(H - Less than

Tested by

Signature:

Name:

Approved by

Signature:

Name:



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 3000288018
Date: 19/10/2018
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 11 October 2018
Sample Brought By : Client
Sample Marking : S-2
Sample Location : Dagon Ayeyar Ah Way Pyay
Analysed Date : 11 October 2018

Lab Code No. : 172/18

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 2540-D Dried at 103-105 °C	20	23.33	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 4500-N_{org} B Macro Kjeldahl Method	1	<1	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	0.023	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012, 5210 D & Instruction Manual BOD-System Oxidirect (Lovibond)	2	6	mg/L
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	28	mg/L

End of Report

SGS (Myanmar) Limited



SUPREME GROUP OF COMPANIES

SUPREME WATER DOCTOR COMPANY

No.(1)-C, Nawaday Garden, Yangon-Pathein Road,
Hlaing Thanyar Township, Yangon, Republic of the Union of Myanmar
Tel : 01-685535, 685577, 685578, 685710, 685715 Fax : 01-685237

WATER ANALYSIS RESULT

Result Form No. : SWD/ PRO / 0800 / 18

Client : Yangon Urban Mass Rapid Transit Construction Project

Location : Myaynigone(S)

Nature of Water : Surface Water - 2

Date of Sample Received : 10.10.2018

Tested on : 10.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.41	0.1~0.5
Dissolved Oxygen	mg/L	4.7	-

Remark :

Approved By

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: E-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	: NO.11, AIRPORT AVENUE, ROAD, YANGON, MYANMAR.		
SAMPLING SOURCE	: DAGONAYTAR HUMMAY STATION		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: OCTOBER 22, 2018
SAMPLING DATE	: OCTOBER 10, 2018	ANALYTICAL DATE	: OCTOBER 22-28, 2018
SAMPLING TIME	: ---	REPORT NO.	:
SAMPLING METHOD	: ---	WORK NO.	:
SAMPLING BY	: CUSTOMER	ANA. FEE NO.	:
ANALYSED BY	:		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD	4.08	0.05
SAMPLE CONDITION				
WATER COLOUR/FLAVOUR			YELLOWISH CLAY	
REMARKS			BROWN	

Wubatta Siraha
ANALYST
TECHNICAL MANAGEMENT
NOVEMBER 21, 2018

Piyanat S.
LABORATORY SUPERVISOR
NOVEMBER 21, 2018

- DO NOT COPY PARTIAL OF THIS ANALYSIS REPORT WITHOUT OFFICIAL APPROVAL.
- ANALYSIS WAS ONLY REFERS TO SUBMITTED SAMPLE ONLY.

E-guard

Operation Department: E-Guard-QS-EQ-F-010 Version: 03 Approved by MD On Date: 01/04/2016 Page 1 of 1

Water Quality Monitoring Sampling/Survey Field Notes

Project: YUMP - MRT	Date: 10/10/2018
Client:	Surveyor:
Location: Dagon Myothit	Time: 11:00 AM
Lat: N 16° 52' 44.488"	Long: 096° 21' 28.023" E
Evaluation:	Barometer Pressure:
Weather: Cloudy	Sample/Location ID: GPS Waypoint as: BH 2 Temperature: 30.4°C Time: 11:00 AM
Turbidity by Secchi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

S	9.01	0.015	0.14	0.1	4.52	10	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes:

Checked by:

ISO TECH LABORATORY

WTL-RE-001

W1018 247

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point - 3)
Location	Intersection Point 23 BOC And Twaw Tay
Date and Time of collection	10.10.2018
Date and Time of arrival at Laboratory	10.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	15.10.2018

Results of Water Analysis — WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	30.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH3)		mg/l	
Ammonium (NH4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Saw Htoo Htoo, B.Sc (Chemistry), Sr. Chemist, ISO 17025 Laboratory

Approved by — Signature: — Name:

ISO TECH LABORATORY

WTL-RE-001

M1018 005

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point - 3)
Location	Intersection Point 23 BOC And Twaw Tay
Date and Time of collection	10.10.2018
Date and Time of arrival at Laboratory	10.10.2018
Date and Time of commencing examination	10.10.2018
Date and Time of completing	11.10.2018

Results of Water Analysis — WHO Drinking Water Guideline (Geneva - 1993)

Total Coliform Count	0	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	Not detected (<1)	CFU/100ml	Not detected
pH	6.8		6.5 - 8.5
Turbidity	20	NTU	5 NTU
Colour (True)	10	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark - Unsatisfactory for drinking purposes.

- This certificate is issued only for the receipt of the test sample.
- < - Less than

Tested by — Signature: — Name: Saw Htoo Htoo, B.Sc (Chemistry), Sr. Chemist, ISO 17025 Laboratory

Approved by — Signature: — Name:



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2002281/18
Date: 19/11/2018
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 11 October 2018
Sample Brought By : Client
Sample Marking : S-3
Sample Location : BOC Tomtae Lan Sone
Analysed Date : 11 October 2018

Lab Code No. : 172/18

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540-D Dried at 103-105 °C	20	34.33	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-NH_3 B Macro Kjeldahl Method	1	1.82	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	1.068	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 D & Instrution Manual BOD System OxiDirect (Lovibond)	2	5	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	40	mg/L

End of Report



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Result Form No. : SWD/PRO / SWDC / 18
Client : Yangon Urban Mass Rapid Transit Construction Project
Location : BOC (Commercial)
Nature of Water : Surface Water - 3
Date of Sample Received : 10.10.2018
Tested on : 10.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.3	0.1~0.5
Dissolved Oxygen	mg/L	3.3	-

Remark :

Approved By



Unified Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	D-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR		
SAMPLING SOURCE	BOC TOMTAE JUNCTION		
SAMPLE TYPE	SURFACE WATER	RECEIVED DATE	OCTOBER 10, 2018
SAMPLING DATE	OCTOBER 10, 2018	ANALYTICAL DATE	OCTOBER 22-30, 2018
SAMPLING TIME	-	REPORT NO.	2018-U2800
SAMPLING METHOD	-	WORK NO.	2018-001164
SAMPLING BY	CUSTOMER	ANALYSIS NO.	1164/18B-0004
ANALYZED BY	MAE KAMLA-HARE TOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT (1164/18B-0004)	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	NON-DISPERSIVE INFRARED METHOD	11.66	0.50
SAMPLE CONDITION				
WATER COLOUR/APPEARANCE			YELLOW/CLEAR	
ODOUR/SMELL			ALGAE	

(a) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22nd EDITION, 2012

Wilbith Singh
(MISS WILAILAK SRISUK)
TECHNICAL MANAGEMENT
NOVEMBER 21, 2018

Sypat S.
(MRS PIYARAT SUTTAMANTRONG)
LABORATORY SUPERVISOR
NOVEMBER 21, 2018

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- RESULTS ONLY FOR ABOVE TESTED SAMPLE ONLY.



eguard

Operation Department
WQ Routine Sampling Survey Field Notes

E Guard-OD-EQ-F-010
Version 00

Approved by MD
On
Date: 02/24/2016
Page 2 of 2

Project: Yangon MRT	Date: 10/10/2018
Client:	Surveyor: Ko Khaing Zaw
Location: BOC Tomtae Jun 400m N	Time: 12:05 PM
Lat: 16°50' 16.439" N	Long: 96° 07' 09.5"
Evaluation:	Barometer Pressure:
Weather: Cloudy	Sample/Location ID: GPS Waypoint no: Sw 3 Temperature: 28.4°C Time:
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

5	5.09	0.498	0.362	0.4	1.46		10'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use; Store in clean, dry dust free environment before use; Adequate for volume required

Notes

Checked by:



ISO TECH LABORATORY

WTL/RE-024

W1018 248

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point - 4)
Location	Mee Khwet Market
Date and Time of collection	10.10.2018
Date and Time of arrival at Laboratory	10.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)	25.5	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH3)		mg/l	
Ammonium (NH4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Mercury (Hg)		mg/l	

Remark : This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name — Zaw Moe Oo, B.Sc (Chemistry), M.Sc (Chemistry), ISO TECH Laboratory

Approved by — Signature — Name



ISO TECH LABORATORY

WTL/RE-081

M1018 006

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point -4)
Location	Mee Khwet Market
Date and Time of collection	10.10.2018
Date and Time of arrival at Laboratory	10.10.2018
Date and Time of commencing examination	10.10.2018
Date and Time of completing	11.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	20	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	1	CFU/100ml	Not detected
pH	7.1		6.5 - 8.5
Turbidity	4.6	NTU	5 NTU
Colour (True)	40	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes.

(This certificate is issued only for the receipt of the test sample.

(+) Less than

Tested by — Signature — Name — Zaw Moe Oo, B.Sc (Chemistry), M.Sc (Chemistry), ISO TECH Laboratory

Approved by — Signature — Name



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000359/18
Date: 16/10/2018
Page 1 of 1

Sample Described as :	Surface Water
Client Name :	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date :	11. October. 2018
Sample Brought By :	Client
Sample Marking :	S-4
Sample Location :	Mee Khwet Zoe Hlaie
Analysed Date :	11. October. 2018
Lab Code No. :	174/18

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 D Dried at 103-105 °C	20	33.67	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-N_{org} B Macro Kjeldahl Method	1	1.68	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	1.454	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF,22nd ed. 2012, 5210 D & manuction Manual BOD System Oxidirect (Lovibond)	2	12	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012 5220 D Closed Reflux, Colorimetric Method	10	69	mg/L

End of Report



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY
No.13-C, Nawaday Garden, Yangon-Pathein Road,
Waing Thanye Township, Yangon, Republic of the Union of Myanmar
Tel - 01-685372, 685377, 685378, 685710, 685715 Fax - 01-685237

WATER ANALYSIS RESULT

Result From No.	SWC/ RE/ / SWDC / 18
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	[illegible]
Nature of Water	Surface Water - 4
Date of Sample Received	10.10.2018
Tested on	10.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.07	0.1-0.5
Dissolved Oxygen	mg/L	3.1	-

Remark :

Approved By

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: M-WARE ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	: NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR.		
SAMPLING SOURCE	: MIN KHAT MARKET BELOW THE TOP		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: OCTOBER 22, 2018
SAMPLING DATE	: OCTOBER 18, 2018	ANALYTICAL DATE	: OCTOBER 22-28, 2018
SAMPLING TIME	: -	REPORT NO.	: 2018-U0393
SAMPLING METHOD	: -	WORK NO.	: 2018-W0749
SAMPLING BY	: CUSTOMER	ANALYSIS NO.	: T1807B0.0003
ANALYZED BY	: MISS SANDAR HAMZ YOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT (M TYANTHARI MIN)	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD	1.93	0.25
SAMPLE CONDITION				
WATER'S COLOUR/TYPE			YELLOW/CLEAR	
ODOUR			NEGAN	

(M) : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23rd EDITION, 2017

MISS YOUNSAN (BSC(UK))
TECHNICAL MANAGEMENT
NOVEMBER 27, 2018

MISS PANRAT SUTTHANUTHONG
LABORATORY SUPERVISOR
NOVEMBER 27, 2018

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- REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.

E-guard

Operation Department — WQ Baseline Sampling/Survey Field Notes

E Guard-OD-EQ-F-016 Version 01

Approved by MD On Date: 03/04/2018 Page 2 of 3

Project: YCDP-MRT	Date: 30/10/2018
Client:	Surveyor:
Location: Min Khat Market	Time: 1:45 PM
Lat: 16°51' 50.910"	Long: 96° 08' 18.926"
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: GPS Waypoint no: MK-A Temperature: 28.9°C Time:
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

1	9:44	1.97	5.26	1	5.06		35

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use; Store in clean, dry dust free environment before use; Adequate for volume required

Notes

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Checked by:

ISO TECH LABORATORY

WTL-RE-001

W1018 249

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point - 5)
Location	Nr Ma Day Intersection Point (Ma Ma Day Housing)
Date and Time of collection	18.10.2018
Date and Time of arrival at Laboratory	18.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	13.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (T)	22.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chloride (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) 5 days at 20 °C		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: Daw Khin Ohn, B.Sc (Chemistry), No. 1 Chemist, ISO TECH Laboratory

Approved by — Signature: — Name:

ISO TECH LABORATORY

WTL-RE-001

M1018 007

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point -5)
Location	Nr Ma Day Intersection Point (Ma Ma Day Housing)
Date and Time of collection	18.10.2018
Date and Time of arrival at Laboratory	18.10.2018
Date and Time of commencing examination	18.10.2018
Date and Time of completing	11.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	10	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	1	CFU/100ml	Not detected
pH	7.0		6.5 - 8.5
Turbidity	50	NTU	5 NTU
Colour (True)	35	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.

: This certificate is issued only for the receipt of the test sample.

: < - Less than

Tested by — Signature: — Name: Daw Thwe Zin, B.Sc (Chemistry), No. 2 Chemist, ISO TECH Laboratory

Approved by — Signature: — Name:



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 20082019
Date: 10/13/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 11. October 2019
Sample Brought By : Client
Sample Marking : D-E
Sample Location : Nawaday Complex Hlaing
Analysed Date : 11. October 2019

Lab Code No. : 170119

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012. 2540-D Dried at 103-105 °C	20	34.33	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012. 4500-N_{org} B Macro Kjeldahl Method	1	3.36	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012.4500-P E Ascorbic Acid Method	0.01	1.209	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012.5520B	5	5.02	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012. 5210 D & Instruction Manual BOD System Oxidirect (Ludzack)	2	13	mg/L
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012.5220 D Closed Reflux, Colorimetric Method	10	68	mg/L

End of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Result Form No. : SWD PRO / SWDC / 19
Client : Yangon Urban Mass Rapid Transit Construction Project
Location :
Nature of Water : Surface Water - E
Date of Sample Received : 10.10.2019
Tested on : 10.10.2019

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.01	0.1~0.5
Dissolved Oxygen	mg/L	5	-

Remark :

Approved By



UAE

United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Prakhanong, Bangkok 10260
Tel: 0 2763 3509 Fax: 0 2763 3509 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: E-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	: NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR.		
SAMPLING SOURCE	: MAHAGAY GARDEN		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: OCTOBER 22, 2019
SAMPLING DATE	: OCTOBER 10, 2019	ANALYTICAL DATE	: OCTOBER 22-28, 2019
SAMPLING TIME	: -	REPORT NO.	: 2019-U0020
SAMPLING METHOD	: -	WORK NO.	: 2019-W0148
SAMPLING BY	: CUSTOMER	ANALYSIS NO.	: 1192019-0020
ANALYZED BY	: MISS KHALAYAMEE YOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	DETECTION LIMIT
TOTAL VOLATILE SOLIDS	mg/L	103-105°C DRY TEMPERATURE BY COMBUSTION METHOD	3.91	1.00
SAMPLE CONDITION				
WATER COLOUR CONDITION			YELLOWISH GRAY	
ODOUR			ALGAE	

Nikhilesh Singh
(MISS NIKHILESH SINGH)
TECHNICAL MANAGEMENT
NOVEMBER 21, 2019

Piyanat S.
(MRS PIYANAT SUTTHIWANICHAKUL)
LABORATORY SUPERVISOR
NOVEMBER 21, 2019

- DO NOT COPY PARTIALLY OR THIS WHOLE FORM WITHOUT OFFICIAL APPROVAL.
- RESULTS SHALL BE REFERS TO SUBMITTED SAMPLE ONLY.



eguard

Operation Department	E Guard-QS-SQ-F-010	Approved by MD On
WQ Routine Sampling/Survey Field Note	Version :01	Date: 01/Jul/2014 Page 1 of 2

Project: YUMA MRT	Date: 10/10/2019
Client:	Surveyor: U Myint... Htay
Location: Nawaday Wharf	Time: 9:32 PM
Lat: 16°51' 42.1780" N	Long: 96° 04' 08.818" E
Evaluation:	Barometer Pressure:
Weather: Cloudy	Sample/Location ID: GPS Waypoint no: No. 5 Temperature: 28.9°C Time:
Turbidity by Secchi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

9	6.45	5.Mar[illegible]	1.61	1.41	3.48	8'	

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use; Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

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.....

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Checked by:

ISO TECH LABORATORY

WTL-RE-001

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (6)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)	20.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark : This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name

Approved by — Signature — Name

ISO TECH LABORATORY

WTL-RE-001

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point 6)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	10	CFU/100ml	Not detected
Thermotolerant Bacteria Coliform Count	2	CFU/100ml	Not detected
pH	7.8		6.5 - 8.5
Turbidity	80	NTU	5 NTU
Colour (True)	30	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purpose.
: This certificate is issued only for the receipt of the test sample.
: < - Less than

Tested by — Signature — Name

Approved by — Signature — Name

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000271/18
Date: 26/10/2018
Page 1 of 1

Sample Described as :	Surface Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	12. October 2018
Sample Brought By	Client
Sample Marking	0.6
Sample Location	FMI Housing
Analysed Date	15. October 2018
Lab Code No	185/18

No	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 D Dried at 103-105 °C	20	18	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-N_{Org} B Macro Kjeldahl Method	1	<1	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-P E Ascorbic Acid Method	0.01	0.100	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 D & Instruction Manual BOD System Gradient (Lumitech)	5	5	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5220 D Closed Reflux, Colorimetric Method	15	20	mg/L

End of Report

SGS (Myanmar) Limited
(Na Na Yi)
Manager

SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY
No.19-C, Ramadey Garden, Yangon-Pathein Road,
Hlaing Thayar Township, Yangon, Republic of the Union of Myanmar
Tel : 01-685376, 685377, 685378, 685718, 685719 Fax : 01-685237

WATER ANALYSIS RESULT

Result Form No	DBW/ PEL / SWDC / 18
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	FMI
Nature of Water	Surface Water - 6
Date of Sample Received	11.10.2018
Tested on	11.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	4.3	0.38	0.1-0.5
Dissolved Oxygen	mg/L	4.0	-

Remark :

Approved By

Unified Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT (Green Route)		
CUSTOMER NAME	: E-GUARD ENVIRONMENTAL SERVICES CO., LTD.		
ADDRESS	: NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR		
SAMPLING SOURCE	: UPC		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: OCTOBER 12, 2018
SAMPLING DATE	: OCTOBER 11, 2018	ANALYTICAL DATE	: OCTOBER 22-26, 2018
SAMPLING TIME	: -	REPORT NO.	: 2018-0220(W)
SAMPLING METHOD	: -	WORK NO.	: 2018-0221(I)
SAMPLING BY	: CUSTOMER	ANALYSIS NO.	: 1134(F)(W)-0001
ANALYSIS BY	: MISS KHALAYAMEE YOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT IN TOKEPAN-0001	DETECTION LIMIT
TOTAL VOLUME CARRIED	mg/L	WEIGHT REMAINED AFTER EVAPORATION METHOD	0.01	0.01
SAMPLE CONDITION				
WATER'S COLOUR/FLAVOR			YELLOW/CLEAR	
ODOR(S)			Normal	

(a) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22nd EDITION, 2012

Nicholas Singh
(MISS KHALAYAMEE YOTHA)
TECHNICAL MANAGEMENT
NOVEMBER 21, 2018

Pyae S.
(MRS PYAYAT SUTTAMANTAWAN)
LABORATORY SUPERVISOR
NOVEMBER 21, 2018

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E-guard

Operation Department: E-Guard-OD-EQ-F-010 Version: 01 Approved by MD On Date: 01/04/2016 Page 1 of 1

Water Quality Monitoring Sampling/Survey Field Notes

Project: YUMI - MRT	Date: 11.10.2018
Client:	Surveyor: U Soe Zaw
Location: Hlaing Creek	Time: 2.30 pm
Lat: 16°51'14.955"	Long: 96°05'22.289"
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: SW Point-6 GPS Waypoint no: Temperature: 30.6°C Time:
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

9.12	0.210	mg	0.1	8.33	1.5m

NTU = 17.2 ORP = 115

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation;
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use HDW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

ISO TECH LABORATORY

WTL-RE-001

W 1818 290

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (T)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	28.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH3)		mg/l	
Ammonium (NH4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Mirex (Mi)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature
Name
ISO TECH Laboratory

Approved by
Signature
Name
ISO TECH Laboratory

ISO TECH LABORATORY

WTL-RE-001

M1818 011

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point-1)
Location	Hlaing Small Creek - Down Stream
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	14	CFU/100ml	Not detected
Thermotolerant (fecal)-Coliform Count	2	CFU/100ml	Not detected
pH	7.0		6.5 - 8.5
Turbidity	103	NTU	5 NTU
Colour (True)	90	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes

: This certificate is issued only for the receipt of the test sample.

: < - Less than

Tested by
Signature
Name
ISO TECH Laboratory

Approved by
Signature
Name
ISO TECH Laboratory

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2060271118
Date: 26/10/2018
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 12. October. 2018
Sample Brought By : Client
Sample Marking : S-7
Sample Location : Hlaing Small Creek (downstream)
Analysed Date : 15. October. 2018

Lab Code No. : 181118

No.	Test Parameter	Method	LOD	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 D Dried at 103-105 °C	10	309.01	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-NH_3 B Macro Kjeldahl Method	1	5.6	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,4500-P B Aeration And Method	0.01	0.632	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 B & Instruction Manual BOD System (Oxidirect-6 protocol)	2	13	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	20	mg/L

End of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

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SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.87	0.1-0.5
Dissolved Oxygen	mg/L	4.4	-

Remark :

Approved By

United Analyst and Engineering Consultant Co., Ltd.
5 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Tel. 0 2393 3808 Fax 0 2393 3800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: E-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	: NO (1), AIRPORT AVENUE ROAD, YANGON, MYANMAR		
SAMPLING SOURCE	: HLAING SMALL CREEK (DOWN) STREAM		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: OCTOBER 22, 2018
SAMPLED DATE	: OCTOBER 11, 2018	ANALYTICAL DATE	: OCTOBER 22-26, 2018
SAMPLING TIME	: -	REPORT NO.	: 2018-U0284
SAMPLING METHOD	: -	WORK NO.	: 2018-0271(1)
SAMPLED BY	: CUSTOMER	ANALYSIS NO.	: 1134/2018-0282,1134/2018-0283
ANALYZED BY	: MISS SHILA HTWE TOTHU		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		DETECTION LIMIT
			S1 1134/2018-0282	S2 1134/2018-0283	
TOTAL COLIFORM (MPN)	mpn	MULTIPLE TUBE FERMENTATION TECHNIQUE	4.60	4.11	0.00
SAMPLE CONDITION					
WATER COLOUR/FLAVOUR			YELLOW/TASTELESS	YELLOW/TASTELESS	
REMARKS			WATER	ABOVE	

(a) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23RD EDITION, 2017

Nebatte Sisak
(MISS NEBATTE SISAK)
TECHNICAL MANAGEMENT
NOVEMBER 01, 2018

Byamkondo S.
(MR. BYAMKONDO SUTTHAKAUTHORN)
LABORATORY SUPERVISOR
NOVEMBER 01, 2018

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- RESULTS ONLY FOR REFERS TO SUBMITTED SAMPLE ONLY.

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eguard

Operation Department	E-Guard-QD-EQ-P-016 Version :01	Approved by MD On : Date: 02/10/2018 Page 1 of 1
WQ Baseline Sampling/Survey Field Notes		

Project: Yangon MRT	Date: 11.10.2018
Client:	Surveyor: Khin Zaw Min
Location: Hlaing Small Creek	Time: 10:45
Lab: 18-61-17-236	Long: 96°06'01.478
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: SW (at = River Temperature) GPS Waypoint no: Temperature: 29.2°C - Right Time:
Turbidity by Secchi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

7.65	0.46	0.206	0.1	2.55	2.6m	

mV = 46.2 ORP = 202

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required

Notes

Checked by:



ISO TECH LABORATORY

WTL-RE-001

W1018 291

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (B)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis — **WHO Drinking Water Guidelines (Geneva - 1993)**

Temperature (°C)	28.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silver (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature: — Name: — ISO TECH Laboratory

Approved by — Signature: — Name: — ISO TECH Laboratory

ISO TECH LABORATORY

WTL-RE-001

M1019 012

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point-B)
Location	Hlaing Small Creek - Drain Stream
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis — **WHO Drinking Water Guidelines (Geneva - 1993)**

Total Coliform Count	16	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	4	CFU/100ml	Not detected
pH	7.5		6.5 - 8.5
Turbidity	130	NTU	5 NTU
Colour (True)	80	TCU	15 TCU
Free Chlorine	90	mg/l	
Total Chlorine	90	mg/l	

Remark: Unsatisfactory for drinking purposes.
This certificate is issued only for the receipt of the test sample.
* - Less than

Tested by — Signature: — Name: — ISO TECH Laboratory

Approved by — Signature: — Name:



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000271/18
Date: 20/10/2018
Page 1 of 1

Sample Described as	Surface Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	12 October 2018
Sample Brought By	Client
Sample Marking	B-B
Sample Location	Hlaing Small Creek (downstream)
Analysed Date	15 October 2018
Lab Code No	162118

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF (2nd ed. 2012, 2540 D Dried at 100-105 °C)	20	215.67	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF (2nd ed. 2012, 4500-N_{Org} B Macro Kjeldahl Method)	1	8.16	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF (2nd ed. 2012,4500-P B Ascorbic Acid Method)	0.01	0.148	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF (2nd ed. 2012,5520B)	5	16	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF (2nd ed. 2012, 5210 D & Instruction Manual BOD System (Indirect Locations)	2	7	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF (2nd ed. 2012,5220 D Closed Reflux, Colorimetric Method)	10	12	mg/L

End of Report

SGS (Myanmar) Limited

(Yin Hu Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Result Form No	[illegible]
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	Hlaing Small Creek up Stream
Nature of Water	Surface Water - B
Date of Sample Received	11.10.2018
Tested on	11.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.05	0.1-0.5
Dissolved Oxygen	mg/L	*	-

Remark:

Approved by

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION
CUSTOMER NAME	: E-GUARD ENVIRONMENTAL SERVICE CO., LTD.
ADDRESS	: NO (1), AIRPORT AVENUE ROAD, YANGON, MYANMAR
SAMPLING SOURCE	: HLAING SMALL CREEK (CHIN-KYAW) STREAM
SAMPLE TYPE	: SURFACE WATER
SAMPLING DATE	: OCTOBER 11, 2018
SAMPLING TIME	: -
SAMPLING METHOD	: -
SAMPLING BY	: CUSTOMER
ANALYSIS BY	: MISS SHILA HTWE TUTHA
RECEIVED DATE	: OCTOBER 12, 2018
ANALYTICAL DATE	: OCTOBER 12-18, 2018
REPORT NO.	: 2018-U0234
WORK NO.	: 2018-W0210
ANALYSIS NO.	: 1134/18(W)-0002,1134/18(W)-0003

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT (1) TEMPERATURE	RESULT (2) TEMPERATURE	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD	4.89	5.11	0.05
SAMPLE CONDITION					
WATER'S COLOUR FORMED			YELLOWISH BROWN	YELLOWISH BROWN	
REMARKS			WATER	WATER	

(1) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, 24TH EDITION, 2017

MISS WUNNA SHWE (SHWE)
TECHNICAL MANAGEMENT
NOVEMBER 21, 2018

MRS PYAIRY SUTTHANAYTHONG
LABORATORY SUPERVISOR
NOVEMBER 21, 2018

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- RESULTS ONLY FOR SAMPLES TO SUBMITTED SAMPLE ONLY.

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e-guard

Operation Department: WQ Baseline Sampling/Survey Field Notes | E-Guard-OD-SQ-F-018 Version :01 | Approved by MD On : Date: 01/5/2018 Page 2 of 3

Project: Yangon MRT	Date: 10 10 2018
Client:	Surveyor: Khin Zaw Myint
Location: Hlaing Small Creek	Time: 12:30 pm
Lat: 16°51' 18.222	Long: 96°06' 01.988
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: GPS Waypoint as: SW 5m - 2 (D) Temperature: 27.7°C Right Time:
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

6.57	0.108	0.116	0.1	5.85	AM	

NW = 5P3 CAP - 023

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use; Adequate for volume required

Notes

Checked by:

ISO TECH LABORATORY

WTL-RE-001

W 1618 282

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (D)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis — WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	23.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH3)		mg/l	
Ammonium (NH4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l

ISO TECH LABORATORY

WTL-RE-001

M1618 013

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point -B)
Location	Hlaing Small Creek - Down Stream
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis — WHO Drinking Water Guideline (Geneva - 1993)

Total Coliform Count	10	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	2	CFU/100ml	Not detected
pH	7.4		6.5 - 8.5
Turbidity	1.64	NTU	5 NTU
Colour (True)	20	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2060271/18
Date: 26/10/2018
Page 1 of 1

Sample Described as	Surface Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	12. October. 2018
Sample Brought By	Client
Sample Marking	S-9
Sample Location	Hlaing Small Creek (downstream)
Analysed Date	16. October. 2018
Lab Code No.	183/18

No.	Test Parameter	Method	LOD	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 D Dried at 103-105 °C	20	353	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-N_{org} B Macro Kjeldahl Method	1	8.16	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water, APHA, AWWA & WEF 22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	0.661	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 D & Instrution Manual,OXITOP System (Undiluted condition)	2	14	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	31	mg/L

End of Report

YOE Enterprise Limited



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.07	0.1-0.5
Dissolved Oxygen	mg/L	4.4	-

Remark :

Approved By



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	E-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR		
SAMPLING SOURCE	HLAING SMALL CREEK (DOWN STREAM)		
SAMPLE TYPE	SURFACE WATER	RECEIVED DATE	OCTOBER 12, 2018
SAMPLING DATE	OCTOBER 11, 2018	ANALYTICAL DATE	OCTOBER 22-26, 2018
SAMPLING TIME	-	REPORT NO.	2018-U0274
SAMPLING METHOD	-	WORK NO.	2018-W0219
SAMPLING BY	CUSTOMER	ANALYSIS NO.	TTA/FWQ-2018/TTA/FWQ-3035
ANALYZED BY	MISS SANLAYANEE YOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT S1 TTA/FWQ-3035	RESULT S-9 TTA/FWQ-3036	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD	5.91	5.40	0.50
SAMPLE CONDITION					
WATER'S COLOUR AMBER			YELLOWISH BROWN	YELLOWISH BROWN	
ODOUR			ABSENT	ABSENT	

(a) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22ND EDITION, 2012

Nilubh Singh
(MISS NILAVAR SINGH)
TECHNICAL MANAGEMENT
NOVEMBER 27, 2018

Sanat S.
(MR) PHARAT SUTTHANAUTHONG)
LABORATORY SUPERVISOR
NOVEMBER 27, 2018

- WE ARE NOT RESPONSIBLE FOR THE ANALYSIS REPORT WITHOUT OFFICIAL APPROVAL.
- THE RESULTS ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.



eguard

Operation Department: WQ Routine Sampling/Survey Field Notes
E-Guard-OD-EQ-F-000 Version :01
Approved by MD Oo Date: 02/10/2016 Page 1 of 2

Project: Yangon MRT	Date: 11-10-2018
Client:	Surveyor: Khin Zaw Min
Location: Hlaing Small Creek (Downstream)	Time: 12:45 pm
Lat: 16°51'19.63"	Long: 96°06'01.98"
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: HC-Blank 9 GPS Waypoint no: Temperature: 29.0°C (Water) Time:
Turbidity by Secchi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

	6.01	0.420	0.208	0.2	1.52		Lpm

NTU <454 ORP >167

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required

Notes

Checked by:



ISO TECH LABORATORY

W1018 203

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (SS)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	30.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH3)		mg/l	
Ammonium (NH4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l



ISO TECH LABORATORY

M1018 014

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Open - SS)
Location	Hlaing Small Creek - Down Stream
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis

WHO Drinking Water Guideline (Geneva - 1993)

Total Coliform Count	14	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	4	CFU/100ml	Not detected
pH	7.1		6.5 - 8.5
Turbidity	14.0	NTU	5 NTU
Colour (True)	30	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000271/18
Date: 26/10/2018
Page 1 of 1

Sample Described as	Surface Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	12 October 2018
Sample Brought By	Client
Sample Marking	S-10
Sample Location	Hlaing Small Creek (downstream)
Analysed Date	15 October 2018
Lab Code No	18418

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 D Dried at 103-105 °C	10	999	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-N_{org} B Macro Kjeldahl Method	1	7.00	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	2.733	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 D & Interference Removal BOD (Sodium Chloride) is preferred	2	11	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	61	mg/L

End of Report

NOR (Myanmar) Limited



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Report No & No	WWD/ RES / 18005 / 18		
Client	Yangon Urban Mass Rapid Transit Construction Project		
Location	Hlaing Small Creek (u) Stream		
Nature of Water	Surface Water (S)		
Date of Sample Received	11.10.2018		
Tested on	11.10.2018		

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.46	0.1 / 0.5
Dissolved Oxygen	mg/L	6.7	-

Remark :

Approved By



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	E-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR		
SAMPLING SOURCE	HLAING SMALL CREEK-DOWN STREAM		
SAMPLE TYPE	SURFACE WATER	REQUIRED DATE	OCTOBER 12, 2018
SAMPLING DATE	OCTOBER 11, 2018	ANALYTICAL DATE	OCTOBER 22-28, 2018
SAMPLING TIME	-	REPORT NO.	2018-UEC/N
SAMPLING METHOD	-	WORK NO.	2018-UEC/N
SAMPLING BY	CUSTOMER	ANALYSIS NO.	1TMP/NO.0004 1TMP/NO.0005
ANALYSED BY	MISS MALAYANEE TOTAN		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT 1S 1TMP/NO.0005	RESULT 2S 1TMP/NO.0005	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	MEGA TEMPERATURE COMBUSTION METHOD	0.01	0.01	0.01
SAMPLE CONDITION					
WATER'S COLOURED AREA			YELLOWCLEAR	YELLOWCLEAR	
SEDIMENT			ABOVE	ABOVE	

(a) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22nd EDITION, 2017

Nikhilesh Singh
(MISS NILAILAK SINGH)
TECHNICAL MANAGEMENT
NOVEMBER 21, 2018

(MRS PYAPAT SUTTAMANUTHONG)
LABORATORY SUPERVISOR
NOVEMBER 21, 2018

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guard



Operation Department | E-Guard-OD-EQ-P-010 Version :01 | Approved by MD On Date: 02/04/2016 Page 2 of 2

WQ Baseline Sampling/Survey Field Notes

Project: Yangon MRT	Date: 11-10-2018
Client:	Surveyor: Kyaw Zaw Min
Location: [illegible]	Time: 11:59
Lat: 16°51'19.636"	Long: 96°05'01.368"
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: 5m = [illegible] 10 [illegible] GPS Waypoint no: Temperature: 22+1°C Time:
Turbidity by Sachi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

	4.96	0.321	0.209	0.2	1.15		3m	

NTU = 1000 ORP = 169

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required

Notes

Checked by:



ISO TECH LABORATORY

WTL-RS.001

W1808 294

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (11)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)	29.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Iron(as Fe)		mg/l	0.01 mg/l
Nitrate (N NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l

ISO TECH LABORATORY

WTL-RS.001

W1808 015

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point -11)
Location	Hlaing River - Upper Stream
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	50	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	4	CFU/100ml	Not detected
pH	7.6		6.5 - 8.5
Turbidity	130	NTU	5 NTU
Colour (True)	80	TCU	15 TCU
Free Chlorine	50	mg/l	
Total Chlorine	50	mg/l	



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 3006271/18
Date: 30/10/2018
Page 1 of 1

Sample Described as	Surface Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	12. October .2018
Sample Brought By	Client
Sample Marking	S-11
Sample Location	Hlaing River (Upper stream)
Analysed Date	15. October .2018
Lab Code No.	180118

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012 2540-D Dried at 100-105 °C	20	417.33	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012 4500-N_{org} B Macro Kjeldahl Method	1	11	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012 4500-P B Ascorbic Acid Method	0.01	0.187	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012 5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012 5210 B Indication Manual BOD System Oxidation Lumbered	2	<2	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012 5220C D Closed Reflux, Colorimetric Method	10	<10	mg/L

End of Report

SGS (Myanmar) Limited



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Result Form No.	[illegible]
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	Hlaing River Stream
Nature of Water	Surface Water - 11
Date of Sample Received	11.10.2018
Tested on	11.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Temperature	mg/L	1.15	5.0-8.5
Dissolved Oxygen	mg/L	4.8	-

Remark :

Approved By

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: E-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	: NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR.		
SAMPLING SOURCE	: HLAING RIVER (POTEIKAN)		
SAMPLE TYPE	: SURFACE WATER	RECEIVING DATE	: OCTOBER 12, 2018
SAMPLING DATE	: OCTOBER 11, 2018	ANALYTICAL DATE	: OCTOBER 23-26, 2018
SAMPLING TIME	: -	REPORT NO.	:
SAMPLING METHOD	: -	WORK NO.	:
SAMPLING BY	: CUSTOMER	ANALYSIS NO.	:
ANALYSED BY	: MISS KHAJAYAMEE TOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		DETECTION LIMIT
			(1)	(2)	
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD	3.09	3.09	0.05
SAMPLE CONDITION					
WATER COLLECTIONED			YELLOWTURBID	YELLOWTURBID	
ODOUR(S)			SWEAK	SWEAK	

(#) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23RD EDITION, 2017.

WAI WAI AUNG (MRS.)
TECHNICAL MANAGEMENT
NOVEMBER 21, 2018

ARIS PYAYAT SUTTHIMATTHAWEE
LABORATORY SUPERVISOR
NOVEMBER 21, 2018

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- RESULTS ON THIS REPORT REFER TO SUBMITTED SAMPLE ONLY.

