Environmental Monitoring Form for Construction Stage
Contract Package 1

Item	Location	Parameter/Means of Monitoring	Result (Average/ Max /Total..)	Standards (Local/Inter Standard)	Frequency	Remarks	Mitigation Measure
Air Quality	Construction site	Visual inspection of mechanical condition and exhaust gas	No major adverse impacts	No standards	Every day before working	At construction camp site	
	Construction site	Visual observation of dust			Every day	site works	
	Storage facilities for dust generation		No major adverse impacts			Every day, especially in dry season	
	AQS-1 (October 21st, 2020) KP: 39+200 Okdong District Hospital, Kompong Speu Province.	**PM10**	AQS1 = 0.048mg/m^3	0.05 mg/m^3 (WHO, average 24h)	2 times in dry season 2 times in wet season	We will use mobile device to check for daily and weekly monitoring. the value of NO2, SO2, PM2.5 and PM10, were not exceeded the Cambodian standard. Therefore, it means that the air quality within those section is still not polluted yet. However, even though, the contractor has to pay more attention for keeping the air quality below the standard by providing more watering in regularly, especially during the day time.	Contractor will provide more watering regularly, especially during the day time. The contractor will prepare and strictly implement plan around construction sites. The drivers of construction vehicles will comply with speed limits to minimize road dust.
		PM2.5	AQS1 = 0.020mg/m^3	0.025 mg/m^3 (WHO, average 24h)			
		SO_2	AQS1 = 0.025mg/m^3	0.30 mg/m^3 (WHO average 24h)			
		NO_2	AQS1 = 0.028mg/m^3	0.10 mg/m^3 (WHO average 24h)			

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Item	Location	Parameter/Means of Monitoring	Result (Average/ Max /Total..)	Standards (Local/Inter Standard)	Frequency	Remarks	Mitigation Measure
Water Quality	WS-1 (21st of October 2020) KP:32+000 at LHS, Pond, 200m from ROW (water sampling point will be replaced due to far from the road WS-2 (21st of October 2020) KP: 32+300 at RHS, in Tonle Sap river, in front of Prek Prang Pagoda WS-3 (21st of October 2020) KP: 36+900 at RHS, downstream, border of Kandal and Kompong Chhnang WS-4 (21st of October 2020) KP: 40+900 at RHS, downstream near factory	Visual observation/inspection	No major adverse impacts	No standards	Every day	Contractor and inspector	
		pH	WS-1=6.90 WS-2=6.80 WS-3=7.17 WS-4=7.20	6.5-8.5 (MoE)	1 time in dry season 1 time in wet season	We will use mobile device to check for daily and weekly monitoring. Seasonal monitoring shall be done at the same point on EIA. Comparing this result with the Cambodia standard, there are showing that the value of pH, TSS and BOD are still below the standard. The value of COD for WS2 is exceeded the standard. The value of Total-Coli-form are higher than standard for WS1 and WS2. It is noted that during the month of October 2020, there is a lot of raining and some location along CP1 are flooded.	Contractor will try to reduce any possible impacts from the construction sites such as improve the management of solid waste, oil waste, application of slope protection to reduce run off of the dirt with the rain water, etc.
		TSS	WS-1=88 WS-2=43 WS-3=56 WS-4=59	25-100 mg/l (MoE)			
		BOD	WS-1=1.90 WS-2=3.20 WS-3=2.80 WS-4=2.95	1-10 mg/l (MoE)			
		COD	WS-1=6.66 **WS-2=13.55** WS-3=6.73 WS-4=7.44	1-8 mg/l (MoE)			
		Total Coliform	**WS-1= 1.1 x 10^5** WS-2= 9.3 x 10^3 WS-3= 9.3x10^3 WS-4= 1.5x10^3	<5,000 (Japanese Standard)			
Noise	ANV-1 (21st of October 2020) KP:39+200 Odong District, Kompong Speu Province (Odong district hospital)	Noise Level (MoE Laboratory)	ANV-1= -58dB (6:00-18:00) -55dB (18:00-22:00) -55dB (22:00-06:00)	- 60 dB (06:00-18:00) - 50dB (18;00-22:00) - 45dB (22:00-06:00) (MoE, residential area)	1 time in dry season 1 time in wet season	Visual check and maintain the construction equipment. The value of noise was a little exceeded the Cambodian Standard and IFC Standard, because this area is nearby the urban area as well as market and the traffic also is congested.	Continue to do the NR5 maintenance and put on the traffic sign on the NR5 to lower the driving speed to reduce the noise during at night. Contractor select quiet equipment and working method as much as possible.
Vibration		Vibration Level (MoE Laboratory)	ANV-1 -21Hz (7:00-20:00) -20Hz (20:00-7-00)	- 65Hz (7:00-20:00) - 60Hz (20:00-7:00) (MoE)			

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Item	Location	Parameter/Means of Monitoring		Result (Average/ Max /Total..)	Standards (Local/Inter Standard)	Frequency	Remarks	Mitigation Measure
Waste Generation	Waste storage at construction site	Slurry and other construction waste	Discharged amount	The result was shown in table of waste data	No standards	Every day	Septic tank	
			Recycled amount					
			The way of recycle					
			Treated amount					
			Local of final disposal					
		General waste	Discharged amount	The result was shown in table of waste data				
			Recycled amount					
			The way of recycle					
			Treated amount					
			Local of final disposal				Land-fill of provincial authority	
Subsidence	Subsidence prone locations along the project road	Visual inspection and interview to the local people		No impact at construction site	No standards	1 time/week to 1 time/month (depending on situation)	Minor affects to prone locations along the project road.	
Hydrology	River, stream, and reservoir where construction works are executed	Visual inspection on volume and speed of water flow		No impacts at construction site		Every day	In The main rivers and canels are crossing NR-5, sometime, was raining.	
Ecosystem	EC-1 KP 35 and KP 37+200 (October, 2020) Odong bypass as requested by JICA and Client	Visual observation of animals, reptiles, and amphibious		Mammal = 3 Amphibian =6 Reptile = 4 Birds = 29 Fishes = 22 Flora = 6	No standards	One time in dry season and one time in rainy season	Visual survey shall be done near permanent river. Based on above team inspection and	Contractor shall use methods to mitigate the impacts of Ecosystem and educate the

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Contract Package 1

			Insect = 4			interviewing with local villager as well as farmers, there are existing some species are vulnerable some least concern which mentioned within IUCN list, and some other species are non within the IUCN list.	Engineers and workers not to catch wild flura and fauna species around construction sites.

Remarks: Past trend and current statute including remedial measures, if necessary.

Note:

WHO: World Health Organization, SO_2: Sulfur Dioxide, COD: Chemical Oxygen Demand
MoE: Ministry of Environment, PM: Particulate Matters, TSS: Total Suspended Solid
NO_2: Nitrogen Dioxide, BOD: Biochemical Oxygen Demand

1. Schedule of Seasonal Monitoring

The seasonal periodical monitoring for air quality was done on 21st of October 2020, noise and vibration were done on 21st of October 2020, water quality sampling was conducted on 21st of October 2020 and ecosystem survey was conducted in October 2020 as the Attachment schedule table below:

Table 1.1 Monitoring Items and Frequency

Year	2018	2019				2020				2021				2022			
	29th Nov	Jan	Apr	Jul	Oct	Feb	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct
Item	Rainy	Dry	Dry	Rainy	Rainy	Dry	Dry	Rainy	Rainy	Dry	Dry	Rainy	Rainy	Dry	Dry	Rainy	Rainy
1. Air Quality	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2. Water Quality	●		●		●		●		●		●		●		●		●
3. Noise	●		●		●		●		●		●		●		●		●
4. Vibration	●		●		●		●		●		●		●		●		●
8. Ecosystem		●	●		●		●		●		●		●		●		●

2. Seasonal Monitoring Points and Areas

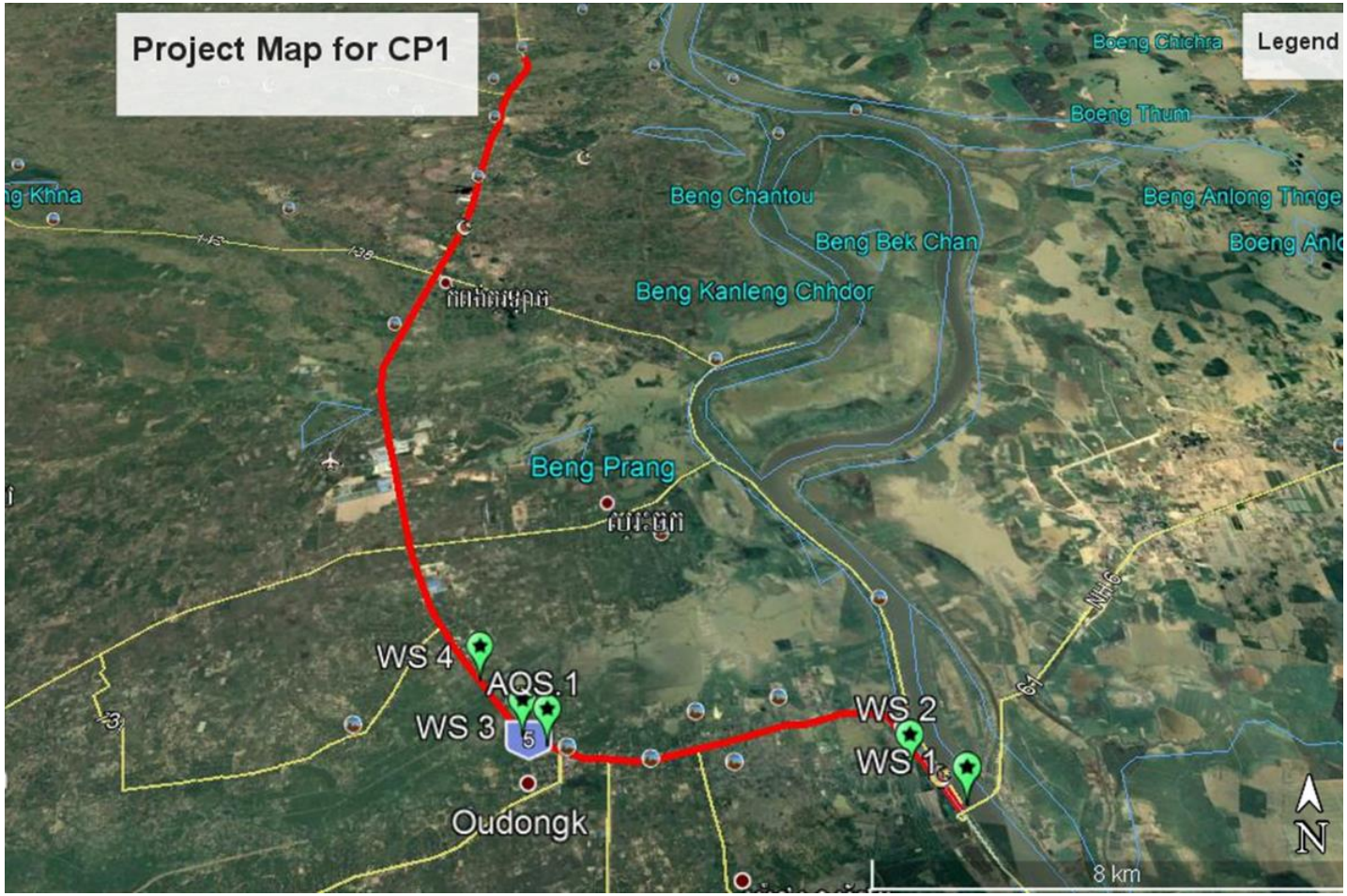


Figure-1: Designed Monitoring Points for Package 1 Section (Sta 31+370 - Sta 73+000)

3. Ecosystem Map and Area for CP1 (Odong Bypass)

4. The Solid Waste Generation in October, 2020

Total Solid Waste Generation in October 2020											
No.	Location Name	Location P.K.	General Waste				Construction waste				
			General Amount Kg/month	Recycled Amount (kg/month)	Recycle meant	Dispose meant	General Amount Kg/month	Recycled Amount (kg/month)	Recycled Amount (m3/month)	Recycle meant	Dispose meant
1	SMCC C.P.01 Office	PK49+800 RHS	22kg	5	Sold to scavenger	Dispose to dump site	0	0		N/A	N/A
2	EWT Office	PK51+000 RHS	24kg	3	Sold to scavenger	Dispose to dump site	0	0		N/A	N/A
3	J.P. Office	PK39+000 LHS	10kg	2	Sold to scavenger	Dispose to dump site	0	0		N/A	N/A
4	SMCC Precast Concrete Yard	PK78+100 RHS	25kg	8	Sold to scavenger	Dispose to dump site	100kg	100kg	0.041 m3	Backfill/Sold to scavenger	Dispose to disposal areas
5	SMCC Concrete Stone Yard	PK72+100 RHS	18kg	4	Sold to scavenger	Dispose to dump site	0	0		N/A	N/A
6	SMCC Staff Accommodations	PK51+000 RHS	63kg	5	Sold to scavenger	Dispose to dump site	0	0		N/A	N/A
7	SMCC Management Accommodations	PK35+550 LHS	51kg	5	Sold to scavenger	Dispose to dump site	0	0		N/A	N/A
8	Bridge 11	PK46+220 MID	00kg	0	Sold to scavenger	Dispose to dump site	50kg	12kg	0.005m3	Backfill/Sold to scavenger	Dispose to disposal areas
9	Bridge 13	PK49+000 MID	12kg	0	Sold to scavenger	Dispose to dump site	200kg	52kg	0.021m3	Backfill/Sold to scavenger	Dispose to disposal areas
10	Construction Site	PK70+355 RHS (RCBC)	12kg	2	Sold to scavenger	Dispose to dump site	45kg	21kg	0.011m3	Backfill/Sold to scavenger	Dispose to disposal areas
11	Construction Site	PK43+424 RHS (RCBC)	22kg	3	Sold to scavenger	Dispose to dump site	82kg	43kg	0.017m3	Backfill/Sold to scavenger	Dispose to disposal areas

12	Construction Site	PK62+733 LHS (RCBC)	25kg	0	Sold to scavenger	Dispose to dump site	65kg	20kg	0.009m3	Backfill/Sold to scavenger	Dispose to disposal areas
13	Construction Site	PK32+900 to 33+000RHS/ LHS (G.Riprap)	32kg	0	Sold to scavenger	Dispose to dump site	65kg	20kg	0.009m3	Backfill/Sold to scavenger	Dispose to disposal areas
14	Construction Site	PK37+500to 550RHS/ LHS (G.Riprap)	24kg	5	Sold to scavenger	Dispose to dump site	42kg	24kg	0.009m3	Backfill/Sold to scavenger	Dispose to disposal areas
15	Construction Site	PK68+305 RHS (RCPC)	22kg	4	Sold to scavenger	Dispose to dump site	82kg	21kg	0.009m3	Backfill/Sold to scavenger	Dispose to disposal areas
16	Construction Site	PK66+124 LHS (RCPC)	21kg	0	Sold to scavenger	Dispose to dump site	47kg	20kg	0.009m3	Backfill/Sold to scavenger	Dispose to disposal areas
17	Construction Site	PK 69+000 LHS (RCPC)	24kg	4	Sold to scavenger	Dispose to dump site	102	54	0.018	Backfill/Sold to scavenger	Dispose to disposal areas
Total General Waste			**407kg**	**50**	**Total Construction Waste**		**771kg**	**388kg**	**0.108m3**		

5. Fauna and flora survey at EC-01

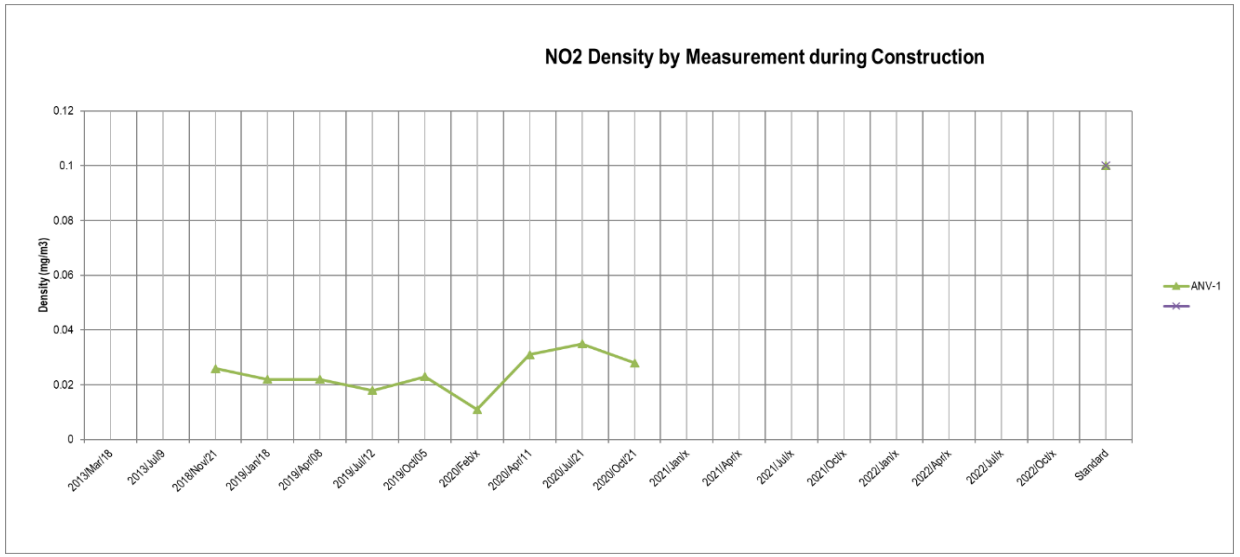
Category-1	Category-2	Family	Local Name	English name	*Scientific name*	IUCN Status
a) Mammal	None	None				
			Kambrok por	Northern Treeshrew	*Callosciurus Erythraeus*	N/A
			Kandol Srae	*Rat spp*		N/A
			Sam pouch Troung Leung	Yellow-Throated Marten	*Martes flavigula*	LC
b) Amphibian	None	None				
			Kingkuok	Common Asian Toad	*Bufo Melanosttrictus*	N/A
			Hing	Common Asian Bullfrog	*Kaloula Pulchra*	LC
			Kangkeb	Paddy Frog	*Fejevarya limnocharis*	N/A
			Kanhkebkob	Regulose Bullfrog	*Hoblobatrachus Rugulosus*	N/A
			Kanhchanhchek	Common tree frog	*Polypedates leucomystax*	LC
			KangKaeb Srae	Paddy frog	*Fejevarya limnocharis*	N/A
c) Reptile	None	None				
			Pous Vek Dom Bouk	Indochinese Spitting Cabra	*Naja Siamensis*	VU
			Pous Vek Krobei	Monocled Cobra	*Naja Kaouthia*	LC
			Pous thlan touch	Burmese Python	*Pyfthon Molurus Bivittaftus*	N/A
			Pous thlan thom	Reticulate python	*Pyfthon Reticulatus*	N/A
d) Birds	None	None				
			Popustoek	Little Grebe	*Tachybaptus Ruficollis*	LC
			Populchampusthum	Thick-Billed Green pigeon	*Treron Curvirostra*	LC
			Populchoeung	Yellow-Footed Green Pigeon	*Treron Phoenicoptera*	N/A
			Chochatkrem	Common kingfisher	*Alcedo atthis*	LC
			Porltouk thngaskhmao	Blue-Eared Barbet	*Megalaima Australis*	LC
			Porltouk Kbal	Lineated Barbet	*Megalaima Lineata*	LC
			Porltouk Ambuk	Coppersmith Barbet	*Megalaima Haemacephala*	LC
			Chek tum	Black-Naped Oriole	*Oriolus chinensis*	LC
			Kvaek	Black-Crowned Night Heron	*Nycticorax Nycticorax*	LC
			Ngeav kork	Stork-Billed kingfisher	*Halcyon Capensis*	N/A
			Antep toing	Greater Racket- Tailed Drongo	*Dicrurus Paradiseus*	LC

