

Environmental Monitoring Report
For
20 MW Ground Mounted Solar Power Plant Project
Connected to Taungtawgwin Substation
(Operation Phase)

Proposed by



Green Power Energy Co., Ltd.

Prepared by



E Guard Environmental Services

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Table of Contents

List of Figures	ii
List of Table	iii
INTRODUCTION	1
1. METHODOLOGY	2
1.1 Ambient Air Quality.....	2
1.2 Ambient Noise.....	2
1.3 Water Quality	4
1.4 Monitoring and Sampling Locations.....	5
2. ENVIRONMENTAL QUALITY	9
2.1 Ambient Air Quality.....	9
2.2 Ambient Noise Level	13
2.3 Wind Speed and Direction	17
2.4 Water Quality Standards	18
2.5 Water quality	20
3. ENVIRONMENTAL MONITORING PLAN	24
3.1 Monitoring records for Safety Plan.....	24
4. Environmental Monitoring Record for Reforestation (Plantation).....	29
5. Records for CSR activities	30
6. Records for GRM	32
7. Records for waste disposal	33
Appendix 1 (Water results).....	35
Appendix 2 (Attendance List of Environmental Awareness Training)	41

List of Figures

Figure 1.1: Air Quality Monitoring Location of Taungtawgwin Solar Power Project.....	6
Figure 1.2: Noise Level Monitoring Locations of Taungtawgwin Solar Power Project	6
Figure 1.3: Water Quality Sampling Locations of Taungtawgwin Solar Power Project.....	7
Figure 2.1: Air quality measuring at Taungtawgwin Solar Power project site during operation period.....	9
Figure 2.2: Fluctuation of Air Pollutants during diel cycle (11th to 12th January, 2023).....	12
Figure 2.3: Fluctuation of Particulate Matters during diel cycle (11th to 12th January, 2023).....	12
Figure 2.4: Noise Level Monitoring In Front of the Main Office	14
Figure 2.5: Noise Level Monitoring Near the Labor Camp.....	14
Figure 2.6: Noise Level at Point 1 (In Front of the Main Office).....	15
Figure 2.7: Noise Level at Point 2 (Near the Labor Camp).....	16
Figure 2.8: Wind Speed and Wind Direction (Blowing From) at Taungtawgwin Solar Power Project Site (11 th to 12 th January, 2023).....	18
Figure 2.9: Wind Class Frequency Distribution at Taungtawgwin Solar Power Project Site (11 th to 12 th January, 2023)	18
Figure 2.10: On-site Water Quality Measuring of Surface Water	23
Figure 2.11: Water Quality Sampling of Surface Water.....	23
Figure 2.12: On-site Water Quality Measuring of Ground Water	23
Figure 2.13: Water Quality Sampling of Ground Water.....	23
Figure 2.14: Water Quality Sampling of Ground Water.....	23

List of Table

Table 1.1: Ambient Air Quality Measurement	2
Table 1.2: Noise level monitoring	2
Table 1.3: Equipment used to measure ambient air and noise measurement	2
Table 1.4: Environmental Quality Parameters for Water quality	4
Table 1.5: Equipment for water sampling.....	5
Table 1.6: Locations of Environmental Quality sampling points	7
Table 2.1: Air Pollutants emission results (Taungtawgwin Solar Power Project) (11 th to 12 th January, 2023).....	11
Table 2.2: Air Emission Levels (Standard).....	13
Table 2.3: Observed Ambient Air Quality Results from Selected Points.....	13
Table 2.4: Observed Values of Noise Level Measurement In Front of the Main Office (Source).....	14
Table 2.5: Observed Values of Noise Level Measurement Near the Labor Camp (receptor).....	15
Table 2.6: Observed Ambient Noise Level Results from Selected Points	17
Table 2.7: Ambient water quality standards for the protection of aquatic life	19
Table 2.8: Comparison of Surface Water Quality, Ground Water Quality and Waste Water Quality with Guidelines	21

INTRODUCTION

The proposed project is developed by Green Power Energy Co., Ltd. is located on an 80.9-hectare site southeast of Kyaukse, Myit Thar Township, Mandalay Region, Myanmar. Its coordinate points are 21° 26' 31.62" N, 96° 17' 10.63" E and the average altitude of the site is 0 m. is the second mega-scale solar PV project by Gold Energy Company Limited (the first being the 30-MW Thapyay Wa project – also in Manadalay district). Taung daw Gwin involved a foundation of 6,807 piles to enable solar tracking so as to maximize PV energy captured by 45,980 solar panels. The project can generate 25.1 MW of direct current, or 22.9 MW of alternating current, per year. About 14% of the energy generated will go towards the nearby Kyaukse town, while the remainder will be linked to the Thapyay Wa substation and connected to the national grid via 6.05 miles of 33-kV transmission line, also built by GPE. With domestic energy consumption forecast to grow between 15-17% per year, solar power has been identified as a potentially significant source of renewable energy. While solar PV energy had been introduced for several years in Myanmar it accounted for about 1% of the country's installed energy generation capacity as at 2020. The solar PV tenders announced by MOEE form the country's largest-ever tender exercise for mega-scale solar projects (between 30 MW to 50 MW each) with a combined potential new capacity of 1.06 gigawatts (GW). However, the COVID-19 pandemic in 2020 and 2021 disrupted business travel and the supply and raised the costs of imported components such as PV panels and equipment. The operating environment was also affected by an economic slowdown and domestic issues. As a result, most of the 28 successful bidders did not complete their projects. Despite these immense challenges, Clean Power Energy Co., Ltd completed the Thapyay Wa (30 MW) project – the first among the 28 eventual bidders to do so.

Key Information

Project Details	Taungdaw Gwin
Location	Kyaukse, Myit Thar Township (Mandalay Division)
Capacity	20 MW
Nature of Project	BOO *
PPA #	20 years
Total Occupied Area	80.9 hectares
No. of panels	45,980
PV efficiency	545 Watts/panel (solar tracking capability)
Annual Generating Power	25.059 MW DC – 22.90 MW AC
Transmission Line	6.05 miles
Project Commencement	Dec-21
Project Commissioning	Nov-22

Commercial Operation Date	Nov-17-2022
Developer	Green Power Energy Limited

1. METHODOLOGY

Baseline environmental parameters and sampling locations were defined according to the objectives for environmental impact assessment, and monitoring purposes. Locations for sampling and analysis of water quality, ambient air quality, vibration and noise level of the project site were identified by E Guard Environmental Services Co., Ltd.

1.1 Ambient Air Quality

The emissions of dust particles and gases were measured for 24hrs continuously at the selected sites using the Environmental Perimeter Air Station (EPAS). The results were compared with National Environmental Quality Guidelines NEQG, American Conference of Governmental Industrial Hygienists (ACGIH) and National Ambient Air Quality Standards (NAAQS). EPAS provides direct readings in real time with data-logging capabilities. Air quality is composed of dust and gas emissions of the ambient air.

Table 1.1: Ambient Air Quality Measurement

Ambient Air Quality (1 location)	
Gas Emission	CO, CO ₂ , SO ₂ , NO ₂
Dust Emission	PM ₁₀ , PM _{2.5}

1.2 Ambient Noise

Noise level LAeq (dBA) will be measured at the selected locations that can reflect the exposure of the nearest local community and sensitive locations. Duration and frequency were measured for 24hrs continuously at the selected site using the Digital Sound Level Meter.

The monitoring procedures, data analysis and interpretation were carried out in accordance with the instrument's manufacture and National Environmental Quality (Emission) Guidelines, World Health Organization (WHO) and International Finance Corporation (IFC) guidelines in order to be in line with Environmental Conservation Department, Ministry of Natural Resources and Environment Conservation (MONREC). "National Environmental Quality (Emission) Guidelines" for Myanmar was also presented the value of noise level as LAeq (dBA).

Table 1.2: Noise level monitoring

Noise monitoring (2 locations)	
Noise Emission	LAeq (dBA) (1hr, 24 hrs.)

Table 1.3: Equipment used to measure ambient air and noise measurement

Davis Vantage Pro2 Wireless Weather Station Provides detailed current weather conditions and expanded forecasts - all at a glance	
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The Vantage Pro2 uses a frequency-hopping spread spectrum radio from 902 MHz to 928 MHz to transmit and receive data up to 1,000' (300m) line of sight. In addition, the weather station features a bubble level, improved anemometer base, redesigned wind cups, and factory-calibrated wind direction. The integrated sensor suite combines temperature and humidity sensors, rain collector with an aluminum-plated tipping bucket, and anemometer into one package for easy setup. Measure inside and outside temperature and humidity, heat index, barometric pressure, dew point, rainfall, wind direction and speed, and wind chill.