E-guard | Operation Department | E-Guard-OD-SQ-F-016 Version (0) | Approved by HOD On: Date: 01/04/2016 | Page 2 of 2

WQ Routine Sampling/Survey Field Notes

Project: YUBN MRT	Date: 11.10.2018
Client:	Surveyor: U. Khaine Zaw
Location: Upper stream	Time: 1.00 pm
Lat: 16°51'29.948"	Long: 96°05'56.573
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: 1.0 km - point - 11 GPS Waypoint no: Temperature: 29.8°C Time:
Turbidity by Secchi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

	6.20	0.126	0.082	0.1	6.4°C		8m

NTU = 8.15 ORP = 0.11

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required

Notes:

Hlaing River

8m - point - 12 Time - 12.54 C Checked by:

6.25 - 0.126 - 0.082 - 0.1 - 6.98

ISO TECH LABORATORY

WTL-INE-001
Issue Date : 01.12.2013
Effective Date : 01.12.2013
Issue No. : 1.0 Page 1 of 1

W-1018-298

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (12)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)	28.6	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N_2NO_3)		mg/l	50 mg/l
Chromic (Hexavalent)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l

ISO TECH LABORATORY

WTL-INE-001
Issue Date : 01.12.2013
Effective Date : 01.12.2013
Issue No. : 1.0 Page 1 of 1

W1018-01a

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point -12)
Location	Hlaing River - Upper Stream
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	12	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	2	CFU/100ml	Not detected
pH	7.5		6.5 - 8.5
Turbidity	100	NTU	5 NTU
Colour (Pure)	40	TCU	15 TCU
Free Chlorine	00	mg/l	
Total Chlorine	00	mg/l	

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000371/18
Date: 26/10/2018
Page 1 of 1

Sample Described as :	Surface Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	12. October. 2018
Sample Brought By	Client
Sample Marking	S-12
Sample Location	Hlaing River (Upper stream)
Analysed Date	16. October. 2018
Lab Code No	18518

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017, 2540 D Dried at 103-105° C	20	364.67	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017, 4500-N_{org} B Macro Kjeldahl Method	1	<1	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017,4500-P E Ascorbic Acid Method	0.05	0.151	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017, 5210 B & Instruction Manual BOD System Oxitherm (Loaded)	2	42	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017,5220 D Closed Reflux, Colorimetric Method	10	115	mg/L

End of Report

SGS (Myanmar) Limited

SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Result from (A)	
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	Hlaing River (Upper stream)
Nature of Water	Surface Water - 12
Date of Sample Received	11.10.2018
Tested on	11.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	1.20	0.1-0.5
Dissolved Oxygen	mg/L	6.7	-

Remark :

Approved By

UAE United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Tel. 0 2743 3535 Fax 0 2743 3600 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: E-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	: NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR.		
SAMPLING SOURCE	: HLAING RIVER (POTEIN)		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: OCTOBER 12, 2018
SAMPLING DATE	: OCTOBER 11, 2018	ANALYTICAL DATE	: OCTOBER 23-26, 2018
SAMPLING TIME	: -	REPORT NO.	: 2018-U2217
SAMPLING METHOD	: -	WORK NO.	: 2018-0317-II
SAMPLING BY	: CUSTOMER	ANALYSIS NO.	: T1810011006T1810011007
ANALYSED BY	: MISS KHAJAYAMEE TOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT S11 T1810011006	RESULT S12 T1810011007	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD	3.06	4.56	0.05
SAMPLE CONDITION					
APPEARANCE			YELLOWISH BROWN	YELLOWISH BROWN	
ODOUR			ODOUR	ODOUR	

(*) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23rd EDITION, 2017.

Wuthikrai Sirisak
MISS WUTHIKRAI SIRISAK
TECHNICAL MANAGEMENT
NOVEMBER 01, 2018

Piyarat S.
MRS PIYARAT SUTTHIWANICHAKUL
LABORATORY SUPERVISOR
NOVEMBER 01, 2018

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- TESTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.

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eguard

Operation Department	E-Guard-OD-SQ-F-E18 Version :01	Approved by SID On Date: 01/04/2016 Page 1 of 2
WQ Routine Sampling/Survey Field Notes		

Project: MRT	Date: 11-10-2018
Client:	Surveyor: U Khin Zaw
Location: Upper Stream	Time: 1:10 pm
Lat: 16°51'28.881"	Long: 96°05'55.521"
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: S11-point-12 GPS Waypoint as: Temperature: 29.84°C Time:
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

6.91	0.15	0.25	0.1	6.98		9.81	

NTU = 6.6 cm = 0.07

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use; Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Hlaing River

Checked by:



ISO TECH LABORATORY

WTL-RE-001

WATER QUALITY TEST RESULTS FORM

Client : Yangon Urban Mass Rapid Transit Construction Project

Nature of Water : Surface Water (13)

Location : Hlaing Thar Yar Township

Date and Time of collection :

Date and Time of arrival at Laboratory :

Date and Time of commencing examination :

Date and Time of completing :

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	28.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) 5 days at 20 °C		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark : This certificate is issued only for the receipt of the test sample.

Tested by

Signature :

Name :

ISO TECH Laboratory

Approved by

Signature :

Name :



ISO TECH LABORATORY

WTL-RE-001

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client : Yangon Urban Mass Rapid Transit Construction Project

Nature of Water : Surface Water (Pond -13)

Location : Hlaing River - Upper Stream

Date and Time of collection :

Date and Time of arrival at Laboratory :

Date and Time of commencing examination :

Date and Time of completing :

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	23	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	4	CFU/100ml	Not detected
pH	7.0		6.5 - 8.5
Turbidity	102	NTU	5 NTU
Colour (True)	90	TCU	15 TCU
Free Chlorine	0	mg/l	
Total Chlorine	0	mg/l	

Remark : Unsatisfactory for drinking purposes.

- This certificate is issued only for the receipt of the test sample.
- + : Less than

Tested by

Signature :

Name :

Approved by

Signature :

Name :



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2060371118
Date: 26/10/2018
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 12. October. 2018
Sample Brought By : Client
Sample Marking : S-13
Sample Location : Hlaing River (Upper stream)
Analysed Date : 19. October. 2018

Lab Code No : 167/18

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540c (Utilized at 103-105 °C)	20	514	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-N_{org} B Macro (Kjeldahl) Method	1	11	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,4500-P. B Aacorbic Acid Method	0.01	0.067	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 B & Instrument Method (BOD System Combined Lumitronic)	2	<2	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	<10	mg/L

End of Report

SGS (Myanmar) Limited

(Wa Wa Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Report Form No :
Client : Yangon Urban Mass Rapid Transit Construction Project
Location : Hlaing Dusar Stream
Nature of Water : Surface Water - 13
Date of Sample Received :
Tested on :

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	1.25	0.1-0.5
Dissolved Oxygen	mg/L	4.6	-

Remark :

Approved By

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: E-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	: NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR		
SAMPLING SOURCE	: HLAING RIVER UPSTREAM		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: OCTOBER 22, 2018
SAMPLING DATE	: OCTOBER 11, 2018	ANALYTICAL DATE	: OCTOBER 22-28, 2018
SAMPLING TIME	: -	REPORT NO.	: 2018-U0218
SAMPLING METHOD	: -	WORK NO.	: W18-0217-01
SAMPLING BY	: CUSTOMER	ANALYSIS NO.	: 1184FB0C00A7184FA4-0004
ANALYZED BY	: MISS KHALAYAMEE YOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT S1 1184FA4-0004	RESULT S2 1184FA4-0005	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD	2.09	0.91	0.30
SAMPLE CONDITION					
WATER COLOUR/TUBBID			YELLOW/TURBID	YELLOW/TURBID	
ODOUR/-			MOSSY	ABOVE	

S1 : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23rd EDITION, 2017

MISS KHALAYAMEE YOTHA
TECHNICAL MANAGEMENT
NOVEMBER 21, 2018

MRS PIYAPAT SUTTAMANUTHANG
LABORATORY SUPERVISOR
NOVEMBER 21, 2018

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- RESULTS ONLY THIS REPORT TO SUBMITTED SAMPLE ONLY.

E-guard

Operation Department — WQ Baseline Sampling/Survey Field Note

E Guard-QD-SQ-F-018 Version :01

Approved by MD On : Date: 01/04/2018 Page 3 of 3

Project: YUMM MRT	Date: 4-10-2018
Client:	Surveyor: U. Nyan Zaw
Location: Upper Stream	Time: 1:30 pm
Lat: 16°51'25.518"	Long: 96°05'44.494
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: GPS Waypoint no: Temperature: 29.9°C Time:
Turbidity by Secchi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

	6.06	0.115	0.081	0.1	7.95		SW

NTU : 57+ ORP : 353

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:

ISO TECH LABORATORY

WTL-RE-001

W1018 297

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (1A)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	23.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N-NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) 5 days at 20 °C		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Mercury (Hg)		mg/l	

Remark : This certificate is issued only for the receipt of the test sample.

Tested by
Signature
Name
ISO TECH Laboratory

Approved by
Signature
Name
ISO TECH Laboratory

ISO TECH LABORATORY

WTL-RE-001

M1018 018

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point 1A)
Location	Hlaing River - Upper Stream
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	23	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	0	CFU/100ml	Not detected
pH	7.1		6.5 - 8.5
Turbidity	0.81	NTU	5 NTU
Colour (True)	4.50	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes

- This certificate is issued only for the receipt of the test sample.
- < : Less than

Tested by
Signature
Name
ISO TECH Laboratory

Approved by
Signature
Name



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2060271119
Date: 26/10/2018
Page 1 of 1

Sample Described as	Surface Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	12 October 2018
Sample Brought By	Client
Sample Marking	S-14
Sample Location	Hlaing River (Upper stream)
Analysed Date	15 October 2018
Lab Code No	1557/18

No	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017, 2540 D Dried at 103-105 °C	20	616.22	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water, APHA, AWWA & WEF 23rd ed. 2017, 4500-NH_3 B Macro-Kjeldahl Method	1	<1	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017,4500-P E Ascorbic Acid Method	0.01	0.099	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 23rd ed. 2017,5520B	2	<2	mg/L
5	BOD	Standard methods for the examination of water & waste water, APHA, AWWA & WEF 23rd ed. 2017, 5210 D & Instruction Manual BOD System Oxitop-C (Lovibond)	2	<2	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 2016 ed. 2017,5220 D Closed Reflux, Colorimetric Method	10	133	mg/L

End of Report

SGS (Myanmar) Limited

Ohn Yin Yu
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.06	0.1~0.5
Dissolved Oxygen	mg/L	6.7	-

Remark :

Approved By



STATE United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	E-GUARD ENVIRONMETAL (SERVICE CO., LTD)		
ADDRESS	NO (1), AIRPORT AVENUE ROAD, YANGON, MYANMAR		
SAMPLING SOURCE	HLAING RIVER UPSTREAM		
SAMPLE TYPE	SURFACE WATER	RECEIVED DATE	OCTOBER 22, 2018
SAMPLING DATE	OCTOBER 17, 2018	ANALYTICAL DATE	OCTOBER 22-28, 2018
SAMPLING TIME	-	REPORT NO.	2018-0529
SAMPLING METHOD	-	WORK NO.	2018-0514
SAMPLING BY	CUSTOMER	ANALYSIS NO.	T1SEP18A0008-T1SEP18A0009
ANALYSED BY	MISS KAINLYANNEE TOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		DETECTION LIMIT
			S-13 T1SEP18A0008	S-14 T1SEP18A0009	
TOTAL ORGANIC CARBON	mg/L	NPOC COMBUSTION OXIDATION METHOD	4.09	5.51	0.30
SAMPLE CONDITION					
WATER COLOUR/TURBID			YELLOW/TURBID	YELLOW/TURBID	
ODOUR/OIT			ABSENT	ABSENT	

TM STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23RD EDITION, 2017

Nilobth Singh
MISS NILALAK SINGH
TECHNICAL MANAGEMENT
NOVEMBER 01, 2018

Piyawat S.
MR. PIYAWAT SUTTAMANOTHAM
LABORATORY SUPERVISOR
NOVEMBER 01, 2018

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eguard

Operation Department | E-Guard-OD-EQ-P-016 Version 02 | Approved by HD On Date: 02/04/2016 Page 1 of 2

EQ Baseline Sampling/Survey Field Note

Project: MRU MRT	Date: 11-10-2018
Client:	Surveyor: Lt Lwin Zaw
Location: Upper Stream	Time: 1:35 pm
Lat: 16°51'25.51"E	Long: 96°05'44.393"
Evaluation:	Barometer Pressure:
Weather:	Sample/Location ID: Point 14 (SW1) GPS Waypoint as: Temperature: 29.6°C Time:
Turbidity by Secchi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

5.84	0.42	0.060	0.1	708		1.00

NTU : 6.22 CAT : 359

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use. Adequate for volume required.

Notes

Hlaing River

Checked by:



ISO TECH LABORATORY

WTL-RE-001

W1018 298

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (15)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)	25.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	3 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name

Approved by — Signature — Name



ISO TECH LABORATORY

WTL-RE-001

M1018 019

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point - 15)
Location	Thin Mon Housing - Down Stream
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	10	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	2	CFU/100ml	Not detected
pH	7.2		6.5 - 8.5
Turbidity	80	NTU	5 NTU
Colour (True)	40	TCU	15 TCU
Free Chlorine	10	mg/l	
Total Chlorine	10	mg/l	

Remark: Unsatisfactory for drinking purpose.

: This certificate is issued only for the receipt of the test sample.

: < - Less than

Tested by — Signature — Name

Approved by — Signature — Name



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2008271/18
Date: 26/10/2018
Page 1 of 1

Sample Described as	Surface Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	12. October 2018
Sample Brought By	Client
Sample Marking	S-15
Sample Location	Thin Mon Housing
Analysed Date	15. October 2018
Lab Code No.	185/18

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 D Dried at 103-105 °C	20	141	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500 N_{ORG} B Macro Kjeldahl Method	1	0.94	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,4500 P B Ascorbic Acid Method	0.01	0.500	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520 D & Instruction Manual 8000 Student Dividend Lucidated	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 D & Instruction Manual 8000 Student Dividend Lucidated	2	<2	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	17	mg/L

End of Report

MSI (Myanmar) Limited
(Ma Hu Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY
No.1/H-C, Nakaidaw Garden, Yangon-Pathein Road,
Hlaing Thar yar Township, Yangon, Republic of the Union of Myanmar
Tel : 01-685376, 685377, 685378, 685719, 685720 Fax : 01-685237

WATER ANALYSIS RESULT

Result from No.	SWDC PED / SWDC / 18
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	Thinmon Housing Down Stream
Nature of Water	Surface Water - 15
Date of Sample Received	11.10.2018
Tested on	11.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.04	0.1~0.5
Dissolved Oxygen	mg/L	3	-

Remark :

Approved By

United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: E-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	: NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR		
SAMPLING SOURCE	: THIRI MON HOUSING		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: OCTOBER 12, 2018
SAMPLING DATE	: OCTOBER 11, 2018	ANALYTICAL DATE	: OCTOBER 22-26, 2018
SAMPLING TIME	: -	REPORT NO.	: 2018-U0219
SAMPLING METHOD	: -	WORK NO.	: 2018-W0219
SAMPLING BY	: CUSTOMER	ANALYSIS BY	: TIN MYO ALIT MAYMA (AV)
ANALYSED BY	: MISS SHALAYSHEE TOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		DETECTION LIMIT
			S1 (THAMEIKKYA)	S2 (THAMEIKKYA)	
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD	3.56	4.97	0.05
SAMPLE CONDITION					
WATER COLOUR/TURBID			YELLOW/TURBID	YELLOW/TURBID	
REMARK			MEDIUM	MEDIUM	

Nilabh Singh
MISS PALALIK SINGH
TECHNICAL MANAGEMENT
NOVEMBER 21, 2018

Byomkesh S.
MRS PIYARAT SUTTAMANOPHOL
LABORATORY SUPERVISOR
NOVEMBER 21, 2018

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eguard

Operation Department: WQ Section Sampling/Survey Field Notes | E Guard-OD-EQ-F-010 Version :01 | Approved by MD On Date: 02/01/2018 Page 2 of 2

Project: Yangon MRT	Date: 11-10-2018
Client:	Surveyor: U Khin Zaw
Location: Thiri Mon Housing	Time: 9:00 Am
Lat: 16°51'25.826"	Long: 96°08'29.775"
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: GPS Waypoint no: Temperature: Time:
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

SA	0.283	0.198	8.1	2.03	560	

NTU - 85.7 ORP +167 Tem 28.45°C

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required

Notes

Checked by:

ISO TECH LABORATORY

WTL-RE-001

W1018 299

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (YR)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	19.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)	28.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO3)		mg/l	50 mg/l
Chloride (Residual)		mg/l	
Ammonia (NH3)		mg/l	
Ammonium (NH4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) 5 days at 20 °C		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silver (Ag)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature
Name
Zaw Win Oo
B.Sc (Chemistry)
In Charge
ISO TECH Laboratory

Approved by
Signature
Name

ISO TECH LABORATORY

WTL-RE-001

M1018 028

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point - 03)
Location	Thiri Mon Housing (Upper Stream)
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	18.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Total Coliform Count	14	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	4	CFU/100ml	Not detected
pH	7.1		6.5 - 8.5
Turbidity	150	NTU	5 NTU
Colour (Pt-co)	80	TCU	15 TCU
Free Chlorine	00	mg/l	
Total Chlorine	00	mg/l	

Remark : Unsatisfactory for drinking purposes

- This certificate is issued only for the receipt of the test sample.
- 0 = Less than

Tested by
Signature
Name
Zaw Win Oo
B.Sc (Chemistry)
In Charge
ISO TECH Laboratory

Approved by
Signature
Name



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000271/18
Date: 25/10/2018
Page 1 of 1

Sample Described as	: Surface Water
Client Name	: Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	: 12 October 2018
Sample Brought By	: Client
Sample Marking	: S-16
Sample Location	: Thiri Mon Housing
Analysed Date	: 15 October 2018
Lab Code No	: 19018

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 D.Dried at 103-105 °C	20	11.33	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water, APHA, AWWA & WEF 22nd ed. 2012, 4500-N_{org} B Macro Kjeldahl Method	1	0.00	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water,APHA, AWWA & WEF 22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	0.043	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water,APHA, AWWA & WEF 22nd ed. 2012, 5210 D & Instrument Manual WOD System Oxitrack Customer	5	<5	mg/L
6	COD	Standard methods for the examination of water & waste water APHA ,AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	<10	mg/L

End of Report

WSE (M) arongT Limited

(Nu Nu Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Result form No	
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	Thirimon Housing Upper Stream
Nature of Water	Surface Water - (S
Date of Sample Received	11.10.2018
Tested on	11.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.46	0.1~0.5
Dissolved Oxygen	mg/L	7	-

Remark :

Approved By



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION
CUSTOMER NAME	S-GUARD ENVIRONMENTAL SERVICE CO., LTD.
ADDRESS	NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR.
SAMPLING SOURCE	THIRI MON HOUSING
SAMPLE TYPE	SURFACE WATER
SAMPLING DATE	OCTOBER 11, 2018
SAMPLING TIME	-
SAMPLING METHOD	-
SAMPLING BY	CUSTOMER
ANALYZED BY	SOE SANDI AYARE THTUN
RECEIVED DATE	OCTOBER 12, 2018
ANALYTICAL DATE	OCTOBER 12-26, 2018
REPORT NO.	UAE/S/2018/10
WORK NO.	UAE/S/2018/10
ANALYSIS NO.	1184/UAE-ENV/S-T1/UAE/S/2018/10

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		DETECTION LIMIT
			S-16 THIRI MON HOUSING	S-16 THIRI MON HOUSING	
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD	4.86	4.31	0.05
SAMPLE CONDITION					
WATER COLOUR/TONE			YELLOWISH BROWN	YELLOWISH BROWN	
SEDIMENT			MEDIUM	MEDIUM	

Ref. STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22ND EDITION, 2012.

Witsuth Sirak
(MRS. WILAILAK SRISAK)
TECHNICAL MANAGEMENT
NOVEMBER 21, 2018

Pharat
(MRS. PHARAT SUTTHAWATTHONG)
LABORATORY SUPERVISOR
NOVEMBER 21, 2018

- SAMPLE DATA PERTAIN TO THE ABOVE ITEM AS RECEIVED BY THE LABORATORY.
- RESULTS REFER ONLY TO SUBMITTED SAMPLE (S).



eguard

Operation Department: E-Guard-QD-EQ-F-016 Version: 02 Approved by MD On Date: 01/04/2016 Page 3 of 3

Project: Yangon MRT	Date: 11.10.2018
Client:	Surveyor: U Win Zaw
Location: Thiri Mon Housing	Time: 9:47 am.
Lat: 16° 51' 26. 322"	Long: 96° 06' 31. 938"
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: Point 16 GPS Waypoint no: Temperature: Time: Downstream
Turbidity by Sechi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

29.00	6.765	0.32	0.1	6.091	6.01	

NTU - 1.45 ORP. 29 Temp - 29.4

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:



ISO TECH LABORATORY

WTL/RE/001

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (ST)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis — WHO Drinking Water Guideline (Geneva - 1993)

Temperature (°C)	25.0	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N_2O_5)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) 3 days at 20 °C		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature / Name / (ISO TECH Laboratory)

Approved by — Signature / Name



ISO TECH LABORATORY

WTL/RE/001

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point - 17)
Location	Small Inya Lake
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis — WHO Drinking Water Guideline (Geneva - 1993)

Total Coliform Count	18	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	2	CFU/100ml	Not detected
pH	6.9		6.5 - 8.5
Turbidity	10	NTU	5 NTU
Colour (True)	40	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes

- This certificate is issued only for the receipt of the test sample.
- < : Less than

Tested by — Signature / Name / (ISO TECH Laboratory)

Approved by — Signature / Name



SGS

ANALYSIS REPORT — ORIGINAL

Job Ref: 2000271/18
Date: 26/10/2018
Page 1 of 1

Sample Described as	Surface Water
Client Name	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	12. October. 2018
Sample Brought By	Client
Sample Marking	S-17
Sample Location	Small Hmyo Lake
Analysed Date	15. October. 2018
Lab Code No	181118

No.	Test Parameter	Method	LOD	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 D Dried at 105-180 °C	20	90	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-N_{org} B Macro Kjeldahl Method	1	1.4	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,4500-P E Ascorbic Acid Method	0.01	0.122	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	3	<3	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 D & Instruction Manual WOD System Oxitop& Luminox	3	19	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	15	64	mg/L

End of Report

MSI (Myanmar) Limited
(Nu Nu Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY
No (3-C, Kawaidan Garden, Yangon-Pathein Road,
Hlaing Tharyar Township, Yangon, Republic of the Union of Myanmar
Tel - 01 685375, 685371, 685378, 685719, 685710 Fax - 01 685237

WATER ANALYSIS RESULT

Result From No.	SWD/ MD / SWDC / 18
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	Small In Ye Lake
Nature of Water	Surface Water - ST
Date of Sample Received	11.10.2018
Tested on	12.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.42	0.1-0.5
Dissolved Oxygen	mg/L	3.4	-

Remark :

Approved By



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000271/18
Date: 26/10/2018
Page 1 of 1

Sample Described as	: Surface Water
Client Name	: Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date	: 12 October 2018
Sample Brought By	: Client
Sample Marking	: S-18
Sample Location	: Main Inlaya Lake
Analysed Date	: 15 October 2018
Lab Code No	: 18218

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 D.Dried at 103-105 °C	20	20	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500-NH_3 B.Macro Kjeldahl Method	1	<1	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,4500-P E.Ascorbic Acid Method	0.01	0.087	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 D.& Instruction Manual BOD System Oxitop& Controller	3	5	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 D.Closed Reflux, Colorimetric Method	10	113	mg/L

End of Report

MSE (Myanmar) Limited
(Ye Nu Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Result From No.	
Client	
Location	
Nature of Water	
Date of Sample Received	
Tested on	

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.28	0.1~0.5
Dissolved Oxygen	mg/L	3.3	-

Remark :

Approved By



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: S GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	: NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR		
SAMPLING SOURCE	: MAIN INLAY YA LAKE		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: OCTOBER 22, 2018
SAMPLING DATE	: OCTOBER 11, 2018	ANALYTICAL DATE	: OCTOBER 22-26, 2018
SAMPLING TIME	: -	REPORT NO.	: UEA-EC0109
SAMPLING METHOD	: -	WORK NO.	: EPA-EC0110
SAMPLING BY	: CUSTOMER	ANALYSIS NO.	: T1A/FEB-0013
ANALYZED BY	: MISS KAINLYANEE YOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT S1 (18/EPA-0013)	DETECTION LIMIT
TOTAL ORGANIC CARBON	mg/L	HIGH TEMPERATURE COMBUSTION METHOD	3.26	0.05
SAMPLE CONDITION				
SAMPLE COLOUR/TURBID			YELLOWISH/MUDDY	
REMARKS			ABOVE	

(a) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 21ST EDITION, 2011

Nilobth Sood
(MISS NILAUBH SINGHA)
TECHNICAL MANAGEMENT
NOVEMBER 01, 2018

Piyapat
(MRS PIYAPAT SUTTHIMANUTHAKU)
LABORATORY SUPERVISOR
NOVEMBER 01, 2018

- DO NOT COPY PARTIAL OF THIS ANALYSIS REPORT WITHOUT OFFICIAL APPROVAL.
- REPORTED RESULTS REFERS TO SUBMITTED SAMPLE ONLY.

01



guard

Operation Department: WQ Baseline Sampling/Survey Field Notes
E Guard-OD-SQ-F-018 Version 01
Approved by MD On
Date: 01/10/2018
Page 2 of 2

Project: Yangon U-MRT	Date: 11-10-2018
Client:	Surveyor: U Wai Lin Zaw
Location: Main Inn Ya Lake	Time: 8:00 Am
Lat: 20°51'09.842"	Long: 96°58'27.101"
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: Point 18 GPS Waypoint no: Temperature: Time:
Turbidity by Secchi Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

9.97	0.09	0.078	8.1	9.15		ug/cm	

Aim of Sampling: MTA - 40.5 ORP - 112 Tem - 29.90

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation, Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required.

Notes

Checked by:



ISO TECH LABORATORY

WTL-RE-001

M1818 302

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (19)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Temperature (°C)	28.0	°C	
Fluoride (F)		mg/l	1.0 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N NO_3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cadmium (Cd)		mg/l	0.01 mg/l
Zinc (Zn)		mg/l	0 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (S)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by — Signature — Name

Approved by — Signature — Name

ISO TECH LABORATORY

WTL-RE-001

M1818 023

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM



Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Point -19)
Location	Parami Station - Upper Stream
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis — **WHO Drinking Water Guideline (Geneva - 1993)**

Fore Coliform Count	20	CFU/100ml	Not detected
Fluorinated Acid Coliform Count	4	CFU/100ml	Not detected
pH	7.1		6.5 - 8.5
Turbidity	128	NTU	5 NTU
Colour (True)	80	TCU	15 TCU
Free Chlorine	Nil	mg/l	
Total Chlorine	Nil	mg/l	

Remark : Unsatisfactory for drinking purposes

: This certificate is issued only for the receipt of the test sample.

: - Less than

Tested by — Signature — Name

Approved by — Signature — Name



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000271/18
Date: 25/10/2018
Page 1 of 1

Sample Described as :	Surface Water
Client Name :	Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date :	12. October. 2018
Sample Brought By :	Client
Sample Marking :	S-19
Sample Location :	Parami Station
Analysed Date :	15. October. 2018
Lab Code No. :	193/18

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2000 D Dried at 103-105 °C	20	190.87	mg/L
2	Total Nitrogen(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 4500 N_{ORG} B Macro Kjeldahl Method	1	0.00	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,4500-P B Ascorbic Acid Method	0.01	0.419	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 B & Instruction Manual BOD System (Oxidirect & potassium)	2	10	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 D Closed Reflux, Colorimetric Method	10	18	mg/L

Sign of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY
No.19-C, Nawaday Garden, Yangon-Pathein Road,
Hlaing Thanyar Township, Yangon, Republic of the Union of Myanmar
Tel : 01-685378, 685377, 685379, 685718, 685719 Fax : 01-685237

WATER ANALYSIS RESULT

Result Form No.	00637 PRD / SWDC / 18
Client	Yangon Urban Mass Rapid Transit Construction Project
Location	Parami Station Upper Stream
Nature of Water	Surface Water - 19
Date of Sample Received	11.10.2018
Tested on	11.10.2018

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	0.44	0.1~0.5
Dissolved Oxygen	mg/L	2.7	-

Remark :

Approved By



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT	: YANGON URBAN MASS RAPID TRANSIT CONSTRUCTION		
CUSTOMER NAME	: E-GUARD ENVIRONMENTAL SERVICE CO., LTD.		
ADDRESS	: NO 11, AIRPORT AVENUE ROAD, YANGON, MYANMAR		
SAMPLING SOURCE	: PARAMI STATION UPPER		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: OCTOBER 12, 2018
SAMPLING DATE	: OCTOBER 11, 2018	ANALYTICAL DATE	: OCTOBER 23-26, 2018
SAMPLING TIME	: -	REPORT NO.	: MTE1018033
SAMPLING METHOD	: -	WORK NO.	: MTE1018033
SAMPLING BY	: CUSTOMER	ANALYSIS BY	: THAPANA MYA
ANALYZED BY	: MTE ANALYTHIKE TOTHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT MTE TTSPPMLM-0174	DETECTION LIMIT
TOTAL COLIFORM BACTERIA	mpn	MEMBRANE FILTRATION (COMBUTION METHOD)	1100	0.00
SAMPLE CONDITION				
WATER COLOUR/TYPE			YELLOWISH BROWN	
ODOUR			BLACK	

Nibedita Singh
ARCE NILALAK SINGH
TECHNICAL MANAGEMENT
NOVEMBER 21, 2018

Piyapat S.
ARCE PIYAPAT KUTTAMANUTHAWAT
LABORATORY SUPERVISOR
NOVEMBER 21, 2018

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- RESULTS ONLY ARE REFER TO SUBMITTED SAMPLE ONLY.



eguard

Operation Department — WQ Baseline - Sampling/Survey Field Notes | E Guard-OD-EQ-F-011 Version :01 | Approved by HD QA Date: 02/2/2018 Page 2 of 2

Project: Yangon MRT	Date: 11-10-2018
Client:	Surveyor: Ulvidan Zaw
Location: Parami Station	Time: 7:20 Am.
Lat: 16° 51' 16.64"	Long: 96° 09' 54.169"
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: GPS Waypoint no: Temperature: Room . 19 Time: Upper r
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

APS	6.42	0.089	0.1	9.47	180

NTU = 215 ORP = 387 Temp 27.6°

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use, Store in clean, dry dust free environment before use; Adequate for volume required

Notes

Checked by:



ISO TECH LABORATORY

WTL/RE/001

M1818 383

WATER QUALITY TEST RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (SS)
Location	Hlaing Thar Yar Township
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	12.10.2018
Date and Time of completing	14.10.2018

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)	26.9	°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate (N-NO3)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (3 days at 20 °C)		mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Iron (Fe)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature
Name
QA/QC ISO TECH Laboratory

Approved by
Signature
Name



ISO TECH LABORATORY

WTL/RE/001

M1819 024

WATER QUALITY TEST (MICROBIOLOGY) RESULTS FORM

Client	Yangon Urban Mass Rapid Transit Construction Project
Nature of Water	Surface Water (Parami Jet)
Location	Parami Station - Down Stream
Date and Time of collection	11.10.2018
Date and Time of arrival at Laboratory	11.10.2018
Date and Time of commencing examination	11.10.2018
Date and Time of completing	12.10.2018

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
Total Coliform Count	91	CFU/100ml	Not detected
Thermotolerant (fecal) Coliform Count	4	CFU/100ml	Not detected
pH	7.0		6.5 - 8.5
Turbidity	89	NTU	5 NTU
Colour (True)	89	TCU	15 TCU
Free Chlorine	90	mg/l	
Total Chlorine	90	mg/l	

Remark : Unsatisfactory for drinking purposes

- This certificate is issued only for the receipt of the test sample.
- 1 - Less than

Tested by
Signature
Name

Approved by
Signature
Name



SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 2000271/19
Date: 20/10/2019
Page 1 of 1

Sample Described as : Surface Water
Client Name : Yangon Urban Mass Rapid Transit Construction Project
Sample Received Date : 12 October 2019
Sample Brought By : Client
Sample Marking : S-20
Sample Location : Parami Station
Analysed Date : 15 October 2019

Lab Code No. : 19A118

No.	Test Parameter	Method	LOQ	Result	Unit
1	Total Suspended Solid	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 2540 D.Dried at 103-105 °C	20	139.67	mg/L
2	Total Manganese(organic)	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 3500-Mn B_{4a} 8-Wayne Kyriakopoulos Method	1	0.56	mg/L
3	Total Phosphorus	Standard methods for the examination of water & waste water APHA, AWWA & WEF 2018 ed. 2012,4500-P E Ascorbic Acid Method	0.01	0.072	mg/L
4	Oil & Grease	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5520B	5	<5	mg/L
5	BOD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012, 5210 B & Instruction Manual BOD System (Oxitop & cultured)	3	12	mg/L
6	COD	Standard methods for the examination of water & waste water APHA, AWWA & WEF 22nd ed. 2012,5220 C Closed Reflux, Colorimetric Method	10	31	mg/L

End of Report

NDS (Myanmar) Limited
(Thu Yin Yi)
Manager



SUPREME GROUP OF COMPANIES
SUPREME WATER DOCTOR COMPANY

WATER ANALYSIS RESULT

Result Form No. : DWD-TEST / SWDC / 19
Client : Yangon Urban Mass Rapid Transit Construction Project
Location : Parami Station Down Stream
Nature of Water : Surface Water / 20
Date of Sample Received : 11.10.2019
Tested on : 11.10.2019

	UNIT	ANALYSIS RESULT	WHO GUIDELINE
Manganese	mg/L	1.85	0.1-0.5
Dissolved Oxygen	mg/L	3.8	-

Remark :

Approved By



United Analyst and Engineering Consultant Co., Ltd.

ANALYSIS REPORT

PROJECT : YANGON URBAN MASS RAPID TRANSIT (CIDB) PROJECTION
CUSTOMER NAME : E-GUARD ENVIRONMENTAL SERVICES CO., LTD.
ADDRESS : NO.11, AIRPORT AVENUE ROAD, YANGON, MYANMAR
SAMPLING SOURCE : PARAMI STATION DOWN
SAMPLE TYPE : SURFACE WATER — RECEIVED DATE : OCTOBER 12, 2019
SAMPLING DATE : OCTOBER 11, 2019 — ANALYTICAL DATE : OCTOBER 12-14, 2019
SAMPLING TIME : - — REPORT NO. : 2019-10/295
SAMPLING METHOD : - — WORK NO. : 2019-10/214
SAMPLING BY : CUSTOMER — ANALYSIS NO. : 1134/NO.6/19
ANALYZED BY : MISS KHAI KHINE YOTHA

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT (S2) 11/10/19 (9:30)	DETECTION LIMIT
TOTAL COLIFORM (MORE SAMPLE CONDITION	mpn/	MEMBRANE FILTER (COMBLED FILTRATION) METHOD	2.0*	0.00
WATER'S COLOUR FORMED			YELLOWISH	
ODOUR/ET			ODOUR	

(*) STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22ND EDITION, 2012

Nilabh Singh
(MISS NILAB.AH SINGH)
TECHNICAL MANAGEMENT
NOVEMBER 21, 2019

Piyanut S.
(MRS PIYANUT SUTTAMANUTHAWAS)
LABORATORY SUPERVISOR
NOVEMBER 21, 2019

- DO NOT COPY PARTIAL OF THIS ANALYSIS REPORT WITHOUT OFFICIAL APPROVAL.
- RESULTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.



eguard

Operation Department / WQ Section / Sampling/Survey Field Form — E Guard-OH-EQ-F-016 Version :01 — Approved by MD On Date: 02/4/2019 Page 2 of 3

Project: Yangon MRT	Date: 11-10-2018
Client:	Surveyor: Ukkaw Zaw
Location: Parami Station	Time: 7:15 Am
Lat: 16° 51' 07.905	Long: 96° 09' 59.003
Evaluation:	Barometer Pressure:
Weather: Sunny	Sample/Location ID: Point - 20 GPS Waypoint no: Temperature: Time: Noon -
Turbidity by Secki Depth (cm):	
NTU converted from chart:	

Surface/Ground/Effluent Water

6.90	0.189	0.103	0.1	2.71		MSW	

MW - 76.4 CRP = 208 Tem - 26.6

Aim of Sampling

- Quality, Consistency, Representative Sample, Prevent Deterioration, Prevent Contamination Suitable sampling techniques; Accurate field measurements; Transportation; Time; Preparation:
- Monitoring Schedule; Review previous field sheets; Equipment checklist; Correct bottles and
- Preservatives; Check bottle types required with lab; Add preservatives – if required
- Sampling Bottles:
- Preferable to use NEW bottles; If not new then rigorous cleaning before re-use. Store in clean, dry dust free environment before use. Adequate for volume required.

