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ESIA Addendum

Physical Environmental Baseline

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ESIA Addendum

Physical Environmental Baseline

0730380

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ACRONYMS AND ABBREVIATIONS

Acronyms	Description
AQM	Air Quality Monitor System
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
ESS	Environmental and Social Standards
ND	Not Detected
PM	Particulate Matter
TSP	Total Suspended Particulate
WBG	World Bank Group
WGS	World Geodetic System

Acronyms	Description
WHO	World Health Organization

1. PHYSICAL ENVIRONMENTAL BASELINE

1.1 INTRODUCTION

This section provides an overview of the environmental baseline conditions within the Project Area of Influence (3 km around the airport boundary), including air quality, noise, and groundwater quality. The sampling points are shown in ***Figure 1.1***.

The environmental baseline aims to update the existing physical baseline conditions within the Project Area of Influence, which was presented in the EIA, to align with international standards. No additional environmental, social or biodiversity baseline surveys were conducted.

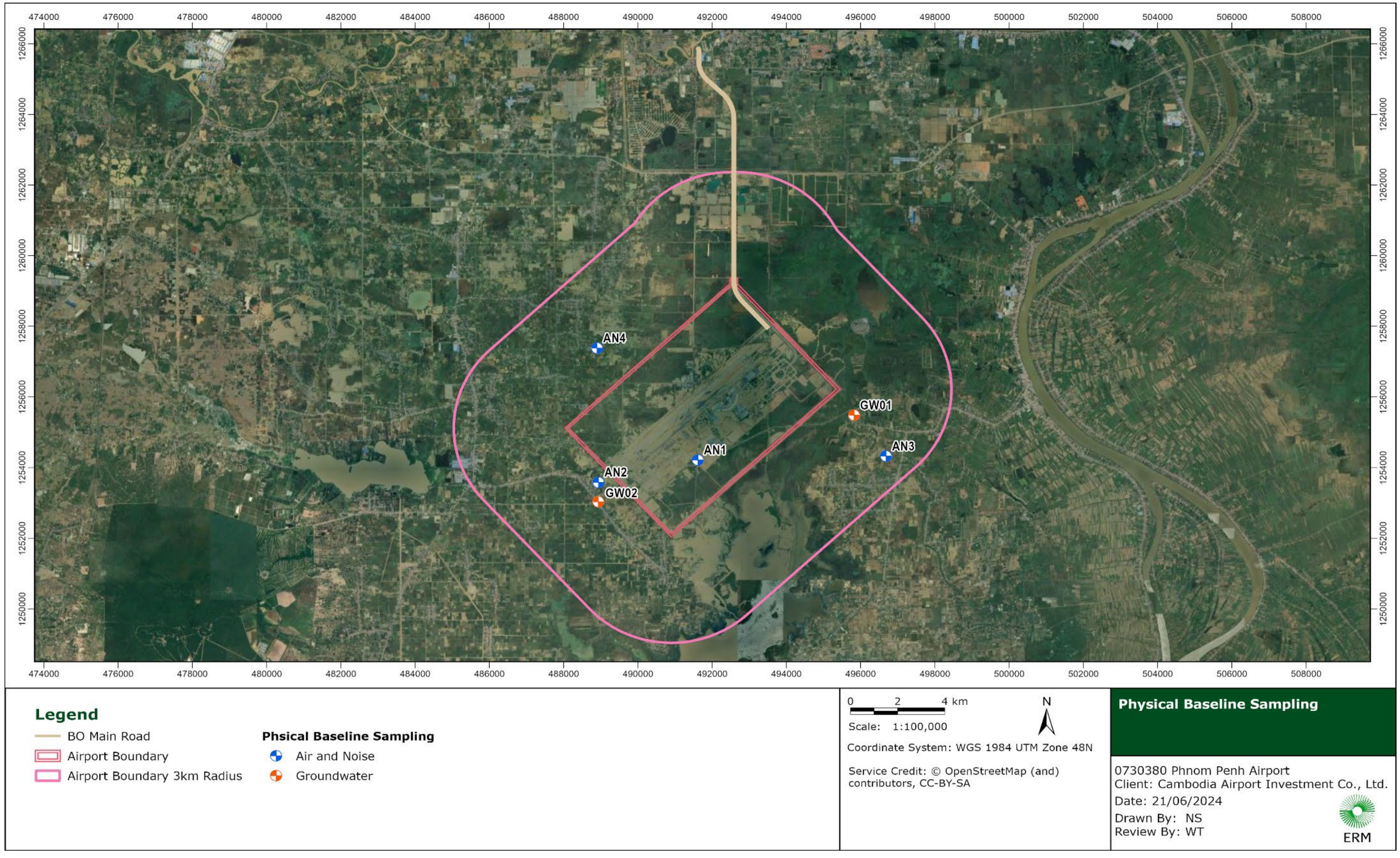

FIGURE 1.1 PHYSICAL BASELINE SAMPLING LOCATIONS

1.2 PROJECT ENVIRONMENTAL STANDARDS

Cambodia has national environmental quality standards. In addition to local environmental quality standards, the World Bank Group (WBG) Guidelines apply their own set of standards for specific effluents, emission, and discharges. Application of these guidelines require that when host country regulations differ from the levels and measures presented in the World Bank Group EHS Guidelines, Projects are required to achieve whichever is the more stringent. If less stringent levels or measures than those provided in the EHS Guidelines are appropriate in view of specific Project circumstances, a full and detailed justification must be provided for any proposed alternatives through the environmental and social risks and impacts identification and assessment process. This justification must demonstrate that the choice for any alternate performance levels is consistent with the objectives of WB ESS 1 and 3.

In comparison of Cambodia and World Bank Group standards, the most stringent standard will be applied for ease of reference for ESIA assessment. The following section lists the standards as defined by local and WBG EHS guidelines for Airlines.