Haz-Scanner EPAS
PM₁₀, PM_{2.5}, NO₂, SO₂, CO, CO₂, Temperature, and Relative Humidity



Digital Sound Level Meter
Noise



1.3 Water Quality

Water samples were collected on site with appropriate sampling equipment and procedures. The sampling team has pre-arranged with the labs in Yangon for analysis and logistic arrangement made to reach the preserved samples with unique IDs to the designated labs within 48hrs.

The sampling and survey team has a list of local laboratories providing analytical services for ground water, waste water and surface water quality analysis. Up to this date, there is no laboratory having accredited certification for water quality testing (environmental analysis) in Myanmar. PRO Lab and Water Quality Laboratory of Forest Research Institute have used for water quality analysis among the list of laboratories. These laboratories have been recognized as a long-term establishment in Myanmar and employed qualified technical staffs.

The following laboratories were used for analysis of water and parameter shown in the **Table 1.4**.

1. PRO Lab, No. (9), Sabae Housing, Pyi Htaung Su Road, (26) Ward, South Dagon Tsp, Yangon, Myanmar. Tel: 09 893 767424
2. Water Quality Laboratory, Forest Research Institute, Yezin, Nay Pyi Taw. Tel: 09 430 19169, 09 420 705131

Table 1.4: Environmental Quality Parameters for Water quality

<i>Surface Water Parameters (1 location)</i>	
Physical Parameter	Total Suspended Solids, Turbidity, Oil and Grease
Chemical Parameter	pH, EC, DO, TDS, Salinity, COD, Total Nitrogen, Total Phosphorus, Potassium
Biological Parameter	BOD
<i>Ground Water Parameters (1 location)</i>	
Physical Parameter	Total Suspended Solids, Turbidity, Oil and Grease
Chemical Parameter	pH, EC, DO, TDS, Salinity, COD, Total Nitrogen, Total Phosphorus, Potassium
Biological Parameter	BOD, Total Coliform Bacteria
<i>Waste Water Parameters (1 location)</i>	
Physical Parameter	Total Suspended Solids, Oil and Grease,
Chemical Parameter	pH, COD, Total Nitrogen, Total Phosphorus
Biological Parameter	BOD, Total Coliform Bacteria

Water samplings are conducted using the following equipment as shown in figure (**Table 1.5**).

Table 1.5: Equipment for water sampling

<p>HORIBA U-50, Multiparameter Water Quality Meter Multiple sensors allow for the measurement of 11 parameters simultaneously. (pH, pH(mv), ORP, DO, Salinity, TDS, Seawater Specific Gravity, Temperature, Turbidity, Water depth) Patented auto-calibration features provide hassle free calibration of pH, dissolved oxygen, conductivity and turbidity. Ultra-sensitive Turbidity Sensors (Models U-50) Precision has been improved over conventional instruments. Improved stability of the dissolved oxygen sensor has been achieved with a new 3 electrode design for fast response and polarographic sensor for ease of maintenance. pH and ORP electrodes can be replaced individually to reduce replacement costs.</p>	
<p>Water Sampling Bottle</p>	

1.4 Monitoring and Sampling Locations

Sampling locations were confirmed by environmental specialist on site before doing the sampling. Water quality sampling locations consist of 3 sampling locations (SWQ: from Myo Gyi Dam Channel, GWQ: from the project site and WWQ: from the discharge water channel of the project site). Air quality was monitored at the selected 1 location; in front of the office in the project site of Taungtagwin Solar Power project site that can get results of the existing ambient air quality. Noise level was monitored at two selected location (N1: in front of the office in the project site of Taungtagwin Solar Power project site as source and N2: near the labor camp as receptor).



Figure 1.1: Air Quality Monitoring Location of Taungdawgwin Solar Power Project



Figure 1.2: Noise Level Monitoring Locations of Taungdawgwin Solar Power Project

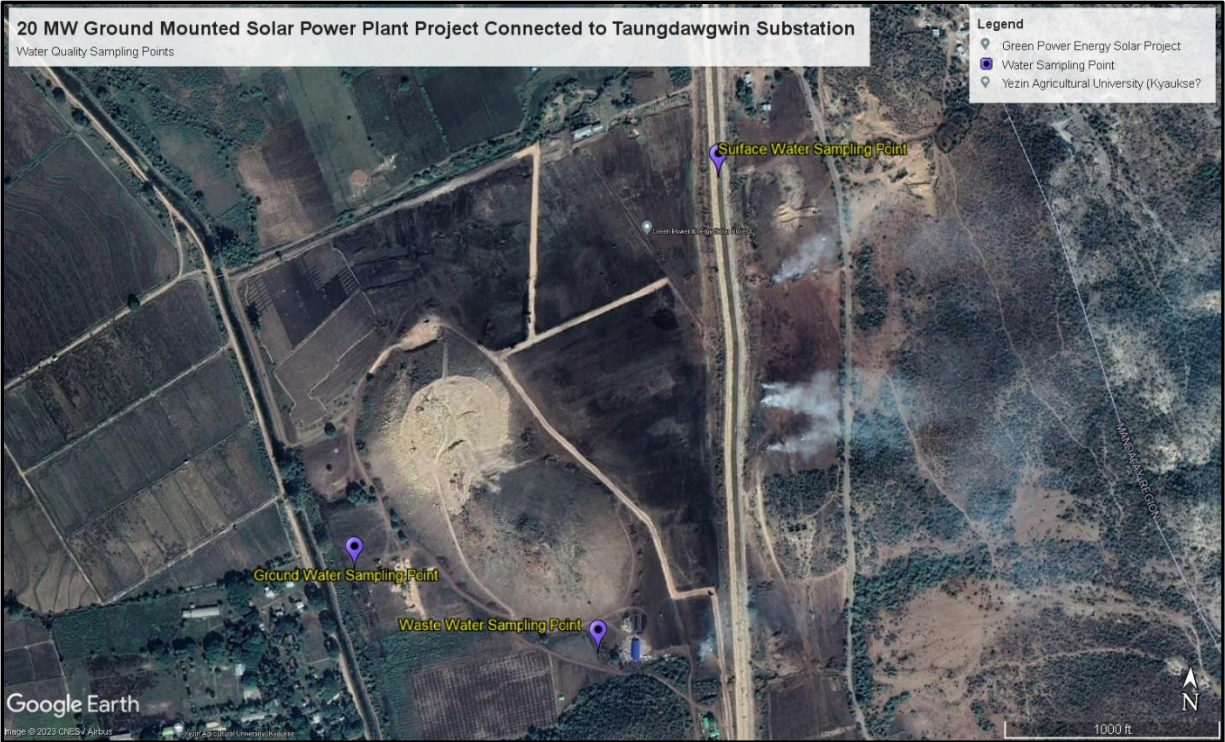


Figure 1.3: Water Quality Sampling Locations of Taungtagwgin Solar Power Project

Table 1.6: Locations of Environmental Quality sampling points

Locations No.	Points	Coordinate	Locations
Ambient Air Quality Monitoring Location			
1.	AQ1	Lat - 21°26'32.48"N Long - 96°17'10.83"E	in front of the office in the project site of Taungtagwgin Solar Power project site
Noise Level Monitoring Locations			
1.	N1	Lat - 21°26'32.48"N Long - 96°17'10.83"E	in front of the office in the project site of Taungtagwgin Solar Power project site
2.	N2	Lat - 21°26'33.08"N Long - 96°16'55.95"E	near the labor camp as receptor
Water Quality Monitoring Location			
1.	SWQ	Lat - 21°26'54.21"N Long - 96°17'12.70"E	from Myo Gyi Dam Channel

Locations No.	Points	Coordinate	Locations
2.	GWQ	Lat - 21°26'34.71"N Long - 96°16'55.06"E	from the project site
3.	WWQ	Lat - 21°26'31.38"N Long - 96°17'7.76"E	from the discharge water channel of the project site

2. ENVIRONMENTAL QUALITY

2.1 Ambient Air Quality

The air quality monitoring was done at selected locations during 11th to 12th January 2023. During this survey, these parameters were measured with adequate devices named Environmental Perimeter Air Station (EPAS) viz; Particulate Matters (PM₁₀ and PM_{2.5}) and gases CO₂, CO, SO₂, NO₂ via 24-hour basis.



Air Quality measuring at Point 1
11.01.2023 to 12.01.2023
(in front of the office in the project site of
Taungtawgwin Solar Power project site)

Figure 2.1: Air quality measuring at Taungtawgwin Solar Power project site during operation period

Particulate matters (PM₁₀ and PM_{2.5}) results are within guideline values as shown in table. Atmospheric particulate matters such as PM₁₀ and PM_{2.5} have their ability to reach the deepest part of lungs and so affect respiratory process. In this air quality survey of the project site, the surveyed results of these particulate matters gathered from EPAS. The results with one-hour interval are shown in the following table.