Notes

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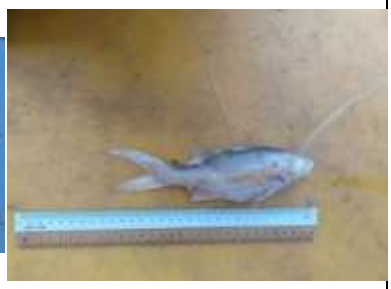
Checked by:

Appendix 5 Photographs of Flora and Fauna Species in the Project Area

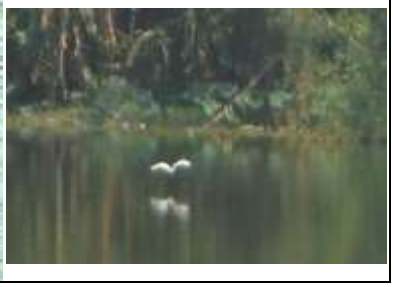
		
Rattus sp. (LC)	*Cobra* sp. (LC)	*Calotes* sp.1(LC)
		
Calotes sp.2(LC)	*Eutropis* sp. (LC)	*Carvus* sp. (LC)
		
Passer domesticus(LC)	*Phalacrocorax niger*(LC)	*Ardeola grayii*(LC)
		
Surniculus lugubris(LC)	*Egreetta garretta*(LC)	*Nectarinia jugularis*(LC)

		
Milvus migrans(LC)	*Columba livia*(LC)	*Xenetondon cancila* (DD)
		
Osteobrama alfredianus (DD)	*Tenualosa ilisha* (LC)	*Polynemus paradiseus* (NE)
		
Pangasius pangasius (LC)	*Channa striata* (LC)	*Clarias batrachus* (LC)
		
Labeo rohita(LC)	*Trichogaster pectroralis* (NE)	*Hyopostomus* sp. (NE)
		

Euploea core godartii (LC)	*Junonia Hubner* (DD)	*Gandaca harina*(LC)
		
Orthetrum sp. (LC)	*Sympetrum* sp. (NE)	*Diplacodes* sp. (DD)

	
Omocestus viridulus (NE)	*Pomacea canaliculate* (LC)

The recorded fauna species during study

Carvus sp. (LC)	*Sterna aurantia* (NT)	*Columba livia* (LC)
		
		

Ardeola grayii (LC)	*Phalacrocorax niger*(LC)	*Egreetta garretta*(LC)
		
Passer domesticus(LC)	*Copsychus saularis*(LC)	*Hypsipetes leucocephalus*(LC)
		
Dicrurus macrocercus(LC)	*Pycnonotus blanfordi*(LC)	*Surniculus lugubris*(LC)
		
Notopterus notopterus (LC)	*Puntius chola*(LC)	*Trichogaster pectoralis* (NE)
		
Exocoetus volitans (LC)	*Mystus vittatus* (LC)	*Pentaprion longimanus* (LC)

		
Cirrhinus mrigala (NE)	*Labeo rohita* (LC)	*Litopenaeus setiferus* (NE)
		
Pomacea canaliculate (LC)	Unknown	*Rhyithemis phyllis* (LC)
		
Diplacodes sp. (NE)	*Orthetrum* sp. (LC)	*Sympetrum* sp. (NE)
		
Ischnura senegalen (LC)	*Neurothemis tullia* (LC)	*Catopsillia* sp. (NE)

Figure ( ) Recorded fauna species during study

		
Acacia auriculiformis (LC)	*Acanthus ilicifolius* (LC)	*Adiantum capillus-veneris L.* (LC)
		
Avicennia officinalis (LC)	*Alternanthera sessilis* (LC)	*Bombax ceiba* (LC)
		
Borassus flabellifer (EN)	*Capsicum annuum* (LC)	*Carica papaya* (DD)
		

Colocasia esculenta (LC)	*Cenchrus setaceus* (LC)	*Cyperus eragrostis* (LC)
		
Delonix regia (LC)	*Ipomoea aquatica* (LC)	*Lemna aequinoctialis* (LC)
		
Pithecellobium dulce (LC)	*Mimosa pudica* (LC)	*Pterocarpus indicus* (VU)
		
Swietenia macrophylla (VU)	*Ziziphus jujuba* (LC)	*Heliotropium indium* (NE)

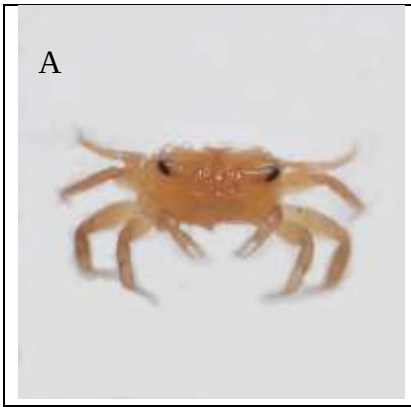
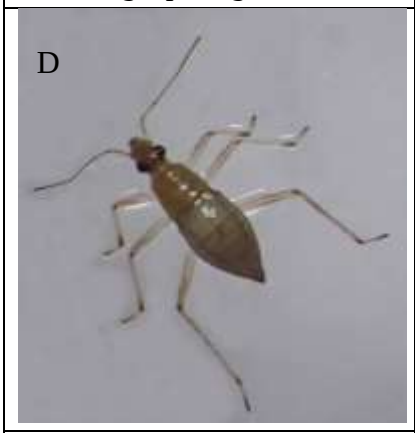
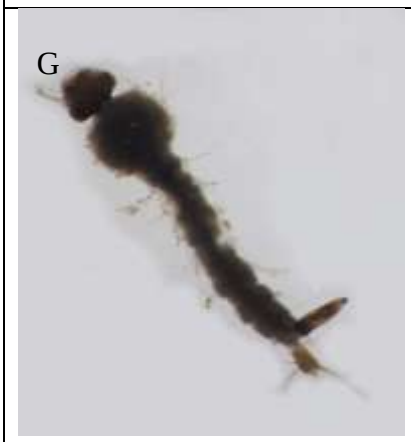
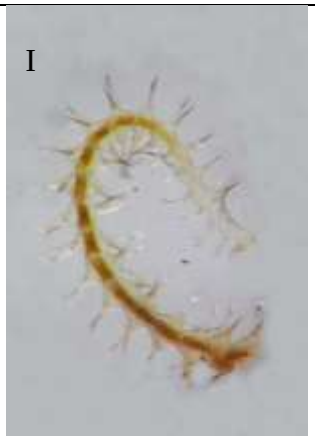
		
Mitragyna diversifolia (NE)	Casuarina equisetifolia (NE)	*Moringa oleifera* (NE)
		
Cheilocostus speciosus (NE)	*Cocos nucifera* (NE)	*Lagerstroemia speciose*(NE)
		
Chromolaena odorata (NE)	*Musa sapientum* (NE)	*Cephalandra indica* (NE)

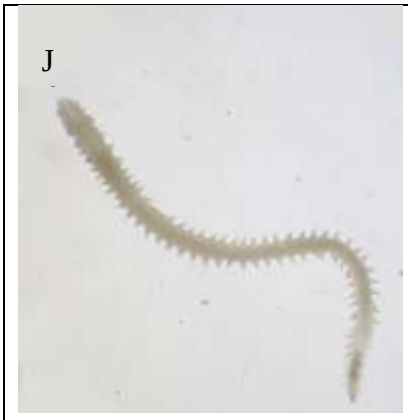
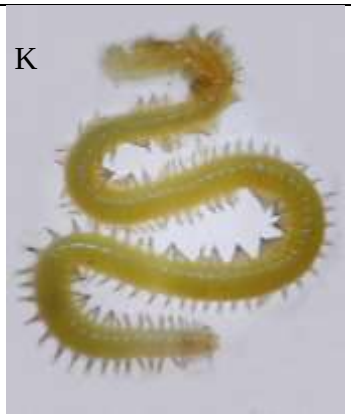
		
Abelmoschus esculentus (NE)	*Mimusops elengi* (NE)	*Tectona grandis* (NE)
		
Albizia lebbek (NE)	*Eichhornia crassipes* (NE)	*Bauhinia acuminate* (NE)

	
Oryza sativa (NE)	*Phagneticola calendulacea (NE)*

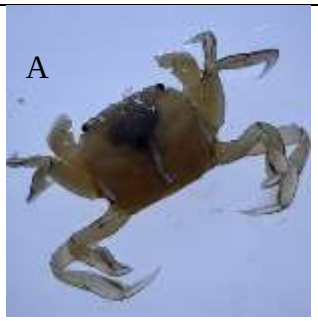
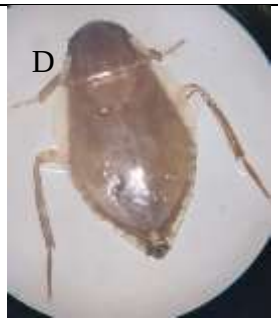
Recorded Flora Species during study

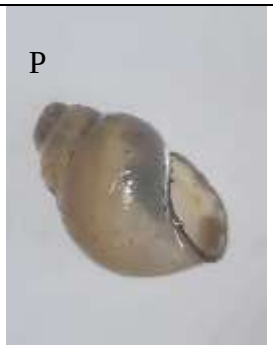
Appendix 6 Benthos Survey in Dry Season

A 	B 	C 
Paragrapsus gaimardii	Damselfly larvae	*Ophiogomphus cecilia*
D 	E 	F 
Mesovelia mulsanti	Creeping water bug	*Dytiscus marginalis*
G 	H 	I 
Mosquito larvae	True fly larvae	*Syllid* sp.

 J	 K	 L
Nereis sp.1	*Nereis* sp.2	*Dero* sp.
 M	 N	 O
Eiseniella tetraedra	*Gyraulus convexiusculus*	*Succinea putris*
 P	 Q	 R
Pomacea lineata	*Pomacea paludosa*	*Floridobia floridana*
 S	 T	A-H= Arthropoda I-M= Annelida N-T= Mollusca
Physella gyrina	*Juga plicifera*	

Appendix 7 Benthos Survey in Wet Season

		
Paragrapsus gaimardii	Skimmers larvae	Beetles larvae
		
Creeping water bug	*Odontomyia* sp.	*Dytiscus marginalis*
		
True fly larvae	*Nereis* sp.	*Dero* sp.
		
Eiseniella tetraedra	*Gyraulus convexiusculus*	*Biomphalaria pfeifferi*

M 	N 	O 
Succinea putris	*Pomacea lineata*	*Pomacea paludosa*
P 	Q 	
Floridobia floridana	*Juga plicifera*	
R 		A = Crustacean B-H=Insecta H-J= Annelida K-R= Gastropoda
Melanoides tuberculata		

Appendix 8 Record of the First Public Consultation (Scoping Stage)

Record of the Public Consultation (Hlaing Tharyar Township)

E Guard Environmental Services Co., Ltd. **Meeting Minutes**	
Subject: Yangon Urban Mass Rapid Transit Construction Project 1st Public Consultation (EIA/LARAP)	**Date:** June 1, 2019
Venue: Sarsana edifice, Aung Myay Thar Pagodo yard, Hlaing Tharyar Township, Yangon	**Time:** 9:00 AM to12:00 AM
Attendees: Total: 1446 (local people: 1331; government officials: 45; parliaments members: 4; NGO/INGOs: 23; media: 25, private companies: 5; interested parties: 12; industrial zone: 1)	

Public consultation of Yangon Urban Mass Rapid Transit-YUMRT was held on 1st June 2019 in Hlaing Tharyar Township, Aung Myay Thar Pagoda yard, Sarsana edifice. Local people, Representatives of Yangon Regional Government, Parliament, Ministry of Transport and Communications, Myanmar Railways, concerned Township/Ward administrators and related governmental departments, people from private companies and media attended the meeting and meeting record is described in below.

Agenda:

1) Opening Ceremony
2) Opening Remarks by U Si Thu Shein (Deputy Assistant Director) from General Administrative Department behalf of Yangon Region Government
3) Speech by U Win Min (Representative of Pyi Thu Hluttaw, Hlaing Tharyar Township)
4) Speech by U Aye Bo (Representative of Amyo Thar Hluttaw, Hlaing Tharyar Township)
5) Introduction of the project by U Htun Aung Thin (General Manager, Lower Myanmar, Myanmar Railways, Ministry of Transport and Communications) and presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plan (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services)

6) Question and Answers by Attendees
7) Closing Remarks by U Htun Aung Thin (General Manager, Lower Myanmar, Myanmar Railways, Ministry of Transport and Communications)
8) Closing Ceremony

Opening Ceremony

Opening Remarks by U Si Thu Shein (Deputy Assistant Director) from General Administrative Department behalf of Yangon Region Government

U Si Thu Shein explained as follows:

Concerned with YUMRT, there is a committee for implementation in Regional Stage. The purpose of this public consultation is to introduce the concerned stakeholders about the implementation of Yangon Urban Mass Rapid Transit-YUMRT), the very first South-North Railway which is 18 km long from Hlaing Tharyar Township to Parami. Questions and suggestions following the presentation are also welcomed.

Speech by U Win Min (Representative of Pyi Thu Hluttaw, Hlaing Tharyar Township)

This project aims at better transportation for people. To get the best result, cooperation of residents is also at most needed. Since the main purpose of this project is to be the best for residents, the possible impacts will be tried to avoid or reduce as much as we can.

Speech by U Aye Bo (Representative of Amyo Thar Hluttaw, Hlaing Tharyar Township)

YUMRT is carried out for the future generation. To develop Hlaing Tharyar Township, residents are requested to participate in implementation of the project.

Introduction of the project by U Htun Aung Thin (General Manager, Lower Myanmar, Myanmar Railways, Ministry of Transport and Communications)

With the rate of increasing population, this project is aiming to get the better transportation system for the residents in Hlaing Tharyar Township. This public consultation was led by Yangon Regional Government and today attendees include people from different industrial zones and concerned departments. Not only the upgrading project of Yangon Circular Railway but also the upgrading the Yangon-Mandalay Road is also being implemented for better transportation. The phase from Hlaing Tharyar Township to Oakkyin to Parami is the priority to implement. The reason to choose East-West of Yangon is that there are over 100 thousands of vehicles during peak hours. People who are depending on UMRT system are 88 percent. Moreover, it is being planned to connect the railway with Toe Kyaung Kalay and then to Upper Myanmar. The phase of Hlaing Tharyar Township, Oakkyin and Paramin is connected with YCR and YBS is connected with the phase of Hlaing Tharyar Township and Oakkyin. This project is located through (5) townships, Hlaing Tharyar, Yankin, Mayangone,

South Okkalapa and Hlaing. To construct railway, there are processes like extension, building station and so on. For this project, Union Ministry and Yangon Region Government will carry out together and then transfer to Transportation Department. In Hlaing Tharyar Township, the railway will be constructed in the middle of Yangon-Pathein Road. The impacts due to this project will be reduced as much as we can. Drawing design for this project has been started since 2018 and it is expecting to finish in 2022. The construction process will be started in 2022 and hopefully finished in 2027. The residents' participation is very important to finish in time. Technical assistance for the project is given by JICA and project will get Loan from Japanese Government. The resettlement action plan will be complied with national and international laws. The government is also managing to get the best suitable results for all people.

The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plant (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services)

The main purpose of this public consultation is to introduce the processes of this project and explain the impacts to the residents officially. The possible impacts are Air Quality, Water Quality, Noise and Vibration. On the other hand, the positive impacts of this project is to create more job opportunities and reduce traffic conjunction. The possible impacts are divided into two parts; construction and operation stages. The first environmental quality measurement has been done in 18 locations along the alignment area.

The survey team will conduct LARAP survey in coming days. I request all the residents to corporate with us when concerned administrators come to your houses and conduct social and resettlement surveys. The cut-off date for this project is May 6, 2019 and it has been announced on Myanmar Alinn Daily and The Mirror newspapers and also announced at related departments.

Question and Answers by Attendees

Category	Questions/ Suggestions	Response	Date/ Place
Land Acquisition and Compensation	Daw Thwe Thwe Oo (Local People, Lower edge, Hlaing Tharyar) *"Concerning with the changing of living location, if we have to move on June and July, there may be difficulties for the students"*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"The students are going to stay peacefully. You don't need to move"* U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"In June and July, we will come to your houses and conduct survey. You do not have to move at that time, we will do interview with survey questionnaires such as 'how many family members in your household', etc., When we take survey, I would like you to be patient and give accurate*	Jun 1, 2019 Hlaing Tharyar Township

Category	Questions/ Suggestions	Response	Date/ Place
		answer so that we can calculate to be reliable result. The compensation procedures will be carried out only after submitting survey results to the Yangon Regional government via Myanmar Railway."	
	U Win Shane (Local People, Wah Wah Win Group, Hlaing Tharyar) *"As squatters like us, we worry that we will be paid the compensation fees which is lower than we should receive. So, I would like to ask the liable persons to make our lives better."*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"For all the squatters, we have considered in every aspects such as how to move, how to settle, etc. Now , we have planned for everyone to be convenient"*	Jun 1, 2019 Hlaing Tharyar Township
	Daw May Thet Khaing Oo (Local People, Yangon- Pathein Road, Hlaing Thar Yar) *"Will compensation be eligible for squatters who do not have smart card?"*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"Concerning smart card issues, I would like to suggest you to contact with respective ward or Township administrators."*	Jun 1, 2019 Hlaing Tharyar Township
	U Toe Toe Aung (Local People, Hlaing Tharyar) *"On May 14, MRTV announced that squatters who hold smart cards will be provided land. And we have found that NGOs are taking surveys to us. I would like the liable persons to figure out this case. "*	U Aye Bo (Representative of Amyo Thar Hluttaw, Hlaing Tharyar Township) "*We are going to arrange at it' s the best for the squatters "*	Jun 1, 2019 Hlaing Tharyar Township
	U Hla Win (Local People, Yangon-Pathein Road, Hlaing Tharyar) *"I request to conduct the survey only after announcing the survey date via respective persons."*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"Before we conduct the survey, we will inform you in advance via ward and general administrators.*	Jun 1, 2019 Hlaing Tharyar Township
Project Component and Schedule	U Hla Swe Win (Interested Person, No (2) Ward, Hlaing Thar Yar) *"Some railway projects were stopped due to low demand of passengers at the time of old government. And the Government has lost large amount of money. Electricity availability for operation of this electric train is known to be weak. And then, have you calculated the estimate number of the passengers who will use this electric train? Do equipment and materials imported for this project by respective company have any warranties?"*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"The previous projects were stopped due to ineffectiveness. According to the feasible survey results, there are 250000 trips during busy time. After calculating these trips, as EW route is more suitable, and we selected to make this happen. We expect this project to be effective till 2030. To fix the final alignment, we have to make detailed design and action plan.* *Quality control for the construction materials will be carried out separately. MOEE is planning to supply 38MW of electricity which is required for construction period from*	Jun 1, 2019 Hlaing Tharyar Township

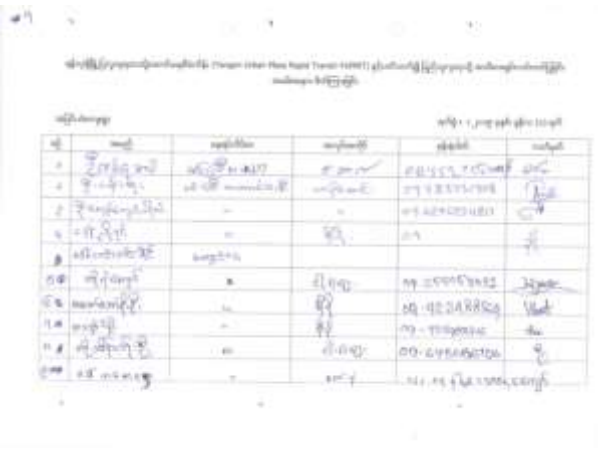
Category	Questions/ Suggestions	Response	Date/ Place
		two sources, West Yangon University and Pathein. Similarly, 50MW of electricity required for operation period will also be supplied by the above two sources." U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"E Guard Environmental services is not railway construction company. It is a service provider to assess the impacts caused by the project. The project will be carried out only after approval from the union government."*	
	Ma Win Myanmar Lay (FMR Research and Advisory) *"How much would you rate to be affordable ticket price for the public?"*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"We are going to minimize the ticket price as much as possible."*	Jun 1, 2019 Hlaing Tharyar Township