1.2.1 AIR QUALITY STANDARD

Under Cambodian regulations, air quality is regulated by Sub-decree on air pollution control and noise disturbance (2000) and announcement on the implementation of the working conditions model for Project development, infrastructure, and tourism of Ministry of Environment (2018). The WBG EHS Guidelines for ambient air quality state that to protect ambient air quality nationally legislated ambient air quality standards should be selected or in their absence for emitted compounds standards from the World Health organization (WHO) or other internationally recognized standards are applicable.

The ambient air quality standards are presented in ***Table 1.1***. The most stringent standards are highlighted.

TABLE 1.1 AMBIENT AIR QUALITY STANDARDS

Parameters	Unit	National Standard[1]	WBG EHS Guideline[2]
TSP (24 h average)	µg/m^3	330	-
PM10 (24 h average)	µg/m^3	50	45
PM2.5 (24 h average)	µg/m^3	25	15
SO_2 (24 h average)	µg/m^3	300	40
CO (8 h average)	µg/m^3	20,000	10,000

Parameters	Unit	National Standard[1]	WBG EHS Guideline[2]
NO_2 (24 h average)	µg/m^3	100	25
O_3 (1 h average)	µg/m^3	200	-
Pb (24 h average)	µg/m^3	5	-

Note:

[1] Sub-decree on air pollution control and noise disturbance (2000) and announcement on the implementation of the working conditions model for Project development, infrastructure, and tourism of Ministry of Environment (2018)

[2] WBG EHS Guidelines, 2007 (aligned with the World Health Organization (2021) WHO global air quality guidelines

- means there is no standard for this parameter

1.2.2 NOISE STANDARD

Table 1.2 provides the applicable noise level standards of maximum noise standard allowed in commercial, service, and mixed areas, maximum noise standard allowed in hotels, administration areas, villas, and flats as stipulated in the sub-decree on air pollution control and noise disturbance (2000) and report on the implementation of the working conditions model for Project development, infrastructure, and tourism of Ministry of Environment (2018), and WBG EHS guidelines.

According to the WBG EHS guidelines, noise impacts should not exceed the levels presented in the table or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. The most stringent standards are highlighted.