Sulfur Dioxide (SO₂) is generated from combustion of fuels such as oil and coal, and as by-product from some chemical production or wastewater treatment processes. On-road and off-road vehicles are also emission source of SO₂. SO₂ irritates the respiratory tract, injures lung tissues and reduces visibility and level of sunlight.

Nitrogen Oxides (NO_x) in the ambient air consist of nitric oxide (NO), nitrogen dioxide (NO₂) and nitrous oxide (N₂O). NO₂ is formed by chemical reaction of NO and ozone. The main sources of NO₂ are combustion of fuel and on-road and off-road vehicles. NO₂ decreases lung function and resistance to infection. The gas emission can be monitored by combustion modification, flue gas recirculation, water/ steam injection and the same measures for SO₂ reduction.

Likewise, **Carbon Monoxide (CO) and Carbon dioxide (CO₂)** have the same emission sources and mitigation measures for SO₂ and NO₂. They are poisonous gas and cause damage to the respiratory organ.

Detail results and variation patterns with one-hour interval of pollutants are shown in tables and figures below. Results of average, peak and minimum of a day are calculated in the table.

Table 2.1: Air Pollutants emission results (Taungtagwin Solar Power Project) (11th to 12th January, 2023)

Date	Time		CO ₂ (ppm)	CO (ppm)	NO ₂ (µg/m ³)	PM ₁₀ µg/m ³	PM _{2.5} µg/m ³	RH %	SO ₂ (µg/m ³)
11.01.2023	12:00-12:59	Average	374.54	0.01	2.43	6.95	4.54	13.24	0.14
11.01.2023	13:00-13:59	Average	384.96	0.00	2.27	7.54	5.03	15.53	0.16
11.01.2023	14:00-14:59	Average	390.39	0.01	2.33	6.04	4.86	16.65	0.19
11.01.2023	15:00-15:59	Average	369.04	0.00	2.06	5.98	3.95	16.93	0.14
11.01.2023	16:00-16:59	Average	382.73	0.02	2.64	5.23	3.58	18.95	0.16
11.01.2023	17:00-17:59	Average	366.34	0.01	2.00	5.95	4.02	19.39	0.13
11.01.2023	18:00-18:59	Average	364.63	0.00	2.02	6.33	4.93	22.53	0.11
11.01.2023	19:00-19:59	Average	371.23	0.00	2.03	5.39	2.85	23.39	0.13
11.01.2023	20:00-20:59	Average	362.13	0.00	2.12	4.95	2.32	26.58	0.05
11.01.2023	21:00-21:59	Average	372.68	0.00	2.00	4.75	2.74	28.39	0.12
11.01.2023	22:00-22:59	Average	361.05	0.00	2.00	4.62	2.61	31.17	0.13
11.01.2023	23:00-23:59	Average	346.53	0.00	2.00	4.53	1.60	32.44	0.16
12.01.2023	0:00-0:59	Average	337.17	0.00	2.00	4.75	1.25	35.53	0.15
12.01.2023	1:00-1:59	Average	294.83	0.00	2.00	4.15	1.43	43.39	0.09
12.01.2023	2:00-2:59	Average	291.15	0.00	2.00	3.54	1.20	44.34	0.09
12.01.2023	3:00-3:59	Average	288.20	0.00	2.00	3.62	1.00	53.67	0.04
12.01.2023	4:00-4:59	Average	289.03	0.00	2.00	4.20	2.37	54.03	0.04
12.01.2023	5:00-5:59	Average	360.76	0.00	2.00	4.07	2.33	56.42	0.13
12.01.2023	6:00-6:59	Average	354.17	0.00	2.00	5.57	3.74	53.47	0.21
12.01.2023	7:00-7:59	Average	378.90	0.00	2.00	5.94	3.65	46.40	0.13
12.01.2023	8:00-8:59	Average	414.02	0.02	2.00	6.28	4.85	31.76	0.21
12.01.2023	9:00-9:59	Average	405.63	0.01	2.05	6.46	4.73	26.87	0.21
12.01.2023	10:00-10:59	Average	388.68	0.02	2.36	5.94	4.14	21.07	0.06
12.01.2023	11:00-11:59	Average	365.70	0.00	2.00	6.06	4.07	16.00	0.18
Average			358.94	0.00	2.10	5.37	3.24	31.17	0.13
1 hour Minimum			288.20	0.00	2.00	3.54	1.00	13.24	0.04
1 hour Maximum			414.02	0.02	2.64	7.54	5.03	56.42	0.21

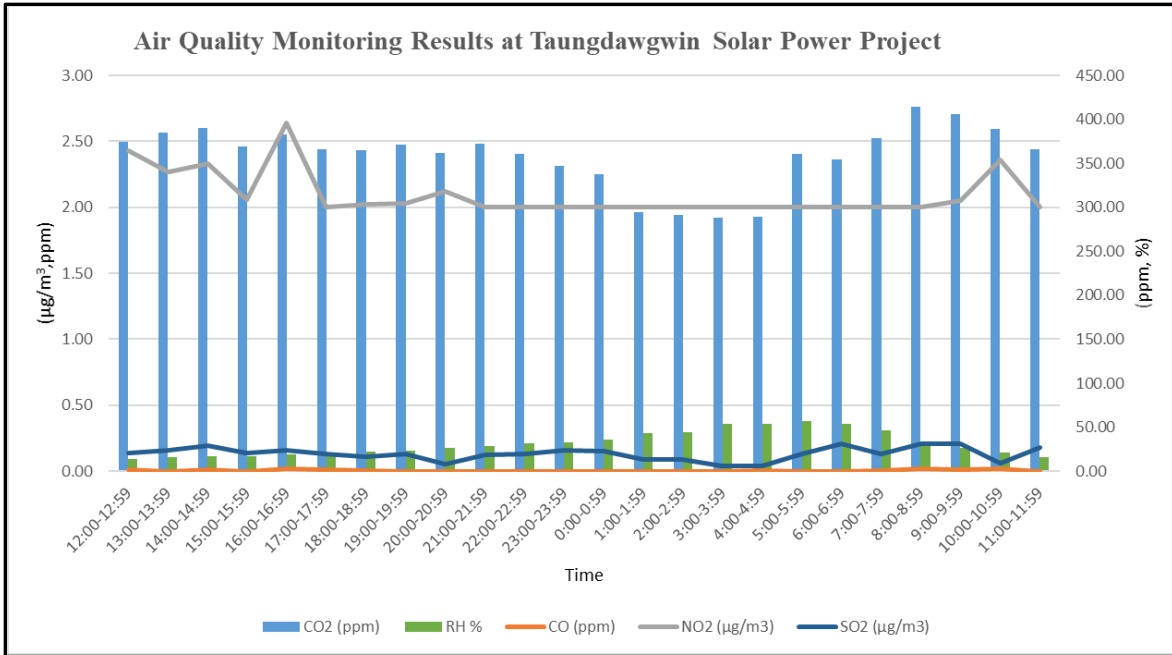


Figure 2.2: Fluctuation of Air Pollutants during diel cycle (11th to 12th January, 2023)

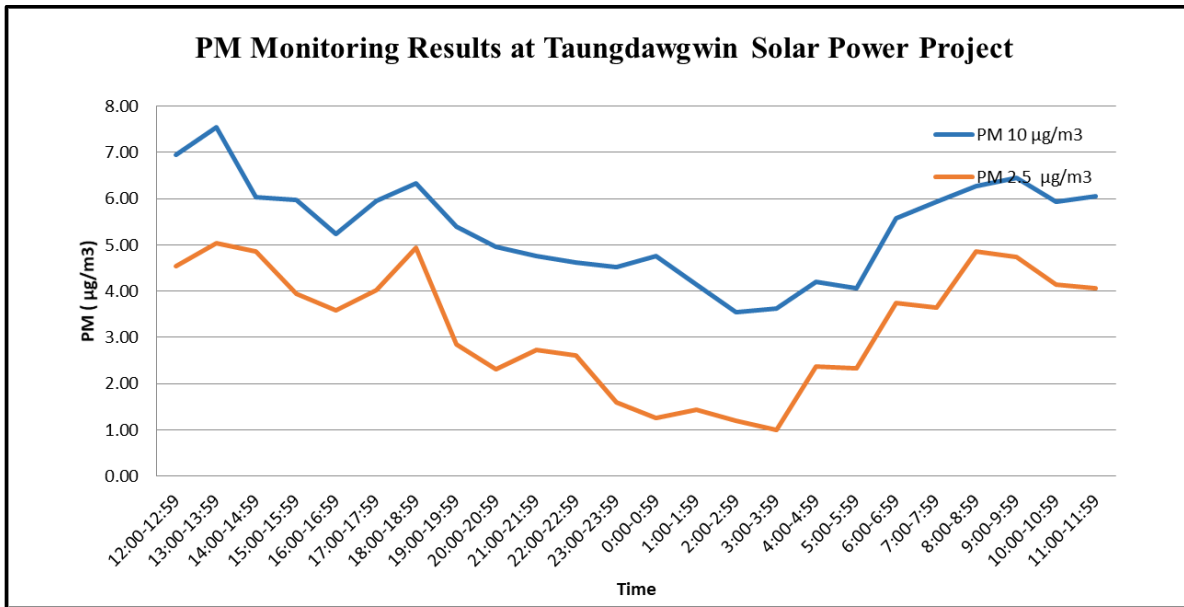


Figure 2.3: Fluctuation of Particulate Matters during diel cycle (11th to 12th January, 2023)