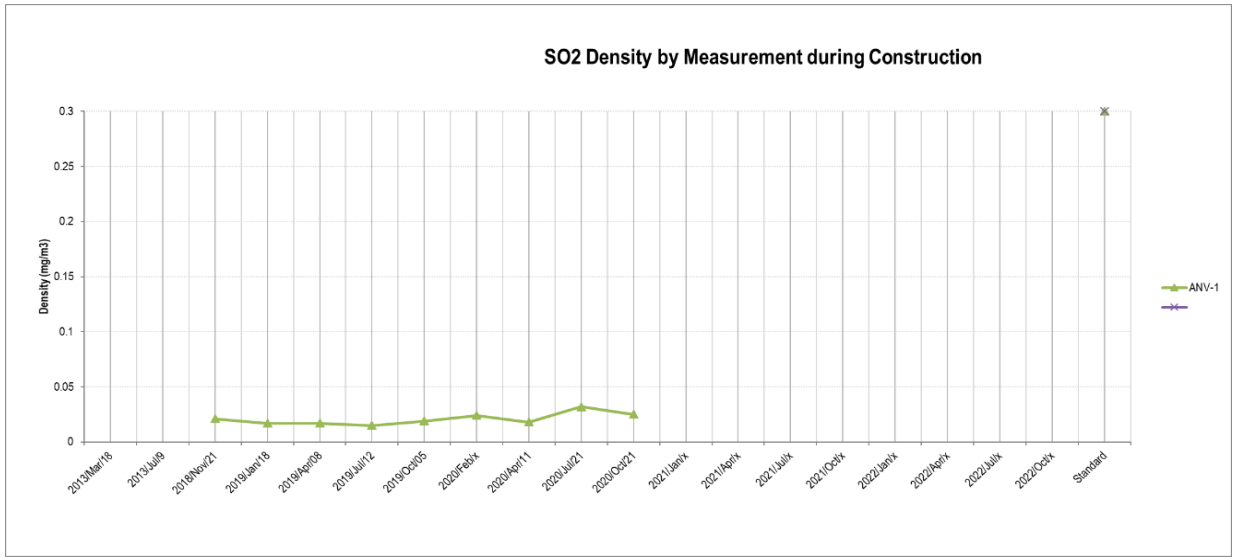
Category-1	Category-2	Family	Local Name	English name	*Scientific name*	IUCN Status
			Kok krourng	Intermediate Egret	*Egretta Intermedia*	N/A
			La out thom	Greater Coucal	*Centropus sinensis*	LC
			Preab Srok	Rock Pigeon	*Columba Livia*	LC
			Pror Voek	Lesser Whistling Duck	*Dedrocygna Javanica*	N/A
			Tror Ses Knorng Plerng Toch	Common Flamedback	*Dinopium Javanense*	LC
			Teav Kiev	Indian Roller	*Coracias Benghalensis*	LC
				Yellow Breasted Bunting	*Emberiza Aureola*	N/A
				Green Bushlark	*Mirafra Marionae*	N/A
				Yellow Bushlark	*Mirafra Marionae*	N/A
			Chap Phteah	Eurasian Tree Sparrow	*Passer montanus*	N/A
			Krouch In Velsrae	Paddyfield Pipit	*Anthus Rufulus*	N/A
			Steang Lolork	Black-shouldered Kite	*Elanus coeruteus*	N/A
			Lolork Bay	Spotted Dove	*Streptopelia chinensis*	N/A
			Tradav Touch	Green Bee-eater	*Merops orientalis*	N/A
			Popech thmar Troung Thnaot	Common Stonechat	*Saxicola torquata*	N/A
				Grey-breasted	*Prinia hodgsonii*	N/A
				Common Myna	*Acridotheres tristis*	N/A
				Crow Pheasant	*Centropus Sinensis*	N/A
e) Fishes	None	None				
			Trey andaeng roeng	Walking catfish	*Clariasbatrachus*	LC
			Trey andaengtun	Black skin catfish	*Clariasmelladerma*	N/A
			Trey Bra kae		*Pangasiusconchophilus*	LC
			Trey Bra kchao		*Pangasiusbocourti*	LC
			Trey Bra thom	Sutchi catfish	*Pangasianodonhypophthalmus*	N/A
			Trey chhkaok		*Cyclocheichthys Enoplos*	N/A
			Trey chhpin	Goldfin tinfoil barb	*Hypsibarbus Malcolmi*	N/A
			Trey ka Ek	Black sharkminnow	*Labeo Chreysophekadion*	L/C
			Trey kaes		*Microbenacheveyi*	N/A
			Trey kanhchrouk	Skunk botia	*Yasuhikotakia morleti*	LC
			Trey khchoeung	Frecklefin Eel	*Trey Chonluanh Moan*	N/A
			Trey khman	Hampala barb	*Hampala Macrolepidota*	LC
			Trey kray	Clown Featherbaack	*Chitala Ornata*	LC

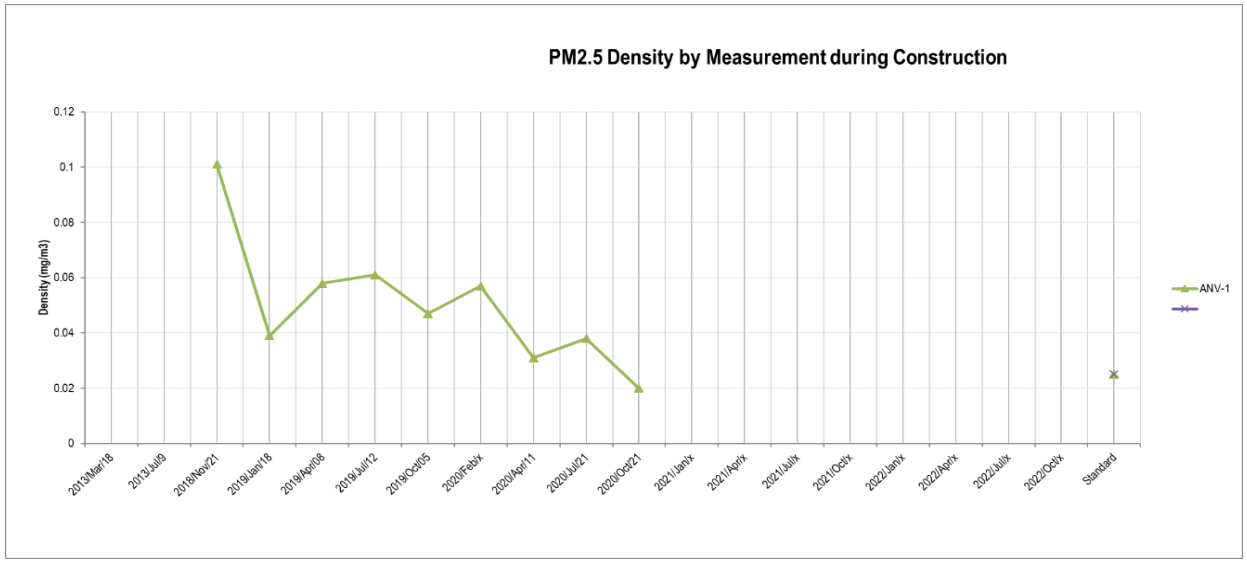
Category-1	Category-2	Family	Local Name	English name	*Scientific name*	IUCN Status
			Trey Krus	Dusky face carp	*Osteochilus lini*	LC
			Trey Sanday/Trey Ros	Snakehead Murrel	*Chana Striata*	LC
			Trey Ampil Tom	Red cheek barb	*Puntius orphoids*	
			Trey slat	Bronze Featherback	*Notopterus Notopterus*	LC
			Trey Stuok		*Wallagoleerii*	N/A
			Trey ta oun		*Ompokhypophthalmus*	N/A
			Trey chhlaing	Asian Redtail Catfish	*Hemibagrusnemurus*	N/A
					Macrognathus siamensis	N/A
					Pseudomystus siamensis	N/A
f) Insect	None	None				
				Scarlet lily beetle	*Lilioceris*	N/A
			Kantum Ruy	Dragon Fly	*Anisoptera*	N/A
				Butterfly	*Rhopalocera*	N/A
			Sramaoch	Ant		N/A
g) Flora	None	None				
				Alstonia	*Alstonia Scholaris*	N/A
				Ahite Waterlily		N/A
				Cardiospermum	*Halicacabum*	N/A
				Sleeping grass	*Mimosa Pudica*	N/A

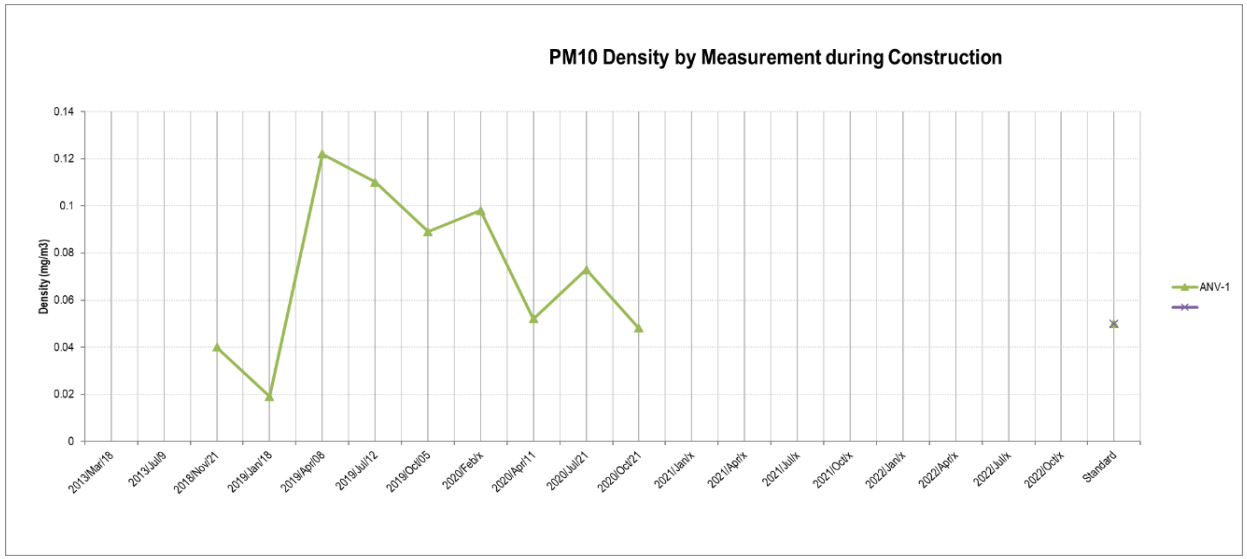
6. Seasonal Monitoring

6.1. Seasonal Monitoring of Air Quality

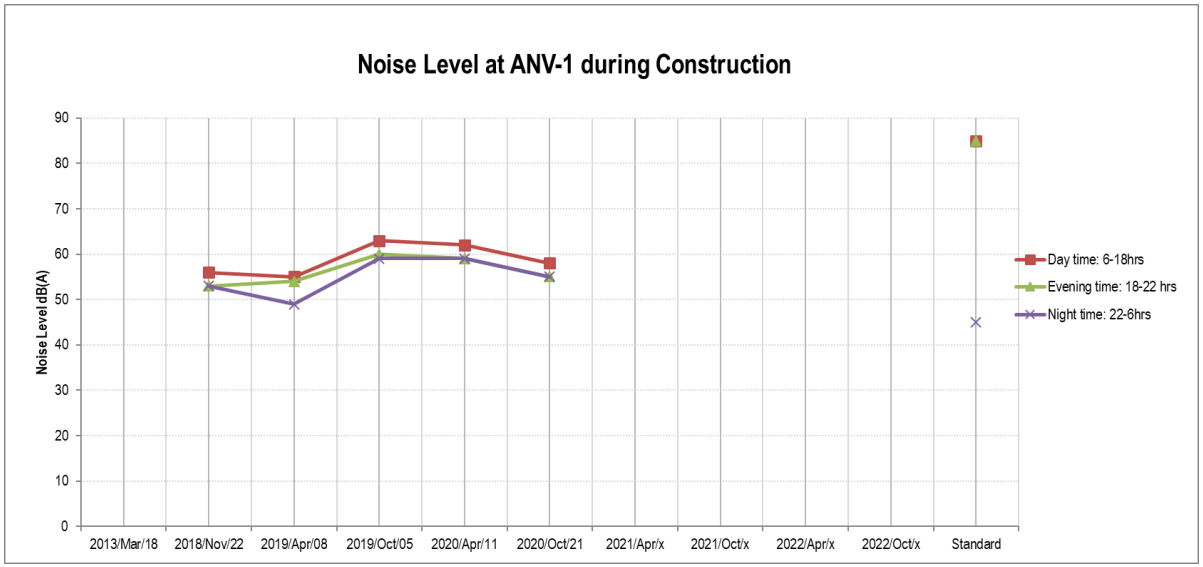


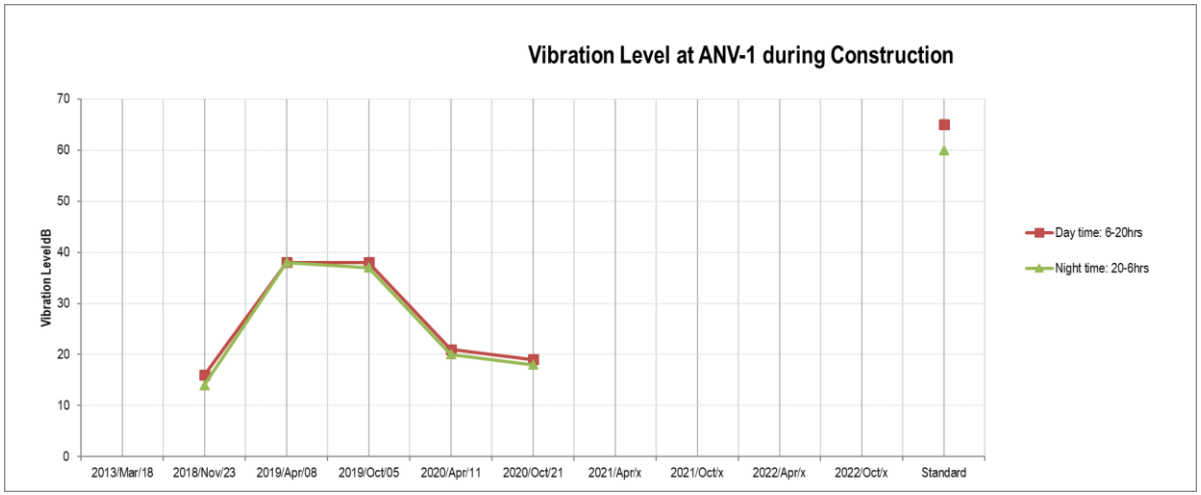



PM2.5 Density by Measurement during Construction
Density (mg/m3)
0.12
0.1
0.08
0.06
0.04
0.02
0
2013/Mar/18
2013/Jul/9
2018/Nov/21
2019/Jan/18
2019/Apr/08
2019/Jul/12
2019/Oct/05
2020/Feb/x
2020/April1
2020/Jul/21
2020/Oct/21
2021/Jan/x
2021/Apr/x
2021/Jul/x
2021/Oct/x
2022/Jan/x
2022/Apr/x
2022/Jul/x
2022/Oct/x
Standard
ANV-1