TABLE 1.2 APPLICABLE NOISE STANDARDS

Site	National Standard[1]			WBG EHS Guideline[2]	
	One Hour L_{Aeq} (dBA)			One Hour L_{Aeq} (dBA)	
	Daytime (6:00 - 18:00)	Evening (18:00 - 22:00)	Nighttime (22:00 - 6:00)	Daytime (07:00 - 22:00)	Nighttime (22:00 - 07:00)
Residential; Institutional; educational	60	50	45	55	45
Industrial; commercial	-	-	-	70	70
Commercial area, service, and mixed area	70	65	50	-	-

Note:

[1] Maximum noise standard allowed in commercial, service, and mixed areas, maximum noise standard allowed in hotels, administration areas, villas, and flats as stipulated in the sub-decree on air pollution control and noise disturbance (2000) and report on the implementation of the working conditions model for Project development, infrastructure, and tourism of Ministry of Environment (2018)

[2] WBG EHS Guidelines, 2007

- means there is no standard for this parameter

1.2.3 GROUNDWATER QUALITY STANDARD

Table 1.3 provides national drinking water quality standard of Ministry of Industry and Handicraft (2004), Prakas on the adoption of terms of references for infrastructure and tourism sectors of MoE (2018) and WHO Drinking Water Standards (2022). The WBG EHS guidelines do not establish specific standards for groundwater quality. Instead, international standard will refer to WHO Drinking Water Standards (2022). The most stringent standards are highlighted.

TABLE 1.3 APPLICABLE GROUNDWATER QUALITY STANDARDS

Parameter	Unit	National Standard[1]	WHO Drinking Water Standard[2]
pH	-	6.5-8.5	6.5-8.5
Electricity conductivity (EC)	µs/cm	500-1,500	-
Total Dissolved Solids (TDS)	mg/l	<800	-
Turbidity	NTU	<5	-
Total Hardness as $CaCO_3$	mg/l	<300	-
Chlorine (Cl_2)	mg/l	250	5
Fluoride (F)	mg/l	<1.5	1.5
Nitrate (NO_3)	mg/l	<50	50
Sulphate (SO_4)	mg/l	<250	-
Aluminium (Al)	mg/l	<0.2	-
Arsenic (As)	mg/l	<0.05	0.01
Cadmium (Cd)	mg/l	<0.003	0.003
Chromium (Cr)	mg/l	<0.05	0.05
Iron (Fe)	mg/l	<0.3	-
Manganese (Mn)	mg/l	<0.1	0.08
Mercury (Hg)	mg/l	<0.001	0.006
E-Coli	MPN/100ml	0	-
Total Coliform	MPN/100ml	0	-

Note:

[1] National drinking water quality standard of Ministry of Industry and Handicraft (2004), Prakas on the adoption of terms of references for infrastructure and tourism sectors of MoE (2018)

[2] WHO Drinking Water Standards (2022)

- means there is no standard for this parameter

1.3 AIR QUALITY

Ambient air sampling was conducted prior to construction activities, which was conducted on 2 to 4 and 6 February 2019 by the Ministry of Environment's Laboratory, in order to determine the current state of ambient air quality around the Project site at four (4) stations. The sampling points and parameters are presented in ***Table 1.4***.

TABLE 1.4 AIR QUALITY MONITORING STATIONS

Monitoring Station	Location	Coordinates WGS1984 (Zone 48N)		Parameter
		X	Y	
AN1	In the airport boundary	491617	1254210	• Total Suspended Particulate (TSP) • Particle matter <10 µm (PM10) • Particle matter <2.5µm (PM2.5) • Sulphur Dioxide (SO_2) • Carbon Monoxide (CO) • Nitrogen Dioxide (NO_2) • Ozone (O_3) • Lead (Pb)
AN2	Potsor Village	488937	1253580	
AN3	Peam Sala Village	496685	1254320	
AN4	Cherng Prey Village	488901	1257380	

1.3.1.1 BASELINE DATA METHODOLOGY

Ambient air quality monitoring was carried out to determine the present baseline air quality condition in the vicinity of the airport boundary. The sampling locations were chosen with the consideration of adjacent sensitive receptors within the airport boundary to represent the background concentrations of the most sensitive conditions.