Table 2.2: Air Emission Levels (Standard)

No.	Parameter	Unit	Maximum Concentration	
			National	Average Period
1.	Carbon monoxide	ppm	9	8-hour
2.	Carbon dioxide	ppm	5000	8-hour
3.	Sulfur dioxide	$\mu\text{g}/\text{m}^3$	20 500	24-hour 10-minute
4.	Nitrogen dioxide	$\mu\text{g}/\text{m}^3$	40 200	1 year 1 hour
5.	Particulate matter PM ₁₀	$\mu\text{g}/\text{m}^3$	20 50	1-year 24-hour
6.	Particulate matter PM _{2.5}	$\mu\text{g}/\text{m}^3$	10 25	1-year 24-hour

Source: Myanmar National Environmental Quality (Emission) Guidelines, National Ambient Air Quality Standards (NAAQS), American Conference of Governmental Industrial Hygienists (ACGIH).

Detail results with one-hour interval of pollutants are shown in **Table 2.1**. The average, peak and minimum values of results per day are calculated. All results are under the Myanmar National Environmental Quality (emission) Guidelines.

Table 2.3: Observed Ambient Air Quality Results from Selected Points

Parameters	Observed Values	NEQG Guidelines Value	ACGIH Guidelines Value	NAAQS Guidelines Value	Baselines Results	Unit	Averaging Period
PM ₁₀	5.37	50	-	-	25.13	$\mu\text{g}/\text{m}^3$	24hrs
PM _{2.5}	3.24	25	-	-	10.84	$\mu\text{g}/\text{m}^3$	24hrs
CO	0.01	-	-	9	0.04	ppm	8hrs
CO ₂	375.48	-	5000	-	451.72	ppm	8hrs
SO ₂	0.13	20	-	-	0.14	$\mu\text{g}/\text{m}^3$	24hrs
NO ₂	2.64	200	-	-	28.97	$\mu\text{g}/\text{m}^3$	1hrs

2.2 Ambient Noise Level

Ambient noise level for the proposed project was measured with Digital Sound Level Meter at two locations: one point was set in front of the main office as source point and one point was set near the labor camp as receptor point, on 11th to 12th January, 2023. Measuring period is 24 hours continuously.



Figure 2.4: Noise Level Monitoring in Front of the Main Office



Figure 2.5: Noise Level Monitoring Near the Labor Camp

The observed values are described in **Table 2.4** and **Table 2.5**; and the following figures are noise level measurement at the proposed project.

Table 2.4: Observed Values of Noise Level Measurement in Front of the Main Office (Source)

No.	Date	Time	Observed Mean Value (Source)	Weight	Day/Night	Average
1	29.11.2022	7:00:13-7:59:13	46.13	A	Day	44.09
2	29.11.2022	8:00:13-8:59:13	45.24	A	Day	
3	29.11.2022	9:00:13-9:59:13	46.11	A	Day	
4	29.11.2022	10:00:13-10:59:13	44.06	A	Day	
5	29.11.2022	11:00:13-11:59:13	44.94	A	Day	
6	29.11.2022	12:00:13-12:59:13	45.93	A	Day	
7	29.11.2022	13:00:13-13:59:13	47.29	A	Day	
8	29.11.2022	14:00:13-14:59:13	45.53	A	Day	
9	29.11.2022	15:00:13-15:59:13	43.96	A	Day	
10	29.11.2022	16:00:13-16:59:13	43.57	A	Day	
11	28.11.2022	17:00:13-17:59:13	43.19	A	Day	
12	28.11.2022	18:00:13-18:59:13	44.22	A	Day	
13	28.11.2022	19:00:13-19:59:13	44.36	A	Day	
14	28.11.2022	20:00:13-20:59:13	41.68	A	Day	
15	28.11.2022	21:00:13-21:59:13	35.13	A	Day	35.49
16	28.11.2022	22:00:13-22:59:13	35.73	A	Night	
17	28.11.2022	23:00:13-23:59:13	35.46	A	Night	
18	29.11.2022	0:00:13-0:59:13	34.84	A	Night	
19	29.11.2022	1:00:13-1:59:13	36.05	A	Night	

No.	Date	Time	Observed Mean Value (Source)	Weight	Day/Night	Average
20	29.11.2022	2:00:13-2:59:13	35.57	A	Night	
21	29.11.2022	3:00:13-3:59:13	34.89	A	Night	
22	29.11.2022	4:00:13-4:59:13	34.81	A	Night	
23	29.11.2022	5:00:13-5:59:13	36.06	A	Night	
24	29.11.2022	6:00:13-6:59:13	35.97	A	Night	
Average			53.27			

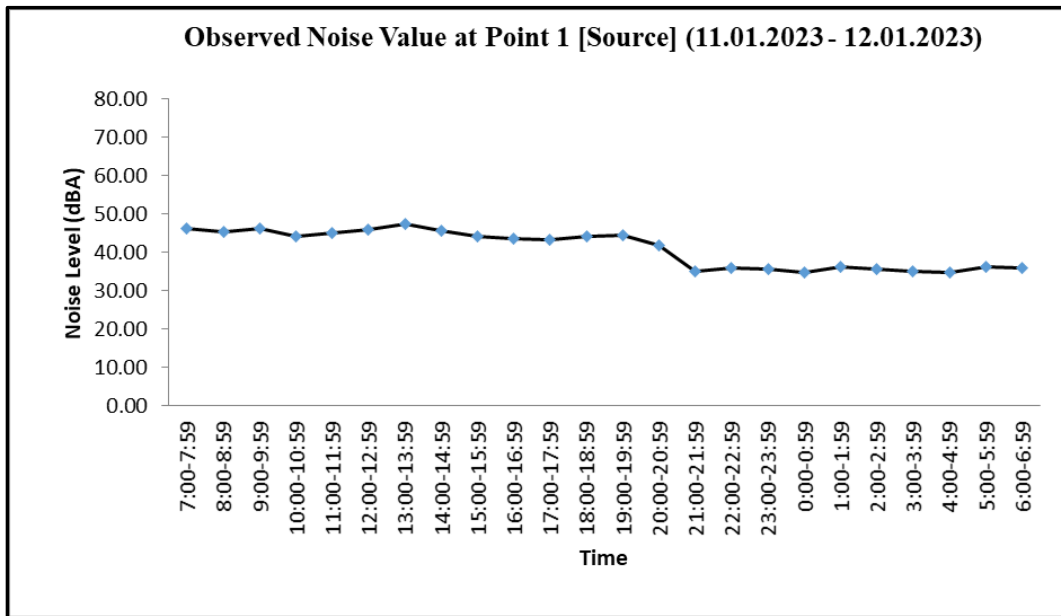


Figure 2.6: Noise Level at Point 1 (In Front of the Main Office)

Table 2.5: Observed Values of Noise Level Measurement Near the Labor Camp (receptor)

No.	Date	Time	Observed Mean Value (Source)	Weight	Day/Night	Average
1	30.11.2022	7:00:13-7:59:13	46.21	A	Day	45.07
2	30.11.2022	8:00:13-8:59:13	48.60	A	Day	
3	30.11.2022	9:00:13-9:59:13	45.33	A	Day	
4	30.11.2022	10:00:13-10:59:13	44.80	A	Day	
5	30.11.2022	11:00:13-11:59:13	44.54	A	Day	
6	30.11.2022	12:00:13-12:59:13	45.53	A	Day	
7	30.11.2022	13:00:13-13:59:13	44.23	A	Day	
8	30.11.2022	14:00:13-14:59:13	43.95	A	Day	
9	30.11.2022	15:00:13-15:59:13	44.44	A	Day	