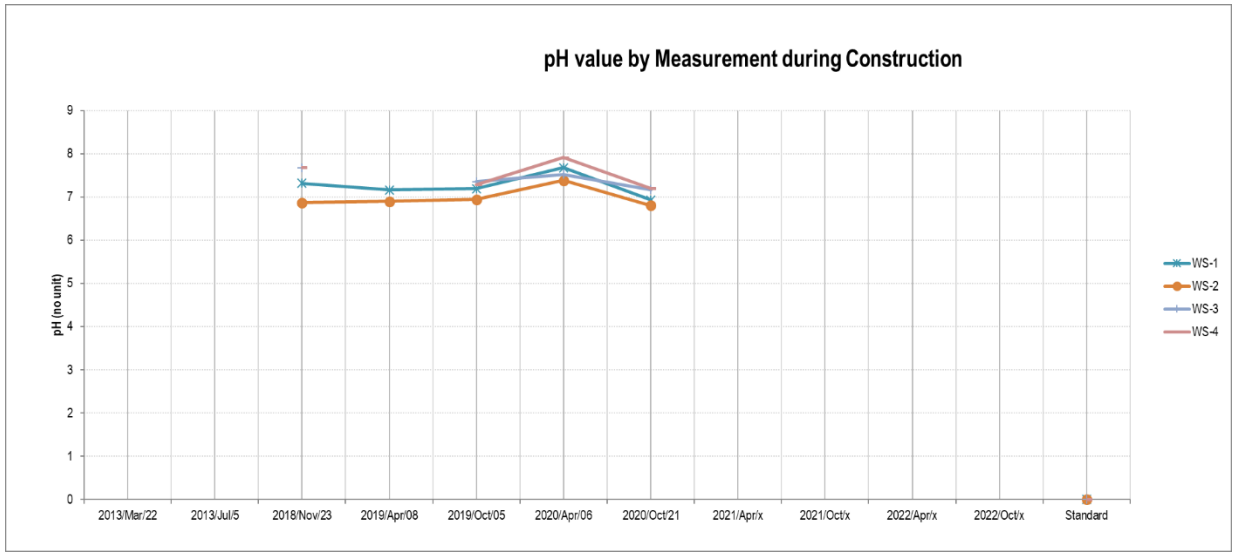

PM10 Density by Measurement during Construction
Density (mg/m3)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
2013/Mar/18
2013/Jul/9
2018/Nov/21
2019/Jan/18
2019/Apr/08
2019/Jul/12
2019/Oct/05
2020/Feb/x
2020/April1
2020/Jul/21
2020/Oct/21
2021/Jan/x
2021/Apr/x
2021/Jul/x
2021/Oct/x
2022/Jan/x
2022/Apr/x
2022/Jul/x
2022/Oct/x
Standard
ANV-1

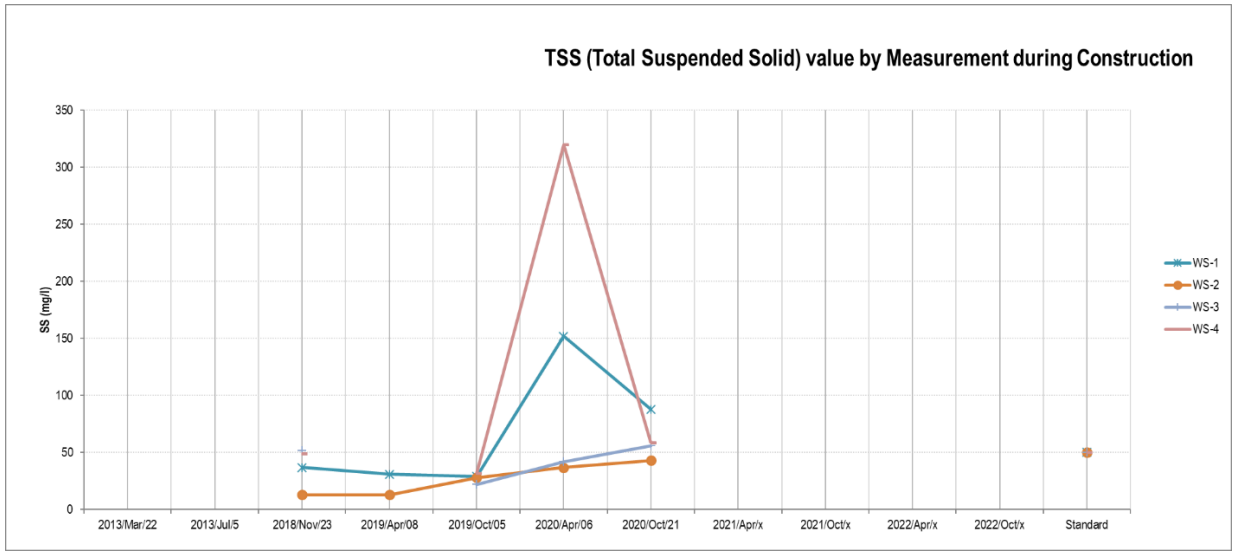
6.2. Seasonal Monitoring of Noise and Vibration

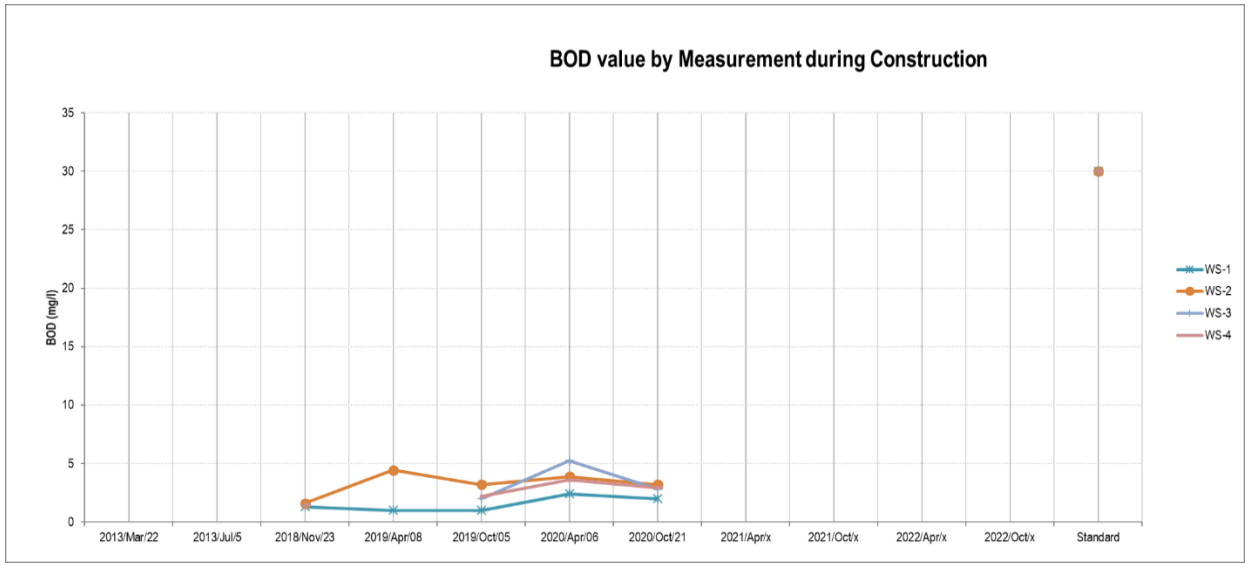




6.3. Seasonal Monitoring of Water Quality






BOD value by Measurement during Construction
BOD (mg/l)
35
30
25
20
15
10
5
0
2013/Mar/22
2013/Jul/5
2018/Nov/23
2019/Apr/08
2019/Oct/05
2020/Apr/06
2020/Oct/21
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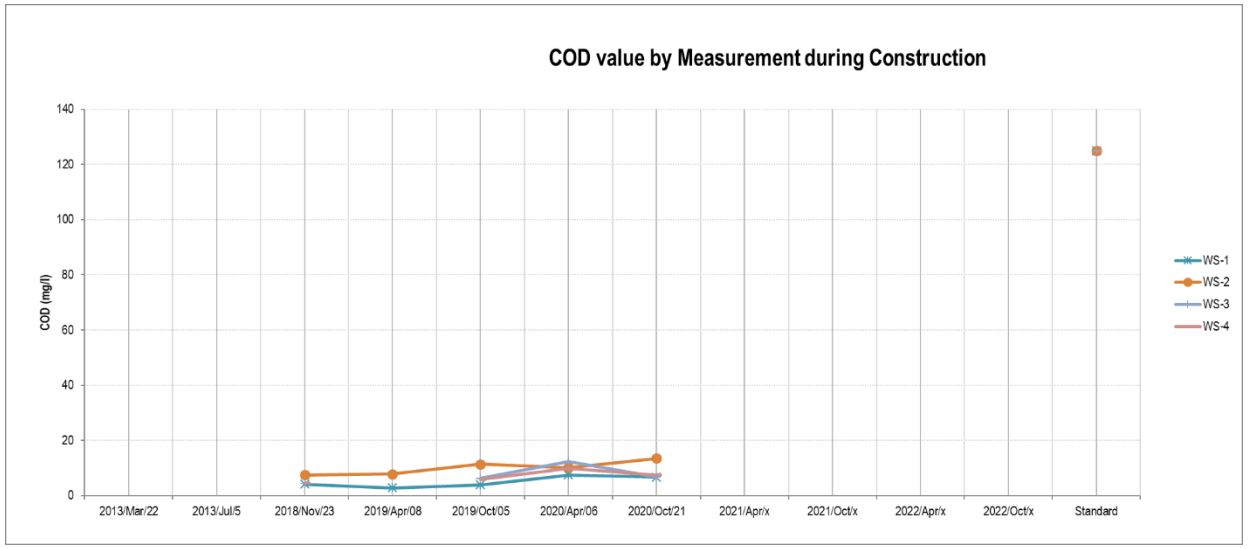
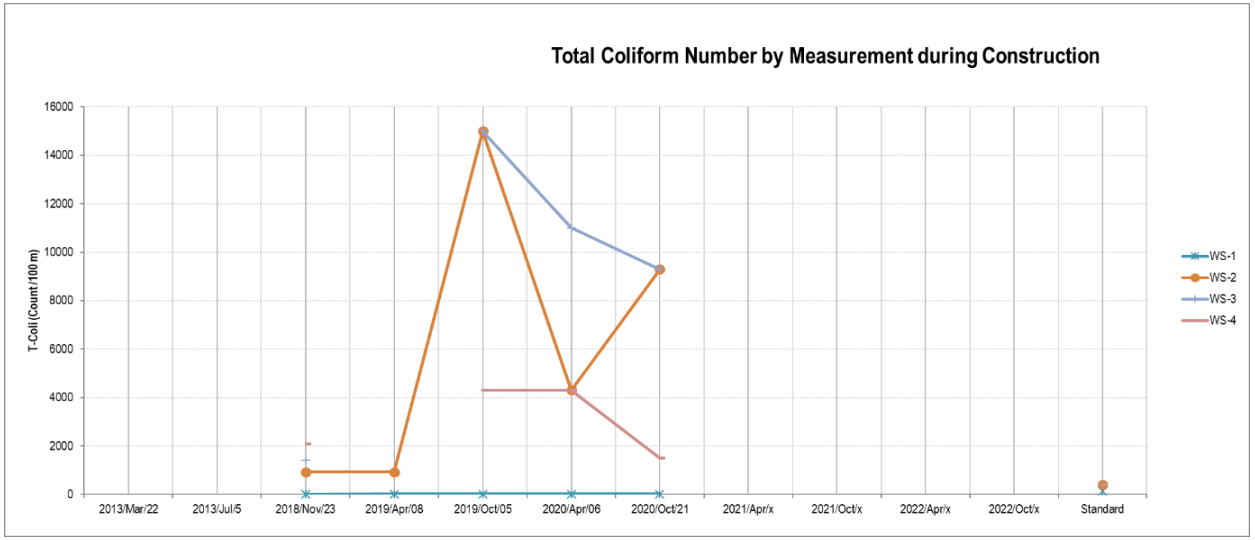
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
WS-1
WS-2
WS-3
WS-4


COD value by Measurement during Construction
COD (mg/l)
140
120
100
80
60
40
20
0
2013/Mar/22
2013/Jul/5
2018/Nov/23
2019/Apr/08
2019/Oct/05
2020/Apr/06
2020/Oct/21
2021/Apr/x
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
WS-1
WS-2
WS-3
WS-4


Total Coliform Number by Measurement during Construction
T-Coli (Count/100 ml)
16000
14000
12000
10000
8000
6000
4000
2000
0
2013/Mar/22
2013/Jul/5
2018/Nov/23
2019/Apr/08
2019/Oct/05
2020/Apr/06
2020/Oct/21
2021/Apr/x
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
WS-1
WS-2
WS-3
WS-4

Environmental Monitoring Form for Construction Stage
Contract Package 2

Item	Location	Parameter/Means of Monitoring	Result (Average/ Max /Total..)	Standards (Local/Inter Standard)	Frequency	Remarks	Mitigation Measure
Air Quality	Construction site	Visual inspection of mechanical condition and exhaust gas	No major adverse impacts	No standards	Every day before working	At construction campsites	
	Storage facilities for dust generation	Visual observation of dust	No major adverse impacts		Every day	site works	
						Every day, especially in dry season	
	AQS-2 (October 22nd, 2020) KP: 89+250 At RHS in Department of Social Veteran and Youth Rehabilitation of Krong Kompong Chhnang, Kompong Chhnang Province. AQS-3 (October 22nd, 2020) KP: 97+300 At LHS, rice field area more than 100m from ROW, in Trapaeng Por Village, Pong Ru commune, Rolea B'ear district, Komponng Chhnang province.	**PM10**	**AQS-2=0.053** AQS-3=0.048	0.05 mg/m^3 (WHO, average 24h)	2 times in dry season 2 times in wet season	Monitoring on air quality at two sites along the National Road 5 (NR5) found that the ambient air quality within the monitoring sites was better than the previous monitoring schedule in April 2020, dry season, even the amount of PM10 at AQS2, Kampong Chhnang Town, was slightly over the standard. This could be owing to the frequent raining in this rainy season, especially the sampling time. Anyway, from these results we could conclude that the presence of the construction activities for the improvement of the NR5 might contribute very little the air quality pollution in the area. This were also because of SMCC has always implemented the dust control measure such as water spraying, application of Calcium Chloride on detour road.	Contractor will continue and enhance the fugitive dust emission control along its construction sites. Contractor will spray water on the access road to construction site and apply the Calcium chloride on the detour road. The contractor will prepare and strictly implement plan around construction sites. The drivers of construction vehicles will comply with speed limits to minimize road dust.
		PM2.5	AQS-2= 0.021 AQS-3=0.02	0.025 mg/m^3 (WHO, average 24h)			
		SO_2	AQS-2=0.027 AQS-3=0.024	0.30 mg/m^3 (WHO average 24h)			
		NO_2	AQS-2= 0.025 AQS-3= 0.032	0.10 mg/m^3 (WHO average 24h)			

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Item	Location	Parameter/Means of Monitoring	Result (Average/ Max /Total..)	Standards (Local/Inter Standard)	Frequency	Remarks	Mitigation Measure
Water Quality	WS-5 (08th of October 2020) KP:82+500 at RHS, Chrey Bak river downstream, near Phnom Chompus Pagoda Andoung Svay commune, Rolea Bíer district, Kompong chhnang province. WS-6 (08th of October 2020) KP: 91+700 at LHS of bypass, Srah Por lake, Thmar Keo village, Svay Chrum commune, Rolea B'ier district, Kompong Chhnang province. WS-7 (08th of October 2020) KP: 106+350 at RHS, downstream Srah Angkam lake, Thmar Keo village, Svay Chrum commune, Rolea B'ier district, Kompong chhnang province. WS-8 (08th of October 2020) KP: 117+118 at RHS, downstream Boribo river, Phsar village, Phsar commune, Boribo district, Kompong Chhnang province.	Visual observation/inspection	No major adverse impacts	No standards	Every day	Contractor and inspector	
		pH	WS-5=6.8 WS-6=6.80 **WS-7=5.5** WS-8=6.72	6.5-8.5 (MoE)	1 time in dry season 1 time in wet season	The lower value of WS7 was also found in previous monitoring, but this time it is much lower. The possible reason might be owing to the natural state of this water body, and too much consumption of the water in this lake in the dry season which caused the concentration of acidic substances dissolve in the water increase. The higher amount of COD at three of the four sampling sites could be owing to running off the pesticide of fertilizer applied on paddy fields in the catchment area of these water bodies. The very high amount of total coliform in Boribo river found at SW-08 was astonishing because when we checked the previous monitoring this last data was almost 50 times to the data in April 2020 or 40 times to the data in October 2019. It might be owing to the contaminants from the upstream of this river.	Contractor will try to reduce any possible impacts from the construction sites such as improve the management of solid waste, oil waste, application of slope protection to reduce run off of the dirt with the rain water, etc.
		TSS	WS-5=57 WS-6=7 WS-7=37 WS-8=39	25-100 mg/l (MoE)			
		BOD	WS-5=2.2 WS-6=1.60 WS-7=2.8 WS-8=2.5	1-10 mg/l (MoE)			
		COD	**WS-5=5.48** **WS-6=5.48** **WS-7=5.96** WS-8=4.79	1-8 mg/l (MoE)			
		Total Coliform	WS-5=4,300 WS-6=4,300 WS-7=1,500 **WS-8=110,000**	<5,000 (Japanese Standard)			

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Item	Location	Parameter/Means of Monitoring	Result (Average/ Max /Total..)	Standards (Local/Inter Standard)	Frequency	Remarks	Mitigation Measure
Noise	ANV-2 (22nd of October, 2020) PK 89+250 at RHS in Department of Social Veteran and Youth Rehabilitation of Krong Kampong Chhnang, Kampong Chhnang province ANV-3 (22nd of October, 2020) PK 97+300 at LHS, residential area in Trapeang Por village, Pong Ro commune, Rolea B'ier district, Kampong Chhnang province	Noise Level (MoE Laboratory)	ANV-2 - 58dB (06:00-18:00) **- 66dB (18:00-22:00)** **- 59dB (22:00-06:00**) ANV-3 **- 69dB (06:00-18:00)** **- 60dB (18:00-22:00)** **- 57dB (22:00-06:00)**	- 60 dB (06:00-18:00) - 50dB (18;00-22:00) - 45dB (22:00-06:00) (MoE, residential area)	1 time in dry season 1 time in wet season	The results of noise measurement at two sites along the NR5 revealed that noise level was slightly over the allowable standard for the residential area stipulated in the Sub-Decree on Air Pollution Control and Noise Disturbance (2000) of the Government of Cambodia. These should be owing to traffic activities on the NR5 which is becoming important road connecting between the crowded cities of Poipet & Battambang to Phnom Penh capital city of Cambodia.	Continue to do the NR5 maintenance and put on the traffic sign on the NR5 to lower the driving speed to reduce the noise during at night. Contractor select quiet equipment and working method as much as possible.
Vibration		Vibration Level (MoE Laboratory)	ANV-2 - 27Hz (07:00-20:00) - 27Hz (20:00-07:00) ANV-3 - 27Hz (07:00-20:00) - 21Hz (20:00-07:00)	- 65Hz (07:00-20:00) - 60Hz (20:00-07:00)		The vibration level measured at AQS2 and AQS3 monitoring sites along NR5 were generally within the standard of the Japanese government for the construction activities. This means that daily traffic activity and construction activities of the project might not have resulted in any concern over the vibration. Below **Error! Reference source not found.** showed the results of vibration	

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Item	Location	Parameter/Means of Monitoring		Result (Average/ Max /Total..)	Standards (Local/Inter Standard)	Frequency	Remarks	Mitigation Measure
							measures at AQS2 and AQS3.	
Waste Generation	Waste storage at construction site and campsites	Slurry and other constructio n waste	Discharged amount	The attached result table will be shown	No standards	Every day	Septic tank	
			Recycled amount					
			The way of recycle					
			Treated amount					
			Local of final disposal					
		General waste	Discharged amount	The attached result table will be shown				
			Recycled amount					
			The way of recycle					
			Treated amount					
			Local of final disposal				Land-fill of provincial authority	
Subsidence	Subsidence prone locations along the project road	Visual inspection and interview to the local people		No impact at construction site	No standards	1 time/week to 1 time/month (depending on situation)	Minor affects to prone locations along the project road.	
Hydrology	River, stream, and reservoir where construction works are executed	Visual inspection on volume and speed of water flow		No impacts at construction site		Every day	In The main rivers and canals are crossing NR-5, sometime, was raining.	