Ambient air quality sampling was conducted at four (4) locations for 24 hours (except parameter CO was conducted in only 8 hours and parameter O_3 was only 1 hour). The samples were collected by the Laboratory of the Ministry of Environment of Cambodia. The following parameters:

- Particulate parameters (PM10, PM 2.5) were measured using AQM09 air quality monitoring system;
- TSP were measured by using TSP sampler KC-120H;
- Sulphur Dioxide, Carbon Monoxide, Nitrogen Dioxide, Ozone, Lead were measured using AQM09 air quality monitoring system.

1.3.1.2 RESULTS AND DISCUSSION

Air monitoring results are presented in ***Table 1.5***. The air quality monitoring data demonstrates that almost all parameters were within the local regulatory limits and in accordance with WBG EHS Guidelines. Specifically, the O_3 parameter in the airport boundary (AN1) (230 µg/m^3) exceeded national standard, while PM10 at Peam Sala village (AN3) (68 µg/m^3) and Cherng

Prey village (94 µg/m^3) and PM2.5 in Peam Sala village (AN3) (28 µg/m^3) and Cherng Prey village (37 µg/m^3) exceeded both national and international standards.

According to EIA conducted by E&A (November 2020), demining activities (clearing vegetation by explosive disposal experts) occurred during the air quality monitoring period. As a result, these activities elevated levels of some air pollutants.

TABLE 1.5 AIR QUALITY RESULTS

Parameters	Unit	Sampling location				Standard	
		In the Airport boundary (AN1)	Potsor Village (AN2)	Peam Sala Village (AN3)	Cherng Prey Village (AN4)	National Standard[1]	WBG EHS Guideline[2]
TSP (24 h average)	µg/m^3	94	81	146	205	330	-
PM10 (24 h average)	µg/m^3	35	41	68	94	50	45
PM2.5 (24 h average)	µg/m^3	19	16	28	37	25	15
SO_2 (24 h average)	µg/m^3	11	8	13	13	300	40
CO (8 h average)	µg/m^3	520	260	620	780	20,000	10,000
NO_2 (24 h average)	µg/m^3	14	11	15	17	100	25
O_3 (1 h average)	µg/m^3	230	60	40	20	200	-
Pb (24 h average)	µg/m^3	ND	ND	ND	ND	5	-

Note:

[1] Air quality standard of Sub-decree on air pollution control and noise disturbance (2000) and announcement on the implementation of the working conditions model for Project development, infrastructure, and tourism of Ministry of Environment (2018)

[2] WBG EHS Guidelines, 2007 (aligned with the World Health Organization. (2021). WHO global air quality guidelines

Exceed both national and international standards
Exceed national standard

ND means not detected

- means there is no standard for this parameter

1.4 NOISE

Noise sampling was conducted on 24 to 25 February 2019 by E&A Consultant Co., Ltd., in order to determine noise condition within and surrounding the airport boundary at four (4) stations. The sampling points and parameters are presented in ***Table 1.6***.

TABLE 1.6 NOISE MONITORING STATIONS

Monitoring Station	Location	Coordinates WGS1984 (Zone 48N)		Parameter
		X	Y	
AN1	In the Airport boundary	491617	1254210	• L_{Aeq} • L_{max} • L_{min}
AN2	Potsor Village	488937	1253580	
AN3	Peam Sala Village	496685	1254320	
AN4	Cherng Prey Village	488901	1257380	

1.4.1.1 BASELINE DATA METHODOLOGY

Noise level was carried out to determine noise condition within and surrounding the airport boundary. Noise sampling was conducted at four (4) locations for 24 hours continuously for the following parameters: L_{Aeq}, L_{max} and L_{min} which were measured using RION-NL-52EX NL-52 by the E&A Consultant Co., Ltd.

1.4.1.2 RESULTS AND DISCUSSION

The noise level results were compared separately due to differences in the time periods defined by the national and international standards. The national standard defines daytime as 06:00 to 18.00, evening as 18:00 to 22:00, and nighttime as 22:00 to 06:00. While the international standard defines daytime as 07:00 to 22:00 and nighttime as 22:00 – 7:00. The results compared to the national standard are provided in ***Table 1.7.*** While the results compared to the international standard are provided in ***Table 1.8***.