No.	Date	Time	Observed Mean Value (Source)	Weight	Day/Night	Average
10	30.11.2022	16:00:13-16:59:13	42.31	A	Day	35.97
11	30.11.2022	17:00:13-17:59:13	45.28	A	Day	
12	29.11.2022	18:00:13-18:59:13	46.97	A	Day	
13	29.11.2022	19:00:13-19:59:13	46.33	A	Day	
14	29.11.2022	20:00:13-20:59:13	45.43	A	Day	
15	29.11.2022	21:00:13-21:59:13	42.03	A	Day	
16	29.11.2022	22:00:13-22:59:13	35.88	A	Night	35.97
17	29.11.2022	23:00:13-23:59:13	34.21	A	Night	
18	30.11.2022	0:00:13-0:59:13	35.04	A	Night	
19	30.11.2022	1:00:13-1:59:13	36.57	A	Night	
20	30.11.2022	2:00:13-2:59:13	35.61	A	Night	
21	30.11.2022	3:00:13-3:59:13	35.39	A	Night	
22	30.11.2022	4:00:13-4:59:13	35.05	A	Night	
23	30.11.2022	5:00:13-5:59:13	37.59	A	Night	
24	30.11.2022	6:00:13-6:59:13	38.41	A	Night	
Average			48.60			

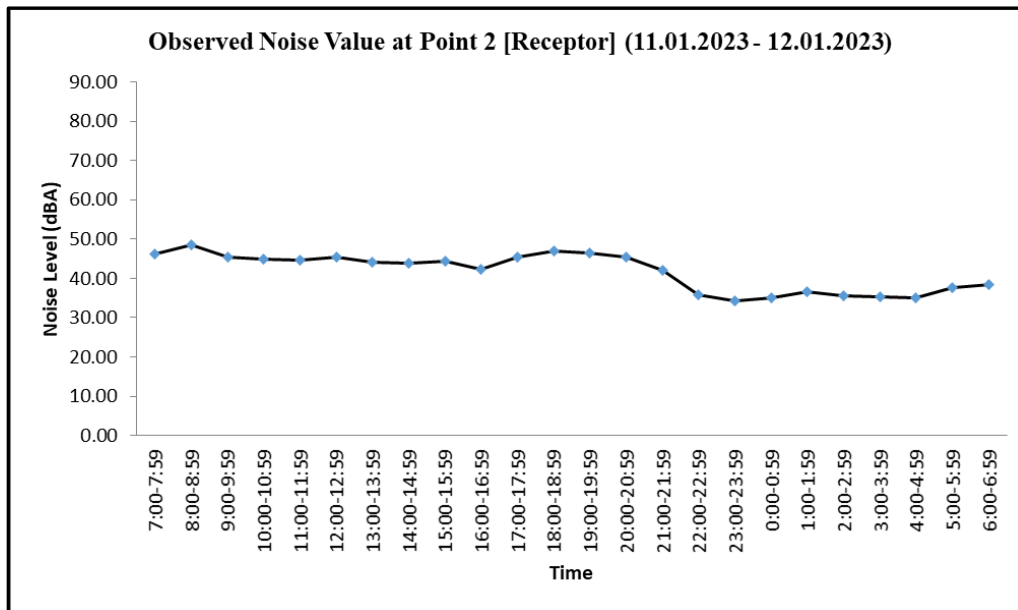


Figure 2.7: Noise Level at Point 2 (Near the Labor Camp)

Table 2.6: Observed Ambient Noise Level Results from Selected Points

Point	Taungtawgwin Solar Power Project	
	Day Time	Night Time
At source (In front of the main office)	44.09	35.49
Guideline Values for Industrial	70	70
At receptor (Near the labor camp)	45.07	35.97
Guideline Values for Residential	55	45
Baseline Results at Point 1 (Project Site)	52.92	41.55
Baseline Results at Point 2 (Project Site)	54.22	40.64

The observed values of the proposed project for daytime at source (in front of the main office) and at receptor (near the labor camp) are 44.09 dB (A) and 45.07 dB (A). The observed values of the proposed project for nighttime at source (in front of the main office) and at receptor (near the labor camp) are 35.49 dB (A) and 35.97 dB (A). The observed daytime value and night time value for both points are lower than the guideline value.

2.3 Wind Speed and Direction

The following figures describe the wind speed and wind direction of the proposed project site on 11th to 12th January, 2023. According to the data, the wind direction is as per following Error! Reference source not found.**8** to Error! Reference source not found.**9**.

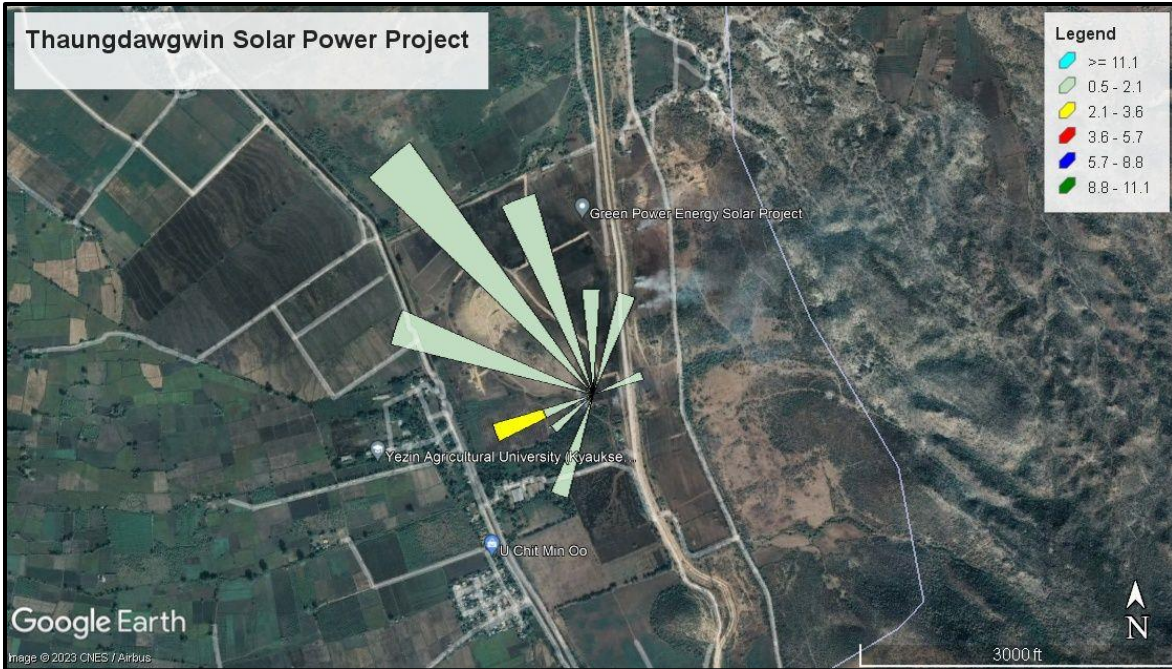


Figure 2.8: Wind Speed and Wind Direction (Blowing From) at Taungdawgwin Solar Power Project Site (11th to 12th January, 2023)

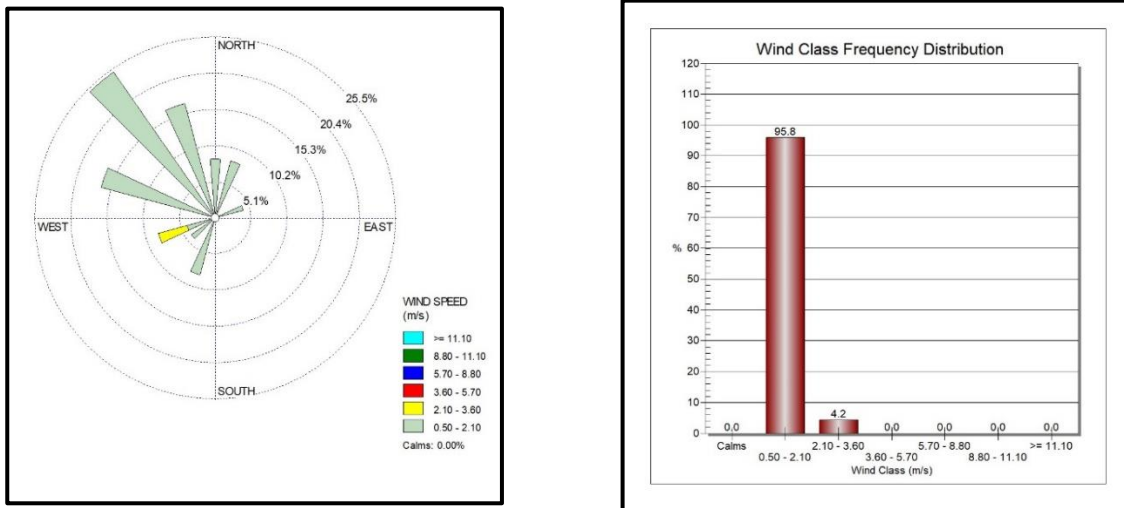


Figure 2.9: Wind Class Frequency Distribution at Taungdawgwin Solar Power Project Site (11th to 12th January, 2023)

2.4 Water Quality Standards

Currently Myanmar does not have surface water quality standards for major rivers and its tributaries, natural and man-made streams or lakes, ground water, or reservoir water. Environmental conservation department is in the process of developing National Ambient Water Quality Standards based on the protection of aquatic life. It is recommended by the environmental specialist to compare the measured water quality results with the standards in Error! Reference source not found. below.