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Ecosystem	EC-02, EC-03, EC-04, EC-05 and EC-06 (23rd of October, 2020)	Visual observation of animals, reptiles, and amphibious	Mammal = 7 Amphibian =5 Reptile = 19 Birds = 39 Fishes = 69 Insect = 7 Flora = 41	No standards	One time in dry season and one time in rainy season	Visual survey shall be done near permanent river Most of the mammal, amphibian, reptile and bird are generally present in the area both rainy season and dry season. The survey found that 2 species of	Contractor shall use methods to mitigate the impacts of Ecosystem and educate the Engineers and workers not to catch wild flura and fauna species around
Item	**Location**	**Parameter/Means of Monitoring**	**Result (Average/ Max /Total..)**	**Standards (Local/Inter Standard)**	**Frequency**	**Remarks**	**Mitigation Measure**
						reptile namely Pous Vek Dom Bok (Naja Siamensis), and An Deurk (Malayemys subtrijuga) are classified as Vulnerable Species in IUCN Red List, and other 61 Species are not yet listed in the IUCN Red List.	construction sites.

Remarks: Past trend and current statute including remedial measures, if necessary.
Note:
WHO: World Health Organization, **SO_2:** Sulfur Dioxide, **COD:** Chemical Oxygen Demand
MoE: Ministry of Environment, **PM:** Particulate Matters, **TSS:** Total Suspended Solid
NO_2: Nitrogen Dioxide**,** **BOD:** Biochemical Oxygen Demand

1. Schedule of Seasonal Monitoring

The seasonal periodical monitoring for air quality was done on 22nd of October 2020, noise and vibration were done on 22nd of October 2020, water quality was conducted on 08th of October 2020 and ecosystem survey was implemented on 23rd of October, 2020.

Table 1.1 Schedule of Seasonal Monitoring

Year	2018	2019				2020				2021				2022			
	29th Nov	Jan	Apr	Jul	Oct	Feb	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct
Item	Rainy	Dry	Dry	Rainy	Rainy	Dry	Dry	Rainy	Rainy	Dry	Dry	Rainy	Rainy	Dry	Dry	Rainy	Rainy
1. Air Quality	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2. Water Quality	●		●		●		●		●		●		●		●		●
3. Noise	●		●		●		●		●		●		●		●		●
4. Vibration	●		●		●		●		●		●		●		●		●
8. Ecosystem		●	●		●		●		●		●		●		●		●

2. Seasonal Monitoring Points and Areas

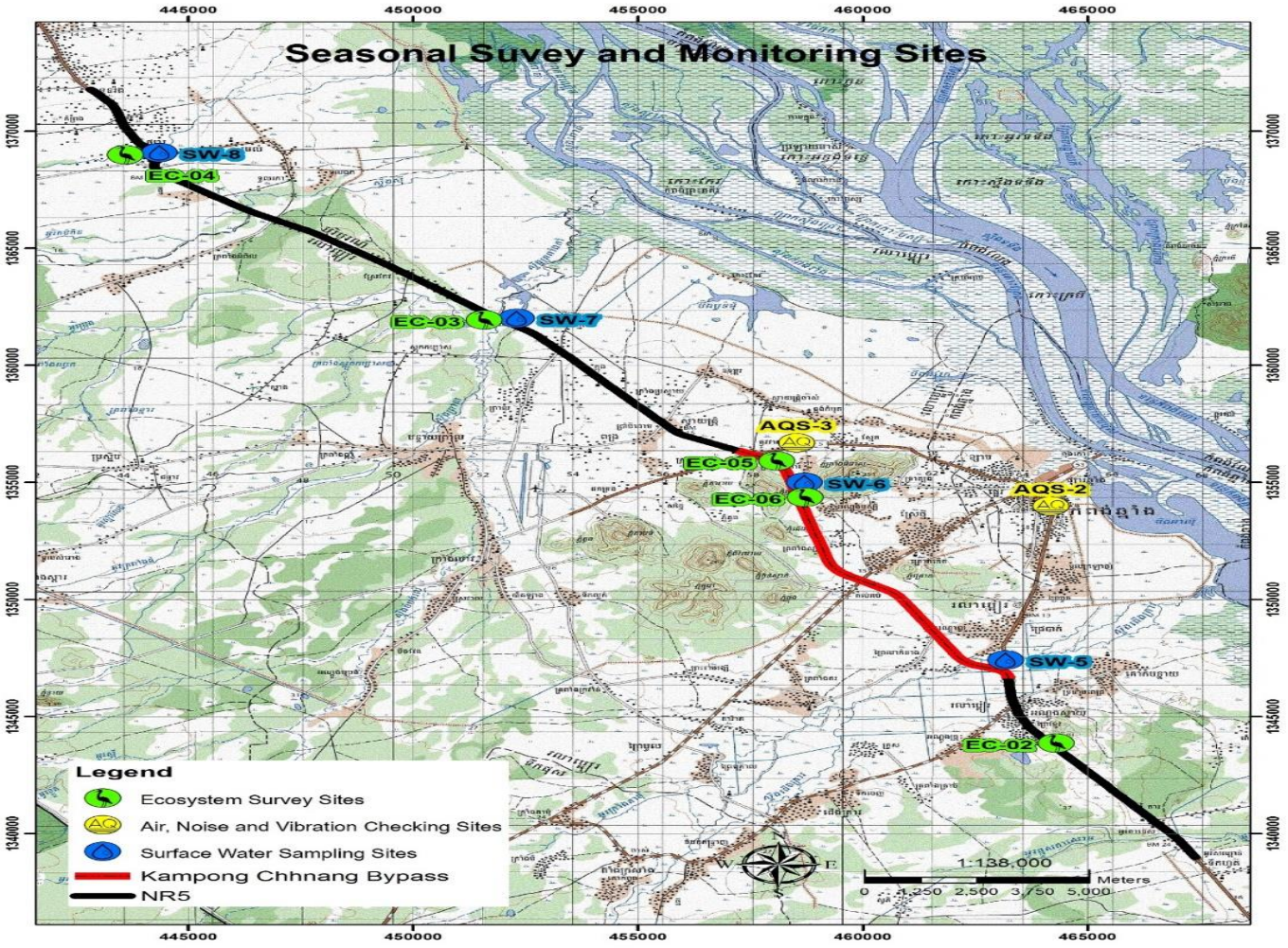


Figure 2.1: Designed Monitoring Points for Package 2 Section (Sta 73+000 - Sta 120+000)

3. The Solid Waste Generation in December, 2020

Location	General Waste				Construction Waste			
	GA (Kg/m)	RA (Kg/m)	MR	DS	GA (Kg/m)	RA (Kg/m)	MR	DS
CP2 Office	310	15	Sold to scavenger	Dumpsite	-	-	-	-
SMCC Accommodation	150	25	Sold to scavenger	Dumpsite	-	-	-	-
MOTORPOOL	450	50	Sold to scavenger	Dumpsite	120 (Scrap)	120	Sold to scavenger	-
LOT1	120	10	Sold to scavenger	Dumpsite	-	-	-	-
LOT2	110	10	Sold to scavenger	Dumpsite	-	-	-	-
SMCC Fabrication Yard A	700	30	Sold to scavenger	Dumpsite	250 (Scrap)	250	Stored in the yard	
SMCC Fabrication Yard B	300	10	Sold to scavenger	Dumpsite	100 (Scrap)	100	Stored in the yard	-
SMCC Fabrication Yard C	150	10	Sold to scavenger	Dumpsite	50 (Scrap)	50	Stored in the yard	-
SMCC Fabrication Yard D	250	20	Sold to scavenger	Dumpsite	100 (Scrap)	100	Stored in the yard	-
All RCBC and RCPC	300	35	Sold to scavenger	Dumpsite	-	-	-	-
TOTAL	**2,840**	**215**			**620**	**620**		

Note: GA = Generated amount ; RA = Recycling amount ; MR = Mean of Recycling, DS = Disposal Site ;
Kg/m = Kilogram per month ; Dumpsite is at Traok Keut village, Sre Thmey commune, Rolea B'ier district, Kampong Chhnang province.

4. Fauna and Flora Survey

Name of Recorded Fauna

No.	Local Name	English Name	*Scientific Name*	IUCN Red List Classification
I- Mammals				
1	Kandol Breng	Rat		N/A
2	Bror Chiev	Bats	*(Order: Chiroptera)*	N/A
3	Tong Haen	Berdmore's Squirrel	*Menetes Berdmorel*	N/A
4	Kambrok Por	Variable Squirrel	*Callosciurus Erythraeus*	LC
5	Sam Pouch Vor	Small Indian Civet	*Viverricula Indica*	LC
6	Skar Touch	Small Asian Mongoose	*Herpestes Javanicus*	LC
7	Tunsay Kul	Burmese Hare	*Lepus Pequensis*	N/A
II- Amphibian				
1	Kingkuok	Common Asian Toad	*Bufo Melanosttrictus*	N/A
2	Hing	Common Asian Bullfrog	*Kaloula Pulchra*	LC
3	Kangkeb	Paddy Frog	*Fejevarya Limnocharis*	LC
4	Kangkebkob	Regulose Bullfrog	*Hoblobatrachus Rugulosus*	N/A
5	Kanhchanhchek	Common Tree Frog	*Polypedates Leucomystax*	N/A
III- Reptile				
1	Tokae	Tockay	*Gekko Gecko*	N/A
2	Thlaen Srakala'et	Small-Scaled Water Skink	*Tropidrophorus Microlepis*	N/A
3	Bangkuoy Trachiek Touch	Scale-Bellied Tree Lizard	*Acanthosanra Lepidogaster*	N/A
4	Pous Breng Touch	Common Blind Snake	*Ramphoryphlops Braminus*	N/A
5	Pous Prey	Indochinese Ratsnake	*Pyftas Korros*	N/A
6	Pous Khse Kor	Striped Keelback	*Amphiesma Stolota*	N/A
7	Pous San Soeur	Keeled Rat Snake	*Ptyas Caranita*	N/A
8	Pous Sam Leab Kong Keb	Chequered Keelback	*Xenochrophis Piscutor*	N/A
9	Pous Vek Dom Bouk	Indochinese Spitting Cobra	*Naja Siamensis*	VU
10	Pous Khiev	Pope's Pit-Viper	*Trimeresurus Popeiorum*	LC
11	Bang Kuoy	Lizard		N/A
12	Pous Thlan Touch	Burmese Python	*Pyfthon Molurus Bivittaftus*	N/A
13	Pous Srkachas	Russull's Viper	*Dabota Russelli*	N/A
14	Kantrorng	Water Dragon	*Physignathus Cocincinus*	N/A
15	Kam Broma	East Asian Porcupine	*Hystrix Brachyura*	LC
16	Pous Vek Krobei	Monocled Cobra	*Naja Kaouthia*	LC
17	Pous Thlan Thom	Reticulated Python	*Python Reticulatus*	LC
18	Kan Theay	Asian Soft Shell Turtle	*Amyda Cartilaginea*	VU
19	An Deurk	Mekong Snail-eating Turtle	*Malayemys subtrijuga*	VU
IV- Birds				
1	Popich Bampongkorsor	Puff-Throated Bulbul	*Alophoixus Pallidus*	LC

2	Chab Angkrong	Scaly-Breasted Munia	*Lonchura Punctulata*	LC
3	Chabchankrong	White-Rumped Munia	*Lochura Striata*	N/A
4	Chabdangkovpor	Rufescent Prinia	*Prinia Rufescens*	LC
5	Chabdangkov	Plain Prinia	*Prinia Inormata*	N/A
6	Chabdounta	Oriental Reed Wabler	*Acrocephalus Orientalis*	N/A
7	Chabpreyveng	Yellow-Breasted Bunting	*Emberiza Aureola*	CR
8	Chabtet	Common Tailorbird	*Orthotomus Sutorius*	LC
9	Popustoek	Little Grebe	*Tachybaptus Ruficollis*	LC
10	Populchampusthum	Thick-Billed Green Pigeon	*Treron Curvirostra*	LC
11	Populchoeung	Yellow-Footed Green Pigeon	*Treron Phoenicoptera*	N/A
12	Chabtet Prey	Dark-Necked Tailorbird	*Orthotomus Atrogularis*	LC
13	Chabkanlang	Purple-Throated Sunbird	*Nectarinia Sperata*	LC
14	Chabpteas	Eurasian Tree Sparrow	*Passer Montanus*	LC
15	Chabkroch	Yellow-Vented Bulbul	*Pycnonotus Goiavier*	LC
16	Chabsrok	Plain-Backed Sparrow	*Passer Flaveolus*	LC
17	Ka Ek	Large-Billed Crow	*Corvus Macrohynchos*	N/A
18	Meam Touch Prey	Asian Barred Owlet	*Glaucidium Cucloides*	N/A
19	Sek Sourm	Alexandrine Parakeet	*Psittacula Eupatria*	LC
20	Sek Sork	Red-Breasted Parakeet	*Loriculus Vemalis*	N/A
21	Kleng Srark	Bam Owl	*Tyto Alba*	LC
22	Ngeav Kork	Stork-Billed Kingfisher	*Halcyon Capensis*	N/A
23	Antep Toing	Greater Racket-Tailed Drongo	*Dicrurus Paradiseus*	LC
24	Kok Kroung Thom	Great Egretta	*Egretta Alble*	N/A
25	Kok Krourng	Intermediate Egret	*Egretta Intermedia*	N/A
26	Kok Kmao Thleurm Andeurk	Black Bittem	*Bupetor Flavicollis*	N/A
27	Lolork Bay	Spotted Dove	*Streptopelia Chinensis*	N/A
28	Preab Srok	Rock Pigeon	*Columba Livia*	LC
29	Pror Voek	Lesser Whistling Duck	*Dedrocygna Javanica*	N/A
30	Kruoch En	Rufous-Winged Bushlark	*Mirafra Assamica*	LC
31	Kruoch Eut	Barred Buttonquail	*Tumix Suscitator*	N/A
32	Tror Cheak Kam	Barn Swallow	*Hirundo Rustica*	LC
33	Tror Dev Kor Vech Toch	Red-Wattled Lapwing	*Vanellus Indicus*	LC
34	Tror Ses Knorng Plerng Toch	Common Flamedback	*Dinopium Javanense*	LC
35	Sarika Keokor	Common Myna	*Acridotheres Tristis*	LC
36	Sarika Keo Krobey	White-Vented Myna	*Acridotheres Javanicus*	N/A
37	Tavao	Common Koel	*Eudynamys Scolopacea*	N/A
38	Teav Kiev	Indian Roller	*Coracias Benghalensis*	LC
39	Chab Porpich Sre	Paddyfield Pipit	*Anthus Rufulus*	LC
V- Fishes				
1	Trey Changva Chunh Cheak	Reticulate Flying Fox	*Cyclocheilichthys Reticulatus*	N/A
2	Trey Riel Angkam		*Henicorhynchus Lobatus*	N/A
3	Trey Andaeng Roeng	Walking Catfish	*Clariasbatrachus*	LC

4	Trey Andaengtun	Black Skin Catfish	*Clariasmeladerma*	N/A
5	Trey Ankot Brak		*Puntius Rhombeus*	N/A
6	Trey Changva Chnout	Pavie's Rasbora	*Rasbora Paviei*	LC
7	Trey Changwa Moul	Southeast Asian Yellowtail Rasbora	*Rasbora Tornieti*	DD
8	Trey Chhlonh	Peacock	*Macrognathus Siamensis*	LC
9	Trey Kamphleanh Sre	Three Spot Gourami	*Trichogaster Trichopterus*	LC
10	Trey Kranh	Climbing Perch	*Anabas Testudineus*	LC
11	Trey Deap/Trey Chdau	Giant Snakehead	*Chnna Mucropeltes*	DD
12	Trey Ptoung	Freshwater Garfish	*Xenentodon Cancila*	N/A
13	Trey Riel Top	Siamese Mud Carp	*Henicorhnchus Siamensis*	LC
14	Trey Bra Kae		*Pangasiusconchophilus*	LC
15	Trey Bra Kchao		*Pangasiusbocourti*	LC
16	Trey Bra Thom	Sutchi Catfish	*Pangasianodonhypophthalmus*	N/A
17	Trey Sroka Kdam	Highfin Barb	*Cyclocheilichthys Armatus*	LC
18	Trey Sroka Kdam	White Eye Barb	*Cyclocheilichthys Repasson*	LC
19	Trey Chhveat		*Pangasiuselongatus*	N/A
20	Trey Chhveat Doung		*Pteropangasiusmicronemus*	N/A
21	Treypor	Spot Pangaasius	*Pangasiuslarnaudii*	LC
22	Trey Ach Kok	Dangila Siamensis Sauvage	*Labiobarbus Siamensis*	LC
23	Trey Ampiltum	Swamp Barb	*Puntius Brevis*	LC
24	Trey Andat Chke	Whitelip Sole	*Achiroides Leucorhynchos*	N/A
25	Trey Andat Chke Veng	Speckled Tonguesole	*Cynoglossus Puncticeps*	N/A
26	Trey Bandol Ampov	Borneo River Sprat	*Clupeoides Borneensis*	LC
27	Trey Chhpin	Goldfin Tinfoil Barb	*Hypsibarbus Malcolmi*	LC
28	Trey Chhpin Prak	Java/Silver Barb	*Barbonymus Goniomotus*	N/A
29	Trey Chra Keng	Sickle Fin Barb	*Puntioplites Falcifer*	LC
30	Trey Domrey	Marble Goby	*Oxyeleotris Marmorata*	LC
31	Trey Ka Ok	Spotted Catfish	*Ariusmaculatus*	N/A
32	Trey Ka-Ek	Black Sharkminnow	*Labeo Chrysophekadion*	LC
33	Trey Kaes		*Micronemacheveyi*	N/A
34	Trey Kahe	Goldfoil/Tinfoil Barb	*Barbonymus Schwanenfeldii*	LC
35	Trey Kahe Krohom	Red Tailed Tinfoil	*Barbonymus Altus*	LC
36	Trey Kahjoskrobey		*Glyptothoraxfuscus*	N/A
37	Trey Kambot Chramos		*Amblyrhynchichthys Truncatus*	N/A
38	Trey Kamphleanh Phlouk	Moonlight Gourami	*Trichogaster Microlepis*	N/A