Closing Ceremony

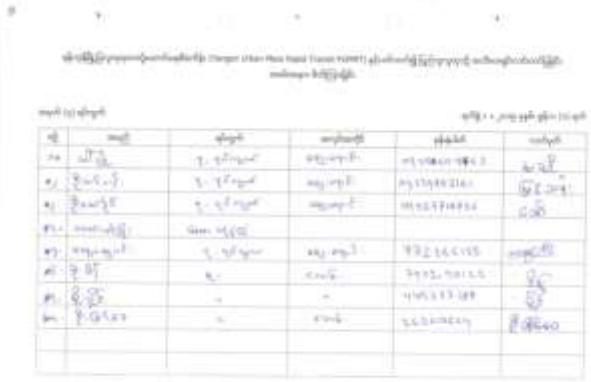
Attendee List

Local Community



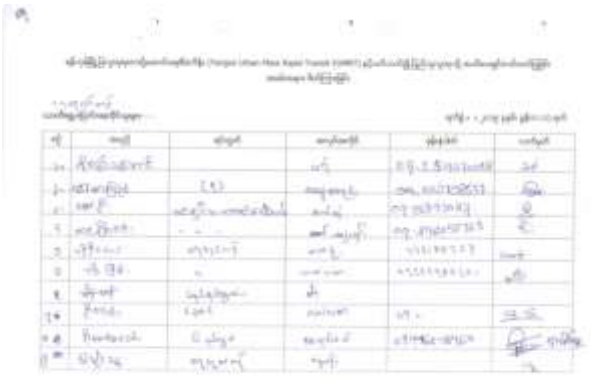




















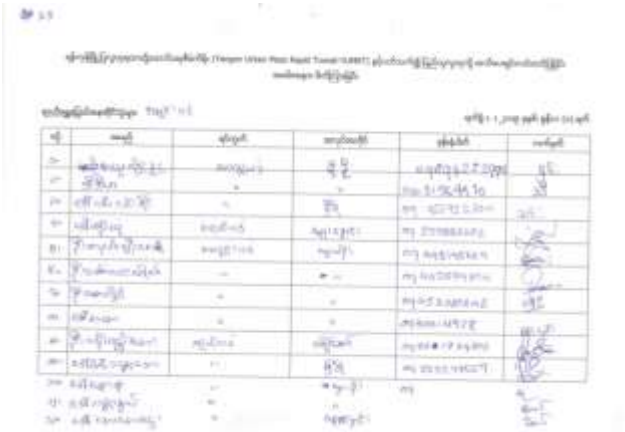


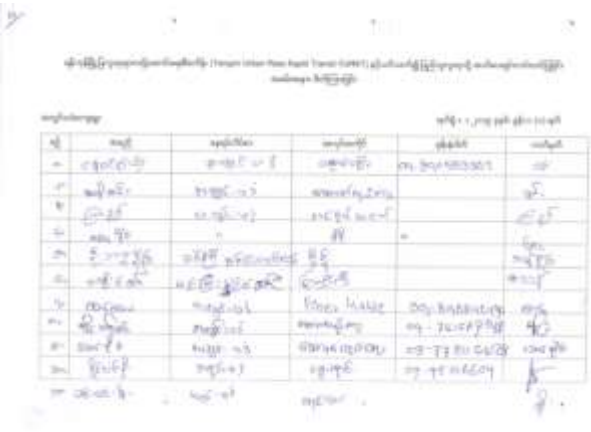


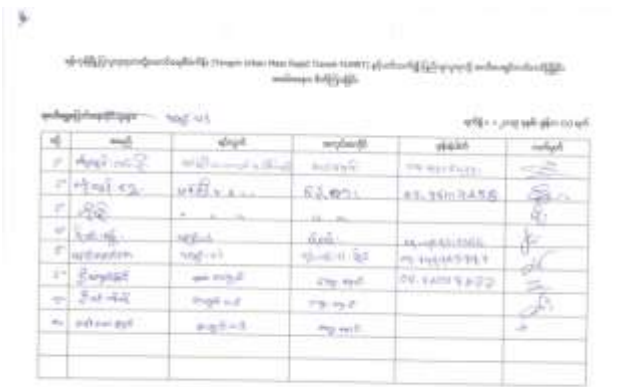




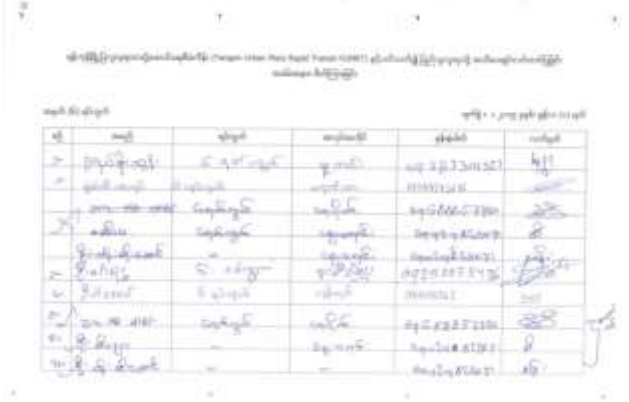




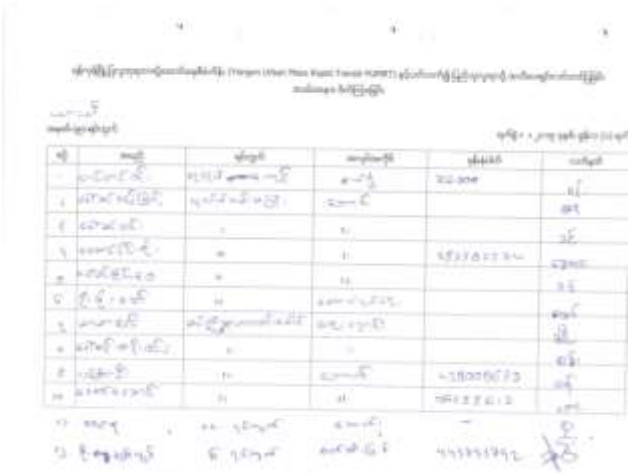














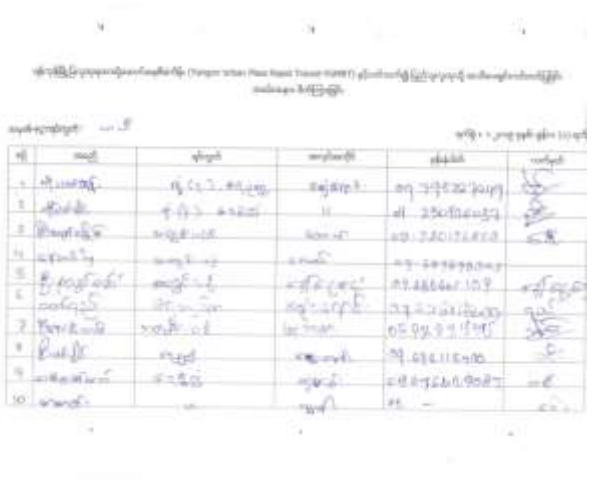


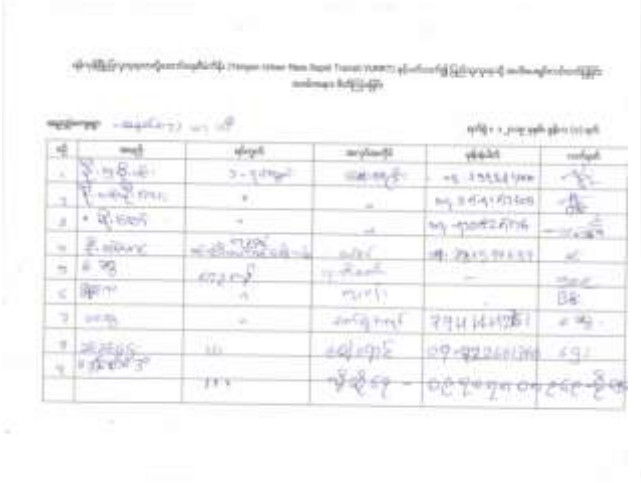


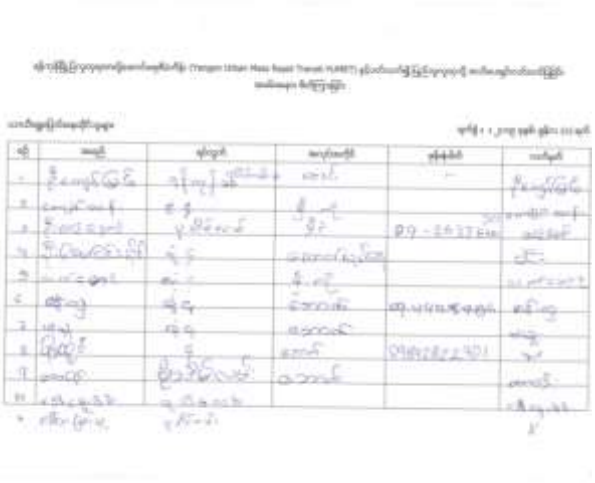




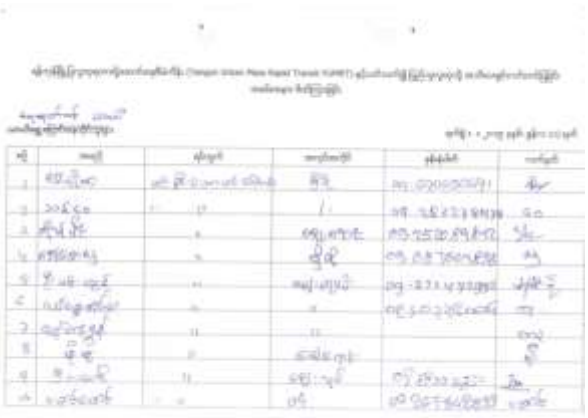




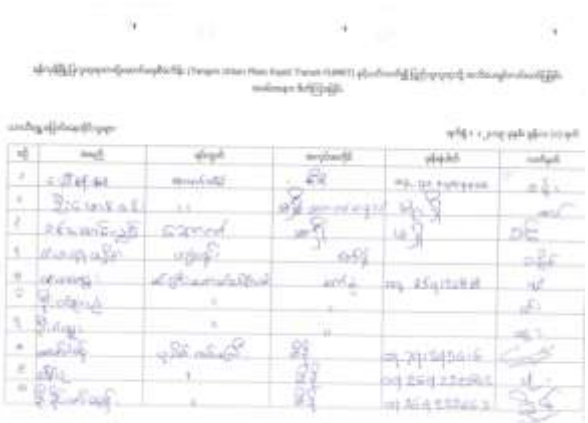




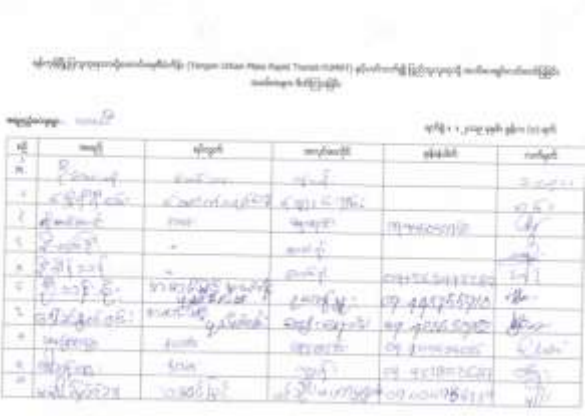














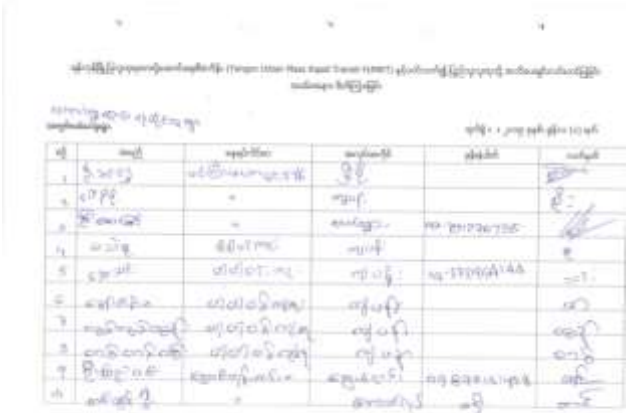


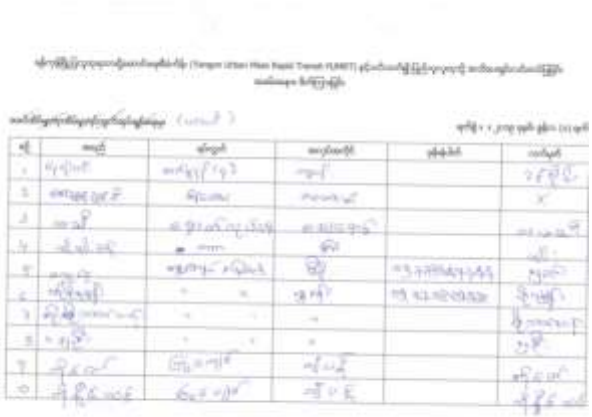


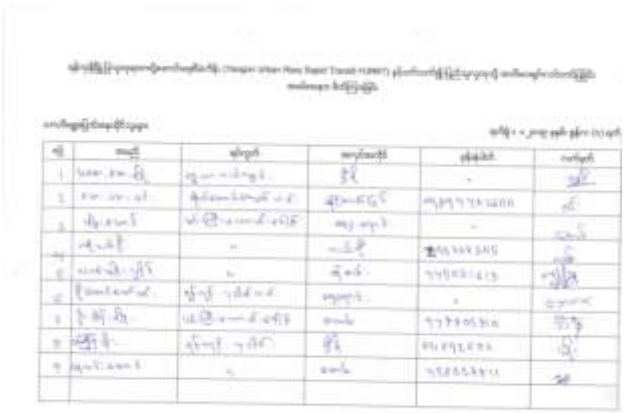




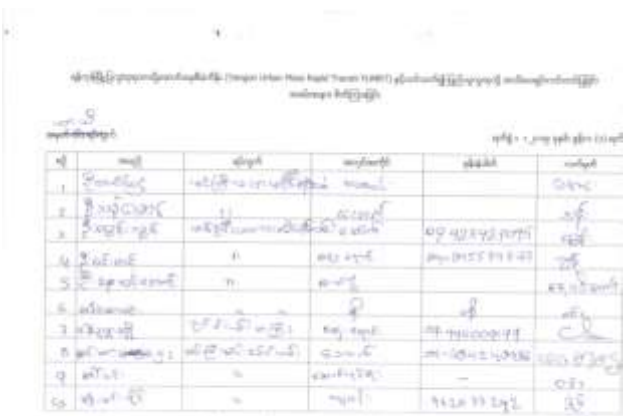


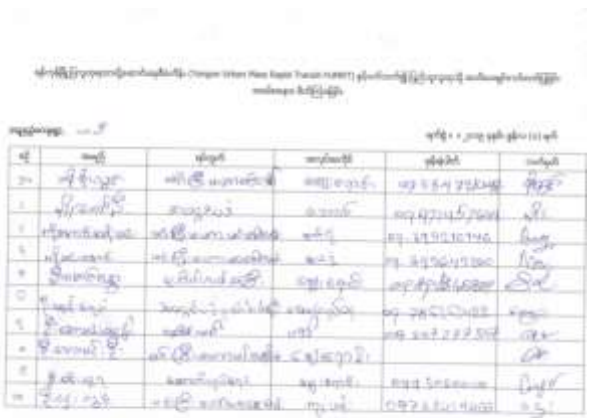








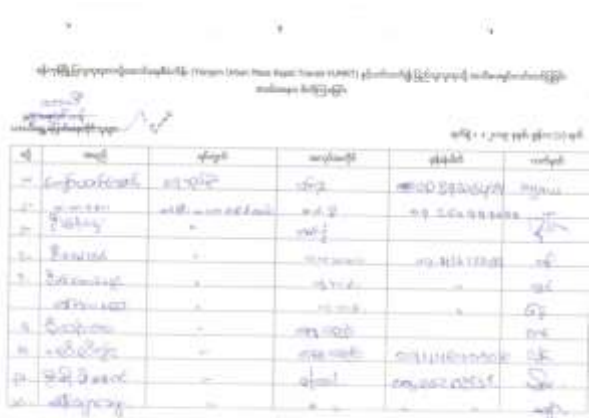


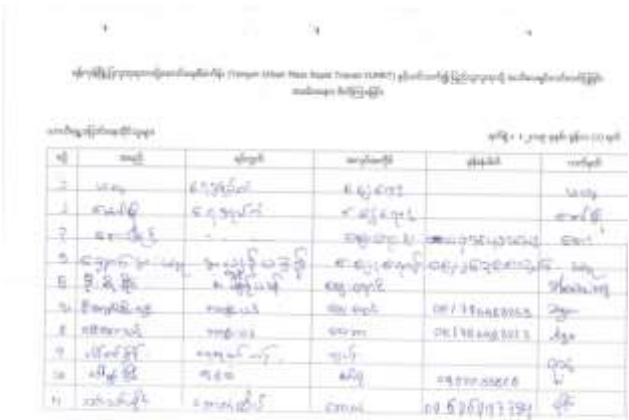


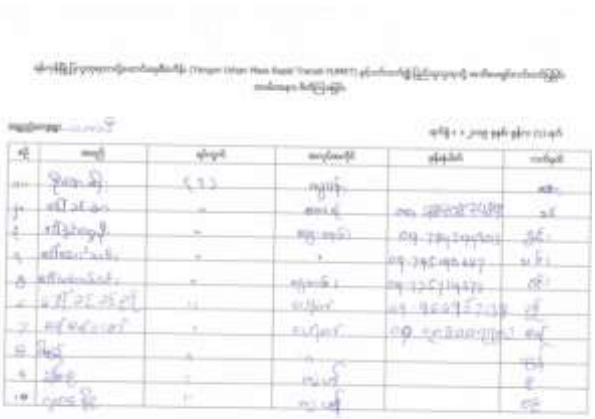




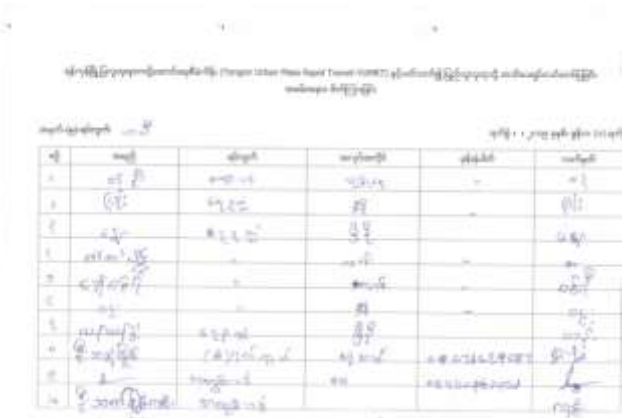






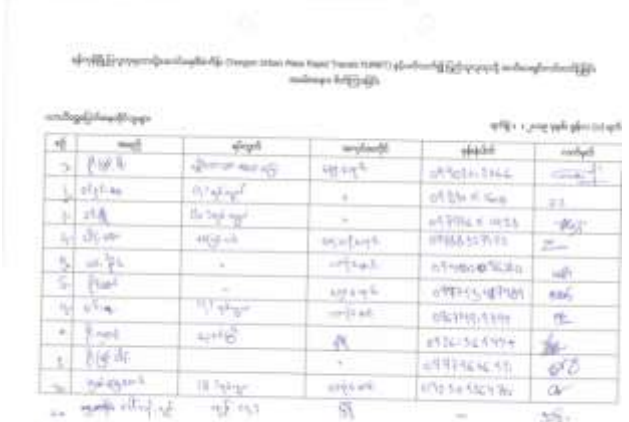


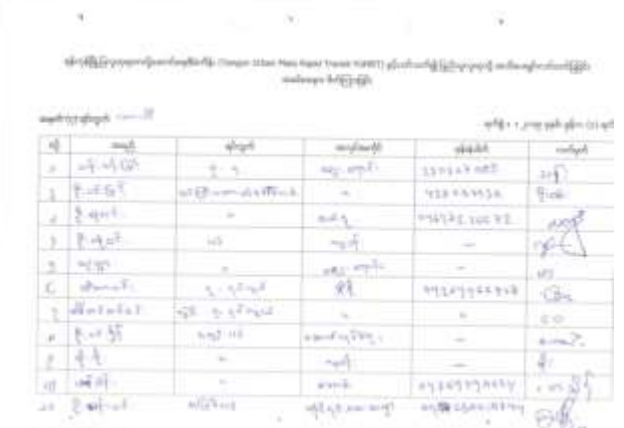








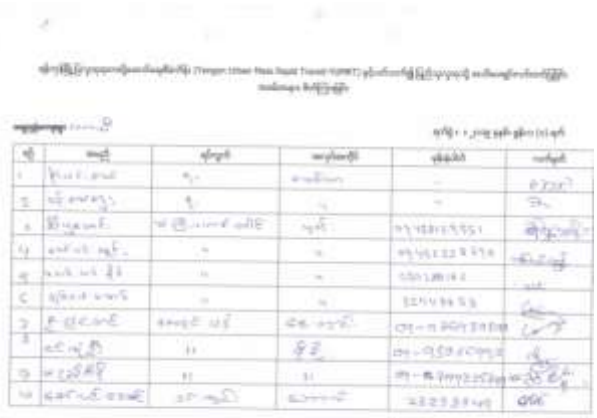


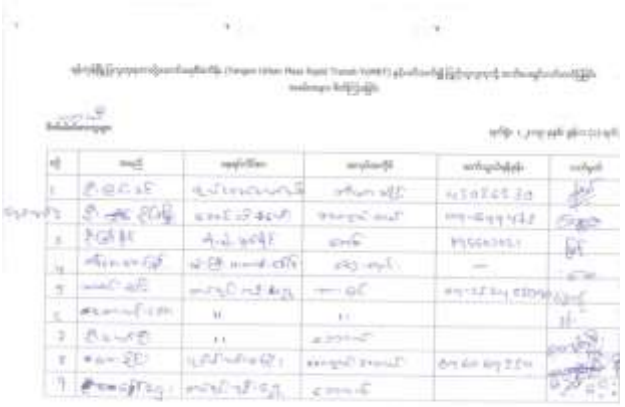


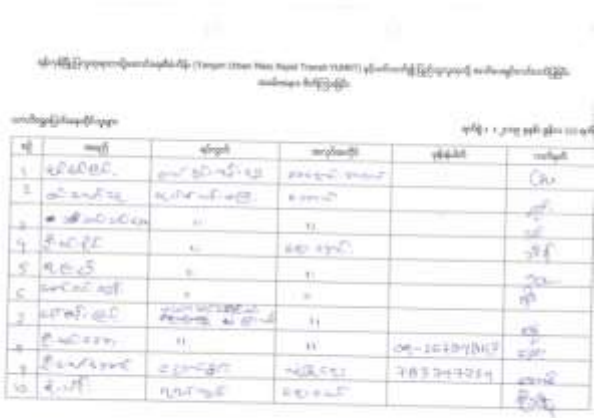




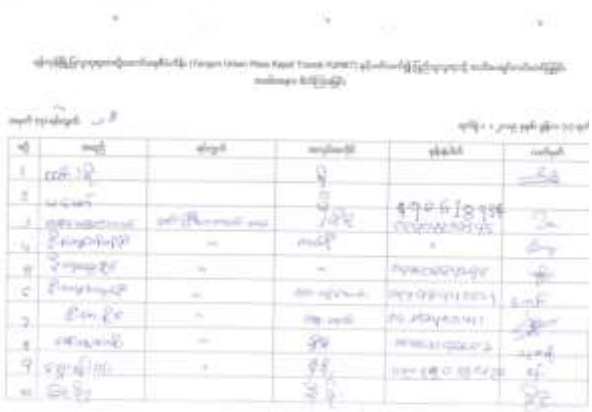




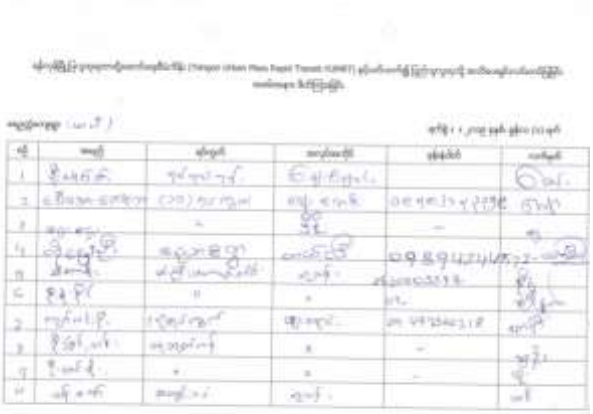




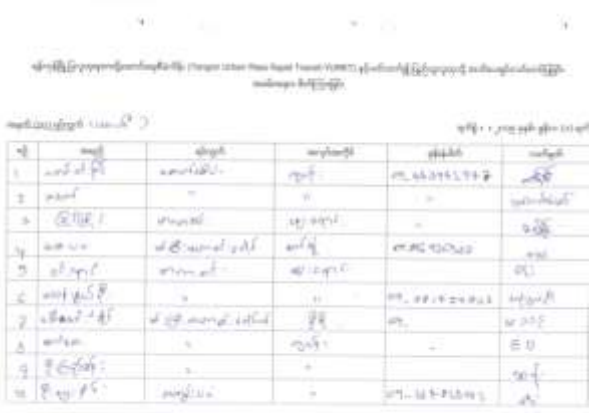








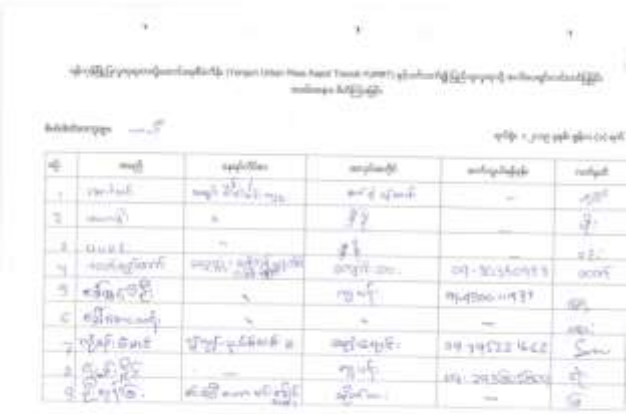


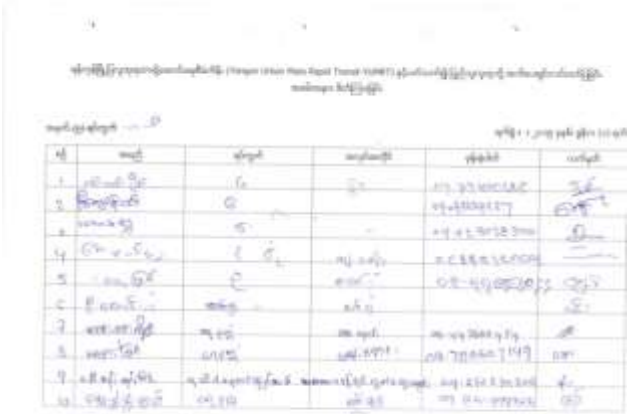






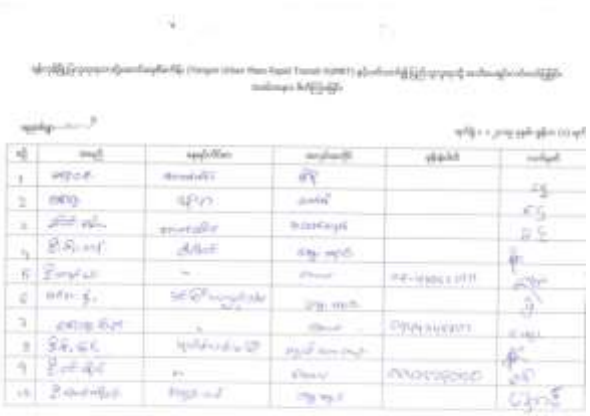




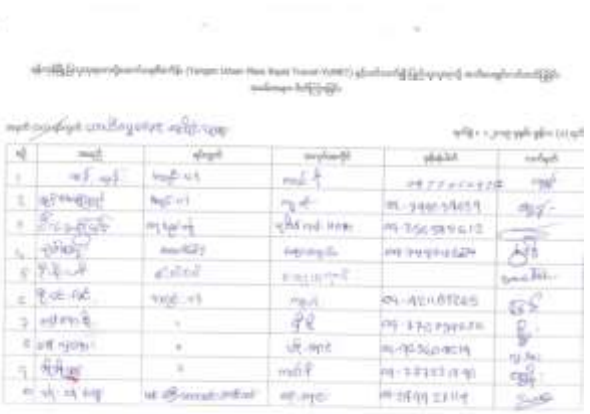




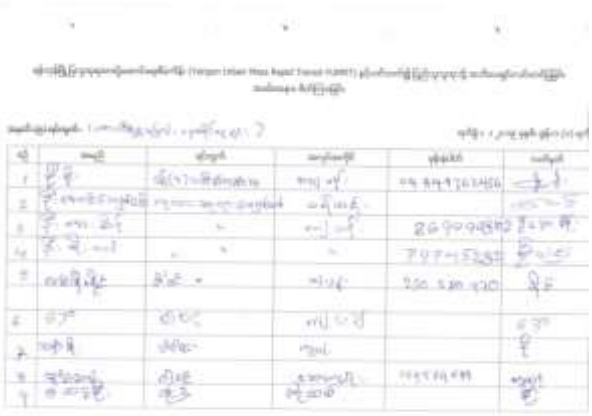




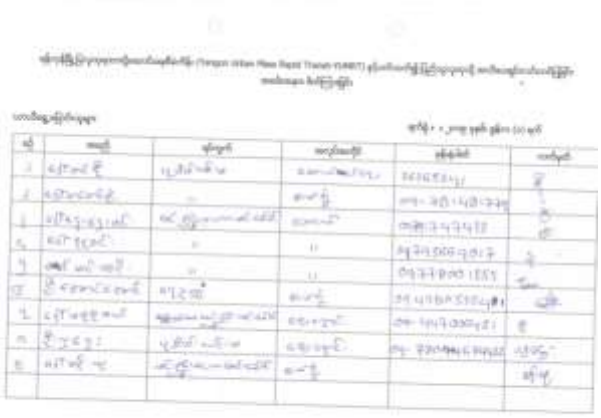


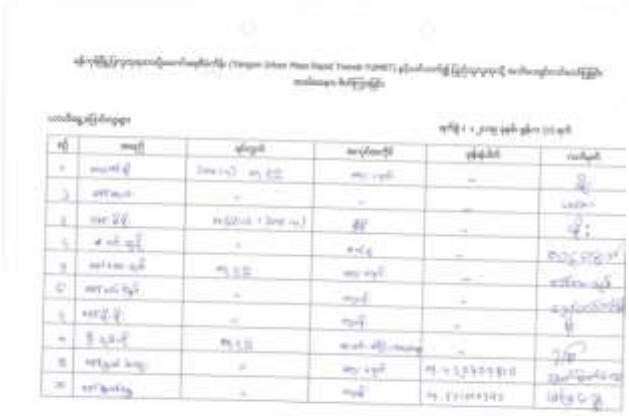




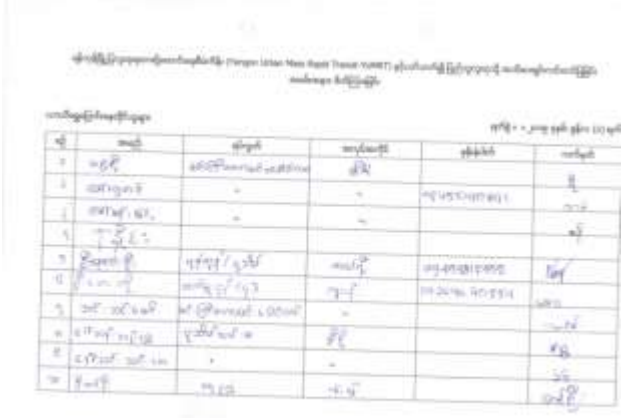


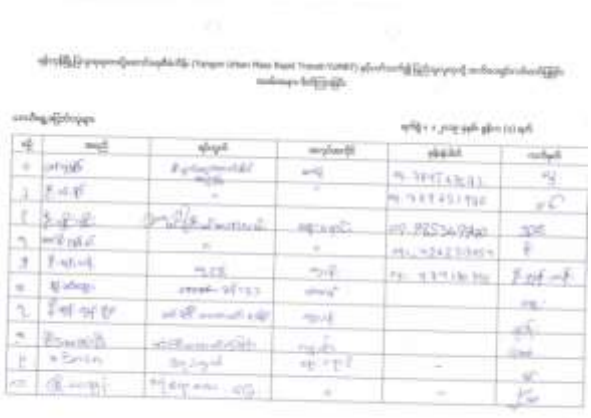


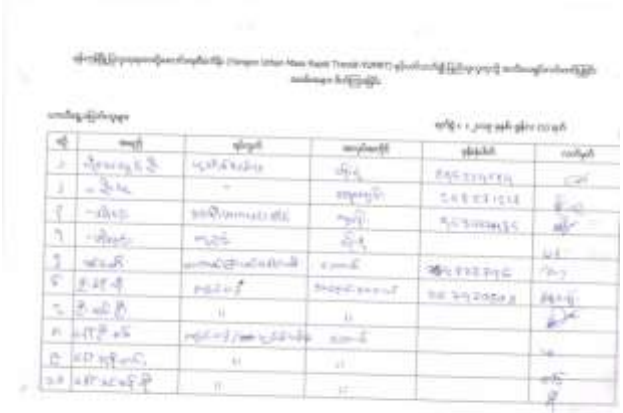




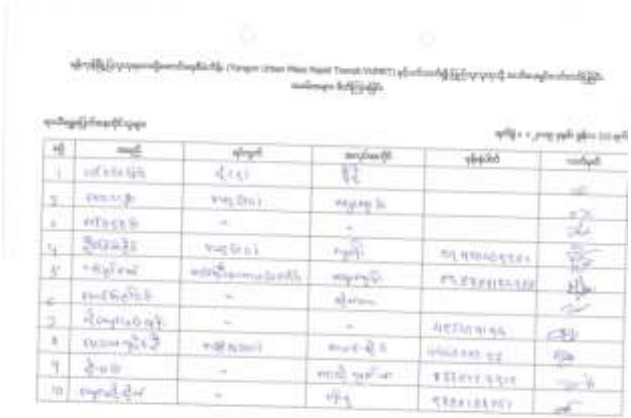


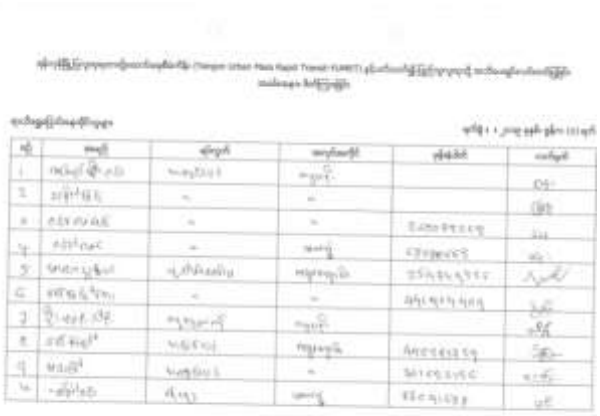


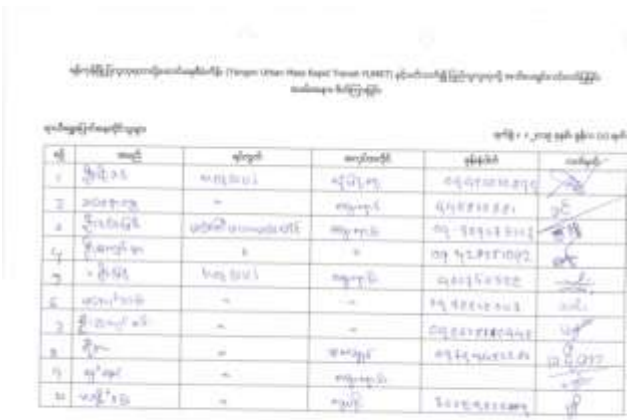


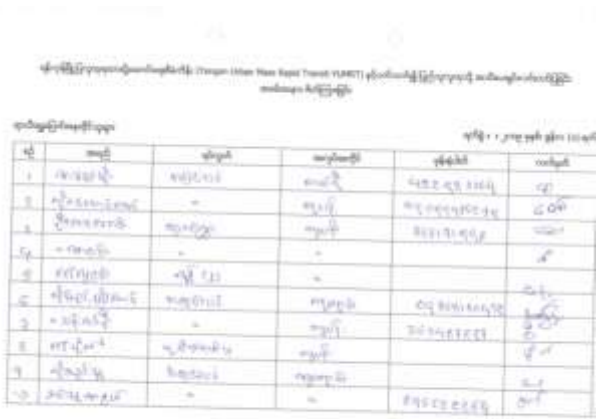


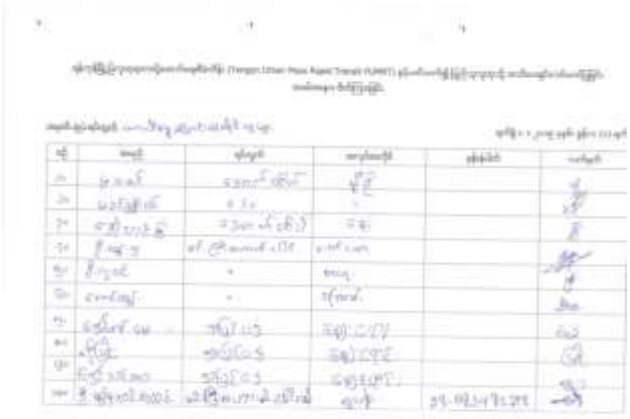


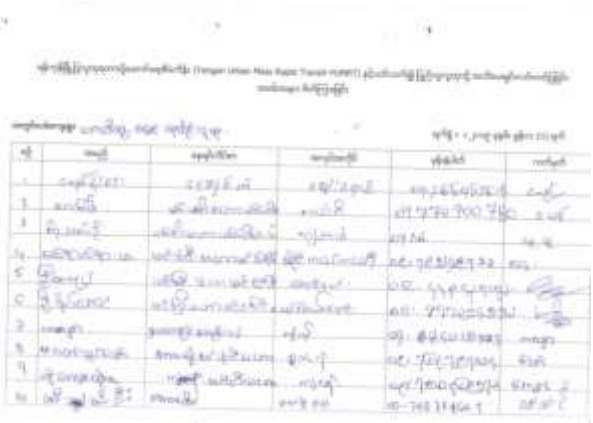


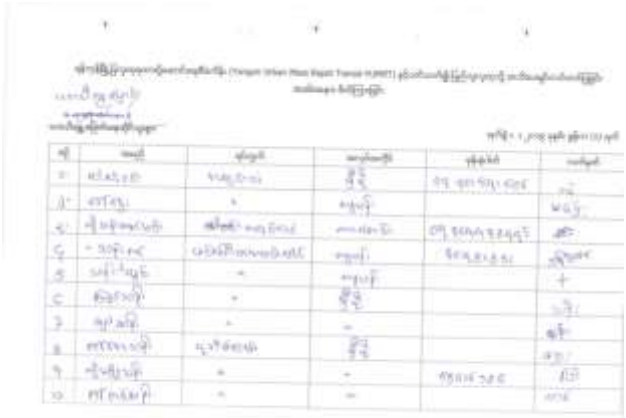


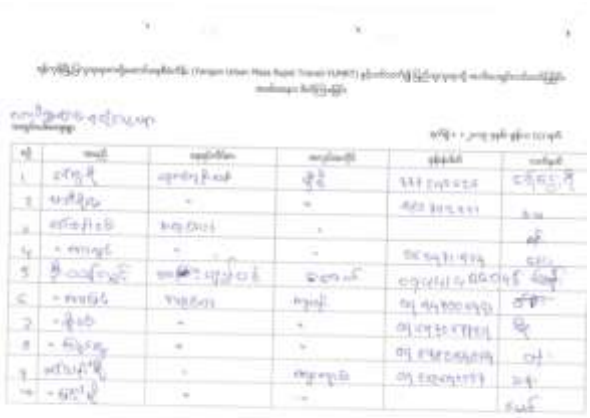


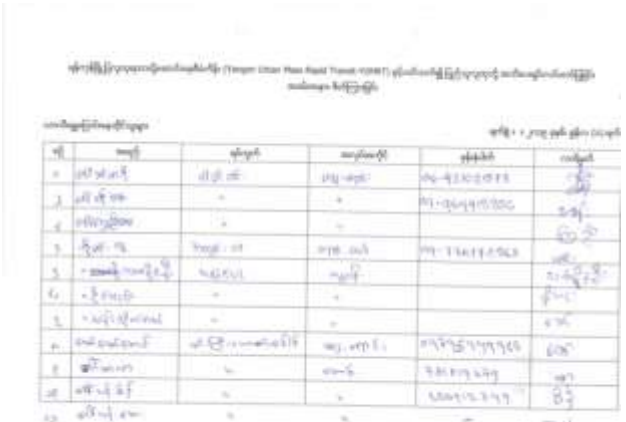


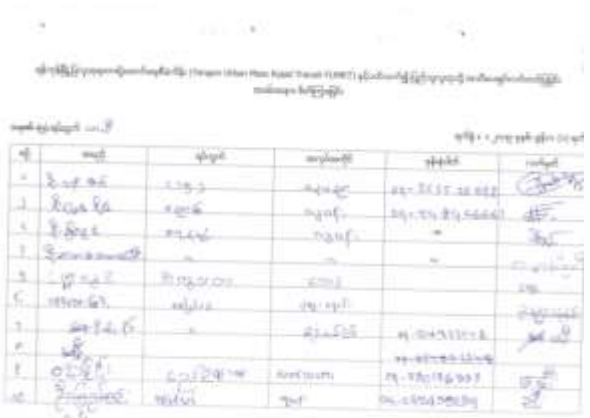








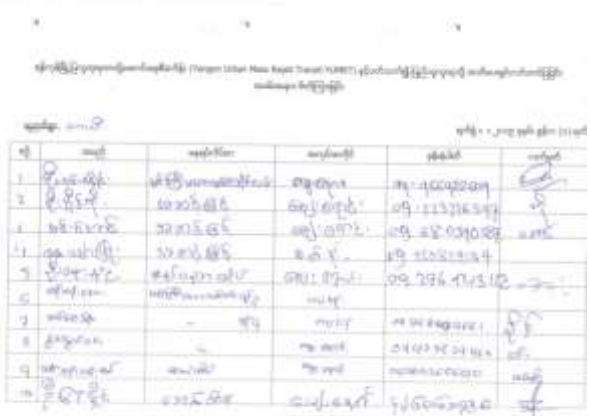




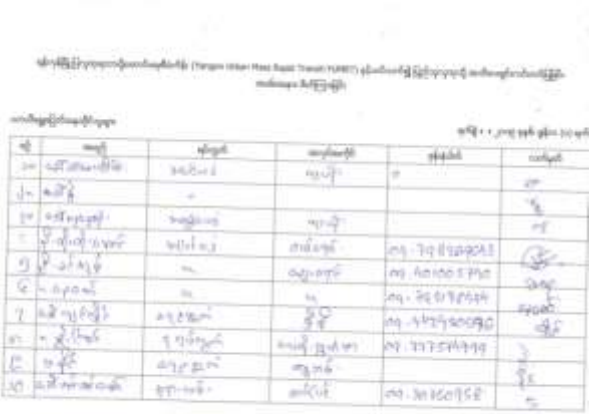






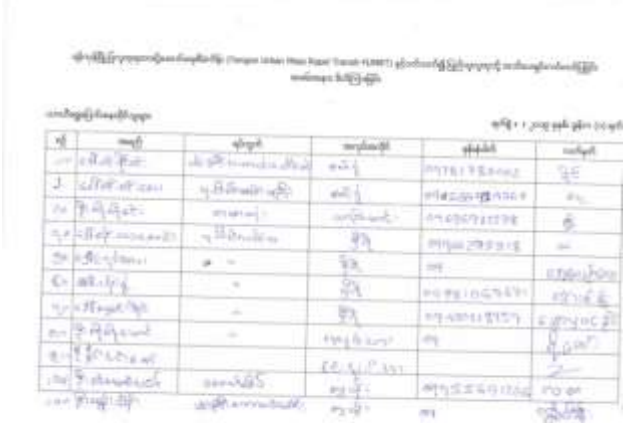


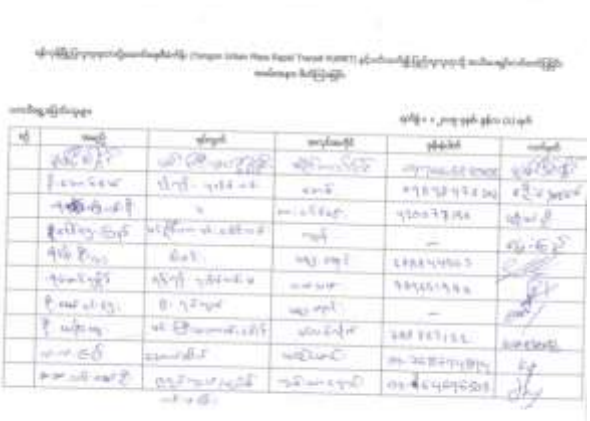




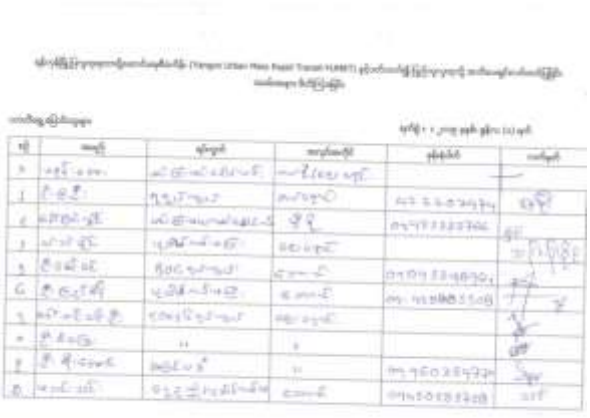


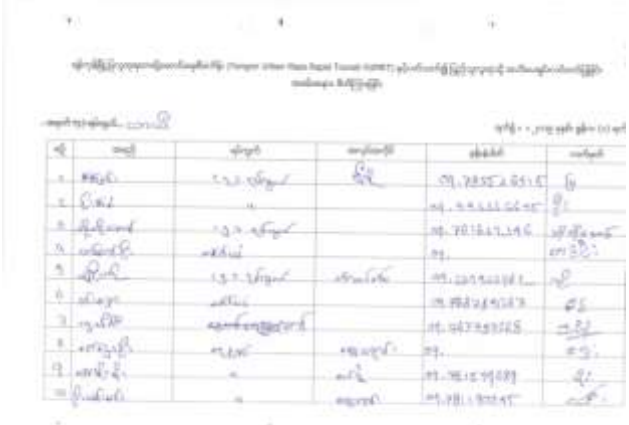


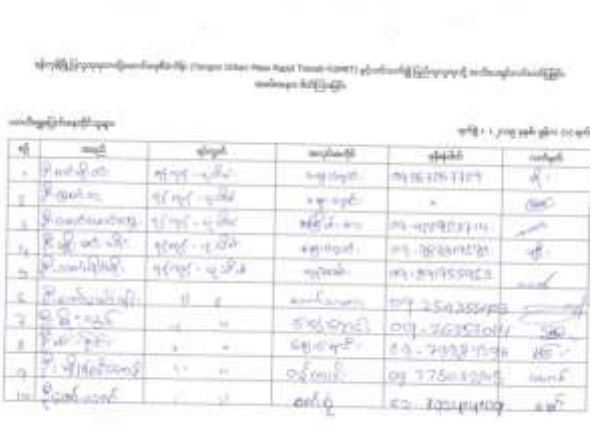


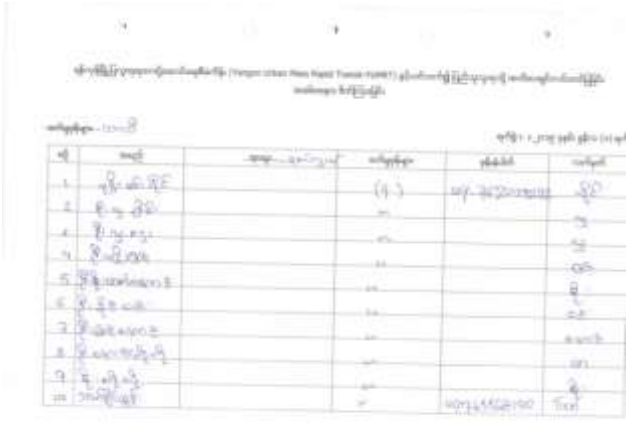






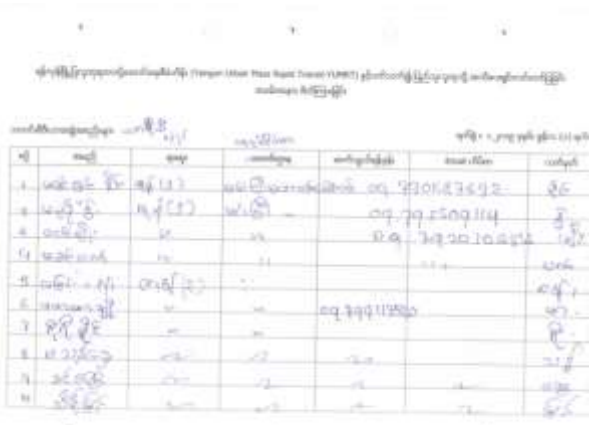






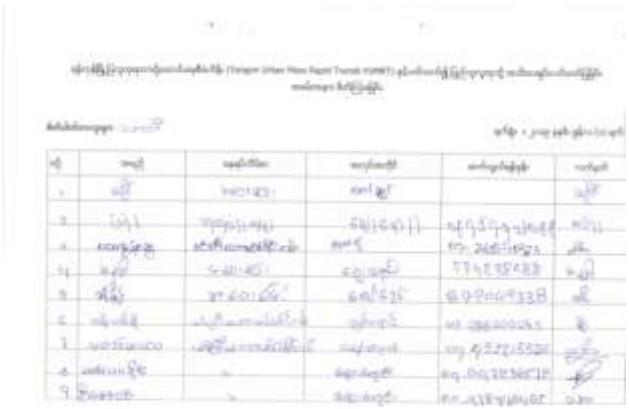








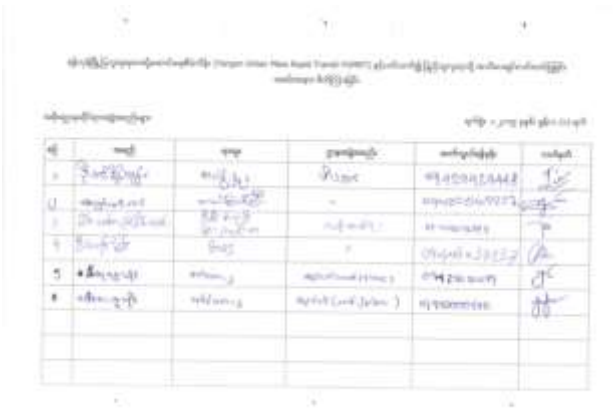




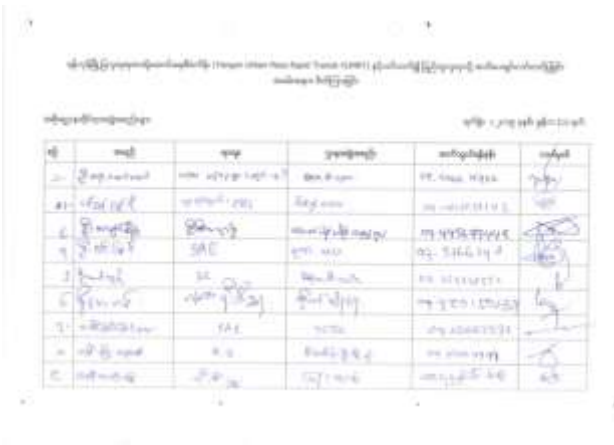
Government Officials

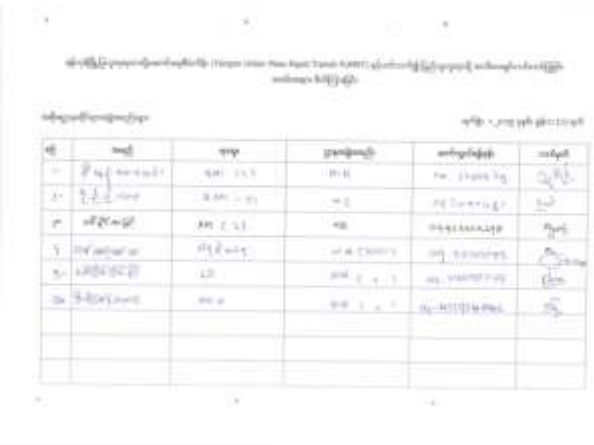












Parliament Member



Media





NGO/ INGOs







Private Companies and Industrial Zone





Interested Parties





Photographs






16°52'20.34813"N 96°3'45.70065"E
Public Consultation for YUMRT Project
1 Jun 2019 8:20:35 am


2019/6/1 08:09












Partipicant's Registration




Opening Speech by U Si Thu Shein from General Administrative Department behalf of Yangon Region Government




Speech by U Win Min U Win Min (Hlaing Tharyar Township), Representative from House of Representative and U Aye Bo (Hlaing Tharyar Township), Representative from House of Nationalities




Presentation on the Project (Introduction) by
U Htun Aung Thin (GM, Myanmar Railways, Lower Myanmar)




Presentation on EIA and LARAP by U Aye Thiha (EIA Consultant)









Q & A Session

Record of the Public Consultation (Hlaing Township + Mayangone Township)

E Guard Environmental Services Co., Ltd. **Meeting Minutes**	
Subject: Yangon Urban Mass Rapid Transit Construction Project 1st Public Consultation (EIA/LARAP)	**Date:** June 8, 2019
Venue: Mayangone Township, Kone Myit Yeik Thar Street, Thiri Mingalar Dhama Station	**Time:** 9:00 AM to12:00 AM
Attendees: Total: 347 (local people: 280; government officials: 30; parliaments members: 12; NGO/INGOs: 3; media: 13, private companies: 6; interested parties: 3)	

Agenda:

1) Opening Ceremony
2) Opening Remarks by U Saw Nyi Nyi Htwe, Township Administrator (Mayangone Township General Administration Department)
3) Speech by U Sein Htun , Chairman of YCDC (Mayangone Township)
4) Introduction of the project by U Htun Aung Thin (General Manager, Lower Myanmar, Myanmar Railways, Ministry of Transport and Communications) and presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plan (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services)
5) Question and Answers by Attendees
6) Closing Remarks by U Htun Aung Thin (General Manager, Lower Myanmar, Myanmar Railways, Ministry of Transport and Communications)
7) Closing Ceremony

The public consultation of Yangon Urban Mass Rapid Transit-YUMRT was held on June 8th, 2019 in Mayangone Township, Kone Myit Yeik Thar Street, Thiri Mingalar Dhama Station. It was attended by local people, Yangon Region Government, Representatives from Parliament, representatives from Ministry of Transport and Communications Myanmar Railways, administrators and related governmental departments, people from private

companies and media. The record of the public consultation is mentioned at the following table.