Table 2.7: Ambient water quality standards for the protection of aquatic life

Parameter	Unit	Concentration	Reference
Aluminum	mg/l	0.005 (if pH < 6.5) 0.1 (if pH > 6.5)	Australian and New Zealand guidelines for fresh and marine water quality. 2000. Australian and New Zealand Environment Conservation Council. Water Quality Guidelines for the Protection of Aquatic Life. 2016. Canadian Council of Ministers of the Environment. Metal mining technical guidance for environmental effects monitoring. 2012. Environment Canada.
Ammonia	mg/l	0.02	As above
Arsenic	mg/l	0.05	As above
Boron	mg/l	0.5	As above
Cadmium	mg/l	0.0002	As above
Chloride	mg/l	0.86	As above
Chromium (hexavalent)	mg/l	0.01	As above
Chromium (trivalent)	mg/l	0.0089	As above
Coliforms (total)	MPN/100ml	5000	As above
Coliforms (faecal)	MPN/100ml	1000	As above
Color	mg/l	Not significantly higher that seasonally adjusted background value	As above
Copper	mg/l	0.002	As above
Cyanide (free)	mg/l	0.005	As above
Dissolved oxygen	mg/l	6	As above
Ethanol	mg/l	1.4	As above
Fluoride	mg/l	0.2	As above
Iron	mg/l	0.3	As above
Lead	mg/l	0.001	As above
Manganese	mg/l	0.05	As above
Mercury	mg/l	0.0001	As above
Molybdenum	mg/l	0.073	As above
Naphthalene	mg/l	0.016	As above
Nickel	mg/l	0.015	As above
Nitrate	mg/l	5	As above

Parameter	Unit	Concentration	Reference
Nitrite	mg/l	0.06	As above
Oil & grease	-	Substantially absent, no iridescent sheen	As above
pH	-	6.5-9	As above
Phenols	mg/l	0.004	As above
Phosphorus	mg/l	0.15	As above
Selenium (total)	mg/l	0.005	As above
Silver	mg/l	0.0001	As above
Sulphide	mg/l	0.002	As above
Temperature	°C	< 2 increase	As above
Thallium	mg/l	0.004	As above
Total suspended solids	mg/l	10	As above
Tributyltin	mg/l	0.000008	As above
Turbidity	-	< 10% change	As above
Uranium	mg/l	0.015	As above
Zinc	mg/l	0.005	As above

2.5 Water quality

Surface water quality were recorded by on-site sampling was done at two selected locations and laboratory analysis at three selected locations systematically. The field surveys for environmental quality monitoring and sampling were done during 11th January, 2023.

Objectives of the sampling and analysis of surface water quality is to understand the existing water quality at the selected locations and to monitor the impacts during construction and operation period.

Water Quality Measurement

Surveyor: Aung Moe Oo	Date: 11.01.2023
Location: Surface Water (from Myo Gyi Dam Channel)	Time: 03:30
Lat. & Long.: 21°26'54.21"N, 96°17'12.70"E	Instrument: Horiba U-50
Temperature: 27.87°C	

Onsite Surface Water Measurement Results

Sr. No.	pH	Electrical Conductivity			DO (mg/l)	Turbidity (NTU)	Remarks
		EC (ms/cm)	TDS (g/l)	Salinity (ppt)			
1	6.26	0.375	0.244	0.2	7.97	13.4	-

Water Quality Measurement

Surveyor: Aung Moe Oo	Date: 11.01.2023
Location: Ground Water (from the project site)	Time: 04:30
Lat. & Long.: 21°26'31.95"N, 96°17'9.66"E	Instrument: Horiba U-50
Temperature: 25.23°C	

Onsite Ground Water Measurement Results

Sr. No.	pH	Electrical Conductivity			DO (mg/l)	Turbidity (NTU)	Remarks
		EC (ms/cm)	TDS (g/l)	Salinity (ppt)			
1	6.54	0.437	0.102	0.1	6.44	9.31	-

Table 2.8: Comparison of Surface Water Quality, Ground Water Quality and Waste Water Quality with Guidelines

Parameter	Unit	SWQ	GWQ	WWQ	International and National Guideline			
					A	B	C	D
Dissolved Oxygen (DO)	mg/l	7.61	2.43	-	-	-	6	-
Oil and Grease	mg/l	5	3	4	-	-	Substantially absent	10
Total Coliform	MPN/ml	-	<0.3	29	-	-	5	4
Total Dissolved Solids	mg/l	205	574	-	-	No guideline	-	-
Turbidity	NTU	1.35	0.66	-	-	Not mentioned	<10	-
Biochemical Oxygen Demand (BOD)	mg/l	1	0.49	1.37	-	-	-	30
Chemical Oxygen Demand (COD)	mg/l	3.4	3.6	3.4	-	-	-	125
Total Nitrogen	mg/l	0.14	0.26	0.12	-	-	-	10
Total Phosphorus	mg/l	0.005	0.007	0.037	-	-	-	2
Total Suspended Solids	mg/l	16	0.25	6.25	-	-	10	50
Potassium	mg/l	3.2	7.75	-	-	-	-	-

SWQ = from Myo Gyi Dam Channel

GWQ = from the project site

WWQ = from the discharge water channel of the project site

A= WHO (Normally found in fresh water/surface water/ground water)

B= WHO (DW) (Health based guideline by the WHO)

C= Ambient water quality standards for the protection of aquatic life

D= National Environmental Quality Emission Guideline (Electric Power Transmission and Distribution)

According to the comparison of water quality results and the guidelines, all other parameters of surface water, ground water and waste water are below the limit except Total Coliform Count of waste water from the waste water drainage of the project site. These waste water should be released into the final out let only after getting settled in the sedimentation ponds.

Photo Record for Water Quality Sampling



Figure 2.10: On-site Water Quality Measuring of Surface Water



Figure 2.11: Water Quality Sampling of Surface Water



Figure 2.12: On-site Water Quality Measuring of Ground Water




Figure 2.13: Water Quality Sampling of Ground Water



Figure 2.14: Water Quality Sampling of Ground Water

3. ENVIRONMENTAL MONITORING PLAN

3.1 Monitoring records for Safety Plan




GREEN POWER ENERGY COMPANY LIMITED.
 # 511-B, 5th Floor, Corner of Pyay Road & Hledan Road, Hledan Centre, Kamayut Township, Yangon, Myanmar.
 Ph: +95 9 444805511 Email: greenpowerenergycold@gmail.com

I. ENVIRONMENTAL MORNING PLAN

I.1 Monitoring Records for Safety Plan

Monthly Record					
Date	Place	Activity	Organization	Number of Attendees	Remarks
October,2022	Working Area	Aware Training About PPE	Taung Daw Gwin Solar Power Plant	15	
November,2022	Power Staion	Fire Safety Training	Taung Daw Gwin Solar Power Plant	50	
December,2022	Working Area	Electrical Safety Training	Taung Daw Gwin Solar Power Plant	17	
January,2023	Power Staion	Provide PPE Safety Equipment	Taung Daw Gwin Solar Power Plant	16	
February,2023	Office Meeting Room	Health Care	Taung Daw Gwin Solar Power Plant	40	
March,2023	PV Field	Harzard and Safety Training	Taung Daw Gwin Solar Power Plant	20	



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I.2 Monitoring Records for Occupational Safety Equipment

Date	Place	Type	Quantity	Remark	Inspected By	Supervisor
12.Jan.2023	Store	Safety Shoe	24		U Zaw Myo Aung	U Zaw Zaw Phyto
12.Jan.2023	Store	Safety Gloves	24		U Zaw Myo Aung	U Zaw Zaw Phyto
12.Jan.2023	Store	Safety Helmet	24		U Zaw Myo Aung	U Zaw Zaw Phyto
12.Jan.2023	Store	Safety Belt	24		U Zaw Myo Aung	U Zaw Zaw Phyto

Records of Health and Safety Plan Activities





Emergency Contact List Attached in the Project Site

EMP Report For 20 MW Ground Mounted Solar Power Plant Project
Proposed by Green Power Energy Co.,Ltd