The results in the airport boundary (AN1) were compared with the maximum noise standard allowed in commercial, service, and mixed areas as stipulated in the sub-decree on air pollution control and noise disturbance (2000) and report on the implementation of the working conditions model for Project development, infrastructure, and tourism of Ministry of Environment (2018). The results showed that the average noise levels for daytime, evening, and nighttime were all within national standard.

The results at Potsor village (AN2), Peam Sala Village (AN3), and Cherng Prey Village (AN4) were compared with the maximum noise standard allowed in hotels, administration areas, villas, and flats as stipulated in the sub-decree on air pollution control and noise disturbance (2000) and report on the implementation of the working conditions model for Project development, infrastructure, and tourism of Ministry of Environment (2018).

Regarding the average noise levels (L_{Aeq}) that exceeded the standards, the following summary can be provided:

- Potsor village (AN2): average noise levels between 18:00 and 20:00 hrs
- Peam Sala Village (AN3): an average noise levels at 8:00 - 9:00 hrs, 18:00 - 22:00 hrs, and 01:00 – 06:00 hrs
- Cherng Prey Village (AN4): average noise levels between 18:00 - 02:00 hrs and 03:00 – 06:00 hrs

However, there are no standards for Maximum Sound Pressure Level, L_{max}) and Minimum sound pressure level, L_{min}).

TABLE 1.7 NOISE RESULTS COMPARED WITH NATIONAL STANDARD

Time[1]	Noise Level dB(A)															
	In the Airport boundary (AN1)				Potsor Village (AN2)				Peam Sala Village (AN3)				Cherng Prey Village (AN4)			
	L_{Aeq}	Standard[2]	L_{max}	L_{min}	L_{Aeq}	Standard[3]	L_{max}	L_{min}	L_{Aeq}	Standard[3]	L_{max}	L_{min}	L_{Aeq}	Standard[3]	L_{max}	L_{min}
06:00 - 07:00	47.1	70	70.2	28	47.3	60	70.1	39.9	57.1	60	80.2	38.0	48.8	60	75.0	35.0
07:00 - 08:00	44.5		68.5	27.1	48.1		71.2	41.1	54.5		78.5	37.1	54.2		74.8	32.7
08:00 - 09:00	52.7		81.8	31.2	48.4		69.0	40.3	62.7		91.8	35.2	47.4		71.5	33.4
09:00 - 10:00	51.2		76	31.1	48.5		70.0	41.0	52.2		76.0	37.4	49.0		68.5	35.5
10:00 - 11:00	57.3		80.7	30.9	54.4		73.3	43.1	57.3		80.7	34.9	53.7		78.0	33.4
11:00 - 12:00	50.7		75.1	30.3	55.3		74.0	43.5	50.7		75.1	36.3	46.1		67.0	30.6
12:00 - 13:00	47.8		63.1	30.7	57.0		85.3	37.6	47.8		73.1	33.7	43.0		61.8	28.4
13:00 - 14:00	50.2		67.6	27.8	59.8		83.8	36.2	50.6		78.0	32.5	48.7		72.2	29.9
14:00 - 15:00	46.2		69	31.2	58.7		79.8	37.4	50.9		75.0	35.5	50.4		74.6	32.7
15:00 - 16:00	48.6		70.4	35.5	58.6		80.4	40.5	49.7		71.7	36.0	47.6		75.4	31.3
16:00 - 17:00	58.6		94.9	40.8	58.6		95.2	40.8	55.0		73.7	37.5	46.8		71.6	35.1
17:00 - 18:00	58.0		78.0	45.3	58.0		78.0	45.3	56.4		76.0	41.4	51.0		84.0	34.5
18:00 - 19:00	55.3	65	81.5	45.1	55.3	50	81.5	45.1	57.9	50	81.8	42.0	52.5	50	78.5	37.4
19:00 - 20:00	50.9		65.1	38.0	54.9		75.1	48.0	52.4		71.3	40.9	50.7		81.7	44.9
20:00 - 21:00	50.1		67.6	38.4	47.1		57.6	38.4	54.5		75.0	39.8	50.6		65.8	46.0
21:00 - 22:00	45.3		66.5	32.8	35.3		66.5	35.8	55.8		65.9	38.6	50.7		67.7	45.1
22:00 - 23:00	34.4	50	67.1	33.1	34.4	45	67.1	30.1	42.7	45	59.7	36.0	49.6	45	60.3	43.3
23:00 - 00:00	35.6		58.2	25.8	35.6		58.2	25.8	43.8		63.9	34.8	50.3		62.4	43.3
00:00 - 01:00	27.1		49.5	40.4	27.1		49.5	40.4	42.3		65.1	34.5	48.6		61.7	42.7
01:00 - 02:00	27.5		49.7	39.1	27.5		49.7	39.1	48.2		75.7	34.9	47.2		68.4	40.7
02:00 - 03:00	33.1		49.0	39.7	24.1		45.0	37.7	50.5		76.2	35.1	45.0		56.1	40.0