Opening Ceremony

Opening Speech by U Saw Nyi Nyi Htwe, Township Administrator (Mayangone Township General Administration Department)

U Si Thu Shein explained as follows:

YUMRT is a Hlaing Tharyar- Parami Mass Rapid Transport Project Phase (1) lead by Yangon Regional Government and cooperated with Ministry of Construction, Myanmar Railway and JICA with the purpose of upgrading transportation system by reducing traffic congestion within Yangon. I would like to tell the public to cooperate in implementation of the project.

Speech by U Sein Htun, Chairman of YCDC (Mayangone Township)

MRT is one of the essential developments of a country. Therefore, I would like to suggest public to cooperate with the government to achieve the project. The opinions and suggestion of the public are important. Hence, I would like to request all the residents to support in achieving the project.

Introduction of the project by U Htun Aung Thin (General Manager, Lower Myanmar, Myanmar Railways, Ministry of Transport and Communications)

YUMRT is one of the functions of YUTRA, the transport master plan which is allied with JICA. We aimed to operate the East-West alignment based on calculations over 2.5 millions of percent trips surveyed by YUTRA. We have set Hlaing Tharyar – Parami phase as phase – 1 and Parami – Toe Kyaungalay phase as phase – 2. Hlaing Tharyar to Parami phase is connected with YCR and YBS is connected with the phase of Hlaing Tharyar Township and Oakkyin. The alignment is going to pass through five townships, Haling Tharyar, Yankin, Mayangone, South-Okkalapa and Hlaing. In carrying through the project, Union Ministry and Yangon Regional Government will carry out together and then assign to Transportation Department. After the project, it will take only 35 minutes from Hlaing Tharyar to Parami. It will be carried out with minimum impacts on people. After drawing detailed design, it will be disclosed to the public. The project is aimed to construct in early 2022 and operate in 2027.

The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plan (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services)

The main purpose of this public consultation is to introduce about project plan and explain the potential impacts to the residents openly. The possible impacts are Air Quality, Water Quality, Noise and Vibration and so on. On the other hand, the positive impacts of this project are to create more job opportunities and reduce traffic conjunction. The possible impacts are divided into two parts; construction and operation stages. The first environmental quality measurement has been done in 18 locations along the alignment area.

The survey team will conduct LARAP survey in coming days. I request all the residents to corporate with us when concerned administrators come to your houses and conduct social and resettlement surveys. The cut-off date for this project is May 6, 2019 and it has been announced on Myanmar Alinn Daily and The Mirror newspapers and also announced in concerned departments.

Question and Answers by Attendees

Category	Questions/Suggestions	Response	Date/Place
Land Acquisition and Compensation Safety	U Kyaw Kyaw Htun (Local People, Mayangone Township) *"For land compensation, which guidelines will be followed?"*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"Land compensation will be considered based on JICA Guidelines, National Guidelines and other International Standard."*	Jun 8th, 2019 Mayangone Township
	U Myint Swe (Ward 10, Ward Administrator) *"We had lost our land for existing road expansion in the past around 20 years ago"*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"We will try to be minimum damage. Regarding the impacts on land, we will present more detail information in the second time of consultation."*	Jun 8th, 2019 Mayangone Township
	Daw Htet Htet Khaing (Local People, Mayangone Township) *"In this meeting, the details such as how many areas of land of each HH will be effected, how much will be compensated, etc., are not included. The meeting should be held after preparation of report which includes detail calculation. And we are suffering due to the sudden announcement of cut-off-date."*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"Details of affected land area and compensation amount will be presented in the next meeting. Land measurements will be done by YCDC."* U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"Concerning with the land*	Jun 8th, 2019 Mayangone Township

Category	Questions/Suggestions	Response	Date/Place
		compensation, detail calculation will be done after the survey. During the survey time"	
	U Min Thu (Local People, Mayangone Township) *"Based on cut-off-date announcement, transaction of the buildings along Parami cannot be done since May 6th. To what extent it is effective and how would you take responsibility if staff housing belonged to Department of Social Welfare is affected by the project? "*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"We will compensate for every kind of damages."*	Jun 8th, 2019 Mayangone Township
Environmental Impact Assessment	U Wai Lin Htun (Local People, Mayangone Township) *"Will air and noise pollution survey result be disclosed to public? How much speed of the train? Is there any plan to install noise barrier in the project area?"*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"The whole report including air and noise pollution analysis will be revealed to public."*	Jun 8th, 2019 Mayangone Township
Safety	U Thein Shwe (Local People, Mayangone Township) *"Since the alignment along Parami Road is narrow and also have many curves, it may be dangerous."*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"In setting alignment along Parami Road, it has planned to be least damage by taking more area on more military side."*	Jun 8th, 2019 Mayangone Township
	U Saw Win Thant (Chaw Dwin Gone, Parami Road No (20) *"At 90°* Bend Parami, the train can slip or fall *off;* we need to consider that point. I think it should be acrossed through the military."	U Htun Aung Thin (GM, Lower Myanmar, MR) *"The alignment will across through the military."*	
Project Component and Schedule	U Wai Lin Htun (Local People, Mayangone Township) *"Will the cost and benefit analysis be disclosed to the public?"*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"All the calculations including cost and benefit analysis is going to be presented to the public."*	Jun 8th, 2019 Mayangone Township
	U Myint Soe (Hundred HH, Ward 7, Mayangone Township) *"We have been living in freehold land for 60 years. We had lost some of our lands due to expansion of Parami Road 20 years ago. Since our ward does not use public*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"The project will be carrying out to be least impacts. Much military area is taken in setting the alignment."*	Jun 8th, 2019 Mayangone Township

Category	Questions/Suggestions	Response	Date/Place
	transportation system such as buses, this I think this is a project which is unbeneficial to us and we can get noise pollution effects due to the project"		
	Daw Khin Sabal (Local People, Mayangone Township) *"The alignment should rather divert to Inya Lake which is low impact on buildings than passing through residential area."*	-	Jun 8th, 2019 Mayangone Township
	Daw Hnin Hnin Aye (Local People, Mayangone Township) *"I request you to show the effected houses along proposed alignment to the public with KMZ file."*	-	Jun 8th, 2019 Mayangone Township
	U Aung Moe Thu (Secretary of Apartment Administration Team, Thirimon Plaza, Ward No. (1), Mayangone Township) *"Will project affect to Thirimon Plaza area?"*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"We have planned not to affect to Thirimon Plaza Yard."*	Jun 8th, 2019 Mayangone Township
	One participant *"I suggest to give priority on the North-South alignment rather than being on East- West alignment."*	-	Jun 8th, 2019 Mayangone Township
	Azura (Ward 7, Local People) *"How will the Hlaing Tharyar to Parami MRT reduce the traffic congestion in Kannar Road, Pyay Road and Kyun Taw Road alternatively?"*	U Htun Aung Thin (GM, Lower Myanmar, MR) *"There are over 110000 trips during busy hours. In North-South line, there are 160000 trips and all the trips are relying on YBS. According to survey results, traffic congestions will be much lower if we can go East- West line in just 35 minutes."*	Jun 8th, 2019 Mayangone Township

Closing Ceremony

Attendee List

Local Community (Hlaing Township)



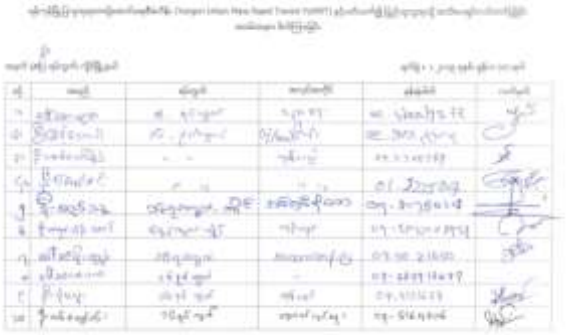


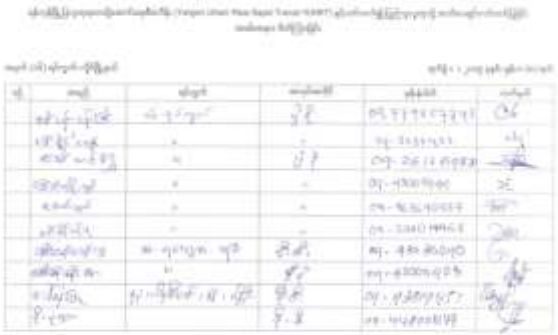


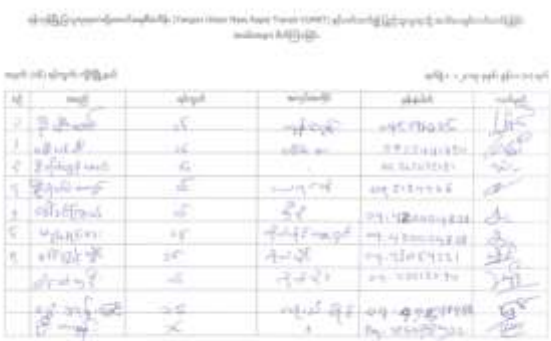


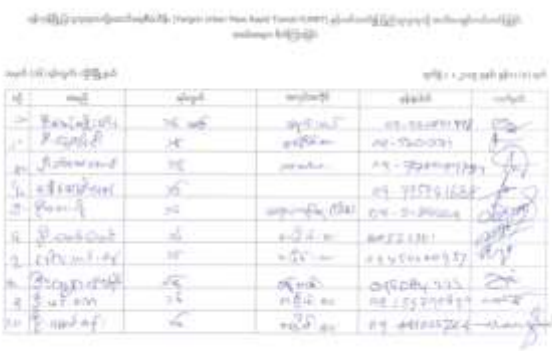














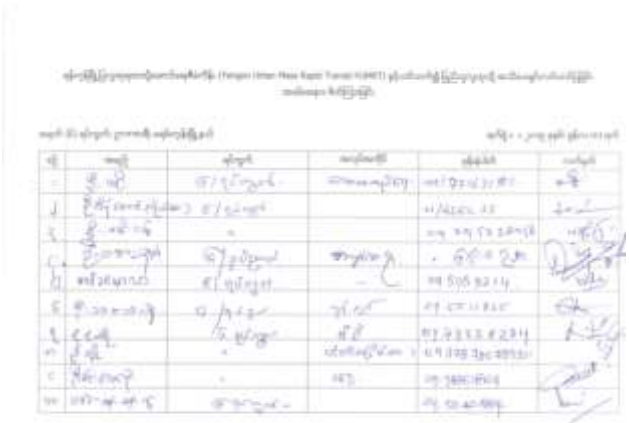




Local Community (Mayangone Township)









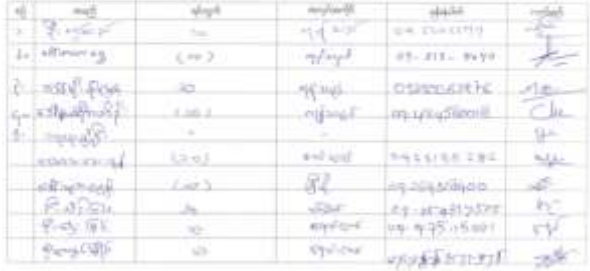


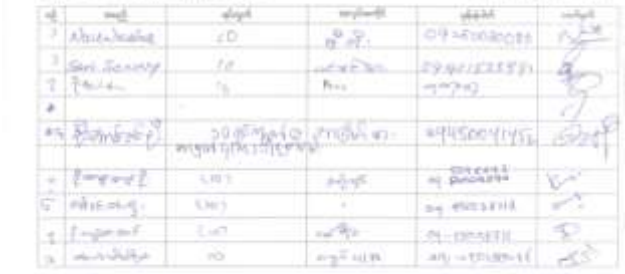


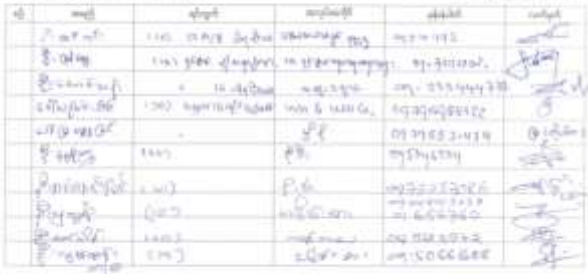




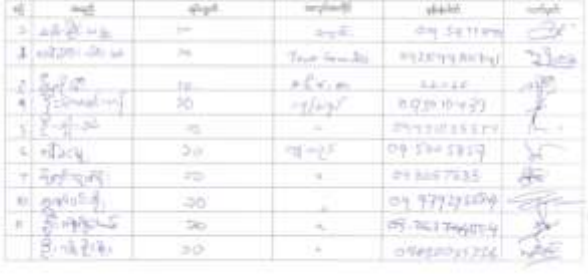


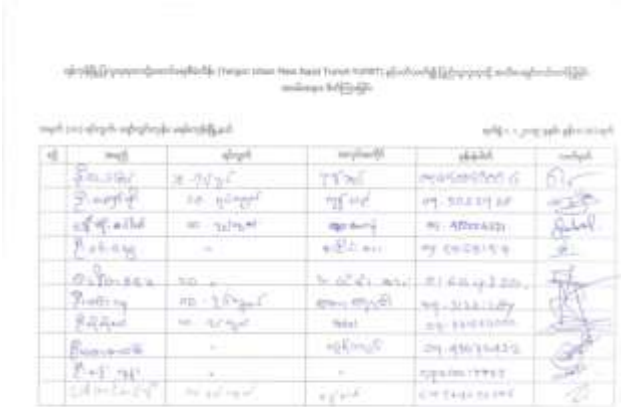


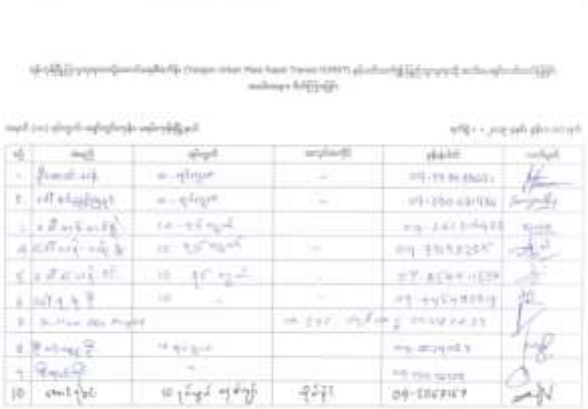






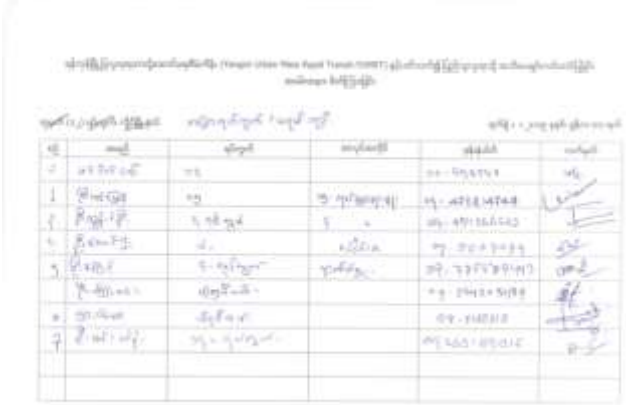


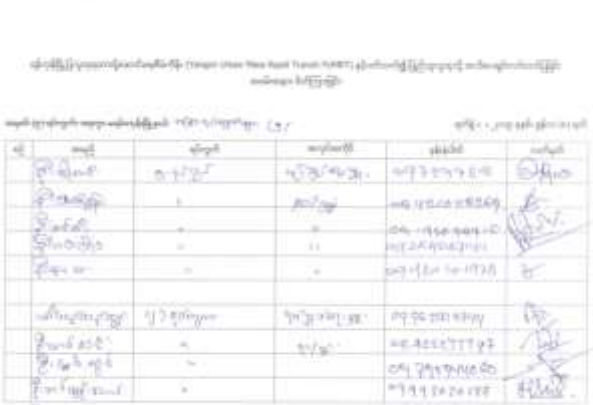














Government Officials









Parliament Member





Media





NGO/ INGOs and Private Companies





Interested Parties



Photographs













Partipicant's Registration




Opening Speech by U Saw Nyi Nyi Htwe, General Administrator (Mayangone Township) and Speech by U Sein Htun , Chairman of YCDC (Mayangone Township)




Presentation on the Project (Introduction) by
U Htun Aung Thin (GM, Myanmar Railways, Lower Myanmar)




Presentation on EIA and LARAP by U Aye Thiha (EIA Consultant)











Q & A Session

Record of the Public Consultation (Yankin Township+ South Okkalapa Township)

E Guard Environmental Services Co., Ltd. **Meeting Minutes**	
Subject: Yangon Urban Mass Rapid Transit Construction Project 1st Public Consultation (EIA/LARAP)	**Date:** June 8, 2019
Venue: South Okkalapa Township, No. (14) Quarter, Thitssar Street, Okkalapa Pagoda compound, Mahar Muni Damar Yone	**Time:** 1:00 PM to 4:00 PM
Attendees: Total: 183 (local people: 110; government officials: 46; parliaments members: 4; NGO/INGOs: 7; media: 7, private companies: 8; interested parties: 1)	

Agenda:

1) Opening Ceremony
2) Opening Remarks by U Aung Myint Kyaw (Township Administrator of South Okkalapa Township, General Administration Department)
3) Speech by Dr. Soe Naing (Representative of Pyithu Hluttaw, South Okkalapa Township)
4) Introduction of the project by U Htun Aung Thin (General Manager, Lower Myanmar, Myanmar Railways, Ministry of Transport and Communications) and presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plan (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services)
5) Question and Answers by Attendees
6) Closing Remarks by U Htun Aung Thin (General Manager, Lower Myanmar, Myanmar Railways, Ministry of Transport and Communications)
7) Closing Ceremony

The public consultation of Yangon Urban Mass Rapid Transit-YUMRT was held on June 8, 2019 in South Okkalapa Township, No. (14) Quarter, Thitsar Street, Okkalapa Pagoda compound, Mahar Muni Damar Yone from 1:00 PM to 4:00 PM. It was attended by local people, Yangon Region Government, Representatives from Parliament, representatives from Ministry of Transport and Communications Myanmar Railways, administrators and related

governmental departments, people from private companies and media. The record of the public consultation is mentioned at the following table.

Opening Ceremony

Opening Remarks by U Aung Myint Kyaw (Township Administrator of South Okkalapa township, General Administration Department)

U Aung Myint Kyaw explained as follows:

If Yangon Urban Mass Rapid Transit project can be implemented, the residents can go from place to place easily. To get a better transportation system, I requested all the people to participate as much as you can in this project.

Speech by Dr. Soe Naing (Representative of Pyithu Hluttaw, South Okkalapa Township)

To be able to go from place to place in short time, this project is needed to finish successfully. I would like to request all of you to give a hand in implanting this project.

Introduction of the project by U Htun Aung Thin (General Manager, Lower Myanmar Administration) from Ministry of Transport and Communications Myanmar Railways.

YUMRT is one of the functions of YUTRA, the transport master plan which is allied with JICA. We aimed to operate the East-West alignment based on calculations over 2.5 million of percent trips surveyed by YUTRA. We have set Hlaing Tharyar – Parami phase as phase – 1 and Parami – Toe Kyaungalay phase as phase – 2. Hlaing Tharyar to Parami phase is connected with YCR and YBS is connected with the phase of Hlaing Tharyar Township and Oakkyin. The alignment is going to pass through five townships, Haling Tharyar, Yankin, Mayangone, South-Okkalapa and Hlaing. In carrying through the project, Union Ministry and Yangon Regional Government will carry out together and then assign to Transportation Department. After the project, it will take only 35 minutes from Hlaing Tharyar to Parami. It will be carried out with the least impacts to people. After drawing detailed design, it will be disclosed to the public. The project is aimed to construct at the start of 2022 and operate at 2027. At the construction phase, we will carry out with the least damage to the buildings at the sides of the alignment.

The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plant (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services)

The main purpose of this public consultation is to introduce the processes of this project and explain the impacts to the residents officially. The possible impacts are Air Quality, Water Quality, Noise and Vibration. On the other hand, the positive impacts of this project are to create more job opportunities and reduce traffic conjunction. The possible impacts are divided into two parts; construction and operation stages. The first environmental quality measurement has been done in 18 locations along the alignment area.

The survey team will conduct LARAP survey in coming days. I request all the residents to corporate with us when concerned administrators come to your houses and conduct social and resettlement surveys. The cut-off date for this project is May 6, 2019 and it has been announced on Myanmar Alinn Daily and The Mirror newspapers and also announced at related departments.

Question and Answers by Attendees

Types	Suggestions/ Questions	Answers	Date/ Place
LARAP	*"I live in South Okkalapa Township I have another building in Yankin Township which is under construction. I want to now LARAP procedure regarding my current situation."* U Hla Sein (South Okkalapa Township)	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"We will only check the real owner with legal documents. We will report to the concerned governments after checking what you own."*	June 8, 2019/ South Okkalapa Township
	"The tract of this railway is directed to north of Parami Overpass. I want to know from which point, the tract will be directed to north. Since our home is located in north of Parami Overpass. *Regarding to cut-off date, for example, if ta house was destructed since 2018 April and reconstruction was started in 2019 April. But the rightful owner is me throughout that time. For LARAP, is there any problem?"* U Yan Min Aung (Yankin Township)	U Htun Aung Thin (GM, Lower Myanmar, MR) *"Railway tract will be constructed passing closely the north of Parami Overpass. There are couples of houses under that overpass. The tract will be passed over those houses. During under construction period, those couple of houses can be affected and we will give compensation for those households. The next thing is some people questioned us whether they are allowed to do sell or buy houses and lands after cut-off date. We will present the detailed design in September expectedly. At that time, you all*	June 8, 2019/ South Okkalapa Township

Types	Suggestions/ Questions	Answers	Date/ Place
		can aware whether your houses or lands will be affected or not. We will also calculate with concerned departments and give compensation complying with JICA's rules and regulations. "	
	"As far as we know, Parami road is 6 lanes and 72 feet in width. The railway line will also be constructed from the north of Parami Overpass. There is Taw Win Housing at the north. Currently, our Inno City Project is under construction. I want to know whether MR project will affect to this Inno City Project" U Hla Moe Kyaw (Corner of Parami Road-Wai Zayanda, Inno City)	U Htun Aung Thin (GM, Lower Myanmar, MR) *"Your project could be affected in the second phase but it's very low chance. Since Parami Road is 6 lanes, your project will not be affected and construction can be continued. Ministry of Defense also gave us 5 lands so you do not need to be worry."*	June 8, 2019/ South Okkalapa Township
Project Procedures	*"Will that be serious to the extent of residents has to move to other places under construction period. Do you take responsibility for consequences after construction period? What is the height of the foundation? Will the presentation and data be printed?* Daw Mya Theingi Kyaw (Parami Road-30)	U Htun Aung Thin (GM, Lower Myanmar, MR) "*There will be no case like moving. There is noise pollution for sure during both construction and operation periods. That's why we are considered even for pile system. During construction period, we will plan not to distract either households or cars. We will also give compensation."* U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) "*A representative person will be listening the residents' problems. We also measure the vibration of the surrounding area before and during construction. The strength of the nearby buildings has to be measured. The range of the affected area by vibration is also calculated by simulation modelling. We will also survey for the affected buildings. For EIA Report, we will present it to the public and also place in concerned departments. Public can also leave comments. We will*	June 8, 2019/ South Okkalapa Township

Types	Suggestions/ Questions	Answers	Date/ Place
		also plan to do consultation session for LARAP to each house. We would like to request all of you to answer all the survey questions correctly." U Htun Aung Thin (GM, Lower Myanmar, MR) "*The foundation is 45 feet. You can also get the presentation file by scanning QR code."*	
Project Procedures	*"Since the MRT will be above the road, how many lanes does a road have? We may consume that there will be enough spaces on each sides.* U Htun Htun Oo (Yankin Ward 8)	U Htun Aung Thin (GM, Lower Myanmar, MR) *"For cars, there is only an express way. Yours are not affected."*	June 8, 2019/ South Okkalapa Township
	"If the MRT tract is tilted to north, there is a 6-floor building. So which way the tract will go, from the front or back of the building. It would be better to use sound proof system as in foreign countries. After passing through the Nga Moe Yeik Creek, to which way the railway will run?" Daw Ni Ni Khaing (Parami-8 quarter)	U Htun Aung Thin (GM, Lower Myanmar, MR) *"The front way of the building will be used. For that case, we will be able to explain more when the detailed design is out. Sound proof system will also meet the international standard. The railway will start from Hlaing Tharyar Township and the final destination is Toe Kyoung Kalay."*	June 8, 2019/ South Okkalapa Township
	"With which shape, will the railway be tilted to the north from Parami Overpass?" U Khin Mg Lay (Parami-8 Quarter)	U Htun Aung Thin (GM, Lower Myanmar, MR) "*With columns, Y shape will be used. The width of the Y shape from edge to edge is 30 ft. The level may or may not be higher than the buildings."*	June 8, 2019/ South Okkalapa Township
	"Drainage canals in our township areas are not cleaned at the moment and what I heard is that it is stopped due to this project plan. Will project block the existing road during construction period?"	U Htun Aung Thin (GM, Lower Myanmar, MR) *"There is 120 ft between each column. We will try our best not to disturb the roads during construction period. It is also*	June 8, 2019/ South Okkalapa Township

Types	Suggestions/ Questions	Answers	Date/ Place
	U Nyi Lin Sat (Parami-8 Quarter)	*responsible by Yangon Region Government. We are also here on behalf of Yangon Region Government. During construction period, we will also take responsibility for cleaning the cannels."*	
	"Can the surrounding structures be higher than the MRT? How much distance of structures can be closed to the MRT?" Ko Thu Aung (Parami)	U Htun Aung Thin (GM, Lower Myanmar, MR) *"We will give the instruction for the minimum distance of buildings from the MRT. For height, it can be higher."*	June 8, 2019/ South Okkalapa Township
LARAP	*"I want to know about the time table of the train. The next thing is we are currently living in market stores of YCDC for over 20 years. Although I have been living in those areas, some of them are not. Do those people also get compensation?"* U Tin Aung Myo (Parami Road, YCDC market stores)	U Htun Aung Thin (GM, Lower Myanmar, MR) *"If I have to repeat, the railway has 18 kilometers distance and have 13 stations in total. The train has 8 sections. It will take 35 minutes to reach final destination. It will come more often in busy time. We will also arrange it according to the survey result."*	June 8, 2019/ South Okkalapa Township

Closing Ceremony

Attendee List

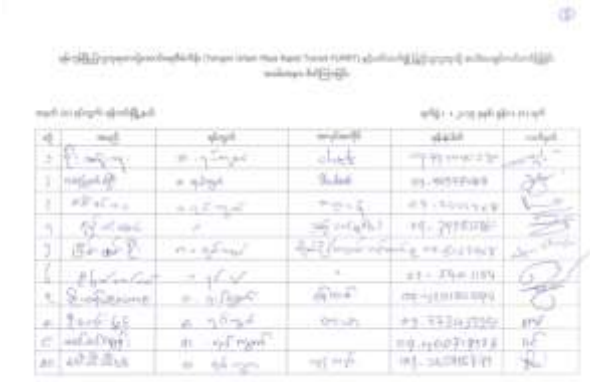
Local Community (Yankin Township)



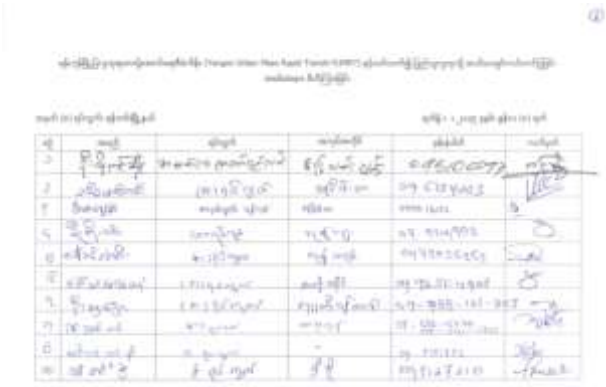














Local Community (South-Okkalapa Township)







Government Officials













Parliament Members



Medias

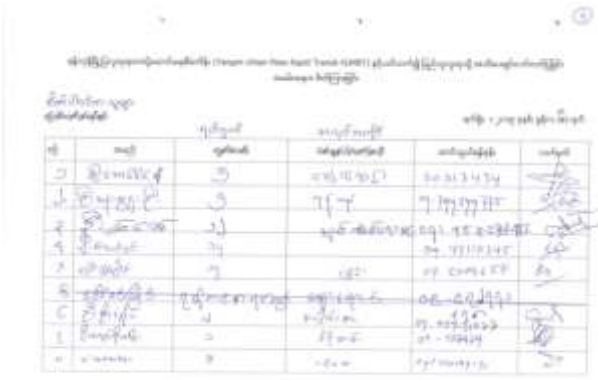


NGO/ INGOs and Private Companies

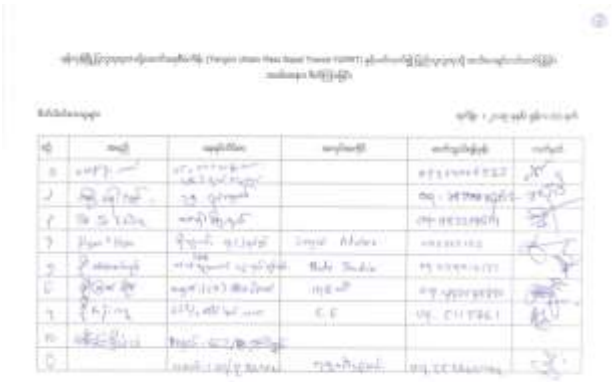


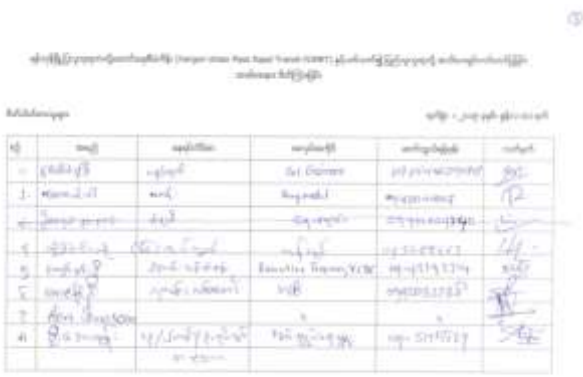


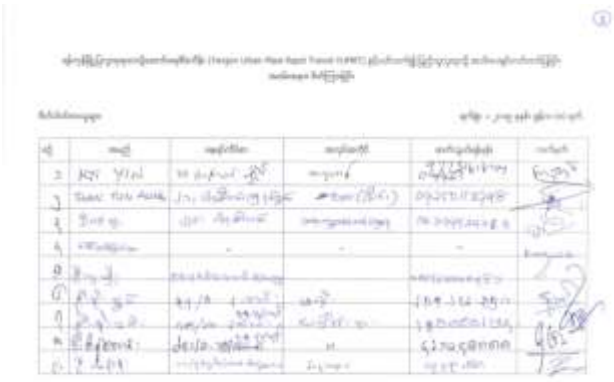
Interested Parties











Photographs













Partipicant's Registration




Opening speech by U Aung Myint Kyaw (Township Administrator of South Okkalapa ownship,
General Administration Department) and
Speech by Dr. Soe Naing (Representative of Pyithu Hluttaw, South Okkalapa Township)




Presentation on the Project (Introduction) by
U Htun Aung Thin (GM, Myanmar Railways, Lower Myanmar)




Presentation on EIA and LARAP by U Aye Thiha (EIA Consultant)





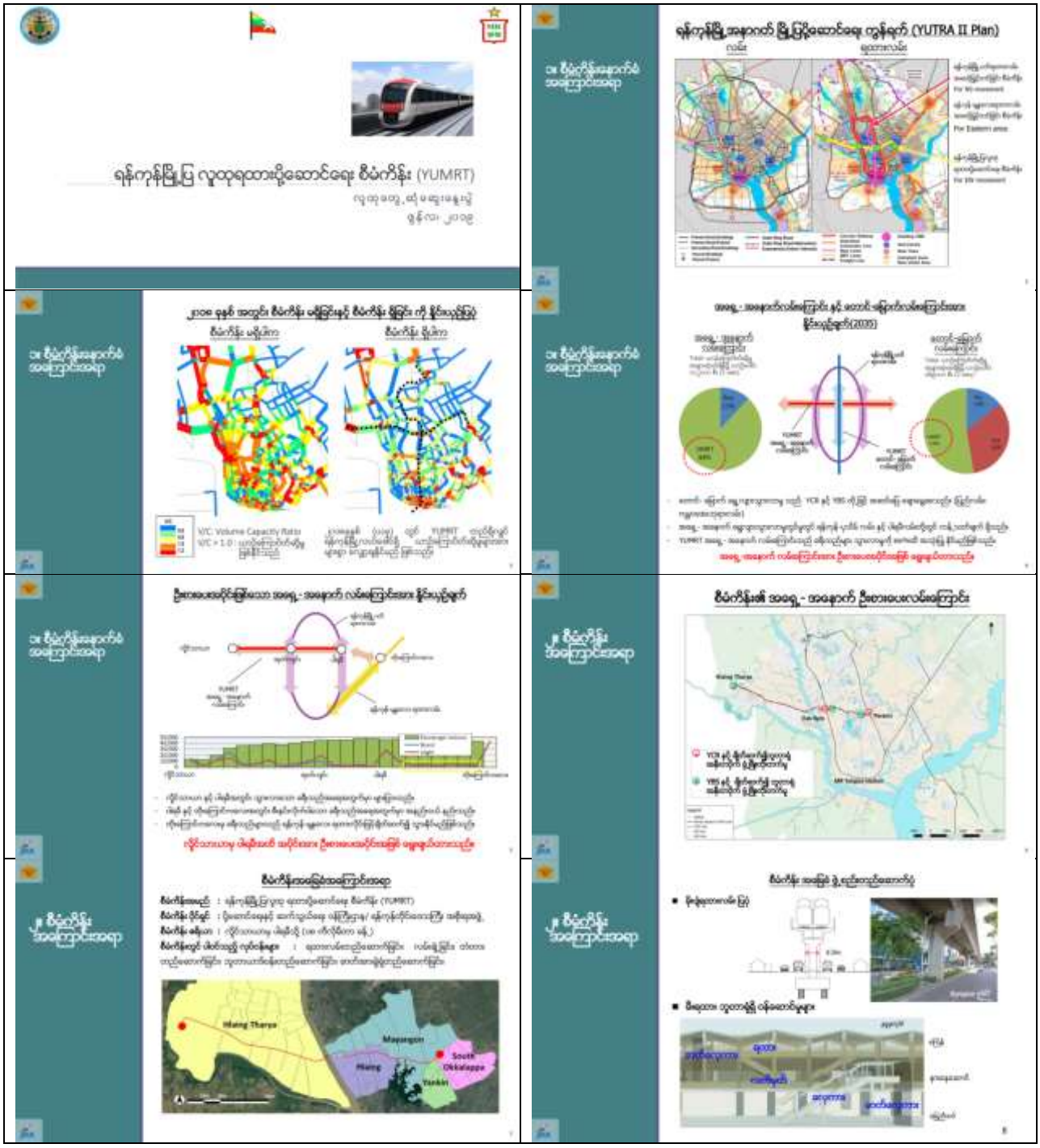






Q & A Session

Appendix 9 Material Used at the Pubic Consultation (Scoping Stage)



စီမံကိန်းလမ်းကြောင်း(လိုင်းသဘော– ပို့ဆောင်ရေး)

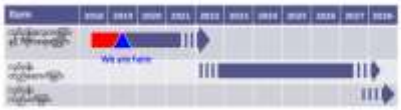


စီမံကိန်းလမ်းကြောင်း(လိုင်းသဘော– ပို့ဆောင်ရေး)



စီမံကိန်း၏ ဆောင်ရွက် အဆိုပြုအသေးစိတ်(ဖွံ့ဖြိုး ဘဏ် မူဝါဒ)

- လုပ်ငန်းစဉ်ကာလတွင်ပြုလုပ် ပြီးစီးရမည့်အပိုင်း : ၂၀၁၈ – ၂၀၂၀ ကြိုတင်ရှာဖွေ ဆွေးနွေးခြင်း (၁၄လအား)
- လုပ်ငန်းကည်းဆောက်လုပ်ခြင်း : ၂၀၂၁ - ၂၀၂၅ ကြိုတင်ရှာဖွေ ဆွေးနွေးခြင်း (၁၄လအား)
- လုပ်ငန်းလည်ပတ်ခြင်း : ၂၀၂၅ မှ စတင်၍ (၁၄လအား)



စီမံကိန်း၏ ဆောင်ရွက် အဆိုပြုအသေးစိတ်(ဖွံ့ဖြိုး ဘဏ် မူဝါဒ)

- အခြားနိုင်ငံများမှ ဥပမာများ
  - Thailand: Bangkok MRT 2013
  - Indonesia: Jakarta MRT 2019