အရေးပေါ်အခြေအနေတုံ့ပြန်မှု အစီအစဉ်

စီမံကိန်းလုပ်ငန်းအတွင်းမှ အရေးကြီး ဆက်သွယ်ရမည့် ဖုန်းနံပါတ်များ		
အမည်	ရာထူး	ဖုန်းနံပါတ်
ဦးကျော်စင်ထက်	စက်ရုံမှူး	09 259 201 955
ဦးဇော်ဇော်ဖြိုး	ဒု-စက်ရုံမှူး	09 777 858 349
ဦးဇော်မျိုးအောင်	လုပ်ငန်းခွင်အန္တရာယ်ကင်းရှင်းရေးအရာရှိ	09 775 900 410
ဦးမျိုးမင်းမြတ်	ကြီးကြပ်ရေးမှူး	09 792 707 988
ဦးနေမင်းထွန်း	ရှေးဦးသူနာပြု	09 449 872 330
ဦးငြိမ်းချမ်းထွေး	အရေးပေါ်အခြေအနေ ထိန်းချုပ်ရေးမှူး	09 977 049 321

အရေးကြီး ဆက်သွယ်ရမည့် ဒေသတွင်းဖုန်းနံပါတ်များ		
အမည်(ဌာန)	အကြောင်းအရာ	ဖုန်းနံပါတ်
မြို့နယ်မီးသတ်ဌာန	မီးလောင်ခြင်းအတွက်	09 267 780 853
တိုက်နယ်ရဲစခန်း	လုံခြုံရေးကိစ္စများအတွက်	09 757 757 042
အနီးဆုံးဆေးခန်း (သိရွာ/အာရောဂျီ)	ထိခိုက်ဒဏ်ရာရသူများအတွက်	09 780 573 818
အနီးဆုံးဆေးရုံ (သိရွာ)	ထိခိုက်ဒဏ်ရာရသူများအတွက်	09 421 209 833
မြို့နယ်လျှပ်စစ်ဌာန	လျှပ်စစ်မီးကိစ္စ	09 661 906 744
မြို့နယ်အထွေထွေ အုပ်ချုပ်ရေးဌာန	အထွေထွေ အုပ်ချုပ်ရေးကိစ္စ	

Fire Extinguisher Check List

No	Date	Description	Location	Number	Unit	Remarks
1	05/01/2023	Fire Extinguisher (50Kg)	Power Station	2	Nos	
2	05/01/2023	Fire Extinguisher (10Kg)	Power Station	3	Nos	
3	05/01/2023	Fire Extinguisher (10Kg)	Briefing Hall	3	Nos	
4	05/01/2023	Fire Extinguisher (10Kg)	Office	2	Nos	
5	05/01/2023	Fire Extinguisher (5Kg)	6Unit (1)	3	Nos	
6	05/01/2023	Fire Extinguisher (5Kg)	6Unit (2)	3	Nos	
7	05/01/2023	Fire Extinguisher (5Kg)	6Unit (3)	3	Nos	
8	05/01/2023	Fire Extinguisher (5Kg)	6Unit (4)	3	Nos	
9	05/01/2023	Fire Extinguisher (5Kg)	Staff Housing	3	Nos	
10	05/01/2023	Fire Extinguisher (5Kg)	Store	3	Nos	
11	05/01/2023	Fire Extinguisher (5Kg)	Messing	3	Nos	
12	05/01/2023	Fire Extinguisher (10Kg)	Kitchen Room	2	Nos	
13	05/01/2023	Fire Extinguisher (5Kg)	Main Gate	1	Nos	
14	05/01/2023	Fire Extinguisher (5Kg)	Gate (1)	1	Nos	
15	05/01/2023	Fire Extinguisher (5Kg)	Gate (2)	1	Nos	
16	05/01/2023	Fire Extinguisher (5Kg)	On Hill Gate	1	Nos	
17	05/01/2023	Fire Extinguisher (5Kg)	Tower	1	Nos	
18	05/01/2023	Fire Extinguisher (10Kg)	Box X'mer (1)	3	Nos	
19	05/01/2023	Fire Extinguisher (10Kg)	Box X'mer (2)	3	Nos	
20	05/01/2023	Fire Extinguisher (10Kg)	Box X'mer (3)	3	Nos	
21	05/01/2023	Fire Extinguisher (10Kg)	Box X'mer (4)	3	Nos	

4. Environmental Monitoring Record for Reforestation (Plantation)



5. Records for CSR activities



GREEN POWER ENERGY COMPANY LIMITED.

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2. Records for CSR activities

Date	Place	Type	Amount (MMK)/ Activites	Received By
October,2022	တောင်တော်တောင်	တောင်တော်ဘုရားလမ်းအသစ်ဖောက်လုပ်ပေးခြင်း		
November,2022	သံရွာဆေးရုံ	Renovated Civil & Electrical Work in Thanywa Hospital		
December,2022	သံရွာဆေးရုံ	ဆေးဝါးလှူတန်းခြင်း		
January,2023	တောင်တော်တောင်	တောင်တော်အတက်လမ်းသို့ မီးကြိုသွယ်တန်းပေးခြင်း		

Photo Records of CSR Activities



6. Records for GRM



GREEN POWER ENERGY COMPANY LIMITED.

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3. Monitoring Records for GRM

Monthly Record					
Date	Place	Activity	Organization Or Individual	Action Plan	Recorded by

GRM Organization of Taungtawgwin Solar Power Project Site

မကျေလည်မှုများ ဖြေရှင်းပေးရေး ကော်မတီ			
စဉ်	အမည်	တာဝန်	ဌာန
၁	ဦးကျော်စိုး	ဥက္ကဋ္ဌ	ဝါတပ်
၂	ဦးစော်မျိုးအောင်	အတွင်းရေးမှူး	GPE Co., Ltd
၃	ဦးရွှေမန်း	အဖွဲ့ဝင် (၁)	မြစ်သားမြို့နယ်၊ လွန်ကျော် အမှတ်(၃)
၄	ဦးအောင်ကြည်	အဖွဲ့ဝင် (၂)	မြစ်သားမြို့နယ်၊ လွန်ကျော် အမှတ်(၃)
၅	ဦးဌေးမင်း	အဖွဲ့ဝင် (၃)	GPE Co., Ltd

7. Records for waste disposal



GREEN POWER ENERGY COMPANY LIMITED.

511-B, 5th Floor, Corner of Pyay Road & Hledan Road, Hledan Centre, Kamayut Township, Yangon, Myanmar.
Ph: +95 9 444805511 Email: greenpowerenergycoLtd@gmail.com

4. Records for Waste Disposal


Date	Place	Type	Amount	Inspected By
15.Oct.2022	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	55 Kg	U Zaw Myo Aung
31.Oct.2022	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	55 Kg	U Zaw Myo Aung
15.Nov.2022	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	55 Kg	U Zaw Myo Aung
30.Nov.2022	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	55 Kg	U Zaw Myo Aung
15.Dec.2022	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	45 Kg	U Zaw Myo Aung
31.Dec.2022	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	55 Kg	U Zaw Myo Aung
15.Jan.2023	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	45 Kg	U Zaw Myo Aung
31.Jan.2023	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	44 Kg	U Zaw Myo Aung
15.Feb.2023	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	30 Kg	U Zaw Myo Aung
28.Feb.2023	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	30 Kg	U Zaw Myo Aung
15.Mar.2023	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	35 Kg	U Zaw Myo Aung
31.Mar.2023	ဝန်ထမ်းလိုင်းများ/ရုံး	အမှိုက်စို/ အမှိုက်ခြောက်	40 Kg	U Zaw Myo Aung

Records for waste disposal








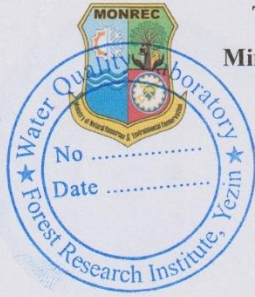
Appendix 1 (Water results)

		Myanmar Innovation Group of Co., Ltd Address : No. (9), Sabae Housing, Pyi Htaung Su Road, (26) Ward, South Dagon Tsp, Yangon, Myanmar. Tel : 09-893 767 424 E-mail : info@prolabmyanmar.com			
LABORATORY ANALYSIS REPORT					
1	Client Name	: Taungdawgwin Solar Power Plant Project			
2	Location	: Myitthar Township, Mandalay Region			
3	Type of Sample	: Ground Water			
4	Sample No.	: 00028/2023			
5	Contact Person	: Ko Wai Yan Htoo			
6	Phone No.	: 09-797005180			
7	Date Received	: 12.01.2023			
8	Date of Test Performed	: 12.01.2023			
9	Date of Issued	: 20.01.2023			
10	Result	:			
No.	Parameter	Result	Unit	WHO STD 2018	Method
1	Dissolved Oxygen	2.43	mg/L	-	Hanna HI98193 - DO and BOD Meter
2	Oil and Grease	3	mg/L	-	^(a) 5520D, Soxhlet Extraction Method
3	Salinity	39.73	mg/L	-	^(a) 4500-Cl B, Argentometric Method
4	Total Coliform	< 0.3	MPN/ml	-	FDA-BAM: MPN Method

Remark:
This certificate is issued only for the receipt of the test sample.
^(a) American Public Health Association, Standard Methods for the Examination of Water and Wastewater.