39	Trey Kampleav		*Kryptopterusmoorei*	N/A
40	Trey Kampleavbrak		*Kryptopteruslimpok*	N/A
41	Trey Kampleavsteuong		*Micronemaapogon*	N/A
42	Trey Kampulbai/Trey Chhkaok Kda	Papillocheilus Ayuthiae Smith 1945	*Cosmochilus Harmandi*	LC
43	Trey Kanh Chanh Chras	Iridescent Glassy Perchlet	*Parambassis Apogonoides*	LC
44	Trey Kanhchrouk	Skunk Botia	*Yasuhikotakia Morleti*	LC
45	Trey Kanhchrouk Chhnout	Tiger Botia	*Syncrossus Helodes*	LC
46	Trey Kanhchrouk Loeurng	Yellow Loach	*Yasuhikotakia Modesta*	LC
47	Trey Kanhchrouk Krohorm	Orangefin Loach	*Yasuhikotakia Lecontei*	LC
48	Trey Kanhjos		*Mystusrhegma*	N/A
49	Trey Kanhjoskdorng		*Mystusbocourti*	N/A
50	Trey Kanhjosthmor	Asian Bumblebee Catfish	*Pseudomystussiamensis*	N/A
51	Trey Kanthor	Snakeskin Gourami	*Trichogaster Pectoralis*	N/A
52	Trey Kantrong Breng	Duskyfin Glassy Perchlet	*Parambassis Wolffii*	LC
53	Trey Kantrop	Captopra	*Pristolepis Fasciata*	LC
54	Trey Khchoeung	Frecklefin Eel	*Trey Chonluanh Moan*	N/A
55	Trey Kromorm	Butter Catfish	*Ompokbimaculatus*	N/A
56	Trey Kros	Pla Rong Mai Tub	*Osteochilus Microcephalus*	LC
57	Trey Krum		*Osteochilus Melanopleurus*	N/A
58	Trey Linh		*Thynnichthys Thynnoides*	LC
59	Trey Phtuok/Trey Ros	Snakehead Murrel	*Channa Striata*	LC
60	Trey Proma	Boeseman Croader	*Boesemania*	N/A
61	Trey Sleuk Russey	Culter Riveroi	*Paralaubuca Riveroi*	LC
62	Trey Slat	Bronze Featherback	*Notopterus Notopterus*	LC
63	Trey Sroka Kdam	Beardless Barb	*Cyclocheilichthys Apogon*	LC
64	Trey Ta Oan		*Ompokhypophthalmus*	N/A
65	Trey Chhveat		*Pteropangasiuspleurotaenia*	N/A
66	Trey Chhlaing	Asian Redtail Catfish	*Hemibagrusnemurus*	N/A
67	Trey Kanhjos		*Mystusalbolineatus*	N/A
68	Trey Kanhjos Bay		*Mystussingaringan*	N/A
69	Trey Tronel		*Hemibagrusfilamentus*	N/A
VI. Insects				
1	Kandob	Grasshopper	*Acrididae Short-horned Grasshoppers*	N/A
2	Me Am Bao	Butterfly	*Pieridae Whites, Sulphurs & Yellows*	N/A
3	Kamphen		*Buprestidae Jewel Beetles*	N/A
4	Kantumruy	Dragonfly	*Libellulidae Common Skimmers*	N/A

5	Sra Morch	Ant		N/A
6	Kanlang			N/A
7	Ruy	Flies	*Calliphoridae*	N/A

Note: IUCN Red List

- LC = Least Concern,,NT = Near Threatened, VU = Vulnerable, N/A = Not Available, DD = Data

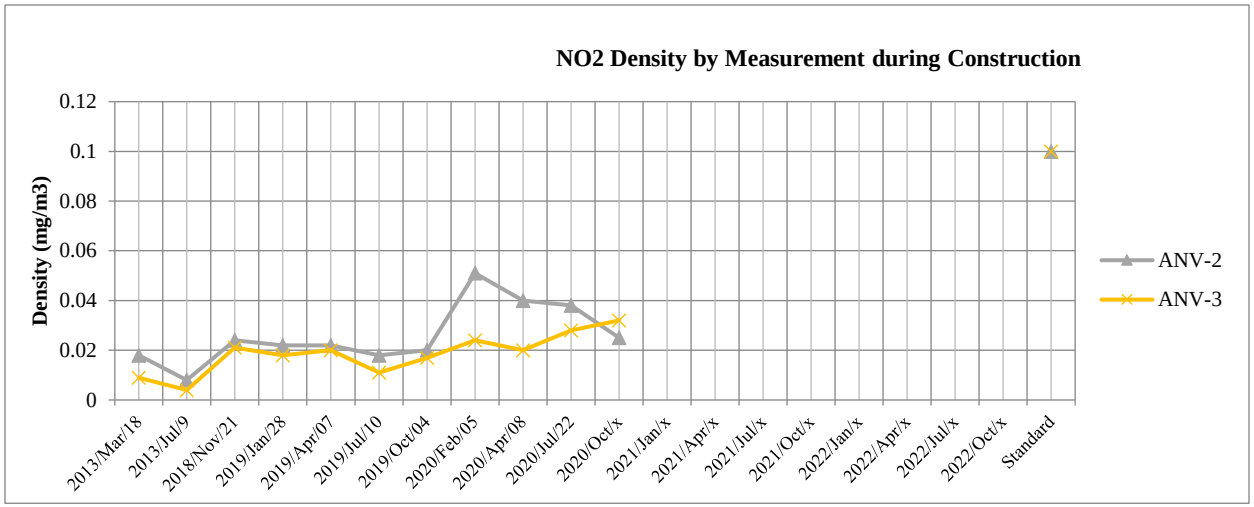
Name of Recorded Flora

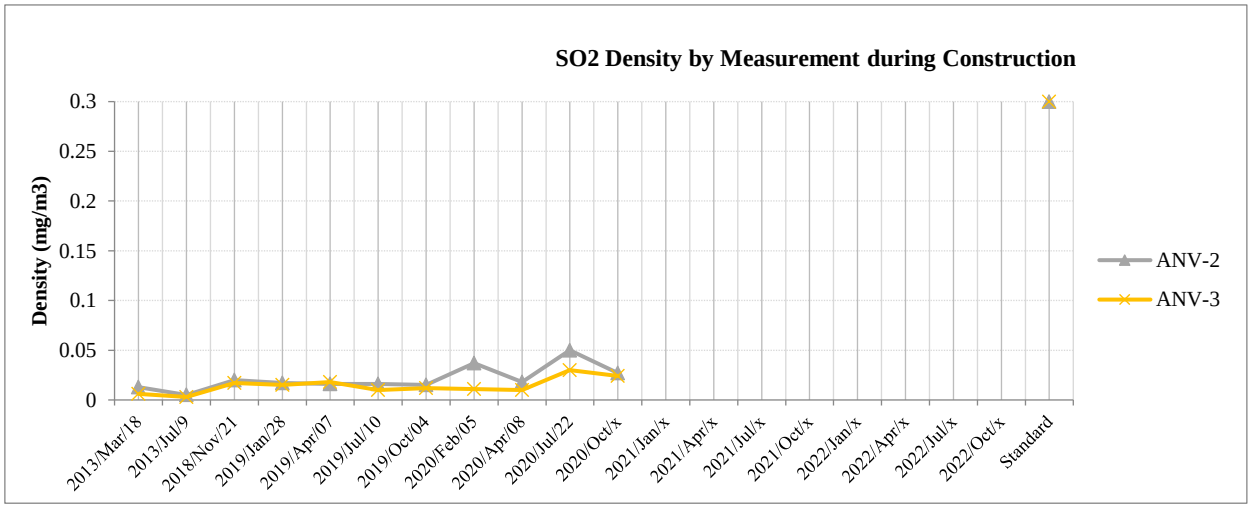
No.	Local Name	Scientific Name	Family	IUCN Red List Status
1	Breng Khyol	*Eucalyptus Camaldulensis Dehnh.*	Myrtaceae	N/A
2	Chrey	*Ficus Sp*	Moraceae	N/A
3	Tnaot	*Borassus Madagascariensis*	Palmae	EN
4	Putrea	*Zizyphus Mauritiana*	Rhamnaceae	LC
5	Ang Kanh	*Cassia Siamensis Lam.*	Leguminosae	N/A
6	Trabaek	*Psidium Guajava*	Myrtaceae	N/A
7	Teuk Dah Ko	*Chrysophyllum Cainito*	Sapotaceae	N/A
8	Trabaek Prey	*Lagerstroemia Floribunda*	Lythraceae	N/A
9	Pring	*Eugenia Spp.*	Myrtaceae	N/A
10	Sangke	*Combritum Quarangulare*	Combritaceae	N/A
11	Acacia Sleuk Touch	*Acacia Auriculiformis Muell.*	Mimosaceae	N/A
12	Por	*Ficus Religiosa L.*	Moraceae	N/A
13	Chan Kiri	*Albizia Saman*	Leguminosae	N/A
14	Svay	*Mangifera Indica*	Anacardiaceae	N/A
15	Sdav	*Azadirachta Indica Ant. Juss.*	Meliaceae	N/A
16	Trosek	*Peltophorum Dasyrrhachis*	Leguminosae	N/A
17	Kor	*Ceiba Pentandra*	Bombacaceae	N/A
18	Svay Chan Ti	*Anacadium Occidentale L.*	Anacardiaceae	N/A
19	Ampil Toek	*Pithecellobium Dulce*	Leguminosae	N/A
20	Sla	*Areca Catechu*	Palmae	N/A
21	Kantuot	*Phyllanthus Acidus*	Euphorbiaceae	N/A
22	Khnol	*Artocarpus Heterophyllus*	Moracea	N/A
23	Tiep	*Annona Squamosa*	Annonaceae	N/A
24	Am Pil	*Tamarindus Indica*	Leguminosae	N/A
25	Doung	*Cocos Nucifera*	Palmae	N/A
26	Maisak	*Tectona Grandis,L.F.*	Verbenaceae	N/A
27	Phka Kradahs	*Bougainvillea Buttiana*	Nyctaginaceae	N/A

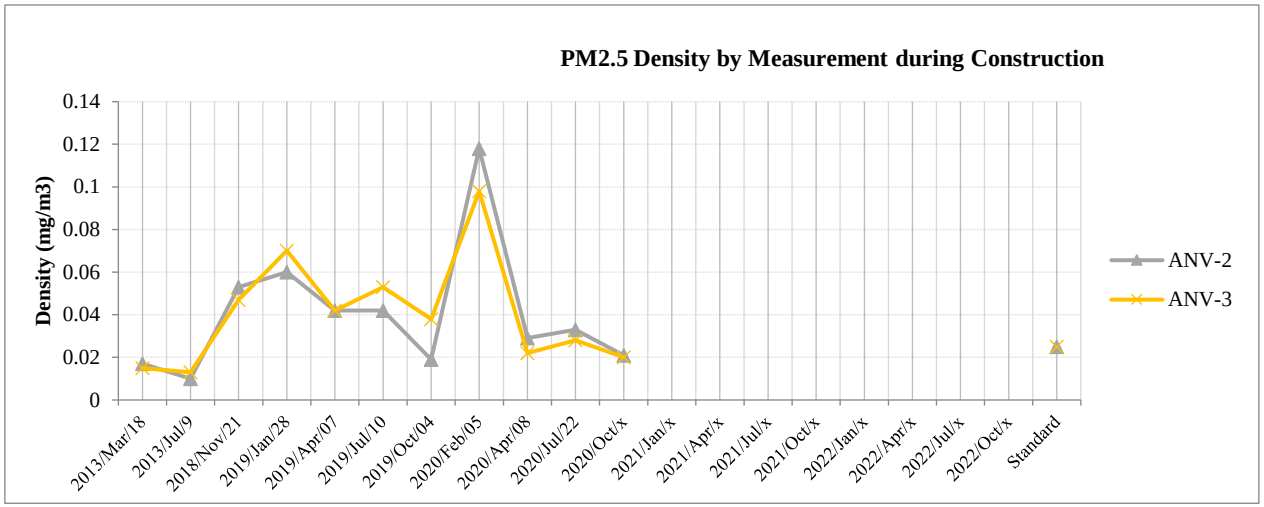
28	Russey Khlei	*Bambusa Bambos*	Poaceae	N/A
29	Russey Srok	*Dendrocalamus Membranaceus*	Gramineae	N/A
30	Russey Ping Pong	*Gigantochloa Albociliata*	Poaceae	N/A
31	Totuem	*Punica Granatum*	Punicaceae	LC
32	Chek	*Musa Spp.*	Musaceae	N/A
33	Kantrieng Khaet	*Chromolaena Odorata*	Compositae	N/A
34	Sbov	*Imperata Cylindrica*	Gramineae	N/A
35	Lhong Khvorng	*Jatropha Curcas*	Euphorbiaceae	N/A
36	Banla Ouyas	-	-	-
37	Kra Saing	-	-	-
38	Pka Sareka Keo	-	-	-
39	Sleuk Kri	-	-	-
40	Trakuon Tech	-	-	-
41	Chhat	-	-	-