Time[1]	Noise Level dB(A)															
	In the Airport boundary (AN1)				Potsor Village (AN2)				Peam Sala Village (AN3)				Cherng Prey Village (AN4)			
	L_{Aeq}	Standard[2]	L_{max}	L_{min}	L_{Aeq}	Standard[3]	L_{max}	L_{min}	L_{Aeq}	Standard[3]	L_{max}	L_{min}	L_{Aeq}	Standard[3]	L_{max}	L_{min}
03:00 - 04:00	27.6		46.7	39.0	28.6		47.7	39.0	52.3		77.2	35.6	48.3		58.5	39.9
04:00 - 05:00	23.6		41.9	39.1	24.0		41.9	39.1	54.6		75.1	35.9	47.5		69.6	39.7
05:00 - 06:00	35.2		47.1	37.9	42.2		58.1	37.9	57.6		79.9	37.4	48.9		81.1	36.3
Average in 24 hours	**44.11**		**66.05**	**34.93**	**45.37**		**67.83**	**39.30**	**52.40**		**74.86**	**36.71**	**49.03**		**70.26**	**37.16**

Note:

[1] Period of time for National standard: Daytime is 06:00 – 18.00, Evening is 18:00 – 22:00, and Nighttime is 22:00 – 06:00

[2] The maximum noise standard allowed in commercial, service, and mixed areas as stipulated in the sub-decree on air pollution control and noise disturbance (2000) and report on the implementation of the working conditions model for Project development, infrastructure, and tourism of Ministry of Environment (2018)

[3] The maximum noise standard allowed in hotels, administration areas, villas, and flats as stipulated in the sub-decree on air pollution control and noise disturbance (2000) and report on the implementation of the working conditions model for Project development, infrastructure, and tourism of Ministry of Environment (2018)

Exceed national standard

The results indicated that all average noise levels (L_{Aeq}) in daytime were within WBG EHS Guidelines. While some average noise levels in nighttime at Peam Sala Village (AN3) and Cherng Prey Village (AN4) exceeded standard.

TABLE 1.8 NOISE RESULTS COMPARED WITH INTERNATIONAL STANDARD

Sampling location	Measurement Time[1]	Noise Level dB (A)	WBG EHS Standard[2]
In the Airport boundary (AN1)	LAeq, daytime	51.2	70
	LAeq, nighttime	32.4	70
Potsor Village (AN2)	LAeq, daytime	53.2	55
	LAeq, nighttime	32.3	45
Peam Sala Village (AN3)	LAeq, daytime	53.9	55
	LAeq, nighttime	49.9	45
Cherng Prey Village (AN4)	LAeq, daytime	49.5	55
	LAeq, nighttime	48.2	45

Note:

[1] Period of time for Internation standard: Daytime is 07:00 – 22:00 and Nighttime is 22:00 – 7:00

[2] WBG EHS Guidelines (Industrial; commercial; residential; institutional; educational)

Exceed international standard

1.5 GROUNDWATER QUALITY

Groundwater samples were taken on 31 January 2019 by E&A Consultant Co., Ltd, in order to determine groundwater condition at two (2) stations. The sampling points and parameters are presented in ***Table 1.9***.