Tested By Name : MAY THU NAING Position : Laboratory Technician Signature : 		Approved By Name : KYAWT KYAWT YIN Position : Technical Consultant Manager Signature : 
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LAB-FO-024-00



The Government of the Republic of the Union of Myanmar
 Ministry of Natural Resources and Environmental Conservation
 Department of Forest
 Forest Research Institute
 Water Quality Laboratory, Yezin



Ref : WQL/0010/2023
 Date: 26-1-2023

ANALYTICAL TEST REPORT

Customer Name: Taungdawgwin Solar Power Project
 Customer Address :

Assignment number	WL/2023-4	Sampling Location	မြစ်သား
Sample number	1	Sampling Date	11-1-2023
Sample type	GW	Sample received date	12-1-2023
Comments			

Parameter	Result	Unit	Method reference	Instruments
pH	6.45	-	ISO 10523:2008	ManTech Robot (PC-1300-475E)
Electrical Conductivity	100.8	mS/m	NS-ISO 7888:1993	ManTech Conductivity, Model 4510 Conductivity/TDS meter
Total Dissolved Solids	574	mg/L	Manual	PROZOR® TDS&EC Test Meter
Turbidity	0.66	FNU	ISO 7027:1999	ManTech Robot (MT-165-981)
BOD	0.49	mg/L	Potentiometric	YSI ProDO Tester
COD	3.6	mg/L	Titrimetic	Titration
Total Nitrogen	0.26	mg/L	Kjeldahl	Kjeldahl distillation assembly
Total Phosphorus	7	µg /L	NS 4725	SFA(SKALAR SAN plus Analyzer) SA 3000/5000,SA 1100
Total Suspended Solids	0.25	mg/L	NS 4733:1983	Circulation and Filtration System
Potassium	7.75	mg/l	Spectrophotometric	AAS(AA 7000),SHIMADZU

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature :

Name : Dr. Thida Cho
 Assistant Research Officer

Approved by

Signature :

Name : Daw Thida Swe
 Assistant Research Officer

LABORATORY ANALYSIS REPORT

- 1 Client Name : Taungdawgwin Solar Power Plant Project
- 2 Location : Myitthar Township, Mandalay Region
- 3 Type of Sample : Surface Water
- 4 Sample No. : 00029/2023
- 5 Contact Person : Ko Wai Yan Htoo
- 6 Phone No. : 09-797005180
- 7 Date Received : 12.01.2023
- 8 Date of Test Performed : 12.01.2023
- 9 Date of Issued : 20.01.2023
- 10 Result :

No.	Parameter	Result	Unit	WHO STD 2018	Method
1	Dissolved Oxygen	7.61	mg/L	-	Hanna HI98193 - DO and BOD Meter
2	Oil and Grease	5	mg/L	-	^(a) 5520D, Soxhlet Extraction Method
3	Salinity	5.42	mg/L	-	^(a) 4500-Cl ⁻ B, Argentometric Method

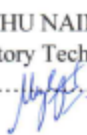
Remark:

This certificate is issued only for the receipt of the test sample.

^(a) American Public Health Association, Standard Methods for the Examination of Water and Wastewater.

Tested By

Name : MAY THU NAING
Position : Laboratory Technician
Signature :




Approved By

Name : KYAWT KYAWT YIN
Position : Technical Consultant Manager
Signature :





The Government of the Republic of the Union of Myanmar
Ministry of Natural Resources and Environmental Conservation



Department of Forest
Forest Research Institute
Water Quality Laboratory, Yezin

Ref: WQL/0011/2023
Date: 26-1-2023

ANALYTICAL TEST REPORT

Customer Name: Taungdawgwin Solar Power Project
Customer Address :

Assignment number	WL/2023-4	Sampling Location	မြစ်သား
Sample number	2	Sampling Date	11-1-2023
Sample type	SW	Sample received date	12-1-2023
Comments			

Parameter	Result	Unit	Method reference	Instruments
pH	6.56	-	ISO 10523:2008	ManTech Robot (PC-1300-475E)
Electrical Conductivity	37.32	<i>mS/m</i>	NS-ISO 7888:1993	ManTech Conductivity, Model 4510 Conductivity/TDS meter
Total Dissolved Solids	205	<i>mg/L</i>	Manual	PROZOR® TDS&EC Test Meter
Turbidity	1.35	<i>FNU</i>	ISO 7027:1999	ManTech Robot (MT-165-981)
BOD	1	<i>mg/L</i>	Potentiometric	YSI ProDO Tester
COD	3.4	<i>mg/L</i>	Titrimetic	Titration
Total Nitrogen	0.14	<i>mg/L</i>	Kjeldahl	Kjeldahl distillation assembly
Total Phosphorus	5.13	$\mu\text{g/L}$	NS 4725	SFA(SKALAR SAN plus Analyzer) SA 3000/5000, SA 1100
Total Suspended Solids	16	<i>mg/L</i>	NS 4733:1983	Circulation and Filtration System
Potassium	3.20	<i>mg/l</i>	Spectrophotometric	AAS(AA 7000), SHIMADZU

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature :

Name : Dr. Thida Cho
Assistant Research Officer

Approved by

Signature :

Name : Daw Thida Swe
Assistant Research Officer

LABORATORY ANALYSIS REPORT

- 1 Client Name : Taungdawgwin Solar Power Plant Project
- 2 Location : Myitthar Township, Mandalay Region
- 3 Type of Sample : Waste Water
- 4 Sample No. : 00030/2023
- 5 Contact Person : Ko Wai Yan Htoo
- 6 Phone No. : 09-797005180
- 7 Date Received : 12.01.2023
- 8 Date of Test Performed : 12.01.2023
- 9 Date of Issued : 20.01.2023
- 10 Result :

No.	Parameter	Result	Unit	WHO STD 2018	Method
1	Oil and Grease	4	mg/L	-	⁽⁴⁾ 5520D, Soxhlet Extraction Method
2	Total Coliform	29	MPN/ml	-	FDA-BAM: MPN Method

Remark:

This certificate is issued only for the receipt of the test sample.

Dispose treated waste water according to state and local regulations.

⁽⁴⁾ American Public Health Association, Standard Methods for the Examination of Water and Wastewater.

Tested By

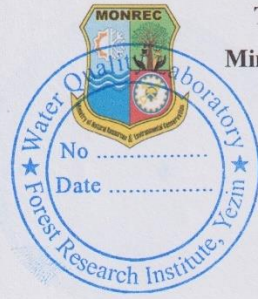
Name : MAY THU NAING
Position : Laboratory Technician
Signature :




Approved By

Name : KYAWT KYAWT YIN
Position : Technical Consultant Manager
Signature :





The Government of the Republic of the Union of Myanmar
Ministry of Natural Resources and Environmental Conservation



Department of Forest
Forest Research Institute
Water Quality Laboratory, Yezin

Ref: WQL/0012/2023
Date: 26-1-2023

ANALYTICAL TEST REPORT

Customer Name: Taungdawgwin Solar Power Project
Customer Address :

Assignment number	WL/2023-4	Sampling Location	မြစ်သား
Sample number	3	Sampling Date	11-1-2023
Sample type	WW	Sample received date	12-1-2023
Comments			

Parameter	Result	Unit	Method reference	Instruments
pH	8.18	-	ISO 10523:2008	ManTech Robot (PC-1300-475E)
BOD	1.37	mg/L	Potentiometric	YSI ProDO Tester
COD	3.4	mg/L	Titrimetic	Titration
Total Nitrogen	0.12	mg/L	Kjeldahl method	Kjeldahl distillation assembly
Total Phosphorus	37.9	µg /L	NS 4725	SFA(SKALAR SAN plus Analyzer) SA 3000/5000,SA 1100
Total Suspended Solids	6.25	mg/L	NS 4733:1983	Circulation and Filtration System

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature :

Name : Dr. Thida Cho
Assistant Research Officer

Approved by

Signature :

Name : Daw Thida Swe
Assistant Research Officer