EIA နှင့် LARAP - အခြေခံနိုင်ငံသားများ

- အခြေခံနိုင်ငံသား
  - သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ ကြီးမားသော သက်ရောက်မှုများ ဖော်ထုတ်ခြင်းနှင့် လျော့ပါးစေရေး အစီအမံများ ချမှတ်ခြင်း
  - ပြည်သူပြည်သားများအနေဖြင့် စီမံကိန်းအကောင်အထည် ဖော်ဆောင်ခြင်းအပေါ် သဘောထားများ ပြည်သူများ၏ သဘောထားများ ရယူခြင်း
- သဘာဝပတ်ဝန်းကျင် ထိခိုက်မှု အကဲဖြတ်ခြင်း (EIA)
  - စီမံကိန်းအကောင်အထည်ဖော်ဆောင်မှုနှင့် ပတ်သက်၍ ရှိနိုင်ခြေရှိသော သက်ရောက်မှုများ ကြိုတင်ခန့်မှန်းခြင်း
  - သဘာဝပတ်ဝန်းကျင် ထိခိုက်မှု လျော့ပါးစေနိုင်ရေး သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ ကြီးကြပ်ခြင်းအစီအမံများ ချမှတ်ခြင်း
- အခြားဘဏ်များတို့၏ ပြန်လည် နေရာချထားရေး အစီအမံ (LARAP)
  - စီမံကိန်းဆောင်ရွက်ခြင်းကြောင့် အများပြည်သူအား ဆက်လက်ရှင်သန်ရေး ပံ့ပိုးပေးခြင်း
  - ပြန်လည်နေရာချထားခြင်း မှတစ် ပြည်သူ - ဘဏ်တော်များ/ လူမှုအဖွဲ့ (ပြန်လည်ရှာဖွေ ပြီးစီးရေး အဆင်ပြေအောင်)

EIA နှင့် LARAP – လုပ်ဆောင့် တိုးတက်အဆွေးနွေးမှုအဆင့် ရည်ညွှန်းချက်

- ပထမအကြိမ်ပြုလုပ်သည့် နည်း (EIA/LARAP သတ်မှတ်ကြေညာပြီး ခရမ်းနှစ်ပြီး : ၁၀၈၄)
  စီမံကိန်း ဒီဇိုင်းလုပ်ငန်းများ/ ပြန်လည်ရှာဖွေခြင်းများ သက်ရောက်မှုများနှင့် ဝန်းကျင်ဆောင်ရွက်မှုများ အသေးစိတ်ကြေညာခြင်း
- ဒုတိယအကြိမ်ပြုလုပ်သည့် နည်း (EIA - ပထမ ပတ်ဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှု ဖော်ထုတ်ခြင်း)
  ပြီးမြောက်သည့် ထိခိုက်မှုများကို ဝန်းကျင်ဆောင်ရွက်ခြင်းများ ချမှတ်ခြင်း ဆက်လက်ဆောင်ရွက်ခြင်း ရှာဖွေခြင်း ပြည်သူပြည်သားများအား ပေးဆောင်ခြင်း
- တတိယအကြိမ်ပြုလုပ်သည့် နည်း (LARAP - ပြန်လည်နေရာချထားရေးအစီအမံများ)
  သက်ရောက်မှုရှိသူများအား ဝန်းကျင်ဆောင်ရွက်ခြင်း ရှာဖွေ ပြန်လည်နေရာချထားရေးအစီအမံများ ပေးဆောင်ခြင်း

Year	2019						
Month	3	4	5	6	7	8	9
Cut-Off-Date			▲				
Public Consultation				▲		▲	
EIA Survey							
LARAP Survey							

EIA – ပြစ်မှုဆိုင်ရာ သက်ရောက်မှုများ(အစီရင် သက်ရောက်မှုများ)

- ဖျက်ဆီးသက်ရောက်မှုများ



- ဆက်စပ်ဖျက်ဆီးသက်ရောက်မှုများ



EIA – ပြစ်မှုဆိုင်ရာ သက်ရောက်မှုများ(ညွှန်ကြားချက်)

ခ) ညွှန်ကြားချက်ဆိုင်ရာ ပြစ်မှုများ

အကြောင်းအရာ	CP	DP	သက်ရောက်မှုအကြောင်းအရာ
ဆောက်လုပ်ရေးအဆင့်	-	+	CP: ဆက်လက်ဆောင်ရွက်မှုအား လုပ်ကိုင်ခြင်း ဆက်လုပ်ခြင်း ပယ်ဖျက်ခြင်း DP: ဘဏ်ဆိုင်ရာပြစ်မှု အကျုံးဝင်ခြင်း ပြီးမြောက်ဆောင်ရွက်ခြင်း
ဆောက်လုပ်ရေးအဆင့်	-	-	CP: ပြီးမြောက်ဆောင်ရွက်ခြင်း ဆောက်လုပ်ရေးအဆင့် သတ်မှတ်ချက်များ ပြီးမြောက်ခြင်း DP: ဆောက်လုပ်ရေးအဆင့် ဆောက်လုပ်ရေးအဆင့် ပြီးမြောက်ခြင်း ဆောက်လုပ်ရေးအဆင့်
လည်ပတ်မှုအဆင့်	-	+	CP: ဆက်လက်ဆောင်ရွက်မှုအား လည်ပတ်ခြင်းကိုပြုလုပ်ခြင်း DP: လည်ပတ်မှုအဆင့် ဆောက်လုပ်ရေးအဆင့် လည်ပတ်ခြင်းကိုပြုလုပ်ခြင်း -
ဖျက်သိမ်းရေးအဆင့်	-	-	CP: ပြီးမြောက်ဆောင်ရွက်ခြင်း ဆောက်လုပ်ရေးအဆင့် ဖျက်သိမ်းခြင်းများ DP: ဖျက်သိမ်းရေးအဆင့် ဆောက်လုပ်ရေးအဆင့် ဖျက်သိမ်းခြင်းများ
ဆိုင်ကိုယ်ပုံ ပြင်ဆင်ခြင်း	•	•	CP: ဆက်လက်ဆောင်ရွက်မှုများ ဆိုင်ကိုယ်ပုံ ပြင်ဆင်ခြင်း DP: ဆောက်လုပ်ရေးအဆင့် ဆိုင်ကိုယ်ပုံ ပြင်ဆင်ခြင်း ဆက်လက်ဆောင်ရွက်ခြင်း

EIA – ပြစ်မှုဆိုင်ရာ သက်ရောက်မှုများ(သဘာဝပတ်ဝန်းကျင်)

ဂ) သဘာဝပတ်ဝန်းကျင်

အကြောင်းအရာ	CP	DP	Contents of Impact
ဆောက်လုပ်	-	•	CP: သစ်တောများကို ခြွင်းချန်ခြင်း ညှပ်ကြိုးခြင်း
လည်ပတ်ခြင်း	-	-	CP: ကြိုးခြင်းဆောက်လုပ်ခြင်းများ DP: ကြိုးခြင်းဆောက်လုပ်ခြင်းများ
သဘာဝပတ်ဝန်းကျင် ထိခိုက်မှုများ ပြုလုပ်ခြင်း	-	-	CP: ချုပ်ကိုင်ခြင်း ဆောက်လုပ်ခြင်း (ပြီးမှတ်) အပါအဝင်များ ပြုလုပ်ခြင်း DP: ဆောက်လုပ်ခြင်းအဆင့် ချုပ်ကိုင်ခြင်းများ (ပြီးမှတ်) အပါအဝင်များ ပြုလုပ်ခြင်း

SIA – ပြစ်မှုဆိုင်ရာ သက်ရောက်မှုများ (လူမှုဝန်းကျင်)

ဃ) လူမှုဝန်းကျင်

အကြောင်းအရာ	CP	DP	သက်ရောက်မှုအကြောင်းအရာ
ပြီးမြောက်ခြင်း ဆောက်လုပ်ခြင်း ပြီးမြောက်ခြင်း	-		CP: ပြီးမြောက်ခြင်း ဖျက်သိမ်း ပြင်ဆင်ခြင်းများ ပြုလုပ်ခြင်း
ဆောက်လုပ်ခြင်း ဆောက်လုပ်ခြင်း ပြီးမြောက်ခြင်း	-	-	CP: ( ) ဆောက်လုပ်ခြင်းများ ပြီးမြောက်ခြင်း DP: ( ) ဆောက်လုပ်ခြင်းများ ပြီးမြောက်ခြင်း
လည်ပတ်ခြင်း ဆောက်လုပ်ခြင်း ပြီးမြောက်ခြင်း	-	-	CP: ပြီးမြောက်ခြင်းများ ဆောက်လုပ်ခြင်းများ DP: SUMIT ပြီးမြောက်ခြင်း ဆောက်လုပ်ခြင်းများ
ပြီးမြောက်ခြင်း	•	-	CP: ဆောက်လုပ်ခြင်းများ ပြီးမြောက်ခြင်း ပါဝင်ခြင်း ပြီးမြောက်ခြင်းများ DP: ဆောက်လုပ်ခြင်းများ
လည်ပတ်ခြင်း ဆောက်လုပ်ခြင်း ပြီးမြောက်ခြင်း	-	-	CP: ဆောက်လုပ်ခြင်းများ ပြီးမြောက်ခြင်း ပါဝင်ခြင်း ပြီးမြောက်ခြင်းများ DP: ဆောက်လုပ်ခြင်းများ ပြီးမြောက်ခြင်း

EIA – စစ်တမ်းဓာတ်ပုံများ အကြောင်းအရာ

- EIA စစ်တမ်းဓာတ်ပုံများ အကြောင်းအရာ
  - EIAနှင့် သက်ဆိုင်သော အချို့သော အကြောင်းအရာများ ဖော်ပြခြင်း
  - လုပ်ဆောင်ခဲ့ပုံများ: ဓာတ်ပုံများပြသခြင်းဖြင့် လုပ်ငန်းစဉ် အဆင့်ဆင့်ကို ရှင်းလင်းတင်ပြခြင်း





  - Site investigation: Final disposal site, Borrow-pit etc.

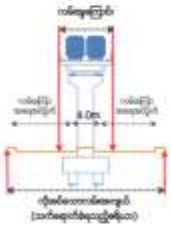



LARAP – ပြန်ဖော်ဆောင်ခဲ့သော သက်ရောက်မှုများ

- ပြန်ဖော်ဆောင်ခဲ့သော သက်ရောက်မှုများ
  - မြေယာ၊ အိုးအိမ်ဥယျာဉ်များ ကျစ်လစ်မှု ဘိုးဘွားပိုင်းခြင်း
  - အဆောက်အဦများ: အစိုးရအဆောက်အဦများ၊ ဘုရားဖူးစင်နှင့် စီးပွားရေးဆိုင်ရာ အဆောက်အဦများ
  - ပျံသန်းတာများ: မိုးတိုင်းမှုတာရုံများမှ စီးပွားရေးဆိုင်ရာ အချို့သောပံများ ထုံးမှုများ
- ထည်ဝန်းစုဆောင်းပိုင်းဆိုင်ရာ ပုံစံ
  - ပံများပေါ်တွင်ကျော်:
    - တတ်နိုင်သမျှပြန်လည်ရရှိနိုင်ရေး ပညာအရေးနှင့်ကြီးပြားရေး ရပ်ကွက်အုပ်ချုပ်ရေးမှူး နှင့် ရပ်ကွက်အုပ်ချုပ်ရေးမှူးများ ပါဝင်ခဲ့ခြင်း ဓာတ်ပုံတင်သွင်းထားသောအဆောက်အဦ ပိုင်ဆိုင်မှုများ ကမ်းလှမ်း ဘိုးဘွားပိုင်းခြင်း အချို့နှင့် အဆောက်အဦအချို့ ပေးဆောင်ခြင်း ပြုခဲ့နိုင်သည်။
  - ရန်ကုန်-ပုသိမ်ပေါ်တွင်ကျော်:
    - တတ်နိုင်သမျှပြန်လည်ရရှိနိုင်ရေး မြေယာ ပစ်ဆောက်ရာတို့ ပေးဆောင်ခြင်း ရပ်ကွက်အုပ်ချုပ်ရေးမှူး ဆုတောင်းခြင်း ပြုခဲ့နိုင်သည်။
  - ဘုရားဖူးတံတားဆန်း ကိုပြခြင်း

LARAP – သက်ရောက်စံရသည့် ခရိယာ

- သက်ရောက်စံရသည့် ခရိယာ
  - လမ်းမတည်ခင်းကို ထိခိုက်မှုများစေ မည်သူများ၊ အဘယ်ကဲ့သို့ ရရှိစေမည်နည်း ဆုတောင်းပေးခြင်း
  - သမို့ သတိပြုရမည့် လမ်းဆစ် လက်မှတ်လမ်းကြား အဆုံးအဖြတ်ကို ထိခိုက်စိမ့်ရှိ လမ်းမည်သို့ ကိုယ်စားပြုခြင်း
    - ပံများပေါ်: လမ်းကြောင်း ၄ ပ (၂၂ ဧကခန့်)
    - မြစ်ကူး-ပုသိမ်လမ်း: လမ်းကြောင်း ၆ ပ (၂၉ ဧကခန့်)





LARAP – စစ်တမ်းဓာတ်ပုံများ အကြောင်းအရာ

- LARAP စစ်တမ်းဓာတ်ပုံများ အကြောင်းအရာ
  - သန်းခေါင်စာရင်းစစ်တမ်း: သက်ရောက်မှုခံစားရသူများ၏ အခြေခံအကြောင်းအရာများ
  - ဝင်ငွေများစစ်တမ်း: မြေယာနှင့် ပိုင်ဆိုင်မှုဆုံးရှုံးမှုကြောင့် ဝင်ငွေဆုံးရှုံးမှုများ ဖြစ်ပေါ်ခဲ့ခြင်း
  - လူမှုစီးပွားစစ်တမ်း : ပတ်သက် အသုံးစရိတ် ပမာဏများ ဆုတောင်းခြင်း၊ ဝေဖန်ခြင်း
  - မရွေ့ပြောင်းရမည့်သူများ ပြည်သူများ၏ အကူအညီ ရရှိမှုနှင့် ဝေဖန်ခြင်း
  - လက်ခံရရှိမည့်သူများ ပြန်လည်ရရှိမည့် ခရိယာ ပြန်လည်ရရှိမည့် ခရိယာများ ဝေဖန်ခြင်း
- LARAP စစ်တမ်းကြွေးမွေး
  - မွေး-မွေးပြီး ၂၀၁၉
- ရရှိတတ်ဆုံးပြဿနာ: ပြ ၈၈ ၂၀၁၉
  - အဆောက်အဦးနှင့် ဓာတ်လိုက်ပြောဆိုခြင်း ကိစ္စရပ်များသည်
  - Cut – Off Date ဆိုင်းငံသူများ ရရှိလာခြင်း ဆိုင်းငံရန် ကာလများ
  - Cut – Off Date ဆိုင်းငံသူများ ရရှိလာခြင်း ဝေဖန်မှုများရရှိခြင်းတို့ကြောင့် မြေယာ မူဝါဒတွင် အသစ်ပြောင်းခဲ့

ကျေးဇူးတင်ပါသည်။



Cut-off Date ဆိုသည်မှာ အဘယ်ကြောင့် ရရှိလာသည်






Appendix 10 Record of the Public Consultation (Draft EIA Stage)

Record of the Public Consultation (Mayangone Township)

E Guard Environmental Services Co., Ltd. **Meeting Minutes**	
Subject: Yangon Urban Mass Rapid Transit Construction Project 2nd Public Consultation (EIA/LARAP)	**Date:** January 12, 2020
Venue: Santi Mar Hall, No.1, Basic Education High School, No (2) Ward, Mayangone Township	**Time:** 8:00 AM to11:00 AM
Attendees: Total: 77 (local people: 39; government officials: 16; parliaments members: 1; NGO/INGOs: 7; media: 4, private companies: 2; interested parties: 8)	

Public consultation of Yangon Urban Mass Rapid Transit-YUMRT was held on 12nd January 2020 in Mayangone Township, No (2) Ward, Santi Mar Hall, No.1, Basic Education High School. Local people, Representatives of Yangon Regional Government, Parliament, Ministry of Transport and Communications, Myanmar Railways, concerned Township/Ward administrators and related governmental departments, people from private companies and media attended the meeting and meeting record is described in below.

Agenda:

1) Opening Ceremony
2) Opening Speech and Introduction of Project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)
3) The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plant (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services Co., Ltd.)
4) Question and Answers by Attendees
5) Closing Remarks by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)
6) Closing Ceremony

Opening Ceremony

Opening Speech and Introduction of Project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)

There is some weakness in communication network and too much traffic in Myanmar recently. According to the analysis, it will be more developed if YUMRT is connected along East – West for Yangon Public Transport. There are many route connected North – South in Yangon region by existing roads network. It is recently only at the stage of considering the road alignment. Public Consultation will be conducted at the detailed design stage again. At that stage, compensation plan will be negotiated according by the affected areas. We will conduct the process to reduce the affected area by JICA Guidelines. There will be 10 feet diameter pile construction in the middle of 6 lanes road. We will extent the existing 6 lanes road from Hlaing Thayar to Bayint Naung Bridge. Besides, existing 4 lanes road from Parami to South Okkalapa will be extended. We will do the affected public area to be less and this project has to be a model for upcoming projects. The main purpose of the proposed project is to reduce traffic congestion, utilization of private vehicles and to implement the developed living standard. Due to the proposed project, there will be benefit for technical and social. The alignment will pass through Hlaing Thayar, Hlaing, Mayangone, South Oakkalar and Yan Kin. At present, there are planned to build 13 stations along the route. It is discussed that there is a distance of 1km between each station. Later, prices around the properties close to the stations may also rise. It will also coordinate with relevant ministries along the railway line. Detailed design will be implemented by 2020-2021. Based on these measurements, the design will be consider less impact. Compensation policies have also been set up for project affected private owned lands. As this project is intended for the benefit of the public, I would like to reply to the public for help.

The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plant (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services Co., Ltd.)

The project situation is a stage that analysis possible impacts. The EIA and LARAP will be presented in two sections. The purpose of the EIA process is to reduce the potential impact of the project and to inform the public whether it is a national project or not. In EIA, construction and operation period are included. During those periods, the impact of environmental and socioeconomic has to be analyzed. In EIA report, Environmental Impact Assessment, Environmental Management Plan and Environmental Monitoring Plan will be included. The potential negative impacts of the project include air pollution, water pollution,

noise and vibration, soil contamination and waste. Impact on terrain, topography and ecosystem has to be analyzed as well. Water and air quality were already measured. Air quality was measured twice during the dry and wet season at 18 locations along the alignment. Similarly, water quality, noise, vibration, ecosystem and sedimentation were measured. The quality of the air quality exceeds 6 to 30 times when compared to the National Environmental Quality Guidelines. As for ecosystem, it has been found to be endangered. It is also recommended to install noise barriers for noise. It is also considered for the people in the community who are involved in the project. Recommended mitigation measures will be linked to the Environmental Monitoring Program's compliance with the project implementation plan. In the operation stage, monitoring should be conducted once a year or twice a year. In the case of LARAP, roughly 3.0 acres of privately owned property, including grandparents, and 5.0 acres of government-owned land are likely to be affected. At the Detailed Design stage, detailed measurements will be taken and how is affected. Afterwards, the affected landowners will be discussed individually. Appropriate compensation and land replacement will be determined by the respective Yangon Region Government for not only affected land and structures but also renter and vendors. We will also plan for Grievance Redress Mechanism. The Traffic Management Plan will be designed to reduce traffic congestion. We will do our utmost for the visual poster.

Question and Answers by Attendees

Category	Questions/Suggestions	Response	Date/Place
Environmental Impact Assessment	Daw Hnin Hnin Aye (Chief Engineer (Retired)), Ward (7) *"I would like to know about visual impact. How much YUMRT affect to the front view of their houses?"*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) He explained again from Geography/Topography at page 21 (EIA). *"As we explained in PPT, to reduce the visual impact caused by the project, compensatory planting of shrubbery species within the limited area under the elevated structure should be implemented."*	January 12nd, 2020. Mayangone Township
	U Myint Soe (Deputy Director (Retired));Engineer, Ward (7) *"If YUMRT train runs above them, their houses may have echoes (noise issues). I also worried that the present front view would change to unpleasant view or whether the*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"The consideration of the Alignments came from a project called YUTRA, which was designed in 2012. Detailed information will be described in the EIA report. We considered three alternatives for each E-W and N-S direction. There is also mitigation*	January 12nd, 2020. Mayangone Township

Category	Questions/Suggestions	Response	Date/Place
	landscape would be covered by pillars. *I also want you to reanalyze the objectives of the project related to climate change. Traffic congestion occurs 70-80% in North-South part of Yangon which should be reduced. If N-S line was considered, air pollution would be reduced up to 6-30 times by reducing the traffic congestion.* *When it comes to transportation part, it is the best choice of an alignment to avoid water bodies or the construction of bridges because it increases the project costs which makes the profitability low.* *Finally, I would like to know whether my opinions and suggestions have been considered or not for choosing the alignment. Some of potential affected people from Mayangone sent the letters to President's Office, State Councilor's Office and also to the respective Ministry. Is there any action taken regarding their letters?"*	*measure such as installing the noise barriers for noise pollution. The large amount of motorized trips in Yangon could be reduced by implementing the YUMRT. Consequently, air pollution and climate change could be reduced. We have already described alternative analysis in EIA report.* *At the National level, there is a Steering Committee and it is decision making body. Alternative alignments and alternative Analysis have been considered through SC and the current alignment was selected since it is the least affected option to the residential areas. Union Ministers and Deputy Ministers of each concerned ministry, Chief Minister of YRG involve in SC."* U Soe Moe Aung (Division Officer, Division (7), Myanma Railways) *"There are five roads connecting North to South part in Yangon such as No (2) Main Road, Waizayandar Road, Pyay Road, Kabaraye Pagoda Road, Bayint Naung Road. However, the road connection from East to West in Yangon is still limited. There is only one direct route from Hlaing Tharyar Township to Yangon. Therefore, the proposed alignment is considered to promote the connection of East and West of Yangon."* U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"All the comments and suggestions of stakeholders were recorded and included in the ESAI Report."*	
	U Myint Soe (Deputy Director (Retired)); Ward (7) *"How will social security be provided during construction? And who is responsible for security?* *Please consider about PAPs concerns and how to incorporate in the plan."*	U Soe Moe Aung (Division Officer, Division (7), Myanma Railways) *"Currently, Ministry of Transport and Communications (MOTC) is in charge for Technical purposes and Yangon Regional Government (YRG) will be responsible for other issues."*	January 12nd, 2020. Mayangone Township
Land Acquisition and Compensation	Daw Wah Wah May Tin Hlaing (Ward (7)) *"According to the procedures, please do the assessment with Third party. I would like to*	U Soe Moe Aung (Division Officer, Division (7), Myanma Railways) *"We will submit your request to relevant agency. We have not considered the current alternative yet. We will inform you if we get*	January 12nd, 2020. Mayangone Township

Category	Questions/Suggestions	Response	Date/Place
	know whether there are any plans to change the alignment. In my opinion, there is no advantage in constructing YUMRT on this route. We have been living here in this place for decades and do not want to move anywhere since majority of residents are retired persons. Our fence has been already broken twice because of YCDC project. *We have already sent a petition to the State Counsellor's office and copied to MOTC."*	*the instruction from the relevant government. "* U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"Suggestion of PAP from Ward (7) will be mentioned in the Report. However, we are not the decision maker."*	
	U Aung Moe Thu (Ward (1), Apartment Supervisor , Thiri Mon Plaza) *"I asked same questions in previous PC about: How close between the Thiri Mon Plaza and Alignment? Was Alignment confirmed or not?* *Thiri Mon Plaza sells agricultural appliances and it needs enough space to access vehicles. How it will be affected during construction stage? Residential apartments are also exiting within Plaza compound. Therefore, they need to know the exact alignment that will pass through main plaza. So that, they can solve some problems like restriction of road during construction period and some traffic issues for Plaza.* *As YUMRT Alignment is closed to Plaza, discussion or negotiation will need to be conducted at Thiri Mon Plaza office. For their Plaza, they are willing to discuss officially anytime and ready for the collaboration."*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"Bridge crossing area has already been confirmed by Steering Committee. However, we can only inform the exact affected areas after the detailed design.* *Traffic Management Plan is also considered for the construction stage. In addition, it is possible to cooperate with the relevant Ministry of Yangon, including the township while the road is blocked.* *They already considered about the negotiating process with each township or Thiri Mon Plaza before DD stage"*	January 12nd, 2020. Mayangone Township
	U Kyaw Win (Ward (10), Retired Doctor) *"Why Mass Rapid Transit can't*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"We are not a decision maker or project*	January 12nd, 2020. Mayangone Township

Category	Questions/Suggestions	Response	Date/Place
	be accomplished in other ways rather than overhead train. Please consider underground or Bus line. *Please consider how much the project is beneficial to the future generations. It should be considered carefully.* *I am now 72 years old and worried that the proposed project will affect my physical and mental health. Please consider about public's feeling and emotional suffering* *People who are not happy with this proposed project including myself have already sent the letters to the upper levels."*	*planner, but we will record your suggestion and it will be described in the report."*	
	U Saw Win Thant (Ward (10), Royal Parami Condo Owner) *"COD was announced Last year May. Since then, it is not allowed to buy or sell, not to move one place to another, not to renovate and not to change the owner's name. No one has said how long the COD will last. At present, it is now allowed to do those activities within COD affected period.* *If the alignment crosses through the War 10, land ownership status in this ward is mostly freehold land. Thus, the compensation cost will be so high. To reduce environmental impact and noise pollution, Land owning to Department of Defense is the best place. At 1st PC, I suggested that it would be more appropriate to pass through Government land. I would like to know if 1st PC recordings were actually reported.* *Because I think SC didn't consider their previous suggestions from 1st PC, we*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"The comments of 1st PC meetings were recorded and reported.* *If you wish to make a change, please contact the YCDC department. You can see or investigate a mapping from YCDC. After the detailed design, we will work on the COD issue as soon as possible.* *The meeting will also include community representatives and will consider the implementations. This is done according to the international standard. Step-by-step process."* U Soe Moe Aung (Division Officer, Division (7), Myanma Railways) *"After 1st PC, MR has already submitted Detail meeting minutes to SC members. Please give more suggestions, they are willing to get new information and opinions from public."*	January 12nd, 2020. Mayangone Township

Category	Questions/Suggestions	Response	Date/Place
	would like to suggest that SC should consider public's suggestions and listen to our voices. We also want to participate in SC meetings as public's representative."		
	Daw Hnin Hnin Aye (Chief Engineer (Retired)); Ward (7) *"Livelihoods aspect also need to be considered in LARAP. Also, if the business is based on land, it is important to consider Compensation for them. Especially a retired person like me, I want to open a small shop in front of my house. I want to know how much specific area of land will be affected."*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"Livelihood restoration is fully considered according to JICA Guideline, ADB Guidelines and Myanmar Law. It also takes into consideration the income based on land. At Detail Design stage, they will inform detail information."*	January 12nd, 2020. Mayangone Township
Project Component and Schedule	Daw Thida Lu (Ward (7), Managing Director at Thidar Shipping) *The project should not be decided by the third party. It has to be decided after reflecting the public's concern. Will the alignment start from Hlaing Thar Yar to Parami road and then pass through the Kabar Aye pagoda road?* *I want to know if there are shouldn't consider only for the project and have to think fairly for the public's concern as well.* *Since Ward (7) is a quiet and critical area, is there any plan to alter the Alignment? What is the benefit of working on Parami Road? It seems there is no remarkable benefit for choosing this road.* *The petition has been sent to President's Office, State Councilor's Office. Also, the copies are sent to the MOTC and other respective Ministries. I do not agree with the project.*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"PAP's concerns and opinions are well noted. The fact that some of them do not welcome the project will be described in the report. The report will also be published so that people can give suggestions or advice.* *The final decision for the project will be decided by higher authorities. The purpose of today's PC is to present the findings and ways to mitigate them."* U Soe Moe Aung (Division Officer, Division (7), Myanma Railways) *"Yes, current line i.e. E to W and then leads to Kabar Aye Pagoda road (N to S) later.* *Alternatives have been considered in FS stage.* *MR received no letter for the time being and will try to respond the matter in proper way once received."*	January 12nd, 2020. Mayangone Township
	Chairman of Myanmar	U Soe Moe Aung (Division Officer, Division	January

Category	Questions/Suggestions	Response	Date/Place
	Environmental Assessment Association (MEAA) *I understand some information are now strictly confidential. But, please share more specific details about the project.* *For example, when will the MRT operation start? What is the height of the project? 15 meters? Is there any height variation along the Alignment? What is the frequency of the train operation?* *Operational information should also be disclosed to public.* *Emergency Plan for Earthquake and Disaster and community safety plan need to be considered.* *Rehabilitation should be considered with LARAP.* *There should be a strategy for assigning a representative to attend SC or WC to find out more about the proposed project. It should be considered for these people as vulnerable group.* *I also recommend to consider traffic management.*	(7), Myanma Railways) *"Yes, the height of the project is 15m.* *However, there will be reduce in height at the intersection with YEX. They will inform public as soon as Detail Design stage starts."*	12nd, 2020. Mayangone Township
General Request	U Aung Moe Thu (Warehouse and Apartment Supervisor; Ward (1)) *I want to request; (1) Please note down and record all of suggestions. (2) Please listen people voice & opinions in future decision making, (3) Please consider the standard suitable for Myanmar People, and (4) Please inform public after finalizing the Alignment*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"They record all the suggestions and will be included in Report"*	January 12nd, 2020. Mayangone Township

Closing Ceremony

Attendance List (MYG)

Local Community













Government Officials





Parliament Members



Private Companies



NGOs/ INGOs



Medias



Interested Parties



Photographs
















Participants' Registration







Opening Speech and Presentation about Project Introduction by U Soe Moe Aung (Division Officer from Division (7), Myanmar Railways)




Presentation on EIA and LARAP by U Aye Thiha (EIA Consultant)









Q & A Session

Record of the Public Consultation (Htantabin Township)

E Guard Environmental Services Co., Ltd. **Meeting Minutes**	
Subject: Yangon Urban Mass Rapid Transit Construction Project 2nd Public Consultation (EIA/LARAP)	**Date:** January 12 , 2020
Venue: No. (1) Ward, Bo Gyoke Street, General Administrative Office Hall, Htantabin Township	**Time:** 14:00 AM to17:00 AM
Attendees: Total: 137 (local people: 80; government officials: 50; parliaments members: 3; NGO/INGOs: 4)	

Public consultation of Yangon Urban Mass Rapid Transit-YUMRT was held on 12nd January 2020 in Htantabin Township, No. (1) Ward, Bo Gyoke Street, General Administrative Office Hall. Local people, Representatives of Yangon Regional Government, Parliament, Ministry of Transport and Communications, Myanmar Railways, concerned Township/Ward administrators and related governmental departments, people from private companies and media attended the meeting and meeting record is described in below.

Agenda:

1) Opening Ceremony

2) Opening Speech and Introduction of Project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)
3) The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plant (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services Co., Ltd.)
4) Question and Answers by Attendees
5) Closing Remarks by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)
6) Closing Ceremony

Opening Ceremony

Opening Speech and Introduction of Project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)

Concerned with YUMRT, this public consultation was held to explain about the project briefly. Since the living standard and vehicles rate are improving day by day, this project is carried out with the help of JICA. According to the survey, the public transportation system which will be faster and better is needed for our country. The reason for choosing this East-west line depends on the budget condition of Myanmar and study of JICA and the design will be overhead. The first public consultation was held in 5 townships. For electricity, there will be underground cable line connected from the West Yangon University which is located in Htan Tapin Township to Hlaing Tharyar Substation and the length will be approximately 11.5 km. The cable line which may be 4 km long will be constructed underground and it will pass through fields of Dike Kone and Yakhine Yoe Kyee Village Tracts. That is the reason why this public consultation was being held. After the detailed design is decided, there will be another meeting to let you know about the location of cables and which fields will be passed. Excavation activities will be avoided as much as possible while the cultivating and harvesting are carrying out. If it is not avoidable, the compensation for fruits and vegetables will be given. This project is carried out to develop the country.

The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plant (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services Co., Ltd.)

According to the Environmental Conservative Law which was released in 2012, the government projects and private projects have to do the environmental impact assessment before the projects begin. As the representative of project owner who are Yangon Regional Government, Ministry of Transport and Communications, we assessed the impacts for this project. The first part is about Environmental Impact Assessment (EIA) and the second part is Land Acquisition and Resettlement Action Plan (LARAP). There will be impacts on social and environment while implanting this project. The negative impacts have to be avoided if it is possible and to be mitigated if it is impossible. Not only assessment but also environmental

management plan and monitoring plan are also included in the report. There will be impacts which are needed to focus on air pollution caused by machines and water pollution caused by bridge construction. Air and water pollution, noise, vibration and waste disposal assessment were also considered. During construction period, the dust, carbon monoxide and nitrogen dioxide will be emitted much than guidelines. Nevertheless, the emission will be reduced when the operation is started. Before implementing the project, the measurement for environmental quality condition and the ecosystem were carried out. During the construction period, the impacts on ecosystem are needed to be avoided as much as possible. The surface runoff water and underground water were also tested and some of the parameters are above the guidelines. The electricity for the YUMRT will be supplied from the substation near West Yangon University by underground pipe line and it will pass through the fields of Htan Ta Pin Township. There will be some impacts because of the project. In future, there will be soil and water quality test running along the pipe line and this public consultation is held for letting local people know beforehand. If there are impacts caused by workers or transportation, grievance mechanism which local people can report the concerned people will be implemented. To implement this project, there are working committee, technical committee and steering committee. For this township, the impacts may be temporary. The impacts will also be reduced as much as possible. To study the ground survey condition, the Google earth is used currently. After confirming the exact alignment, the concerned authorized people will come and meet each and every owner of the impacted lands. From June to August, the socio-economic survey has already done. There are 5 acres of private land and 10.6 acres of governmental lands can be impacted. The private buildings are over 1000 and the governmental are 31 units. Similar to this, the total affected households are 1165 and persons are 4873. The project is now at the feasibility stage. The cut-off date was announced in newspapers on May 6, 2019. The compensation will be discussed at detailed stage.

Question and Answers by Attendees

Types	Suggestions/ Questions	Date/ Place
About YUMRT	**U Phay Chit (Representative Person of Amyotha Hluttaw Htantabin Constituency)** *"I would like to suggest all of you to think not only about our families but also for our country."*	January 12nd, 2020. Htantabin Township

Closing Ceremony

Attendance List (Htantabin)

Local Community

















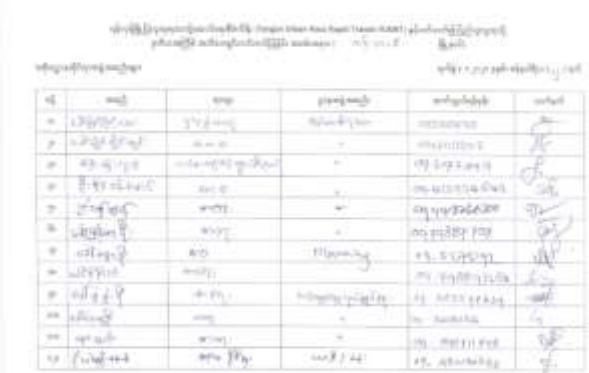


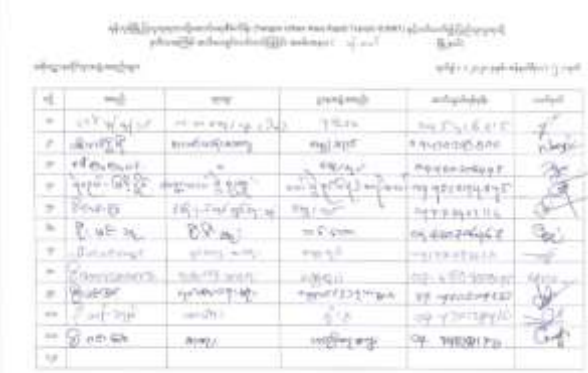


Government Officials











Parliament Members



NGOs/ INGOs



Photographs













Participants' Registration







Opening Speech and Presentation about Project Introduction by U Soe Moe Aung (Division Officer from Division (7), Myanmar Railways)




Presentation on EIA and LARAP by U Aye Thiha (EIA Consultant)




Q & A Session

Record of the Public Consultation (Yankin and South Okkalapa Township)

E Guard Environmental Services Co., Ltd. **Meeting Minutes**	
Subject: Yangon Urban Mass Rapid Transit Construction Project 2nd Public Consultation (EIA/LARAP)	**Date:** January 13th , 2020
Venue: No. (14) Ward, Thitsar Street, Okkalapa Pagoda compound, Mahar Muni Damar Yone, South Okkalapa Township.	**Time:** 14:00 AM to17:00 AM
Attendees: Total: 137 (local people: 49; government officials: 49; parliaments members: 3; NGO/INGOs: 12, interested parties; 12; media; 1)	

Public consultation of Yangon Urban Mass Rapid Transit-YUMRT was held on 12nd January 2020 in South Okkalapa Township, No. (14) Ward, Thitsar Street, Okkalapa Pagoda compound, Mahar Muni Damar Yone. Local people, Representatives of Yangon Regional Government, Parliament, Ministry of Transport and Communications, Myanmar Railways, concerned Township/Ward administrators and related governmental departments, people from private companies and media attended the meeting and meeting record is described in below.