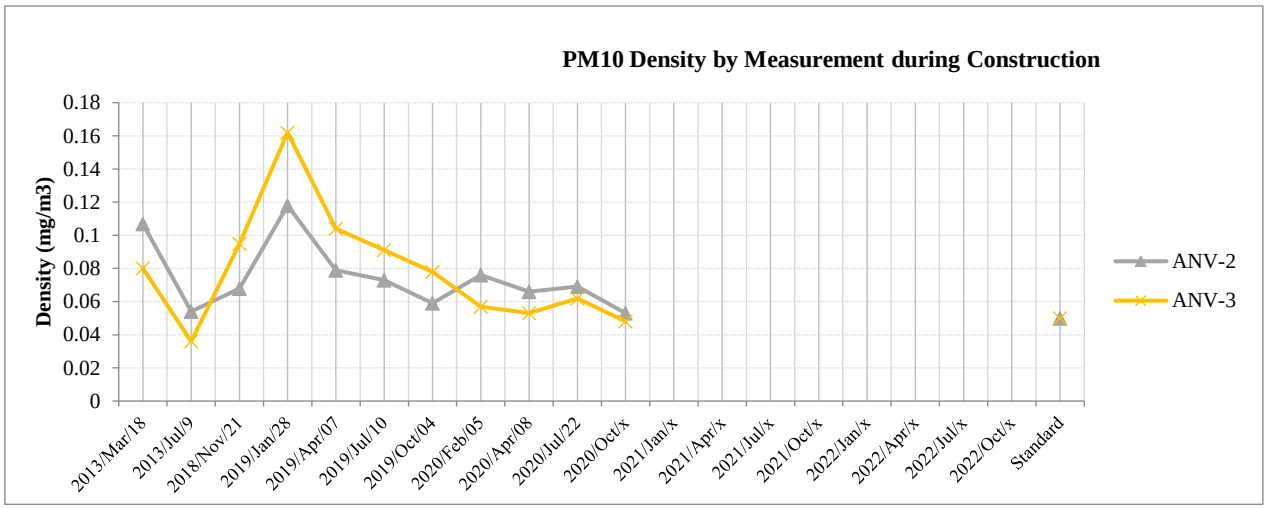
5. Seasonal Monitoring

5.1. Seasonal Monitoring of Air Quality

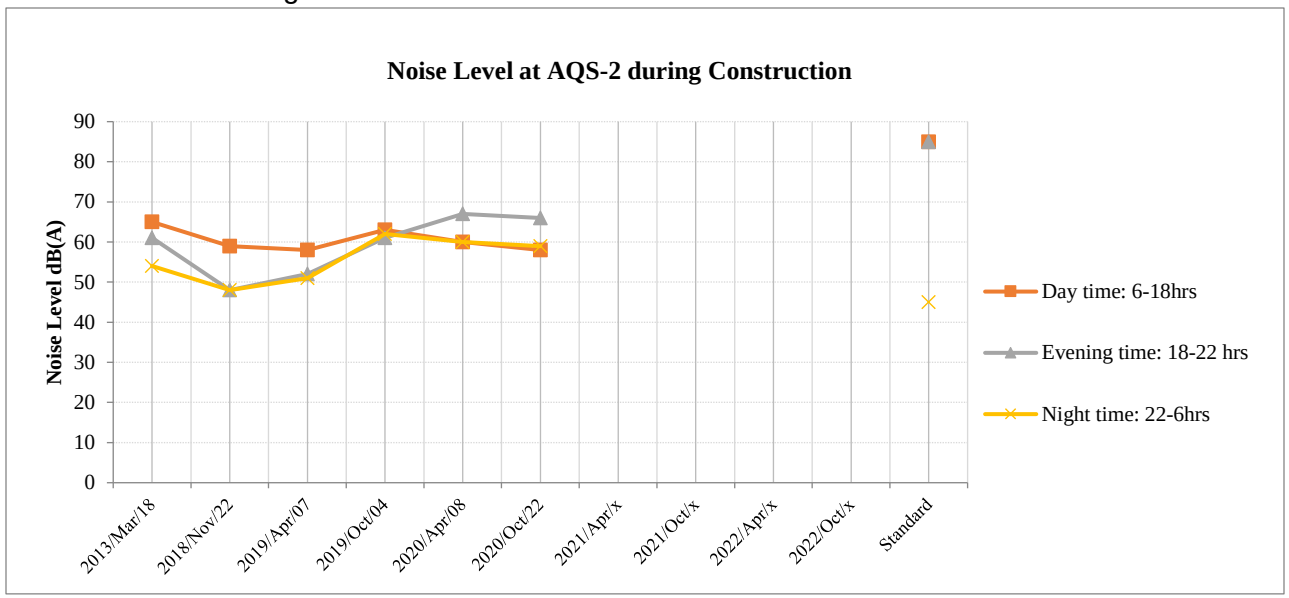


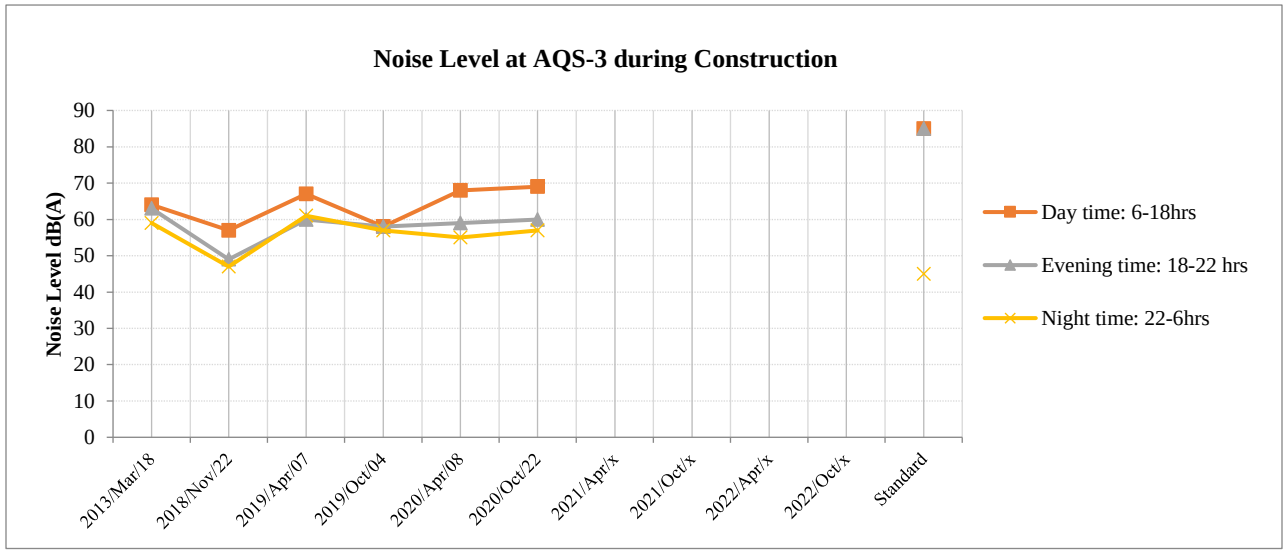


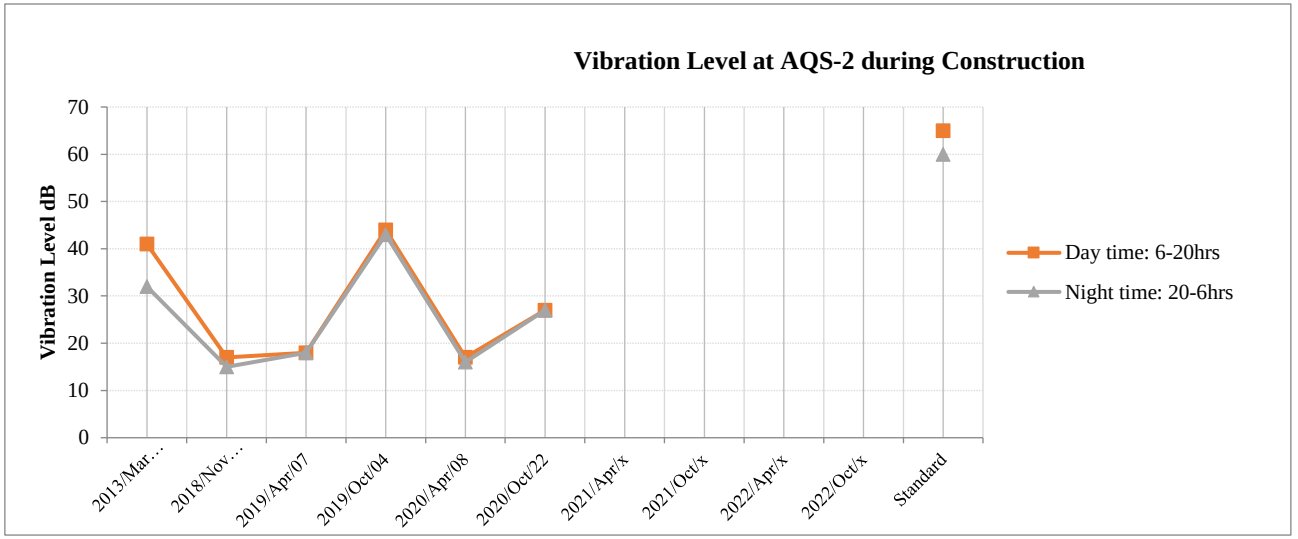

PM2.5 Density by Measurement during Construction
Density (mg/m3)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
2013/Mar/18
2013/Jul/9
2018/Nov/21
2019/Jan/28
2019/Apr/07
2019/Jul/10
2019/Oct/04
2020/Feb/05
2020/Apr/08
2020/Jul/22
2020/Oct/x
2021/Jan/x
2021/Apr/x
2021/Jul/x
2021/Oct/x
2022/Jan/x
2022/Apr/x
2022/Jul/x
2022/Oct/x
Standard
ANV-2
ANV-3

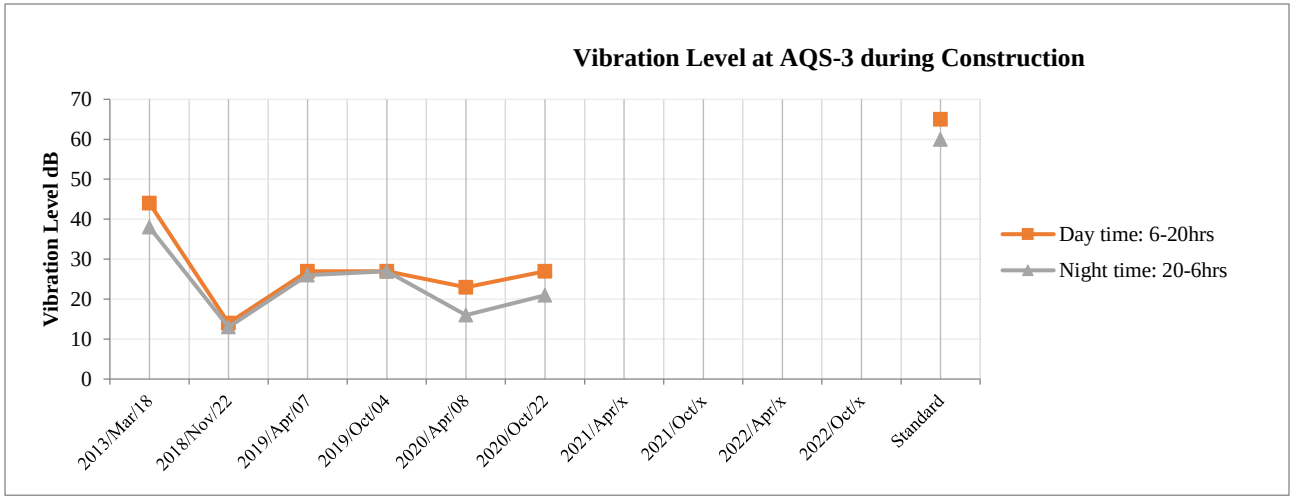

PM10 Density by Measurement during Construction
Density (mg/m3)
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
2013/Mar/18
2013/Jul/9
2018/Nov/21
2019/Jan/28
2019/Apr/07
2019/Jul/10
2019/Oct/04
2020/Feb/05
2020/Apr/08
2020/Jul/22
2020/Oct/x
2021/Jan/x
2021/Apr/x
2021/Jul/x
2021/Oct/x
2022/Jan/x
2022/Apr/x
2022/Jul/x
2022/Oct/x
Standard
ANV-2
ANV-3

5.2. Seasonal Monitoring of Noise and Vibration

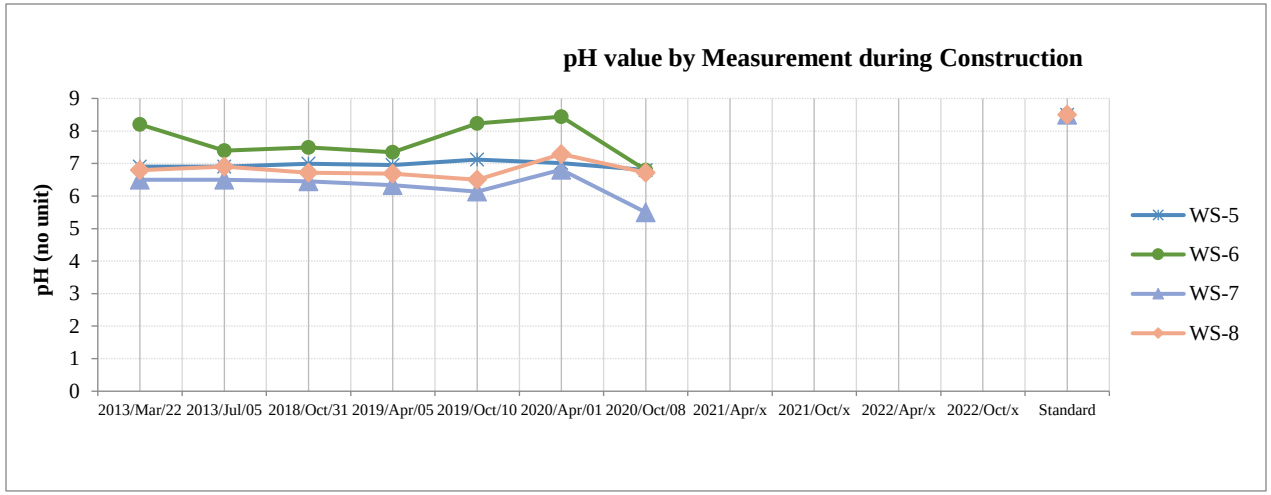


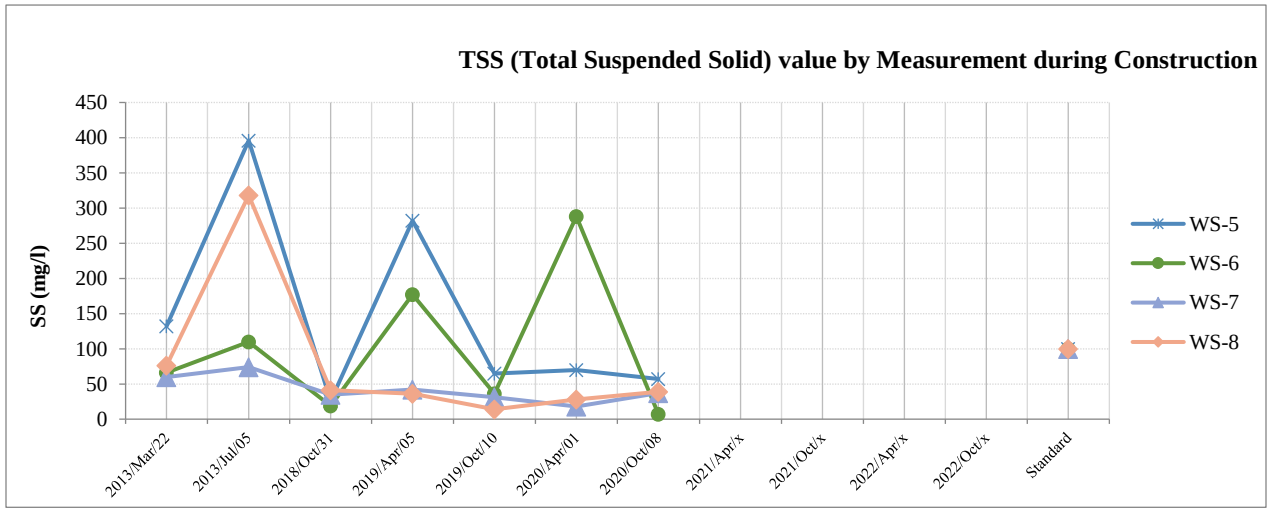


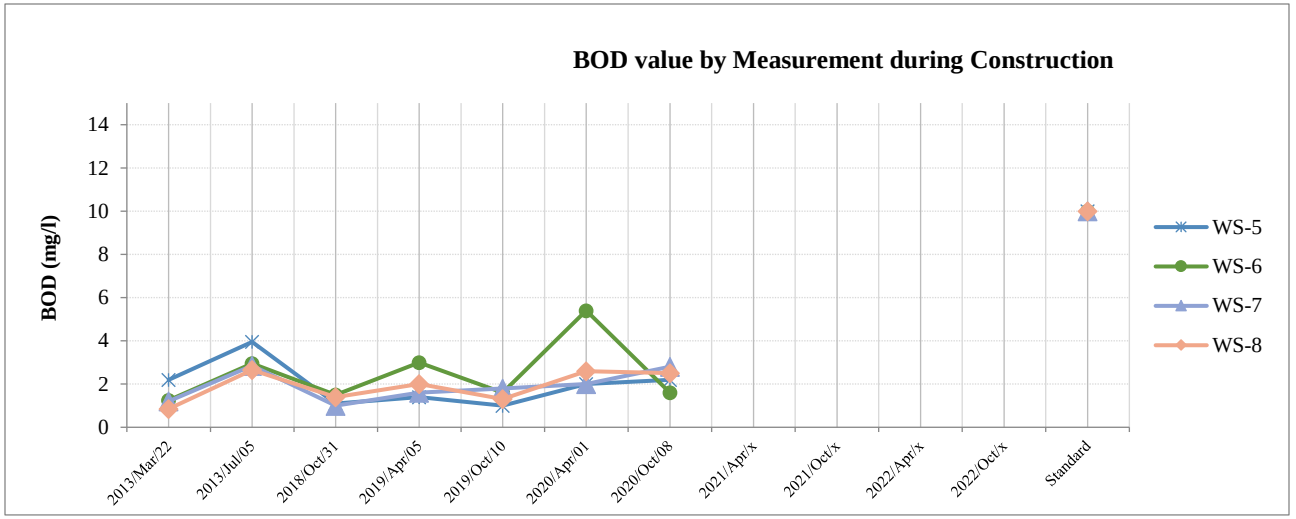

Vibration Level at AQS-2 during Construction
Vibration Level dB
70
60
50
40
30
20
10
0
2013/Mar…
2018/Nov…
2019/Apr/07
2019/Oct/04
2020/Apr/08
2020/Oct/22
2021/Apr/x
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
Day time: 6-20hrs
Night time: 20-6hrs

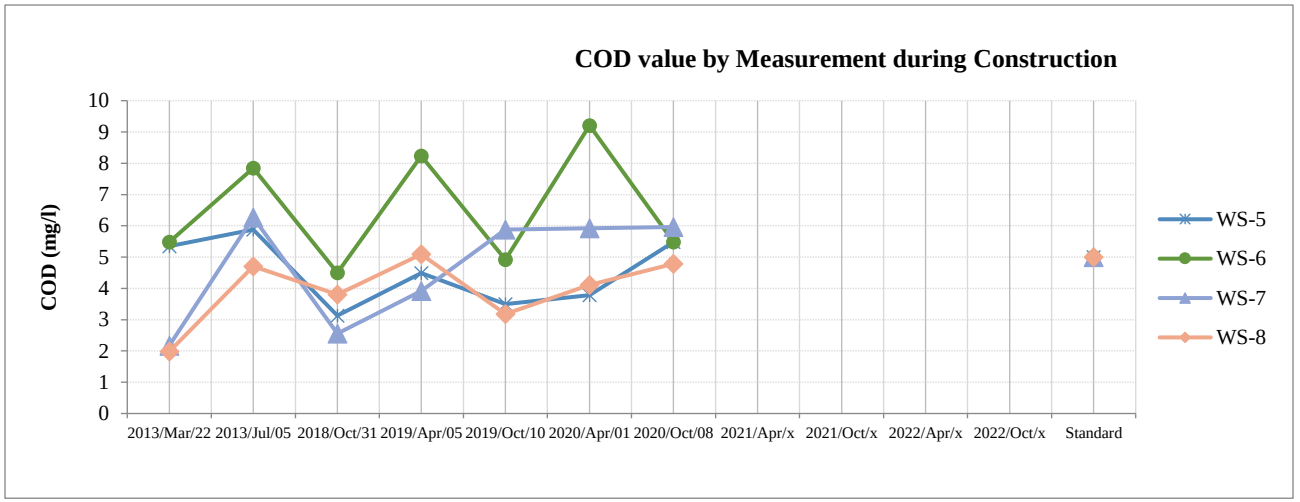

Vibration Level at AQS-3 during Construction
Vibration Level dB
70
60
50
40
30
20
10
0
2013/Mar/18
2018/Nov/22
2019/Apr/07
2019/Oct/04
2020/Apr/08
2020/Oct/22
2021/Apr/x
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
Day time: 6-20hrs
Night time: 20-6hrs