TABLE 1.9 GROUNDWATER QUALITY MONITORING STATION

Monitoring Station	Location	Coordinates WGS1984 (Zone 48N)		Parameter
		X	Y	
GW01	In Preak Khmer Village, Sa'ang Phnom commune, Sa'ang district, Kandal province, about 1 km to the east of the Project	495823	1255480	• pH • Turbidity • Electricity conductivity (EC) • Total Dissolved Solids (TDS) • Total Hardness (as $CaCO_3$) • Chlorine (Cl_2)

Monitoring Station	Location	Coordinates WGS1984 (Zone 48N)		Parameter
		X	Y	
GW02	In Potsor Village, Potsor commune, Bati district, Takeo province, about 1 km to the west of the Project	488936	1253030	• Fluoride (F) • Nitrate (NO_3) • Sulphate (SO_4) • Iron (Fe) • Arsenic (As) • Mercury (Hg) • Chromium (Cr) • Manganese (Mn) • Aluminium (Al) • Cadmium (Cd) • Total Coliform • E-Coli

1.5.1.1 BASELINE DATA METHODOLOGY

The sampling was conducted at two locations from hand-tube wells in the residential areas to the western and eastern part of the Project site. Water sampling was collected in compliance with MOE laboratory's guidelines. The sample was analyzed at the MoE's water quality laboratory.

1.5.1.2 RESULTS AND DISCUSSION

The results of groundwater sampling at both stations indicated that most parameters met the standards set by the National drinking water quality standard of Ministry of Industry and Handicraft (2004), Prakas on the adoption of terms of references for infrastructure and tourism sectors of MoE (2018), and WHO Drinking Water Standards.

Except one parameter was not meet standards, which was arsenic in Preak Khmer Village (GW-01), Potsor Village (GW-02) exceeded both national and international standards.

According to the EIA conducted by E&A (November 2020), Kandal province is known for having high levels of arsenic in groundwater compared to other provinces in Cambodia and groundwater is mainly used for cooking, bathing, and cleaning.

TABLE 1.10 GROUNDWATER QUALITY RESULT

Parameter	Unit	Result		Standard	
		In Preak Khmer Village (GW-01)	In Potsor Village (GW-02)	National Standard[1]	WHO Drinking Water Standard[2]
pH	-	6.71	7.40	6.5-8.5	6.5-8.5
Electricity conductivity (EC)	µs/cm	116.00	123.00	500-1,500	-
Total Dissolved Solids (TDS)	mg/l	78.00	98.00	<800	-
Turbidity	NTU	0.00	0.00	<5	-
Total Hardness as $CaCO_3$	mg/l	38.90	46.40	<300	-
Chlorine (Cl_2)	mg/l	0.02	0.01	250	5
Fluoride (F)	mg/l	0.15	0.18	<1.5	1.5
Nitrate (NO_3)	mg/l	0.39	0.48	<50	50
Sulphate (SO_4)	mg/l	2.35	2.65	<250	-
Aluminium (Al)	mg/l	ND	ND	<0.2	-
Arsenic (As)	mg/l	0.12	0.14	<0.05	0.01
Cadmium (Cd)	mg/l	ND	ND	<0.003	0.003
Chromium (Cr)	mg/l	ND	0.003	<0.05	0.05
Iron (Fe)	mg/l	0.04	0.006	<0.3	-
Manganese (Mn)	mg/l	0.001	0.003	<0.1	0.08
Mercury (Hg)	mg/l	ND	ND	<0.001	0.006
E-Coli	MPN/100ml	0	0	0	-
Total Coliform	MPN/100ml	0	0	0	-

Note:

[1] National drinking water quality standard of Ministry of Industry and Handicraft (2004) and Prakas on the adoption of terms of references for infrastructure and tourism sectors of MoE (2018)

[2] WHO Drinking Water Standards (2022)

[3] According to WHO Drinking water standard, there are no guideline values proposed for electricity conductivity (EC), total dissolved solids (TDS), turbidity, hardness, sulfate (SO_4), aluminium (Al), iron (Fe), E-Coli and total coliform

Exceed both national and international standards

< means less than

ND means Not Detected

NTU means Nephelometric Turbidity Unit

MPN means Most Probable Number

- means there is no standard

ERM HAS OVER 160 OFFICES ACROSS THE FOLLOWING COUNTRIES AND TERRITORIES WORLDWIDE

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France
Germany
Ghana
Guyana
Hong Kong
India
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Mexico
Mozambique
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