Agenda:

1) Opening Ceremony
2) Opening Speech by Dr. Saw Naing (Representative of Pyithu Hluttaw, South-Okkalapa Constituency)
3) Introduction of the Project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)
4) The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plant (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services Co., Ltd.)
5) Question and Answers by Attendees
6) Closing Remarks by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)
7) Closing Ceremony

Opening Ceremony

Opening Speech by Dr. Saw Naing (Representative of Pyithu Hluttaw, South-Okkalapa Constituency)

In our neighboring countries, MRT Project has already been implemented since years ago. We can say that it is a little bit late comparing with other countries. I believe that the audiences attending here also have international knowledges and experiences. I would like to request you to speak openly about the needs of the project.

Introduction of the Project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)

Firstly I would like to explain about the working process of the Yangon Urban Mass Rapid Transit (YUMRT). Since 2012, we made assessment on urban transportation in cooperation with Japan International Corporation Agency (JICA). We have found that transportation systems in Yangon have poor connection to each other. Five North-South connected roads in Yangon are connected with public transportation system such as YBS. Therefore, if we make railway route along East- West route where no public transportation is, the connection will be improved. Yangon is facing with traffic congestion due to population increase. If public transportation gets better, traffic congestion will decrease and use of private vehicles will be

reduced. Phase 1 of the project will be 18 km long alignment starting from Hlaing Tharyar Station along Yangon-Pathein Highway, passing through Hlaing River, to Parami road. Phase 2 will extend from Parami, passing through Pinlon Road, to Thilawa. The assessments for the projects have carried out along with JICA from 2018 to 2019. Road widening process has to be done due to railway construction. 13 stations will include from Hlaing Tharyar to Parami. The project is also planned to be able to connect with YCR. Therefore, we expected to emerge markets, office towers and residents near stations and improve employment opportunities. A new bridge will be constructed across from Hlaing Tharyar to Hlaing River. The project alignment will pass across Hlaing Tharyar Township, Hlaing Township, Mayangone Township, Yankin Township and South Okkalapa Township. The alignment is designed to be least affected to the private land. The detailed design of the project will be completed around 2021, 2022. The project is being implemented to be a model for upcoming projects.

The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plant (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services)

As instructed by JICA Study Team, we have observed the project by dividing 2 parts. The first part is assessing possible environmental impacts caused by the project and the second part is the compensation policy which will be used in land acquisition. The Working Committee, the Technical Committee and the Steering Committee are all involved in the project. It is presented only after a series of discussions with these committees.

I will present about environmental impact assessment as first part. If a project is being implemented, there will definitely have impacts around the environment. These impacts have to be minimized as possible as it can be. The first public consultation has been held at respective townships on June, 2019. The assessments are carried out mainly focused on construction phase and operation phase. Moreover, mitigation measures and monitoring plans will also be included. The project proponent must follow the measures as instructed in EIA report. Environmental Impact Assessment report needs to get approval from respective Environmental conservation Department. Positive and negative impacts are expected due to the project. I will briefly explain these impacts. During CP (Construction Phase), water pollution is expected from construction works and toilets from base camp. Stations and toilets from depots may also cause water pollution during OP (Operation Phase). Similarly, there will be impacts on ecosystem and topography. As for social environment, Project Affected Persons (PAPs) may have concerns when moving from their long term lived area to another. As positive impact, increasing employment opportunities, easier transportation for students are expected. Environmental quality measurements were carried out two times as dry season and wet season along the alignment. All air quality results from dry season and almost all air results from wet season are found to be exceeding National Environmental Quality (Emission) Guideline (NEQEG). Vibration level is also found to be higher than the stipulated guideline. In Ecosystem, vulnerable species such as Burmese rose wood and mahogany, and nearly threatened species such as river tern are found. Most of the surface and ground water

results are exceeding over NEQ Guideline. Mitigation measures for these negative impacts are described in Environmental Management Plan (EMP). To reduce water pollution, wastewater treatment systems must be installed. To reduce noise level, noise barriers should be equipped. Monitoring is needed whether these mitigations measures are actually followed or not.

Part (2) will discuss about land acquisition. Land acquisition will be considered based upon Myanmar Land Acquisition Law, JICA Environmental and Social Consideration Law and policies from Asia Development Bank. We are planning to be least affect to the private lands. Socioeconomic surveys have already taken from each household along the alignment during June and August. 5 Acre of private land and 10.6 acre of government land will be affected because of the project. No private land on South-Okkalapa Township may be affected. 0.1 acre of military land will be affected. In Yankin Township, 0.5 acre of freehold land and 0.5 acre of government land can be affected. Total of 15.6 acre of land may be affected due to the project. The project is expected to affect 1021 units of private buildings, 79 units of mobile vendors and 31 units' government buildings. In terms of households, 1165 households and nearly 5000 populations may be affected. Currently, there is no exact measurement of affected areas. The exact range of compensation and affected areas will be decribed after detailed design stage. On 2019, May 6, cut-off-date of the project has already announced through newspaper. Compensation issues will only apply to residents who lived prior to the cut-off-date. Legally owned land owner can take land substitution or donate their land or sell their land. For tenants, 1 year or 3 year of rental fees will be compensated. For the buildings, the compensation will be done as described above. Moving costs and job opportunities will also be provided. Income lost issues will be considered at detailed design stage. Yangon Regional Government will also negotiate with project affected households. *Grievance Redness Mechanism will be considered.* Traffic Management Plan will also be included. As for landscape, *the project will also be designed to be environmentally friendly.*

Question and Answers by Attendees

Types	Suggestions/ Questions	Answers	Date/ Place
Environmental Impact Assessment	U Nyi Nyi Lwin (Ward 5, South Okkalapa Township) *"Will there be a noise and vibrate reduction plan and how can it reduce the negative impact? Is there any long term plan for preventing impacts during operation period?"*	U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"At this moment, it is at the Feasibility Study Stage. To start the Detailed Design Stage, it is important to get the permission and approval from the relevant organizations. Construction management consultant team, to be selected through tender process, will manage environmental monitoring during the construction and operation of the project."*	January 13th, 2020, South Okkalapa Township.

Types	Suggestions/ Questions	Answers	Date/ Place
		U Soe Moe Aung (Division Officer, Division (7), Myanma Railways) *"Tender will follow standard guidelines according to the international standard. In tender documents, there will be instruction on what to do during construction. For example, in YCR project, there is a third party organization to monitor the noise, vibration and other environmental impacts, that are described in bidding documents."*	
	U Min Ko Ko (Ward (8), Yankin Township) *"What is the minimum distance from the train cars and the buildings? Are there any plans to protect security and privacy of houses close to the alignment as passengers can easily see inside the houses through train windows? Is there any plan to block the window views from the train cars?"*	U Soe Moe Aung (Division Officer, Division (7), Myanma Railways) *"It is not possible to block the vision of the train window as the passenger may want to enjoy the scenery. But the design to protect the security and privacy of the surrounding residential area houses will be considered.* *The height of pier is 10m and the urban railway trainsets will run over this pier. If the noise barriers are installed along the alignment, noise and vibration can be protected and reduced."* U Aye Thiha (MD, E Guard Environmental Service Co., Ltd) *"The detailed studies will be carried out in Detailed Design Study."*	January 13th, 2020, South Okkalapa Township.
Technical	U Nyi Nyi Lwin (Ward 5, South Okkalapa Township) *"Gauge, railcars and rolling stocks that are currently used in Myanmar are not modernized. So, what kind of railcars will be used in YUMRT?* *How about the network coverage and station designs?*	U Soe Moe Aung (Division Officer, Division (7), Myanma Railways) *"The railway gauge will be standard gauge. The urban railway electrification system is OHC system.* *The operation will start in 2027. At first, the urban railway will be operated by 5 cars. Later, it will*	January 13th, 2020, South Okkalapa Township.

Types	Suggestions/ Questions	Answers	Date/ Place
	What is the speed per hour? How about the ticket fare? *Is YURMT linked with other transit modes?"*	*be operated by 8 cars. The travel time will be 30 minutes for* *18km. However, it is important to carry out the detailed further studies.* *As an example, YCR ticket is 100 kyats/20km and 200 kyats/40km.* *TOD may be developed at the Okkyin and Parami Station. Discussions with MOD is ongoing at this moment. In the future, if the YUMRT network and captured areas are to be extended, more development can be expected with the participation and investment from private sectors."*	

Closing Ceremony

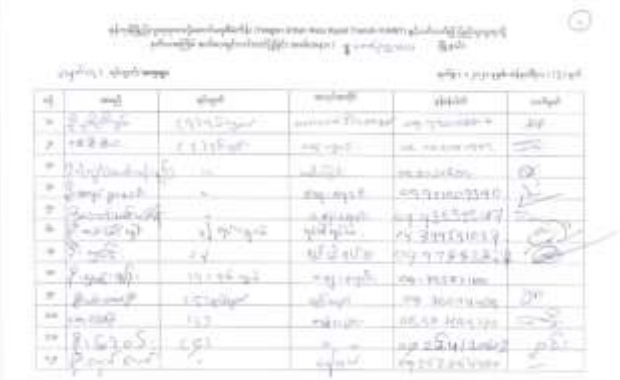
Attendance List (YK and SOK)

Local Community











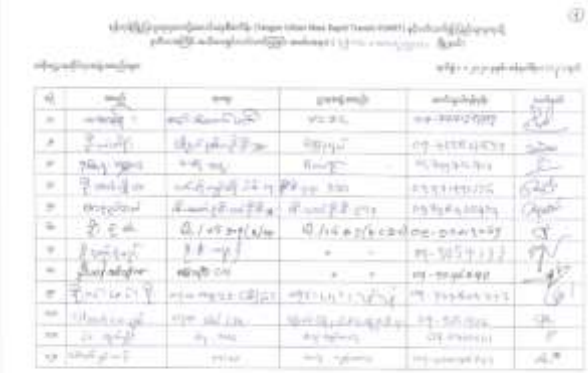


Government Officials











Parliament Members



NGOs/ INGOs



Interested Parties





Media



Photographs














Participants' Registration




Opening Speech by Dr. Saw Naing (Representative of Pyithu Hluttaw, South-Okkalapa Constituency)




Introduction of the Project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)




Presentation on EIA and LARAP by U Aye Thiha (EIA Consultant)






Q & A Session

Record of the Public Consultation (Hlaing Tharyar Township)

E Guard Environmental Services Co., Ltd. **Meeting Minutes**	
Subject: Yangon Urban Mass Rapid Transit Construction Project 2nd Public Consultation (EIA/LARAP)	**Date:** January 14 , 2020
Venue: No. (6) Ward, Kyan Sitt Thar Street, Aung Myay Thar Si Pagoda Yard, Sarsana edifice, Hlaing Tharyar Township	**Time:** 8:00 AM to11:00 AM
Attendees: Total: 922 (local people: 887; government officials: 25; parliaments members: 1; NGO/INGOs: 5, interested parties; 2; media; 2)	

Public consultation of Yangon Urban Mass Rapid Transit-YUMRT was held on 14th January 2020 in Hlaing Tharyar Township, No. (6) Ward, Kyan Sitt Thar Street, Aung Myay Thar Si Pagoda Yard, Sarsana edifice. Local people, Representatives of Yangon Regional Government, Parliament, Ministry of Transport and Communications, Myanmar Railways, concerned Township/Ward administrators and related governmental departments, people from private companies and media attended the meeting and meeting record is described in below.

Agenda:

1) Opening Ceremony
2) Opening Speech and Introduction of Project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)
3) The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plant (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services Co., Ltd.)
4) Question and Answers by Attendees
5) Closing Remarks by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)
6) Closing Ceremony

Opening Ceremony

Opening Speech and Introduction of the Project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)

Environmental and Social Assessments for the project are being carried out since 2018. Due to rapid population increase, better and faster public transportation system that is suitable with the current development must be implemented to decrease the traffic congestions. Local people from Hlaing Tharyar will get benefits from the project such as job opportunities. The objective of the project is to be able to connect east side and west side of Yangon. Phase 1 of the project will start from Hlaing Tharyar to Parami and Phase 2 is planned to extend from Parami to Thilawa. North-South railway is also planned to be implemented. 5 North-South roads in Yangon are well connected with YBS. However, East-West road is poorly connected with YBS. That is why the project is being implemented. Project information will further be explained. Future Urban Transport Network in Yangon (YUTRA II Plan) was being carried out along with JICA since 2012 to have better connection between railways and buses. If public transportation system is getting better, uses of private vehicles can also be reduced. The project aims for a modernized and comfortable urban life and to encourage investment opportunities. We will carry out the project to become model case for future projects in Myanmar. The project alignment is from Hlaing Tharyar to Parami. Road widening is required due to construction of the railroad. A new bridge will be built across Hlaing River. The alignment of the project is 18 km long and will pass through Hlaing Tharyar Township,

Haling Township, Mayangone Township, Yankin Township and South-Okkalapa Township. 13 stations will be included. The required electricity will be obtained from underground electricity route which is connected from sub station near West Yangon University to Hlaing Tharyar Sub Station. More employment opportunities will be developed due to the Project.

The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plant (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services Co., Ltd.)

*Concerning with the project, 2 parts will be explained. The first one is Environmental Impact Assessment (EIA) and the second, Land Acquisition Resettlement Action Plan (LARAP)**.** The project is being implemented in cooperation relevant ministries, departments and organizations.*

In implementing the project, social and environmental impacts must be minimized as least as we can. Assessments were carried out by dividing construction phase (CP) and operation phase (OP). Mitigation measures to the impacts and monitoring plans will also be carried out. Due to the project, traffic congestion will be reduced and job opportunities will be increased. Moreover, negative impacts such as air pollution, water pollution may happen. During construction period, excavation works, bridge construction and toilets from basecamps may lead to water pollution. Water pollution is also expected due to toilets from stations and depots while operation period. In social environment, project affected persons may have concerns on land acquisition issues. There will be impacts on fishermen due to construction of bridge along Hlaing River. Environmental quality monitoring was carried out both in dry season and wet season. Resulted air quality is found to be higher than National Environmental Quality (Emission) Guideline (NEQG). Noise and vibration levels also exceed their stipulated guidelines. In Ecosystem vulnerable species such as Burmese rose wood and mahogany, and nearly threatened species such as River tern are found. Surface water and ground water results are also exceeding NEQG. Measurements were also carried out along electricity route from Htantabin to Hlaing Tharyar. To minimize these impacts, mitigation measures are also descried. Monitoring plan makes sure that these mitigation measures are actually followed or not. During construction period, soil quality, water quality and waste disposal are mainly needed to be monitored and, during operation period, air quality, noise and vibration.

In part (2) Land Acquisition Resettlement Action Plan (LARAP) will be explained. Alignment is designed to have minimum impact to private lands. Socioeconomic surveys along the alignment were also conducted last year. 5 Acre of private land and 10.6 acre of government land will be affected because of the project. No private land on South-Okkalapa Township may be affected. 0.1 acre of military land will be affected. In Yankin Township 0.5 acre of freehold land and 0.5 acre of government land can be affected. In Hlaing Tharyar Township, 1.5 acre of government land may be affected. Total of 15.6 acre of land may be affected due to the project. The project is expected to affect 941 units of private buildings, 67 units of mobile vendors and 2 units of government buildings within Hlaing Tharyar Township.

Overall, the project is expected to affect 1021 units of private buildings, 79 units of mobile vendors and 31 units of government buildings. In terms of households, 1165 households and nearly 5000 populations may be affected. Currently, there is no exact measurement of affected areas. On today's event, I will present about compensation policy. Cut-off-date has already announced throuh newspapers on May, 2019. Compensation policy is only applicable for residents who lived prior to the cut-off-date. Resettlement palns are being planned for people who live along Yangon-Pathein Highway Road. If necessary, vocational trainings and job opportunities will be provided. Moving costs will also be provided. Extra provision will be given for vulnerable person headed households. In detailed design stage, the number of project affected households will be reduced as possible. *Any grievances during the project will be resolved.*

Question and Answers by Attendees

Types	Suggestions/ Questions	Answers	Date/ Place
Land Acquisition and Resettlement Action Plan Technical	U Win Htay (Nyaung Village, Hlaing Thar Yar Township) *"Most squatters along Yangon-Pathein Road are the ones migrated from Delta Region due to Nargis Cyclone. Others are due to poverty. We are living here and also working here. They totally depend on this place. If they have to move from here, there may be many difficulties as we have to settle again at the new places. There may be a lot of difficulties related to the resettlement issue, economic difficulties and children's education etc."*	**U Aye Thiha (MD, E Guard Environmental Services Co., Ltd)** *"The detail will be explained in the* *LARAP presentation later."*	January 14th, 2020, Hlaing Tharyar Township.
	Daw Thwe Thwe Oo (Yay Okkan Village, Hlaing Thar Yar Township) *"I would like to be informed one or two months in advance so that we have time to prepare for relocation. We are afraid of being forced to abandon our houses suddenly while the children or family members are not at home. I suggest that it would be better if the relocation period is given during the schools are closed."*	U Soe Moe Aung (Division Officer, Division (7), Myanma Railways) *"The construction will start in 2022. Before that, road widening will be done. We will announce all the information in time, including when and where to move."*	January 14th, 2020, Hlaing Tharyar Township.
	U Tin Aye (Nyaung Village, Hlaing Thar Yar Township) *"When will the construction start?*	U Aye Thiha (MD, E Guard Environmental Services Co., Ltd) *"The construction will start in*	January 14th, 2020, Hlaing Tharyar Township.

Types	Suggestions/ Questions	Answers	Date/ Place
	When will they have to move? *Most of the people here are low incomes group so cannot afford to rebuild our houses after relocated to new places. What are the additional supports can we expect? How long can we live here?"*	*2022. YRG already has the relocation plan. The affected ones will have to follow this. Every step will be informed. There will be enough time to move."* U Soe Moe Aung (Division Officer, Division (7), Myanma Railways) *"It is based on the international guidelines and plan. The road widening will be carried out by YRG and we will update the information to the public"*	

Closing Ceremony

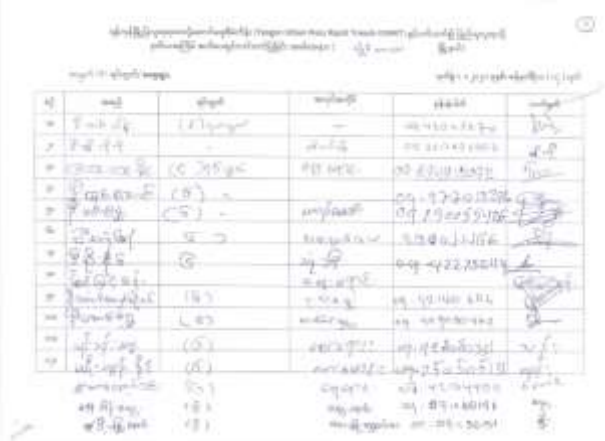
Attendance List (HTY)

Local Community



















































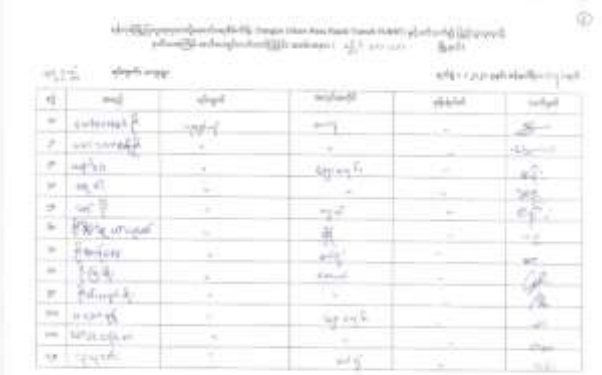


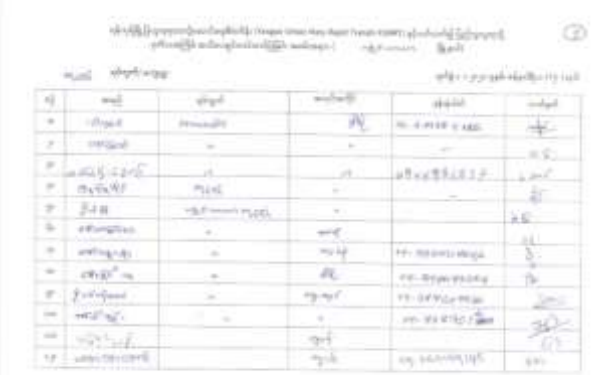


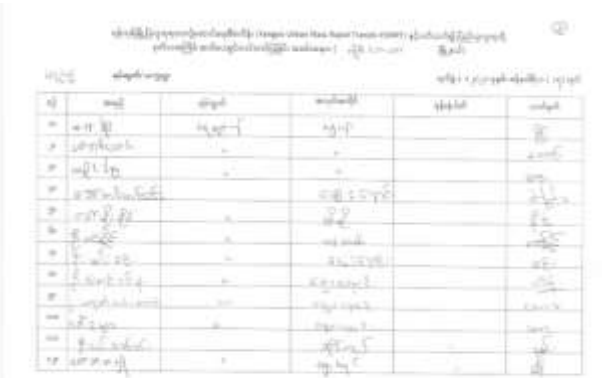












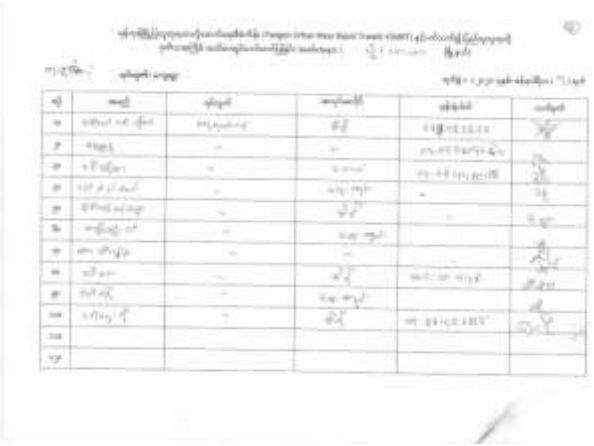


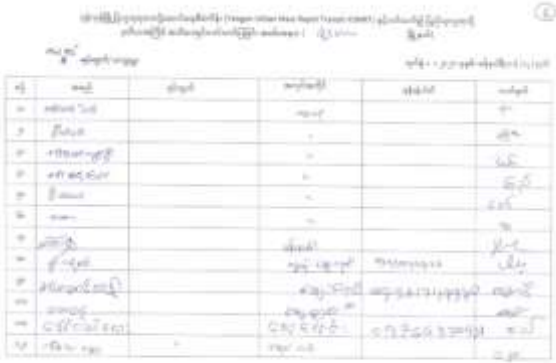


























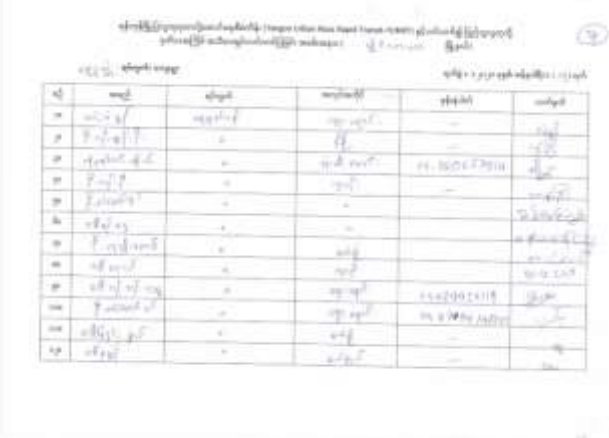












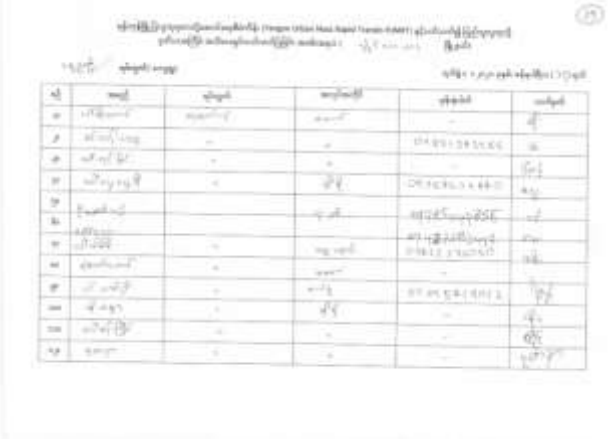






































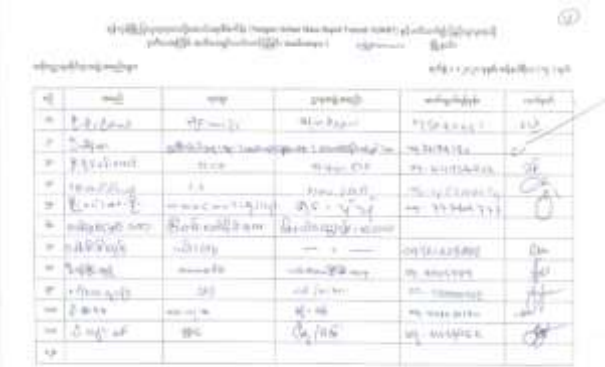






Government Officials







Parliament Members



NGOs/ INGOs



Medias



Interested Parties



Photographs














Participants' Registration






Opening Speech and Introduction of the Project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)




Presentation on EIA and LARAP by U Aye Thiha (EIA Consultant)










Q & A Session

Record of the Public Consultation (Hlaing Township)

E Guard Environmental Services Co., Ltd. **Meeting Minutes**	
Subject: Yangon Urban Mass Rapid Transit Construction Project 2nd Public Consultation (EIA/LARAP)	**Date:** January 14th , 2020
Venue: No. (12) Ward, Aung Dahma Yeik Thar Street, Hlaing Mingalar Hall, Hlaing Township.	**Time:** 14:00 AM to17:00 AM
Attendees: Total: 113 (local people: 61; government officials: 29; parliaments members: 1; NGO/INGOs: 7, interested parties; 12; media; 3)	

Public consultation of Yangon Urban Mass Rapid Transit-YUMRT was held on 14th January 2020 in No. (12) Ward, Aung Dahma Yeik Thar Street, Hlaing Mingalar Hall, Hlaing Township. Local people, Representatives of Yangon Regional Government, Parliament, Ministry of Transport and Communications, Myanmar Railways, concerned Township/Ward administrators and related governmental departments, people from private companies and media attended the meeting and meeting record is described in below.

Agenda:

1) Opening Ceremony
2) Opening Speech and Introduction of Project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)
3) The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plant (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services Co., Ltd.)
4) Question and Answers by Attendees
5) Closing Remarks by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)
6) Closing Ceremony

Opening Ceremony

Opening speech and introduction of the project by U Soe Moe Aung (Division Officer, Division (7), Myanma Railways)

The current situation of our transportation system in Myanmar is that although there are many routes, the network connection is weak. After carrying out the study, it was found that the YUMRT connecting from East to West of Yangon is the most suitable option for the better transportation. The routes connected from South and North are way much more than the others. With the loan from Japan and the budget condition of Myanmar, YUMRT which will be 18 km long from Hlaing Thar Yar Station to Parami is the priority to implement. From point of view of the human resource, Hlaing Thar Yar Township has higher amount of population and workers than any other townships. It normally takes at least one or two hours from Hlaing Thar Yar Township to Parami or South Okkalapa Township if you take by bus. But it will only take half an hour if this project is successfully implemented. The main purpose of this project is to reduce traffic problem and to develop the living standard. There might be around 13 stations along the way and the distance between each station may be approximately 1 km. In the future, the price of houses and buildings or land may be higher than before. For the governmental lands along the way, the concerned ministries will discuss with each other. Because of the alignment, some of the places in (No.16) ward of Hlaing Township which is located between Insein Road and Baho Road might be slightly affected. The alignment was drawn based on the Yangon Mapping Data of YCDC. The detailed design stage will be done during 2020-2021 for detailed measuring. Depending on those measurements, the design will be re-managed to reduce impacts. The compensation policy has been already stated for public places as project affected unit. This project is mainly for the benefits of citizen and I would like to request all of you to give us a hand in implementation.

The presentation about Environmental Impact Assessment (EIA) and Land Acquisition Resettlement Action Plan (LARAP) by U Aye Thiha (Managing Director, E Guard Environmental Services Co., Ltd.)

The project is at the stage of where the possible impacts are being studied. The presentation will be included two parts; the first part is about Environmental Impact Assessment (EIA) and the last is Land Acquisition and Resettlement Action Plan (LARAP). The main purpose of EIA is to reduce the impacts caused by the projects whether they are governmental or private and to disclose the information to the public. In EIA, there are construction phase and operation phase. During these phases, the possible impacts on environment and social caused by the projects will be studied. The environmental management plan (EMP) and the environmental monitoring plan (EMoP) are also part of the EIA. The potential negative impacts are air quality, water quality, noise and vibration, soil quality and disposal wastes. The impacts on ecosystem, terrain and topography have also been studied. The current air and water qualities were also assessed. For air quality, it was carried out in dry and wet seasons and there were total 18 places for assessment. The other concerned environmental qualities were also assessed. The air quality in 18 places for both seasons has 6 to 30 times higher than National Environmental Quality (Emission) Guideline. To prevent noise pollution, noise barriers will be installed. The environmental monitoring plan is to monitor whether the project proponent is following the rules and methods that were suggested by us. It will help in checking the possible impacts are happening or not and moreover, it will be

useful for future projects. The monitoring has to be carried out once in 6 months or a year. For LARAP, there are 1.5 acre of private land and 3.5 acre of governmental land in Hlaing Township. But in detailed design stage, the affected land areas will be known in detailed. After that, the concerned authorized persons will have a discussion with each and every owner of the houses, buildings and land. The policy for compensation is not only for the legal owners but also for the rental or street stalls. Yangon Region Government will implement about the compensation method. The grievance mechanism can also be carried out. For the traffic problem during construction period, the traffic management plan will be also included. There are plans to reduce the visual impacts also.

Question and Answers by Attendees

Types	Suggestions/ Questions	Answers	Date/ Place
Land Acquisition and Resettlement Action Plan	**U Tin Oo (No.16 Ward, Hlaing Township)** *"I am currently living on freehold land. I donated a part of my land in the previous YCDC road widening Project. There was no compensation for that. Now, my remaining land is only 90ft and I think the project will affect 50% of the land. I wish this project will not affect much of my land."*	**U Soe Moe Aung (Division Officer from Division (7), Myanmar Railways)** *"The alignment of YUMRT is planned along the main road. We can guess the affected area by measuring 11 meters (about 40ft) from the middle of the road.* *In DD stage, we will consider the alignment design to minimize the impacts and the land requirements.* *JICA loan is only for construction. Compensation is from the national budget."* **U Aye Thiha (MD, E Guard Environmental Services Co., Ltd)** *"According to the international practices, compensation is considered depending on how many percentages of total land area is affected and then it will be included in compensation policy. Sometimes, your land is only affected* *10ft, but the remaining is not sufficient enough for living or any development. The project will consider full coverage of compensation if affected percentage is higher or remaining land is not sufficient for living."*	January 14th, 2020, Hlaing Township.
	U Myoe Thant (No. 87, No.16 Ward, Hlaing	**U Aye Thiha (MD, E Guard Environmental Services Co.,**	January 14th, 2020, Hlaing

Types	Suggestions/ Questions	Answers	Date/ Place
	Township) *"During social survey, the survey team came and asked the neighboring houses only. They left my 6-storyed building which is in the middle of those houses. There are similar cases like this and I wants to know the reason."*	**Ltd)** *"Social survey was for structures and lands which will be potentially affected by the project. We do not survey the houses which are not affected by the project.* *This may be due to two reasons, (1) the building is not affected (2) the owner could not be contacted. We will check* *again his building on the map after this* *PC or the next day.* *GAD staffs and other concerned government officials also participated during survey as they know well about the ground condition. We also have the list of people who could not be contacted at that time."*	Township.
	U Aung Myo Oo (U Phoe Mhan Street, **Hlaing Township)** *"My 6-storyed building is facing to the Parami Road. When I measured 11 meters from the middle of the road, it is found out that approximately 3ft will be affected out of 35ft. Only the staircase area will be affected. I would like to know how this issue will be solved."*	**U Aye Thiha (MD, E Guard Environmental Services Co., Ltd)** *"Detail affected area will be measured and discussed in DD stage because there may be unknown structural impacts.* *We will consider how to resolve or reconstruct based on the individual impact on each building. We will also discuss with the people who are currently living in that building for the requirements of set back or how to rebuild it. We will take every condition into consideration for each affected type."*	January 14th, 2020, Hlaing Township.
	U Win Kyi (West side of Parami Road, in front of AYA Bank, No.16 Ward, Hlaing Township) *"My house was built around 30 years ago and it is 14ft behind the YCDC drainage. But during social survey, the survey team came and asked only his house. The neighboring 6-storyed building was not surveyed. Comparing to other houses and buildings, my house is 14 ft far from the drainage and I would like to know why."*	**U Aye Thiha (MD, E Guard Environmental Services Co., Ltd)** *"Sometimes, there are different ways in measuring or assessing the lands. We will check again his building on the map after this PC"*	January 14th, 2020, Hlaing Township.

Types	Suggestions/ Questions	Answers	Date/ Place
	Female *"I would like to issue the complaint letter to the higher-level authority. So, I want to know which organization is above YRG and want to know where to contact if the public wants to send suggestion letter to JICA."*	**U Aye Thiha (MD, E Guard Environmental Services Co., Ltd)** *"The letter can be issued to President and or State Counsellor as the highest authority. Regarding the complaint letter to JICA, it can be issued via GM of MR."*	January 14th, 2020, Hlaing Township.
	Male *"Your project could be affected in the second phase but it's very low chance. Since Parami Road is 6 lanes, your project will not be affected and construction can be continued. Ministry of Defense also gave us 5 lands so you do not need to be worry."*	**JST Local Staff** *"According to the current alignment, your structure is not within the affected area"*	January 14th, 2020, Hlaing Township.
Technical	**U Tint Lwin (No.16 Ward, Hlaing Township)** *"Are the areas for drainages, platforms already included in the mentioned 11m measurement?"*	**U Aye Thiha (MD, E Guard Environmental Services Co., Ltd)** *"We will present about it in detailed design stage."*	January 14th, 2020, Hlaing Township.