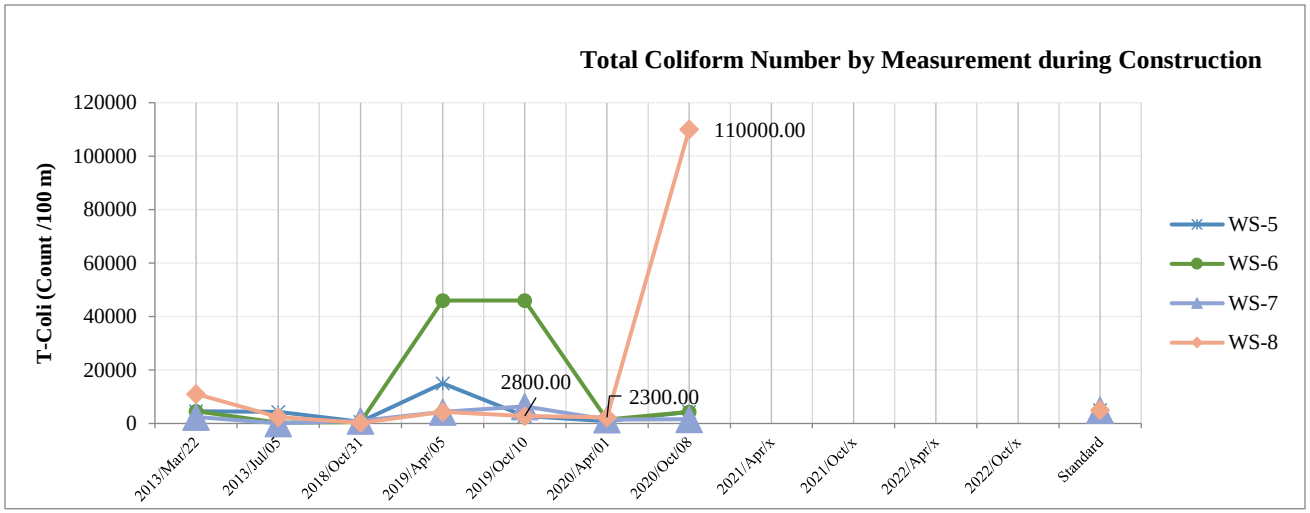
5.3. Seasonal Monitoring of Water Quality






BOD value by Measurement during Construction
BOD (mg/l)
14
12
10
8
6
4
2
0
2013/Mar/22
2013/Jul/05
2018/Oct/31
2019/Apr/05
2019/Oct/10
2020/Apr/01
2020/Oct/08
2021/Apr/x
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
WS-5
WS-6
WS-7
WS-8


COD value by Measurement during Construction
COD (mg/l)
10
9
8
7
6
5
4
3
2
1
0
2013/Mar/22
2013/Jul/05
2018/Oct/31
2019/Apr/05
2019/Oct/10
2020/Apr/01
2020/Oct/08
2021/Apr/x
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
WS-5
WS-6
WS-7
WS-8


Total Coliform Number by Measurement during Construction
T-Coli (Count /100 m)
120000
100000
80000
60000
40000
20000
0
110000.00
2800.00
2300.00
2013/Mar/22
2013/Jul/05
2018/Oct/31
2019/Apr/05
2019/Oct/10
2020/Apr/01
2020/Oct/08
2021/Apr/x
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
WS-5
WS-6
WS-7
WS-8

Environmental Monitoring Form for Construction Stage
Contract Package 3

Item	Location	Parameter/Means of Monitoring	Result (Average/ Max /Total..)	Standards (Local/Inter Standard)	Frequency	Remarks	Mitigation Measure
Air Quality	Construction site	Visual inspection of mechanical condition and exhaust gas	No major adverse impacts	No standards	Every day before working	At construction camp site	
	Construction site	Visual observation of dust			Every day	site works	
	Storage facilities for dust generation		No major adverse impacts			Every day, especially in dry season	
	AQS-4 (13th of November, 2020) PK-135+600 Kbal Damrei village, Ansa Chambork commune, Krakor district, Pursat province AQS-5 (14th of November, 2020) PK-170+340 Kcandol Sar Village, Beung Kantout commune, Krakor district, Pursat province	**PM10**	AQS4 = 0.028mg/m^3 AQS5 = 0.045mg/m^3	0.05 mg/m^3 (WHO, average 24h)	2 times in dry season 2 times in wet season	The results showed that the ambient air quality in sampling site AQS-4 and AQS-5 along the national road no.5 withing package 3 is in acceptable condition. The result is under standard of the Ministry of Environment and guideline value of Environmental, Health, and Safety General Guidelines (IFC). But ambient of air quality PM2.5 at AQS-5 looks slightly above the standard value of MoE and guideline value of Environmental, Health and Safety General Guideline. This is might be because of transportation of material from nearby borrow pit.	The contractor will prepare and strictly implement plan around construction sites. The drivers of construction vehicles will comply with speed limits to minimize road dust. Contractor will spray water on the access road to construction site.
		PM2.5	AQS4 = 0.024mg/m^3 **AQS5 = 0.028mg/m^3**	0.025 mg/m^3 (WHO, average 24h)			
		SO_2	AQS4 = 0.031mg/m^3 AQS5 = 0.044mg/m^3	0.30 mg/m^3 (WHO average 24h)			
		NO_2	AQS4 = 0.048mg/m^3 AQS5 = 0.024mg/m^3	0.10 mg/m^3 (WHO average 24h)			

Environmental Monitoring Form for Construction Stage
Contract Package 3

Item	Location	Parameter/Means of Monitoring	Result (Average/ Max /Total..)	Standards (Local/Inter Standard)	Frequency	Remarks	Mitigation Measure
Water Quality	WS-9 (13th of November, 2020) PK-170+700 Ou Chankok river, Tnot Chum commune, Krokor district, Pursat province	Visual observation/inspection	No major adverse impacts	No standards	Every day	Contractor and inspector	
		pH	7.03	6.5-8.5 (MoE)	1 time in dry season 1 time in wet season	The water quality in this main river (Thlea Ma'am) is under the water quality standard as stipulated in the Sub-decree on Water Pollution Control (1999) of MoE, Except Total Coliform parameter are higher than MoE standard and Japanese standard, caused by agriculture and business activity at upstream of river since 2000.	Contractor will try to reduce any possible impacts from the construction sites such as improve the management of solid waste, oil waste, application of slope protection to reduce run off of the dirt with the rain water, etc.
		TSS	**30.00**	25-100 mg/l (MoE)			
		BOD	2.40	1-10 mg/l (MoE)			
		COD	7.64	1-8 mg/l (MoE)			
		Total Coliform	**7,500**	<5,000 (Japanese Standard)			
Noise	ANV-4 (13th of November, 2020) PK-135+600, Kbal Damrei village, Ansar Chambork commune, Krakor district, Pursat province. ANV-5 (14th of November, 2020) PK-170+340, Kandol Sar village, Beung Kantuot commune, Krakor district, Pursat province.	Noise Level (MoE Laboratory)	ANV-4, 60 dB (06:00-18:00) 58 dB (18:00-22:00) 60 dB (22:00-06:00) AQS-5 62 dB (06:00-18:00) 60 dB (18:00-22:00) 60 dB (22:00-06:00)	- 60 dB (06:00-18:00) - 50dB (18;00-22:00) - 45dB (22:00-06:00) (MoE, residential area)	1 time in dry season 1 time in wet season	We found that there are so many construction activities at the monitoring site during the monitoring date, the monitoring sites are already disturbed by the transportation activities on NR5, which is an important route connecting Phnom Penh capital city to Battambong and Poipet, is an international border gate to Thailand.	Continue to do the NR5 maintenance and put on the traffic sign on the NR5 to lower the driving speed to reduce the noise during at night. Contractor select quiet equipment and working method as much as possible.

Environmental Monitoring Form for Construction Stage
Contract Package 3

Item	Location	Parameter/Means of Monitoring		Result (Average/ Max /Total..)	Standards (Local/Inter Standard)	Frequency	Remarks	Mitigation Measure
Vibration		Vibration Level (MoE Laboratory)		AQS-4 41 Hz (7:00-20:00) 41 Hz (20:00-07:00) AQS-5 43 Hz (7:00-20:00) 42 Hz (20:00-07:00)	- 65Hz (06:00-18:00) - 60Hz (18:00-06:00) (MoE)		Vibration levels are under the allowable maximum standard level of MoE, guideline value of IFC and Japanese Standard. This is because of no major construction activities have been during the point of time of the construction stage.	
Waste Generation	Waste storage at construction site and campsites	Slurry and other construction waste	Discharged amount	The result table will be shown below.	No standards	Every day	Septic tank	
			Recycled amount					
			The way of recycle					
			Treated amount					
			Local of final disposal					
		General waste	Discharged amount	The result table will be shown below.				
			Recycled amount					
			The way of recycle					
			Treated amount					
			Local of final disposal					
Subsidence	Subsidence prone locations along the project road	Visual inspection and interview to the local people		No impact at construction site	No standards	1 time/week to 1 time/month (depending on situation)	Minor affects to prone locations along the project road.	

Environmental Monitoring Form for Construction Stage
Contract Package 3

Item	Location	Parameter/Means of Monitoring	Result (Average/ Max /Total..)	Standards (Local/Inter Standard)	Frequency	Remarks	Mitigation Measure
Hydrology	River, stream, and reservoir where construction works are executed	Visual inspection on volume and speed of water flow	No impacts at construction site		Every day	In The main rivers and canals are crossing NR-5, sometime, was raining.	
Ecosystem	EC-1 KP 170+700 (13th of November, 2020)	Visual observation of animals, reptiles, and amphibious	Mammal = 2 Amphibian = 5 Reptile = 8 Birds = 10 Flora = 38 Insect = 4 Fish = 23	No standards	One time in dry season and one time in rainy season	Visual survey shall be done near permanent river This survey was conducted by interviewing with local fisherman and local people about the presence of fauna resource listed in the table of checklist and taking photos of observation fauna resource by the environmentalist.	Contractor shall use methods to mitigate the impacts of Ecosystem and educate the Engineers and workers not to catch wild flura and fauna species around construction sites.

Remarks: Past trend and current statute including remedial measures, if necessary.

Note:
WHO: World Health Organization,
MoE: Ministry of Environment
NO_2: Nitrogen Dioxide
SO_2: Sulfur Dioxide
PM: Particulate Matters
BOD: Biochemical Oxygen Demand
COD: Chemical Oxygen Demand
TSS: Total Suspended Solid

1. Schedule of Seasonal Monitoring

The seasonal periodical monitoring for air quality was conducted on 13tu and 14th November, 2020, noise and vibration were done on 13th - 14th November 2020, water quality was conducted on 13th of November, 2020 and ecosystem survey was implemented on 13th of November, 2020.

Table 1.1 Schedule of Seasonal Monitoring

Year	2018	2019					2020				2021				2022			
	Dec	Feb	Apr	May	Jul	Oct	Jan	Apr	Jul	Nov	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct
Item	Dry	Dry	Dry	Dry	Rainy	Rainy	Dry	Dry	Rainy	Rainy	Dry	Dry	Rainy	Rainy	Dry	Dry	Rainy	Rainy
1. Air Quality	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2. Water Quality	●			●		●		●		●		●		●		●		●
3. Noise	●			●		●		●		●		●		●		●		●
4. Vibration	●			●		●		●		●		●		●		●		●
8. Ecosystem		●	●			●		●		●		●		●		●		●

2. Seasonal Monitoring Points/Areas and Ecosystem survey

Figure-2: Designed Monitoring Points for Package 3 Section (Sta 120+000 - Sta 171+200)

3. The Solid waste Generation in December, 2020

Location	General waste				Construction waste			
	General amount	Recycle amount	Mean of recycle	Disposal	General amount	Recycle amount	Mean of recycle	Disposal
HS office (sta.145)	52.6 kg	5.3 kg	provide to cleaner	dumpsite				
					2.5 kg of scarp waste	1.2 kg	provide to scavenger	dumpsite
DP office (sta.144)	42.5 kg	6.2 kg	provide to cleaner	dumpsite				
					2.1 kg of scarp waste	0.8 kg	provide to scavenger	dumpsite
LSC office (sta.132)	36.4 kg	5.5 kg	provide to cleaner	dumpsite				
					2.4 kg of scarp waste	1.2 kg	provide to scavenger	dumpsite
SR office (sta.166)	35.6 kg	6.8 kg	provide to cleaner	dumpsite				
					2.4 kg of scarp waste	1.5 kg	provide to scavenger	dumpsite
Bridge 38 (sta.170+697)	0.0 kg			dumpsite	0.3 m3 of concrete waste	0.3 m3	backfill at courtyard	
Bridge 36 (sta.147+112)	0.0 kg			dumpsite	0.3 m3 of concrete waste	0.3 m3	backfill at courtyard	
Bridge 28 (sta.135+978)	0.0 kg			dumpsite	0.2 m3 of concrete waste	0.2 m3	backfill at courtyard	
Box culvert 32 (sta.163+070)	0.0 kg			dumpsite	0.2 m3 of concrete waste	0.2 m3	backfill at courtyard	
Box culvert 27 (sta.157+444)	0.0 kg			dumpsite	0.2 m3 of concrete waste	0.2 m3	backfill at courtyard	
Box culvert 21 (sta.149+902)	0.0 kg			dumpsite	0.2 m3 of concrete waste	0.2 m3	backfill at courtyard	
Box culvert 17 (sta.142+224)	0.0 kg			dumpsite	0.2 m3 of concrete waste	0.2 m3	backfill at courtyard	
Box culvert 14 (sta.139+117)	0.0 kg			dumpsite	0.2 m3 of concrete waste	0.2 m3	backfill at courtyard	
Pipe culvert 35 (sta.168+080)	0.0 kg			dumpsite	0.2 m3 of concrete waste	0.2 m3	backfill at courtyard	
Pipe culvert 29 (sta.159+612)	0.0 kg			dumpsite	0.2 m3 of concrete waste	0.2 m3	backfill at courtyard	
Pipe culvert 14 (sta.137+445)	0.0 kg			dumpsite	0.2 m3 of concrete waste	0.2 m3	backfill at courtyard	
Curb	0.0 kg			dumpsite	1.0 m3 of concrete waste	1.0 m3	backfill at courtyard	
Total	**167.1 kg**	**23.8 kg**			**9.4 kg + 3.4 m3**	**4.7 kg + 3.4 m3**		

4. Fauna and Flora Survey

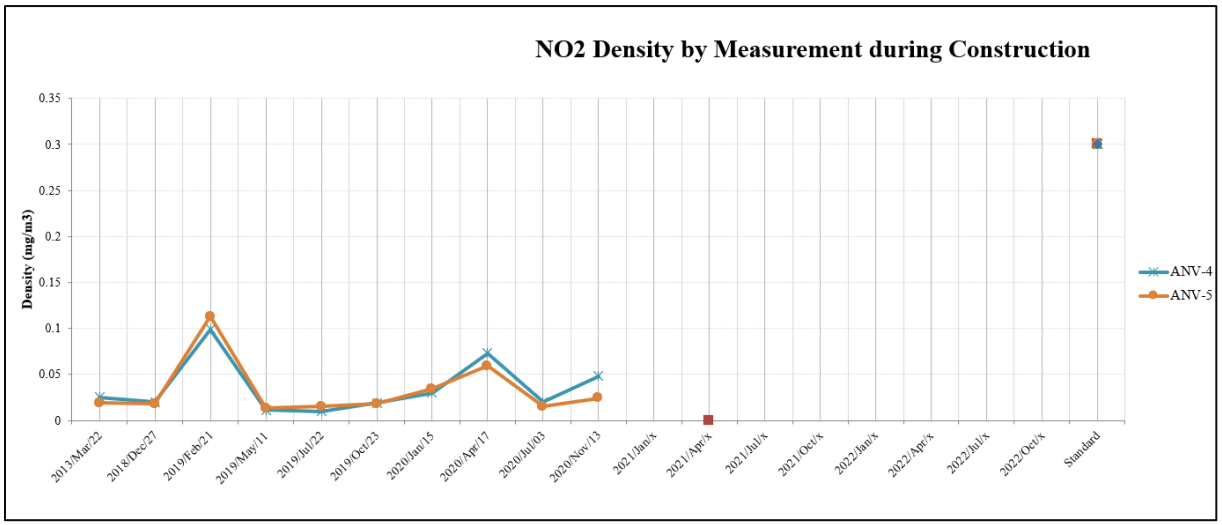
Category-1	Category-2	Family	Common name	Scientific name	IUCN Status
a) Mammal	Rodentia		Rat		N/A
	Chiroptera		Bat	*Order Chiropter*	N/A
b) Amphibian	Anura	Bufonidae	Common Asian Toad	*Bufo Melanosttrictus*	N/A
	Anura	Microhylidae	Common Asian Bullfrog	*Kaloula Pulchra*	LC
	Anura	Discrolossidae	Paddy Frog	*Fejevarya Limnocharis*	N/A
	Anura	Malacostraca	Crab	*Brachyura*	N/A
	Anura	Rhacophoridae	Common Tree Frog	*Polypedates Leucomystax*	LC
c) Reptile	Squamata	Gekkonidae	Tockay	*Gekko Gecko*	N/A
	Squamata	Typhlopidae	Common Blind Snake	*Ramphoryphlops Braminus*	N/A
	Squamata	Colubriade	Indochinese Ratsnake	*Ptyas Korros*	N/A
	Squamata	Colubridae	Keeled Rat Snake	*Ptyas Caranita*	N/A
	Squamata	Colubridae	Chequered Keelback	*Xenochrophis Piscator*	N/A
	Squamata	Viperidae	Pope's Pit-Viper	*Trimeresurus Popeiorum*	LC
	Squamata		Lizard		N/A
	Squamata	Viperidae	Russull's Viper	*Dabota Ruseelli*	N/A
d) Birds	Psittaciformes	Psittaculidae	Red-Breasted Parakeet	*Loriculus Vemalis*	N/A
	Gruiformes	Rallidae	Watercock	*Gallicrex Cinerea*	LC
	Columbiformes	Columbidae	Rock Pigeon	*Columba Livia*	LC
	Anseriformes	Anatidae	Lesser Whistling Duck	*Dedrocygna Javanica*	N/A
	Passeriformes	Motacillidae	Paddyfield Pipit	*Anthus Rufulus*	LC
		Columbidae	Doves	*Columbidae*	
			Crows	*Corvus*	
			Kok Sor		
			Wild Bird		
			Rich		
e) Fishes	Osteoglossiformes	Notopteridae	Slat	*Notopterus Notopterus*	LC
	Siluriformes	Bagridae	Chhlaing	*Hemibagrus Nemurus*	N/A
	Cypriniformes	Cyprinidae	Sleuk Russey	*Paralaubuca Riveroi*	LC
	Siluriformes	Bagridae	Kanhjos	*Mystus Albolineatus*	N/A
	Cypriniformes	Cyprinidae	Linh	*Thynnichthys Thynnoides*	LC
	Anabantiformes	Channidae	Phtuok / Trey Ros	*Channa Striata*	LC
	Cypriniformes	Cyprinidae	Kros	*Osteochilus Microcephalus*	LC
	Cypriniformes	Cyprinidae	Riel Angkam	*Henicorhynchus Lobatus*	LC
	Cypriniformes	Cyprinidae	Riel Tob	*Henicorhynchus siamensis*	
	Cypriniformes	Cyprinidae	Changwa Moul	*Rasbora Tornieri*	N/A
	Cypriniformes	Cyprinidae	Chhpin	*Hypsibarbus Malcolmi*	LC
	Synbranchiformes	Mastacembelidae	Chhlonh	*Macrognathus Siamensis*	LC
	Cypriniformes	Cyprinidae	Ka-ek	*Labeo Chrysophekadion*	LC
	Synbranchiformes	Mastacembelidae	Khchoeung	*Mastacembelus Armatus*	N/A
	Cypriniformes	Cyprinidae	Chakaeng	*Puntioplites Falcifer*	LC
	Siluriformes	Siluridae	Sanday / Trey Kropoit	*Wallago Attu*	N/A
	Perciformes	Osphronemidae	Kroem	*Betta Splendens*	N/A
	Synbranchiformes	Synbranchidae	Antong	*Monopterus Albus*	
			Kantrob	*Pristolepis fasciata*	
			Kranh	*Anabas testudineus*	
			Kombot Chromos	*Amblyrhynchichthys micracanthus*	
			Kompleang Plok	*Trichogaster microlepis*	
			Sroka Kdam	*Cyclocheilichthys lagleri*	
f) Insect	Odonata		Kanthomroy	*Dragonfly*	N/A
	Lepidoptera		Meombav	*Butterfly*	N/A
			Locusts		
			Kanlong		