Closing Ceremony

Attendance List (Hlaing)

Local Community





Government Officials







Parliament Members



NGOs/ INGOs



Medias



Interested Parties



Photographs
















Participants' Registration







Opening Speech and Presentation about Project Introduction by U Soe Moe Aung (Division Officer from Division (7), Myanmar Railways)




Presentation on EIA and LARAP by U Aye Thiha (EIA Consultant)









Q & A Session

Appendix 11 Material used at the Pubic Consultation (Draft EIA Stage)

<Introduction>





<Environmental Impact Assessment>



၂။ ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများ (ပြန်လည်တင်ပြခြင်း)

EIA -ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများ (လူမှုဘဝနှင့်ကျန်းမာရေး)

- စီမံကိန်းဆောက်လုပ်ခြင်းသည် နှစ်နာမည်ဖြစ်နှင့်လျော်မကြေမရေ ရရှိသော်လည်း ၎င်းတို့နှစ်ရှည်လများနေထိုင်ခဲ့သော မြေနေရာဒေသတွင် စိတ်ပူပန်မှုများ ခံစားရနိုင်ခြင်း

- နေရာဆောင်းအား ပြောင်းရွှေ့နေထိုင်သည့် အဓိန်ကျင် ယခင်နေရာသို့ နေထိုင်ခဲ့လေ့ရှိသကဲ့သို့ လိုက်လျောညီလျွေမှု နှိမ်ပါးမည်လား ဟူသော စိုးရိမ်ကြောင့်ကြမှုများ ဖြစ်ပေါ်လာနိုင်ခြင်း

၃။ လွှင့်ဆင်းတိုင်းတာမှု နည်းလမ်းများ

EIA လွှင့်ဆင်းတိုင်းတာခဲ့သည့် အဓိက အချိုးအစားများ

ဒေသအညီအမျှ
- တိုင်းတာထည့်နေရာ: လူဘဝနှင့် တစ်ရပ်ကွက်နှင့် အခြေခံရာရာများ
- တိုင်းတာထည့်ပြီးရိန်းရေး: နှစ်ကြိမ်(အခြေခံကိန်းညွှန်းများနှင့် ခိုရသည်)
- တိုင်းတာထည့်နေရာ: ၁၀ နေရာ
- တိုင်းတာထည့် အချိုးအစား: PM_{10}/$PM_{2.5}$, CO, NO_2, SO_2



ရေဘုတ်နှင့်ကုန်ဆံမှု
- တိုင်းတာထည့်နေရာ: လူဘဝနှင့်ကိန်းရိန်း သမိုးသားဘောက်ပြုခဲ့များ ရောက်ခံရရာများနှင့် ထိရှုခံစားသည့်သည့် နေရာများ
- တိုင်းတာထည့်ပြီးရိန်းရေး: တစ်ကြိမ်
- တိုင်းတာထည့်နေရာ: ၂၅ နေရာ
- တိုင်းတာထည့် အချိုးအစား: VOA, Ltrmp



၄။ အလှည့်ချေပ်ရေးဝန်

ဒေသအညီအမျှ
- PM_{10} $PM_{2.5}$ NO_2 ထိုးကာထည့်လာသို့ အသေးစည်းအား အလုပ်ခိုင်းနှင့် ရိုးကြောင်းရှိ အသေးစည်းအား အများအပြားရှိ ရုပ်သည့် အချိုးအား တစ်ခန်းကျတိုင်းရာ အည်အရေးပေးလာတို့ကျွမ်း ကမ်းလှမ်းနေရသည်ကို ကိုယ်အရေးရှိခဲ့သည်
- ထိုးကာထည့်ပြီး ရုပ်သည့် အချိုးအား တစ်ခန်းကျတိုင်းရာ အည်အရေးပေးလာတို့ကျွမ်း ကမ်းလှမ်းနေရသည်ကို ၆ ဆ ၃ ဆ ဆင် ကျွမ်းနေရသည်ကို ကျွန်ခြင်းသည်
- ပေးပို့ရေးကျွမ်းခြား ဒုံရန်ရှိရသည် ရိုးကြောင်းတက် ထိုးကာထည့်လာသို့ ပြီးနှံခြင်းအောက်ပြုလ် ထိုးကာထည့်လာသို့ ရိုးကြောင်းတက် တာရှိနေခြင်းအရေးသို့ ကျွန်ခြင်းသည်

ရေထုံးကုန်ဆံမှု
- Lamp တစ်ခေတ်ကစ်ရေးသွားကို ရေထုံးကုန်ဆံမှုတစ်ခုတို့ ရုပ်သည့် အချိုးအား တစ်ခန်းကျတိုင်းရာ အည်အရေးပေးလာတို့ကျွမ်း ကမ်းလှမ်းနေရသည်ကို ကိုယ်အရေးရှိခဲ့သည်ကို ကိုယ်အရေးရှိခဲ့သည်
- ထိုးကာထည့်ရေးသွားကို အခြေခံရာတို့ကိုယ်အရေးရှိခဲ့သည်ကို ကိုယ်အရေးရှိခဲ့သည်
  ဆင် ဆင် အောက်ပုံခြင်းသား ကျွန်ခြင်းသည်

ဒေသအနေနှင့်
အားလုံး
- ဖြူးပြုခဲ့အရေးရုပ်ခြင်းရေးအရေးဖြစ်ပေါ် - ထိုးကာထည့်
- ဖြူးပြုခဲ့အရေးရုပ်ခြင်းရေးအရေးဖြစ်ပေါ် - ရေးကာထည့်



သယ်ယူရာ
- ဖြူးပြုခဲ့ ပြီးကမြောက်များတွင် ရုံ ခြားရေးရေးအရေးဖြစ်ပေါ် - ပြန်ပြီးရေး

၄။ အလှည့်ချေပ်ရေးဝန် (ပြောက်သွေ့ရာသီ)



၄။ အလှည့်ချေပ်ရေးဝန် (ရိုးတ်ရာသီ)



၄။ အလှည့်ချေပ်ရေးဝန် (ပြောက်သွေ့ရာသီ)



၄။ အလှည့်ချေပ်ရေးဝန် (ရိုးတ်ရာသီ)



၄။ အကျဉ်းချုပ်ရလဒ်
(ဖိုင္ဒတ်ရာသီ)



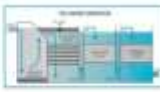
၅။ ပတ်ဝန်းကျင်ဆိုင်ရာ
စီမံခန့်ခွဲမှု အစီအစဉ်
(EMP)

ရေထုညစ်ညမ်းမှု

[တည်ဆောက်ခြင်းအဆင့်]



[စီမံကိန်းလည်ပတ်သည့်အဆင့်]



၅။ ပတ်ဝန်းကျင်ဆိုင်ရာ
စီမံခန့်ခွဲမှု အစီအစဉ်
(EMP)

အုပ်ချုပ်နှုံ့ ဘုန်ကြီး

[တည်ဆောက်ခြင်းအဆင့်]

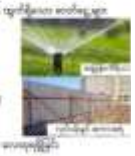


[စီမံကိန်းလည်ပတ်သည့်အဆင့်]

၅။ ပတ်ဝန်းကျင်ဆိုင်ရာ
စီမံခန့်ခွဲမှု အစီအစဉ်
(EMP)

စားသုံးဆေးရေ

[တည်ဆောက်ခြင်းအဆင့်]



မြေဆီလွှာ ညွှန့်ညွှတ်မှု

[တည်ဆောက်ခြင်းအဆင့် / စီမံကိန်းလည်ပတ်သည့်အဆင့်]

၅။ ပတ်ဝန်းကျင်ဆိုင်ရာ
စီမံခန့်ခွဲမှု အစီအစဉ်
(EMP)

နှုန်းပစ်ရည်/ အနှံ့အသတ်

[တည်ဆောက်ခြင်းအဆင့်]

ဒေသစနစ်

[တည်ဆောက်ခြင်းအဆင့်]



၅။ ပတ်ဝန်းကျင်ဆိုင်ရာ
စီမံခန့်ခွဲမှု အစီအစဉ်
(EMP)

ရေဆင်း

[တည်ဆောက်ခြင်းအဆင့်]



ထေစိတ်အနေအထား/ မြေမျက်နှာသွင်ပြင်

[တည်ဆောက်ခြင်းအဆင့် / စီမံကိန်းလည်ပတ်သည့်အဆင့်]



၆။ ပတ်ဝန်းကျင်ဆိုင်ရာ
စောင့်ကြပ်ကြည့်ရှုမှု
အစီအစဉ် (EMoP)

ရည်ရွယ်ချက်

စီမံကိန်းတည်ဆောက်ခြင်းနှင့် အဓိက စောင့်ကြပ်ကြည့်ရှုရမည့် အရာများ

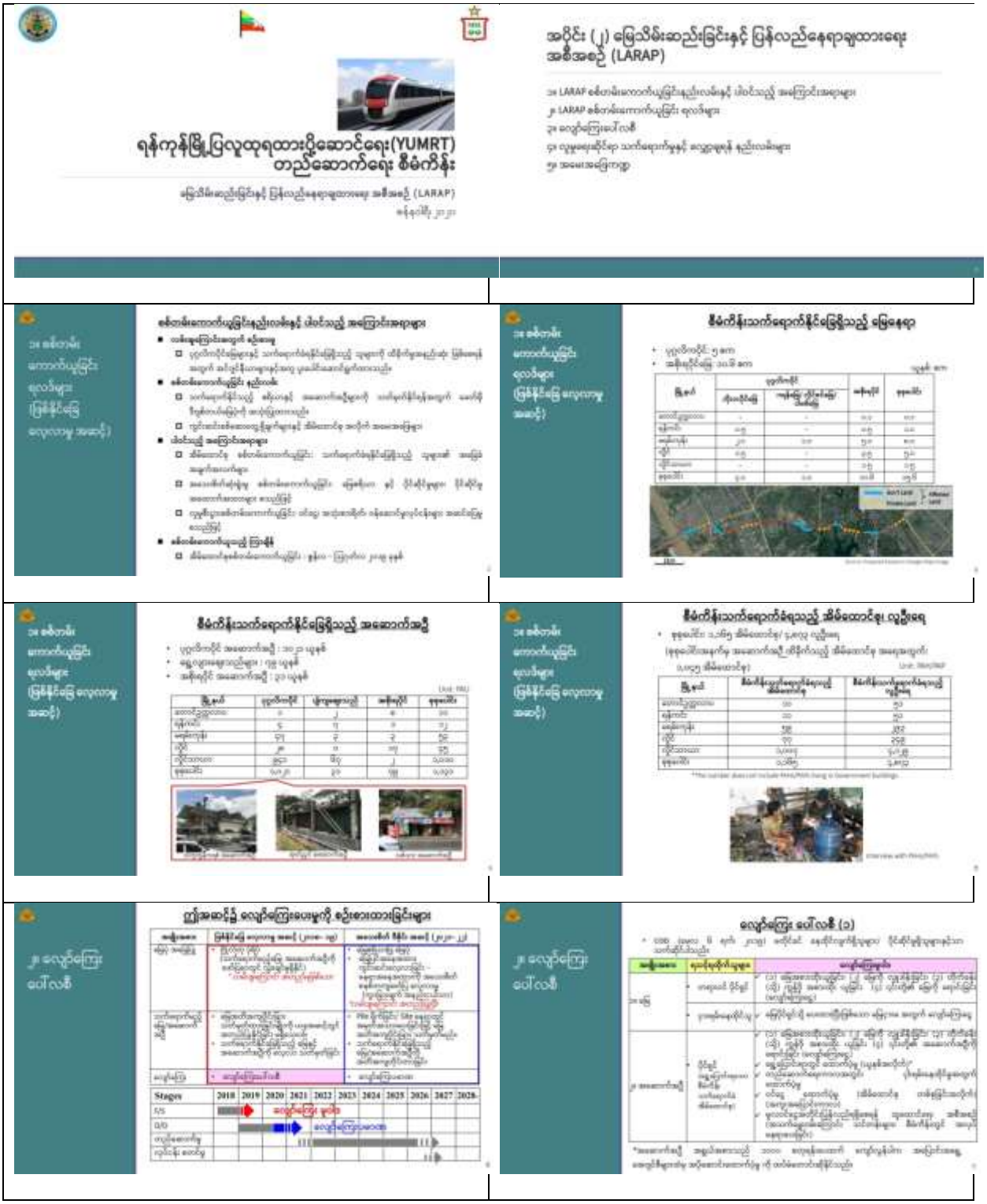
စီမံကိန်းလည်ပတ်ဆောက်ခြင်း အဓိက စောင့်ကြပ်ကြည့်ရှုရမည့် အရာများ





အပိုင်း (၁): ပတ်ဝန်းကျင်ထိခိုက်မှု
ဆန်းစစ်ခြင်း(EIA) အတွက်
အမေး/အဖြေကဏ္ဍ

<Land Acquisition and Resettlement Action Plan>



၂။ လျော်ကြေး ပေါ်လစီ

လျော်ကြေး ပေါ်လစီ (၂)

အချို့အစား	ရသင့်ရှုတိုက်သူများ	လျော်ကြေးပမာဏ
၂။ အဆောက်အဦ*	• အများ	✓ ပြိုဆင်သို့ ဆောက်လုပ်ခြင်းအား အတွက် လျော်ကြေးရရှိ
	• မှတ်ပုံတင်သည်	✓ အနှုပြောင်းရွှေ့ရသောအခါ အဆောက်အဦးပေးခြင်း
	• ဘဏ္ဍာရေးပံ့ ကျွမ်းကျင်မှု ခန့်မှိုင်းသူများ*	✓ မူဘဝပြန်လည်ထိုင်ခြင်းလုပ်ငန်းဆောင် (ပင်ကိုယ်ရေးရာပြုခြင်း၊ ပြောင်းရွှေ့ရေးကျွမ်းကျင်မှုပြုခြင်း၊ သင်တန်းများ စီမံကိန်းတွင် အလုပ်အခန့်ထားပေးခြင်း)
၃။ သစ်ပင်	• ပိုင်ရှင်	✓ အသီးပွင့် ပန်းပေး ဆက်ပြီး သစ်ပင်၏ ၃ နှစ်စာ ရရှိမည့်ဈေးကွက်ဖြင့်ပြု ပေးခြင်း
၄။ အရောင်းပြည့်သူပိုင် အဆောက်အဦများ	• အစိုးရပိုင် ရုပ်ပွတ်ဆဲ့ အငည်ပိုင်	✓ ဆုရရှားစားကို ပေးပေးခြင်း

*ဘဏ္ဍာရေးကျွမ်းကျင်မှုရရှိပြီးသူများ အတွက် ရန်ကုန်ကိုင်းဝေးကြီး အစိုးရစီ အစီအရင်ခံစဉ် ရရှားပေးရန် ပြုစီးသည့်ရရှားများအားလုံးကို ဆောင်ရွက်ပေးသည်

*ရရှားမိုင်ပိုင်ခွင့်... အလုပ်သမား ပို့ဆောင်ရေး = မိုး ၁၅) ခွန်အုပ်ပမာဏ = ကျပ်သန်း ၁၀၀

ရုပ်ခိုင်ခြင်းနှုန်း... အထက်ပါ အတိုင်ပြုထုတ်ထားကို ပြီရှိရရှိပြောဆသော

(SEZ Development Law 2015 အပေါ် မူတည်၍)

၂။ လျော်ကြေး ပေါ်လစီ

လျော်ကြေး ပေါ်လစီ (၃)

အချို့အစား	ရသင့်ရှုတိုက်သူများ	လျော်ကြေးပမာဏ
၄။ ပင်လယ်ပြည်သူပိုင် နေရပ်ဒေသ ဆိုးမြေ	• တိုက်ခန့်ပိုင်ခွင့်	✓ အိမ်ဆောင်ရောက်ခန့်ရှုပြီးအတိုက် ပင်လယ် ဆောက်လုပ်ခြင်းပြုခြင်း (အရှုပ်အရေး ရုပ်ရှုပ်ခြင်း) "အလုပ်အကိုင်အတိုက် ချစ်ရှုတ်ပေး"
	• အချုပ်ပိုင်ခွင့်များ*	✓ အိမ်ဆောင်ရောက်ခန့်ရှုပြီးအတိုက် ပင်လယ် ဆောက်လုပ်ခြင်းပြုခြင်း (အရှုပ်အရေး ရုပ်ရှုပ်ခြင်း) "အလုပ်အကိုင်အတိုက် ချစ်ရှုတ်ပေး"
	• ရုပ်ခိုင်ခြင်းနှုန်းများ*	✓ အိမ်ဆောင်ရောက်ခန့်ရှုပြီးအတိုက် ပင်လယ် ဆောက်လုပ်ခြင်းပြုခြင်း (အရှုပ်အရေး ရုပ်ရှုပ်ခြင်း) "အလုပ်အကိုင်အတိုက် ချစ်ရှုတ်ပေး"
၆။ အပိုဆောင်း ဆောက်လုပ်ရေး	• အစိုးသမီး ခုနစ်ခန်း သားစိုးရှိ ပြီးဆောင်ပေး အိမ်ဆောင်ရှိ • ဒေသန္တရဆောင်ရွက်ရေး ရှိသော အိမ်ဆောင်ရှိ	✓ အိမ်ဆောင်ရောက်ခန့်ရှုပြီးအတိုက် ခန့်ထား ဆောက်လုပ်ပေးခြင်း ✓ အလားတူ ခန့်ရောက်ပြီးတိုက် ရှားခန့်ရောသူ့ ဆောက်လုပ်ပေးခြင်း (ဆောင်းပြီးရှိမှုတ်ထားလျှင်)

*ခန့်ရောက်ပိုင်ခွင့်... အလုပ်သမား ပို့ဆောင်ရေး = မိုး ၁၅) ခွန်အုပ်ပမာဏ = ကျပ်သန်း ၁၀၀

ရုပ်ခိုင်ခြင်းနှုန်း... အထက်ပါ အတိုင်ပြုထုတ်ထားကို ပြီရှိရရှိပြောဆသော

(SEZ Development Law 2015 အပေါ် မူတည်၍)

၃။ လူမှုဆိုင်ရာ သက်ရောက်မှုနှင့် လျော့ပျောက်ရန် နည်းလမ်းများ

လျော့ပျောက်ရန် နည်းလမ်းများ (အကြို တည်ဆောက်ရေးကာလ)

- ပြုပြင်မံဆင့်ပြောင်း ပြန်လည်ရေးဆွဲထားခြင်း အသက်မွေးမှု

< သက်ရောက်မှု >

- စီမံကိန်းကြောင့် ဘဝမြို့ အိမ်ဆောင်ရှ/ ၄.၈၇၃ လူဦးရေ သက်ရောက်နိုင်ပေသည်

< လျော့ချခြင်း >

- အသေးစိတ် ဒီဇိုင်းအလိုလျော် စီမံကိန်းသက်ရောက်မှုလို့ ဆိုးသော နှင့် သက်ရောက်နိုင်သည့် အိမ်ဆောင်ရှ အဆုတ်ဆုတ်ကို လျော့ချရမည်
- အသေးစိတ် ဒီဇိုင်းအလိုလျော် လျော်ကြေးမှုနှင့် အလွှာအညှိ ကိန္နရှိများကို နှိုင်းယှဉ်ဆောင်ရွက်မှု (Special Treatment) အလုပ်လုပ်ခန့် အဖွဲ့ကို ခွဲခြမ်းစုပ်ခြင်း
- လျော်ကြေးမော်ဟော်မော် အခြံခြံဖြစ် သင်္ကေတမော လျော်ကြေးမှုနှင့် အလွှာအညှိကို မတော်လို) သေစုခြင်း
- ဆောက်လုပ်ခွင့်များကို ပြုပြင်သေးသည့် အစီအရင်ခံစာရပ် အထက်ဆောင်ရွက်ပေးရမည်



၃။ လူမှုဆိုင်ရာ သက်ရောက်မှုနှင့် လျော့ပျောက်ရန် နည်းလမ်းများ

လျော့ပျောက်ရန် နည်းလမ်းများ (တည်ဆောက်ရေးကာလအတွင်း)

- သင့်ဆောင်ရောက်ရေး
< သက်ရောက်မှု >
- ဟုတ်ဆောက်ရေးလာသောကြောင့် သင်ပြစ်ခြင်း မတူရွှဲပုံပြုခြင်း
< လျော့ချခြင်း >
- ဟုတ်ဆောက်ရေးအား စီမံခန့်ခွဲမှု အစီအရင်ခံ ရှင်း ပြီးမှုတ် ပင်စင်ခြင်း အစီအရင်ခံ
- ဟုတ်ဆောက်ရေးအား ဆိုင်းဘုတ်များ ထားခြင်း နှင့် သက်ရောက်ခြင်း



- ကျန်စက်ရေးခွင့် ပြုခြင်းမှု
< သက်ရောက်မှု >
- ဟုတ်ဆောက်ရေးလာသောကြောင့် ပြုပြင်မှုများ မူလပြုလာစေခြင်း၊ ကုမ္ပဏီစရာများများ ပြုခြင်းမှုလာသောကြောင့် ခွဲခြမ်း 50m
< လျော့ချခြင်း >
- အလုပ်သမားများ အပြုအမူ အရေးအခြင်းနှင့် ပတ်သက်သော မူဝါဒ ဟန်ဆောင်မှုခြင်း
- ပြုခြင်းမှု ပတ်သက်ပြီး ထားတင်လုပ်သမှု ရရှားများ၊ စီမံခန့်ခေသခြင်း၊ ဟုတ်ပြီးခြင်း အလုပ်သမားများအား စီမံကို စီမံကိန်း သက်ရောက်ခံသမှု ဟုတ်ပေးခြင်း ဂုဏ်ရှုနှင့် ဆက်သွယ်ရေးများကို သင်ပေးခံရမည်ဖြစ်သည်

၃။ လူမှုဆိုင်ရာ သက်ရောက်မှုနှင့် လျော့ပျောက်ရန် နည်းလမ်းများ

လျော့ပျောက်ရန် နည်းလမ်းများ (တည်ဆောက်ရေးကာလအတွင်း)

- ပြုပြင်ပုံသေးသေး
<သက်ရောက်မှု>
- စီးရှားသောမိမိ ဟိတား အသင်ပြင် ဘုတ်ခန့်ရှုများကြောင့် ပြုပြင်ပုဂ္ဂိုလ်များ ကျဉ်းပွားခြင်း



<လျော့ချခြင်း>
- ပတ်ဝန်းကျင် အရေးအသားနှင့် ဂို့ကိုးတွေ့ဆုံခြင်းစေသည့် ဒီဇိုင်း ပြုစီရမည်
အသင်ပြင် အဆောက်အဦများ ပတ်သက်ပြုင် ဒီဇော ရှုပေး များ ထားပေးသင့်သည်

အမေးအဖြေကဏ္ဍ

အပိုင်း (၂): LARAP



Appendix 12 Cut off Date

THE GLOBAL NEW LIGHT OF MYANMAR

Vol. VI, No. 19, 3rd Waxing of Kason 1381 ME | www.globalnewlightofmyanmar.com | Monday, 6 May 2019

Republic of the Union of Myanmar

Yangon Region Government

Yangon City Development Committee

Notification No. 32/ 2019

14th Waning of Tagu, 1381 M.E.

(3 May, 2019)

Notification of Cut-off Date for Yangon Urban Mass Rapid Transit (YUMRT) Project

1. In exercise of the powers conferred by section 67 and 336 of the Yangon City Development Law, this is to notify the public of the Cut-off Date of Yangon Urban Mass Rapid Transit (YUMRT) Project.

2. The Ministry of Transport and Communications (MOTC), in collaboration with Yangon Region Government (YRG) and Japan International Cooperation Agency (JICA), is implementing the Yangon Urban Mass Rapid Transit (YUMRT). Phase I of East-West Line of YUMRT, (Hlaing Thar Yar – Parami) will be implemented as a priority. It will be 18 kilometers in length, starting from Hlaing Thar Yar Station, travelling along Yangon-Pathein Road, and crossing the Hlaing River, then along Parami Road, ending at Parami Station. The required width of road is 29 meters for Yangon-Pathein Road and 22 meters for Parami Road.

3. The affected area of the YUMRT project will be as the followings;

(a) 54.36 Acres (22 Hectares) from Hlaing Thar Yar Station for the construction of YUMRT Depot;

(b) 14.5 meters width at each side from the center of YUMRT alignment along Yangon-Pathein Road;

(c) 11 meters width at each side from center of YUMRT alignment along Parami Road.

4. It is officially announced that 6 May, 2019 (3rd Waxing of Kason, 1381 M.E.) is the Cut-off Date so that to the affected areas in article 3 of this notification are to be acquisitioned and supported by Yangon Region Government for resettlement.

5. According to the Environmental and Social Impact Assessment Policy of JICA and standard practices of international monetary organizations, the survey for project area will be conducted tentatively from 6 May 2019 to 30 June 2019. COD is to be defined as the first date of conducting survey as per above-mentioned standard practices.

6. This is hereby announced that there will be no compensations, resettlements and grievances for the matters, such as renovation and expansion of existing buildings, construction of new buildings, transfer of land ownership and sales of land after COD in the affected area in article3 of this notification.

Sd./-
Maung Maung Soe
Chairman (Mayor)
Yangon City Development Committee

ကြေးမုံ
The Mirror Daily
Monday, 6 May 2019

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်
ရန်ကုန်တိုင်းဒေသကြီးအစိုးရ
ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ
အမိန့်ကြော်ငြာစာအမှတ်(၃၂/၂၀၁၉)
ရန်ကုန်မြို့ ၁၃၈၁ ခုနှစ် တန်ခူးလပြည့်ကျော် ၁၄ ရက်
(၂၀၁၉ ခုနှစ် မေလ ၃ ရက်)

ရန်ကုန်မြို့ပြလူထု ရထားပို့ဆောင်ရေးစီမံကိန်း (Yangon Urban Mass Rapid Transit-YUMRT) အကျုံးဝင်သည့်နောက်ဆုံးနေ့ (Cut-off Date)ကို ထုတ်ပြန်ကြေညာခြင်း

၁။ ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးဥပဒေပုဒ်မ ၆၇ နှင့် ၃၃၆ ပါပြဋ္ဌာန်းချက်များအရ ရန်ကုန်မြို့ပြလူထုရထားပို့ဆောင်ရေးစီမံကိန်း(Yangon Urban Mass Rapid Transit-YUMRT)အတွက် စီမံကိန်းအကျုံးဝင်သည့် နောက်ဆုံးနေ့(Cut-off Date)ကို အများပြည်သူတို့သိရှိရန် ထုတ်ပြန်ကြေညာလိုက်သည်။

၂။ ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန(MOTC)၊ ရန်ကုန်တိုင်းဒေသကြီးအစိုးရ(YRG)နှင့် ဂျပန်နိုင်ငံ အပြည်ပြည်ဆိုင်ရာပူးပေါင်းဆောင်ရွက်ရေးအေဂျင်စီ(JICA)တို့သည် ရန်ကုန်မြို့ပြလူထုရထားပို့ဆောင်ရေးစီမံကိန်း (YUMRT)ကို အတူတကွ ပူးပေါင်းအကောင်အထည်ဖော်ဆောင်ရွက်လျက်ရှိပါသည်။ ယင်းစီမံကိန်းတွင် ရန်ကုန်မြို့ အရှေ့-အနောက် ဆက်သွယ်သွားလာနိုင်မည့် ရထားလမ်းကြောင်း၏အဝိုင်း (၁) (လှိုင်သာယာ-ပါရမီ)လမ်းဝိုင်း အရှည် (၁၈) ကီလိုမီတာကို ကနဦး တည်ဆောက်မည်ဖြစ်ပါသည်။ လမ်းကြောင်းမှာ လှိုင်သာယာ ဘူတာမှစတင်ပြီး ရန်ကုန်-ပုသိမ်လမ်းအတိုင်း လှိုင်မြစ်ကိုဖြတ်ကျော်၍ ပါရမီလမ်းအတိုင်း ပါရမီဘူတာအထိဖြစ်ပါသည်။ လိုအပ်သောလမ်းအကျယ်မှာ ရန်ကုန်-ပုသိမ်လမ်းတစ်လျှောက်တွင် (၂၉)မီတာနှင့်ပါရမီလမ်းတစ်လျှောက်တွင် (၂၂)မီတာဖြစ်ပါသည်။

၃။ ရန်ကုန်မြို့ပြလူထု ရထားပို့ဆောင်ရေးစီမံကိန်း (YUMRT) ဆောင်ရွက်ရာတွင် ရထားလမ်းတစ်လျှောက် အကျိုးသက်ရောက်မည့် နေရာများမှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်-

(က) လှိုင်သာယာဘူတာပရိဝုဏ်အတွင်း YUMRT ယာဒင်းတည်ဆောက်ရန်အတွက် (၅၄.၃၆)ဧက (၂၂) ဟက်တာ၊

(ခ) ရန်ကုန်-ပုသိမ် လမ်းတစ်လျှောက်တွင် ရထားလမ်း၏အလယ်မျဉ်းမှ တစ်ဖက်တစ်ချက်စီ (၁၄.၅) မီတာအကျယ်၊

(ဂ) ပါရမီလမ်းတစ်လျှောက်တွင် ရထားလမ်း၏ အလယ်မျဉ်းမှ တစ်ဖက်တစ်ချက်စီ (၁၁)မီတာအကျယ်။

၄။ YUMRT စီမံကိန်းဆောင်ရွက်ရာတွင် အထက်အပိုဒ်(၃)ပါ စီမံကိန်းဧရိယာအတွင်း မြေသိမ်းဆည်းရေးနှင့် ပြန်လည်နေရာချထားရေးလုပ်ငန်းများကို အကောင်အထည်ဖော်ဆောင်ရွက်မည့်ရန်ကုန်တိုင်းဒေသကြီး အစိုးရအဖွဲ့အနေဖြင့် ပြန်လည်နေရာချထားရေး ပံ့ပိုးမှုများပေးအပ်နိုင်ရန်အတွက် ၂၀၁၉ ခုနှစ်၊ မေလ (၆)ရက် (၁၃၈၁ ခုနှစ်၊ ကဆုန်လဆန်း ၃ ရက်နေ့)အား အကျုံးဝင်သည့်နောက်ဆုံးရက်စွဲ Cut-off Date(COD)အဖြစ် တားဝင်ထုတ်ပြန် ကြေညာလိုက်သည်။

၅။ ဂျပန်နိုင်ငံအပြည်ပြည်ဆိုင်ရာပူးပေါင်းဆောင်ရွက်ရေးအေဂျင်စီ(JICA)၏ သဘာဝပတ်ဝန်းကျင်နှင့် လူမှုပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းမူဝါဒနှင့် နိုင်ငံတကာဥပဒေကြေးအဖွဲ့အစည်းများမှ ချမှတ်ထားသော စံနှုန်းများနှင့်အညီ ၂၀၁၉ ခုနှစ် မေလ ၆ ရက်နေ့မှ ဇွန်လ ၃၀ ရက်နေ့ကာလသည် စီမံကိန်းသက်ရောက်မည့် ဧရိယာတစ်ခုလုံးကို စစ်တမ်းကောက်ယူမည့် လျာထားကာလဖြစ်ပါသည်။ COD နေ့ရက်သည် အထက်ဖော်ပြပါ မူဝါဒစံနှုန်းများနှင့်အညီ စစ်တမ်းကောက်ယူမည့် ပထမဆုံးနေ့ရက်အဖြစ် သတ်မှတ်ထားခြင်းဖြစ်ပါသည်။

၆။ COD နေ့ရက်နောက်ပိုင်း အထက်အပိုဒ်(၃)ပါ နယ်မြေအတွင်း တည်ရှိနေသော အဆောက်အဦများကို ပြုပြင် တည်ဆောက်ခြင်း၊ တိုးချဲ့တည်ဆောက်ခြင်း၊ အဆောက်အဦအသစ် တည်ဆောက်ခြင်း၊ မြေယာလွှဲပြောင်းခြင်း၊ ရောင်းချ ခြင်းများအတွက် မြေယာလျော်ကြေးနှင့် ပြန်လည်နေရာချထားရေး၊ ကန့်သာကြေး ပံ့ပိုးမည်အစီအစဉ်များ ရရှိခံစားနိုင်မည် မဟုတ်ကြောင်း အသိပေးကြေညာအပ်ပါသည်။

ပုံ/xxx
မောင်မောင်စိုး
ဥက္ကဋ္ဌ(မြို့တော်ဝန်)
ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ

မြန်မာ့အလင်း

၁၂၇၅ ခုနှစ်က တည်ထောင်သည်။ Established in 1914

Myanma Alinn Daily

၁၃၈၁ ခုနှစ်၊ ကဆုန်လဆန်း ၃ ရက် ၂၀၁၉ ခုနှစ်၊ မေ ၆ ရက်၊ တနလံာနေ့ အတွဲ (၅၈)၊ အမှတ် (၂၁၈)

အနှစ်ရှိသော တရားကိုရနိုင်

အနှစ်ရှိသော တရားကိုလည်း အနှစ်ရှိသော တရားဟူ၍ အနှစ်မရှိသော တရားကိုလည်း အနှစ်မရှိသော တရားဟူ၍ သိကြကုန်သောကြောင့် ထိုသူတို့သည် မှန်ကန်သော ကြံစည်မှုလျှင် အာရုံရှိကုန်ရကား အနှစ်ရှိသော တရားကို ရနိုင်ကြကုန်၏။

ယမကဝဂ်(ခမ္မပဒ-၁၂)

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်
ရန်ကုန်တိုင်းဒေသကြီးအစိုးရ
ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ
အမိန့်ကြော်ငြာစာအမှတ်(၃၂/၂၀၁၉)
ရန်ကုန်မြို့၊ ၁၃၈၁ ခုနှစ် တန်ခူးလပြည့်ကျော် ၁၄ ရက်
(၂၀၁၉ ခုနှစ် မေလ ၃ရက်)

ရန်ကုန်မြို့ပြလူထု ရထားပို့ဆောင်ရေးစီမံကိန်း(Yangon Urban Mass Rapid Transit-YUMRT) အကျုံးဝင်သည့်နောက်ဆုံးနေ့(Cut-off Date)ကို ထုတ်ပြန်ကြေညာခြင်း

၁။ ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးဥပဒေပုဒ်မ ၆၇နှင့် ၃၃၆ပါ ပြဋ္ဌာန်းချက်များအရ ရန်ကုန်မြို့ပြလူထု ရထားပို့ဆောင်ရေးစီမံကိန်း(Yangon Urban Mass Rapid Transit-YUMRT)အတွက် စီမံကိန်းအကျုံးဝင်သည့် နောက်ဆုံးနေ့ (Cut-off Date)ကို အများပြည်သူတို့သိရှိရန် ထုတ်ပြန်ကြေညာလိုက်သည်။

၂။ ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန(MOTC)၊ရန်ကုန်တိုင်းဒေသကြီးအစိုးရ(YRG)နှင့် ဂျပန်နိုင်ငံအပြည်ပြည်ဆိုင်ရာ ပူးပေါင်းဆောင်ရွက်ရေးအေဂျင်စီ(JICA)တို့သည် ရန်ကုန်မြို့ပြလူထုရထားပို့ဆောင်ရေးစီမံကိန်း(YUMRT)ကို အတူတကွ ပူးပေါင်းအကောင်အထည်ဖော်ဆောင်ရွက်လျက်ရှိပါသည်။ ယင်းစီမံကိန်းတွင် ရန်ကုန်မြို့၊ အရှေ့-အနောက်ဆက်သွယ်သွားလာနိုင်မည့် ရထားလမ်းကြောင်း၏ အပိုင်း(၁)(လှိုင်သာယာ-ပါရမီ)လမ်းပိုင်းအရှည်(၁၈)ကီလိုမီတာကို ကနဦးတည်ဆောက်မည်ဖြစ်ပါသည်။ လမ်းကြောင်းမှာ လှိုင်သာယာဘူတာမှစတင်ပြီး ရန်ကုန်-ပုသိမ်လမ်းအတိုင်းလှိုင်မြစ်ကို ဖြတ်ကျော်၍ ပါရမီလမ်းအတိုင်း ပါရမီဘူတာအထိ ဖြစ်ပါသည်။ လိုအပ်သောလမ်းအကျယ်မှာ ရန်ကုန်-ပုသိမ်လမ်းတစ်လျှောက်တွင် (၂၉) မီတာနှင့် ပါရမီလမ်းတစ်လျှောက်တွင်(၂၂)မီတာ ဖြစ်ပါသည်။

၃။ ရန်ကုန်မြို့ပြလူထုရထားပို့ဆောင်ရေးစီမံကိန်း(YUMRT)ဆောင်ရွက်ရာတွင် ရထားလမ်းတစ်လျှောက် အကျိုးသက်ရောက်မည့်နေရာများမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်-

(က) လှိုင်သာယာ ဘူတာပရဝုဏ်အတွင်း YUMRT ယာဒ်ဝင်းတည်ဆောက်ရန်အတွက် (၅၄-၃၆)ဧက(၂၂)ဟက်တာ၊

(ခ) ရန်ကုန်-ပုသိမ် လမ်းတစ်လျှောက်တွင် ရထားလမ်း၏ အလယ်မျဉ်းမှ တစ်ဘက်တစ်ချက်စီ(၁၄-၅)မီတာအကျယ်၊

(ဂ) ပါရမီလမ်းတစ်လျှောက်တွင် ရထားလမ်း၏အလယ်မျဉ်းမှ တစ်ဘက်တစ်ချက်စီ (၁၁)မီတာအကျယ်။

၄။ YUMRT စီမံကိန်းဆောင်ရွက်ရာတွင် အထက်အပိုဒ်(၃)ပါ စီမံကိန်းဧရိယာအတွင်း မြေသိမ်းဆည်းရေးနှင့် ပြန်လည်နေရာချထားရေးလုပ်ငန်းများကို အကောင်အထည်ဖော်ဆောင်ရွက်မည့် ရန်ကုန်တိုင်းဒေသကြီးအစိုးရအဖွဲ့အနေဖြင့် ပြန်လည်နေရာချထားရေး ပုံပိုးမှုများပေးအပ်နိုင်ရန်အတွက် ၂၀၁၉ခုနှစ်၊ မေလ ၆ရက်(၁၃၈၁ ခုနှစ် ကဆုန်လဆန်း ၃ရက်နေ့) အား အကျုံးဝင်သည့်နောက်ဆုံးရက်စွဲ Cut-off Date (COD)အဖြစ် တရားဝင်ထုတ်ပြန်ကြေညာလိုက်သည်။

၅။ ဂျပန်နိုင်ငံ အပြည်ပြည်ဆိုင်ရာ ပူးပေါင်းဆောင်ရွက်ရေးအေဂျင်စီ(JICA)၏ သဘာဝပတ်ဝန်းကျင်နှင့်လူမှုပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း မူဝါဒနှင့် နိုင်ငံတကာငွေကြေးအဖွဲ့အစည်းများမှ ချမှတ်ထားသော ဝန်နှုန်းများနှင့်အညီ ၂၀၁၉ ခုနှစ် မေ ၆ရက် မှ ဇွန် ၃၀ ရက်နေ့ကာလသည် စီမံကိန်းသက်ရောက်မည့် ဧရိယာတစ်ခုလုံးကို စစ်တမ်းကောက်ယူမည့် လျှာထားကာလ ဖြစ်ပါသည်။ COD နေ့ရက်သည် အထက်ဖော်ပြပါမူဝါဒဝန်နှုန်းများနှင့်အညီ စစ်တမ်းကောက်ယူမည့် ပထမဆုံးနေ့ရက်အဖြစ် သတ်မှတ်ထားခြင်းဖြစ်ပါသည်။

၆။ COD နေ့ရက်နောက်ပိုင်း အထက်အပိုဒ်(၃)ပါ နယ်မြေအတွင်းတည်ရှိနေသောအဆောက်အဆုံများကို ပြုပြင်တည်ဆောက်ခြင်း၊ တိုးချဲ့တည်ဆောက်ခြင်း၊ အဆောက်အဆုံအသစ်တည်ဆောက်ခြင်း၊ မြေယာလွှဲပြောင်းခြင်း၊ ရောင်းချခြင်းများအတွက် မြေယာလျော်ကြေးနှင့် ပြန်လည်နေရာချထားရေး၊ ကရုဏာကြေးပုံပိုးမည့်အစီအစဉ်များ ရရှိခံစားနိုင်မည်မဟုတ်ကြောင်း အသိပေးကြေညာအပ်ပါသည်။

ပို/xxx

မောင်မောင်စိုး

ဥက္ကဋ္ဌ(မြို့တော်ဝန်)

ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