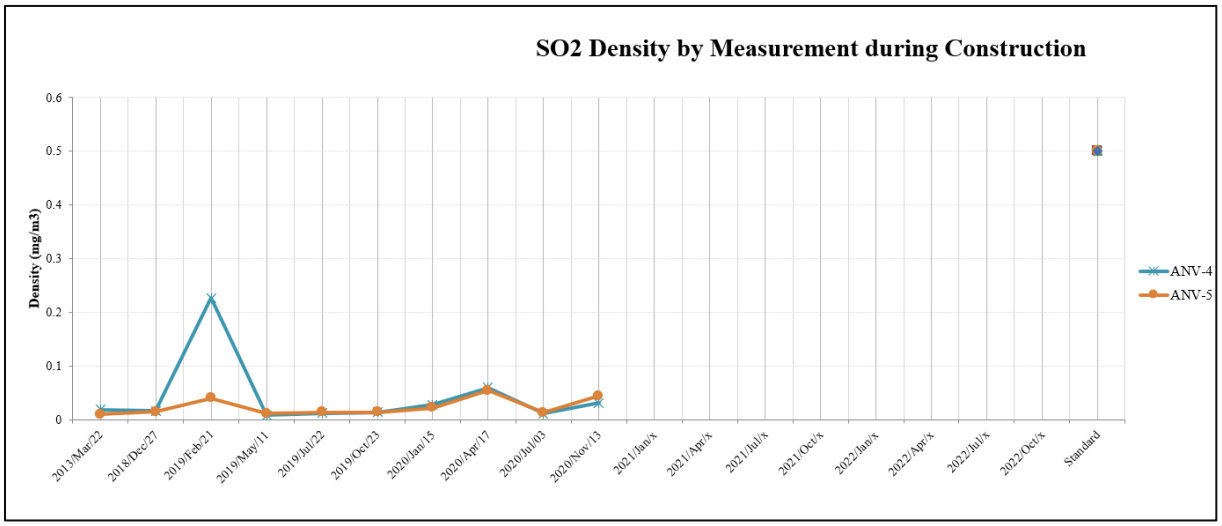
g) Flora	Rosales	Moraceae	Chrey	*Ficus Sp*	N/A
	Rosales	Rhamnaceae	Putrea	*Zizyphus Mauritiana*	LC
	Fabales	Leguminosae	Ang Kanh	*Cassia Siamensis Lam.*	N/A
	Rosales	Moraceae	Snay	*Sterblus Asper*	N/A
	Myrtales	Myrtaceae	Pring	*Eugenia Spp.*	N/A
	Malvales	Dipterocarpaceae	Thbaeng	*Dipterocapus Obtusifolius,Teysm*	N/A
	Fabales	Leguminosae	Kanthum Thet	*Leucaena Leucocephala*	N/A
	Fabales	Mimosaceae	Acacia Sleuk Touch	*Acacia Auriculiformis Muell.*	N/A
	Rosales	Moraceae	Por	*Ficus Religiosa L.*	N/A
	Fabales	Leguminosae	Chan Kiri	*Albizia Saman*	N/A
	Sapindales	Anacardiaceae	Svay	*Mangifera Indica*	N/A
	Malpighiales	Simaroubaceae	Cham Bak	*Irvingia Malayana*	LC
	Sapindales	Anacardiaceae	Poun Sva	*Spondias Sp*	N/A
	Sapindales	Meliaceae	Sdav	*Azadirachta Indica Ant. Juss.*	N/A
	Ericales	Lecythidaceae	Raing Toek	*Barringtonia Acutangula (L.) Gaertn.*	N/A
	Fabales	Leguminosae	Trosek	*Peltophorum Dasyrrhachis*	N/A
	Rosales	Rosaceae	Thlork	*Parinarium Annamensis, Hance*	N/A
		Bombacaceae	Kor	*Ceiba Pentandra*	N/A
	Sapindales	Sapindaceae	Pong-Ro	*Schleicheria Oleosa*	N/A
	Sapindales	Anacardiaceae	Svay Chan Ti	*Anacadium Occidentale L.*	N/A
	Sapindales	Sapindaceae	Chonlos	*Erioglossum Edule*	N/A
	Fabales	Leguminosae	Ampil Toek	*Pithecellobium Dulce*	N/A
	Arecales	Palmae	Sla	*Areca Catechu*	N/A
	Malpighiales	Euphorbiaceae	Kantuot	*Phyllanthus Acidus*	N/A
		Papilionaccac	Thnong	*Pterocarpus Pedatus, Pierre*	N/A
	Fabales	Leguminosae	Char	*Butea Monosperma*	N/A
	Myrtales	Myrtaceae	Kandoal	*Careya Spaerica*	N/A
	Myrtales	Combretaceae	Trahs	*Combretum Trifoliatum*	N/A
	Caryophyllales	Nyctaginaceae	Phka Kradahs	*Bougainvillea Buttiana*	N/A
	Poales	Gramineae	Russey Srok	*Dendrocalamus Membranaceus*	N/A
	Poales	Poaceae	Russey Ping Pong	*Gigantochloa Albociliata*	N/A
	Zingiberales	Musaceae	Chek	*Musa Spp.*	N/A
	Pandanales	Pandanaceae	Rom Chek	*Pandanus Humilis*	N/A
	Poales	Gramineae	Sbov	*Imperata Cylindrica*	N/A
	Boraginales	Boraginaceae	Pramaoy Damrei	*Heliotropium Indicum*	N/A
		Pontedderiaceae	Kamphlaok	*Eichhornia Crassipes*	N/A
	Boraginales	Boraginaceae	Cheng Tokae	*Coldenia Procumbens*	N/A
	Poales	Cyperaceae	Kak	*Cyperus Cyperiodes*	N/A

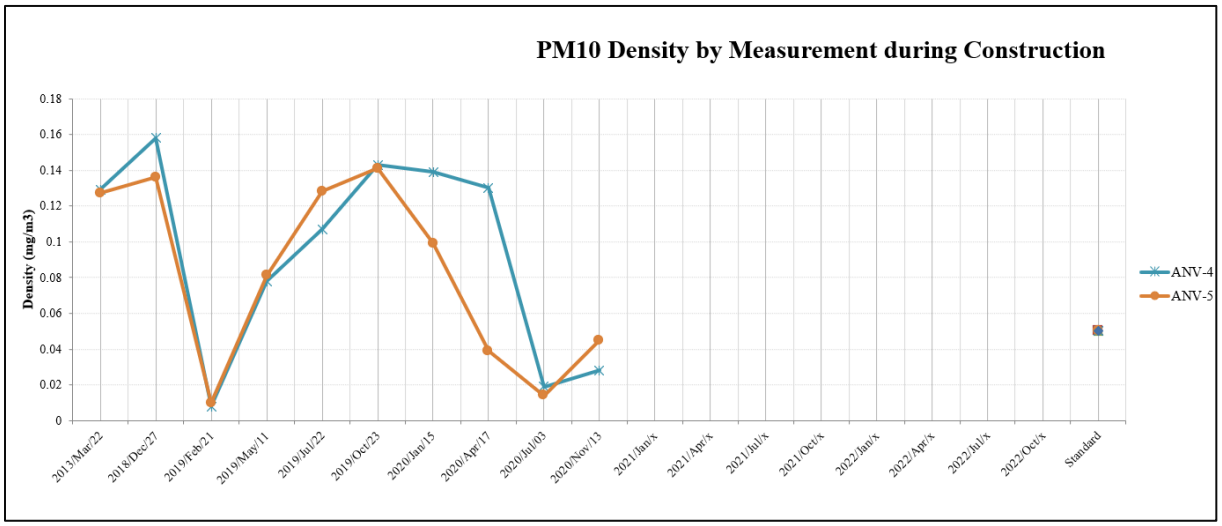
Note) : IUCN Status:Critically Endangered (CR),Endangered (EN),Vulnerable (VU),Near Threatened (NT),Least Concern (LC)

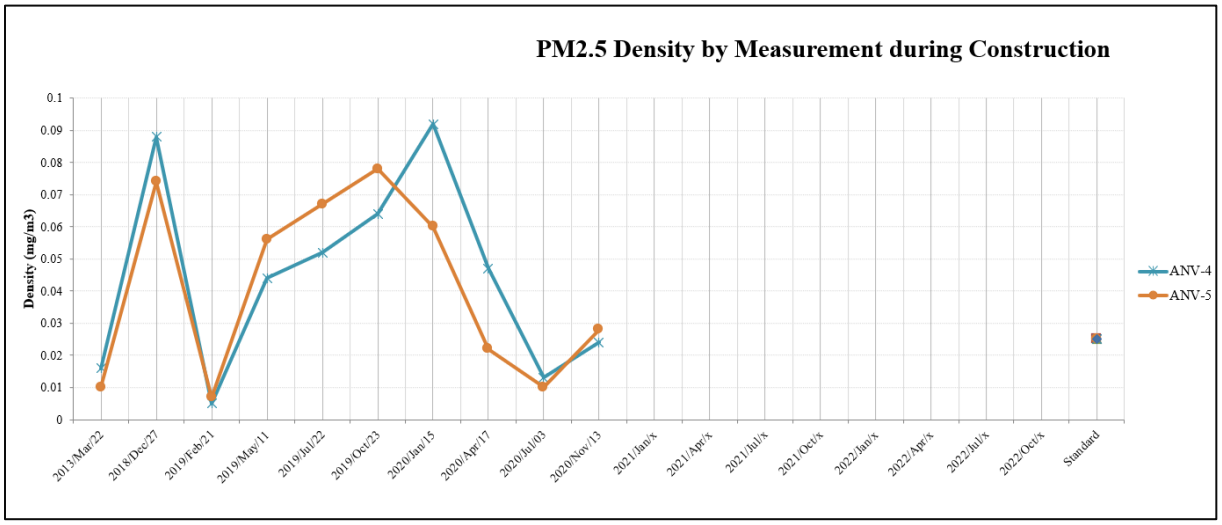
5. Seasonal Monitoring

5.1 Seasonal Monitoring of Air Quality

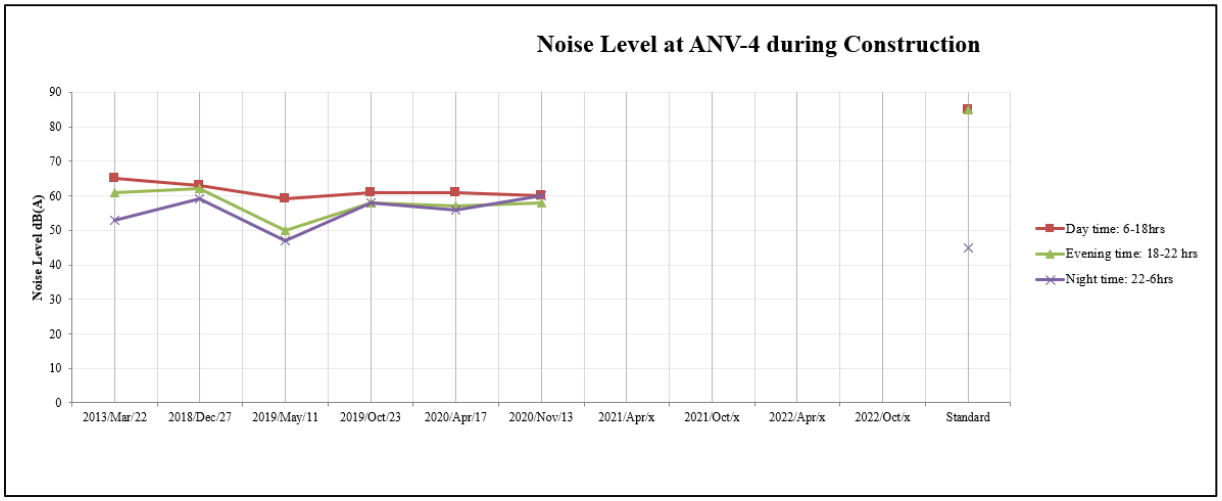


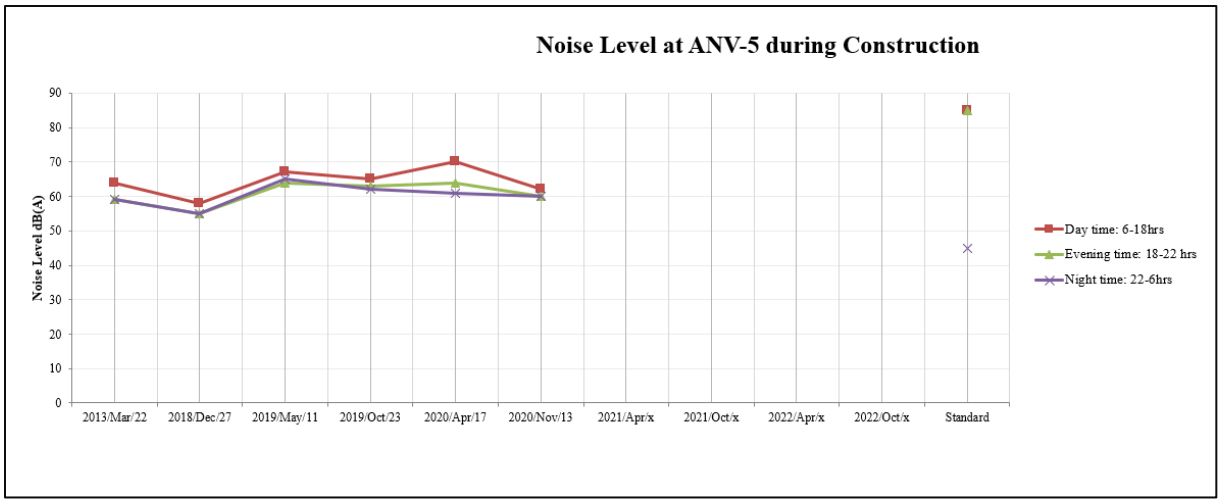


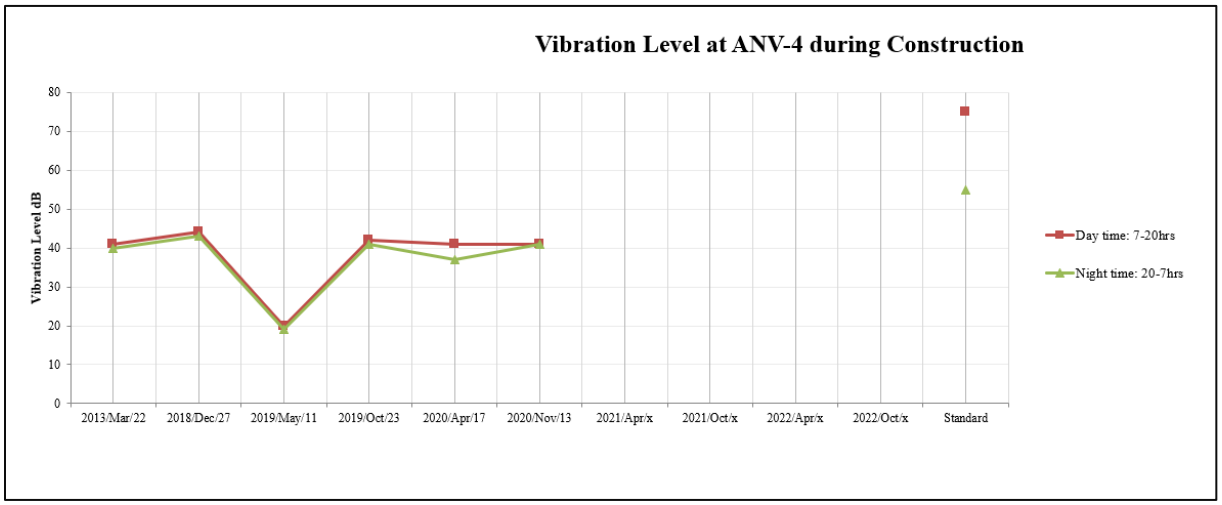


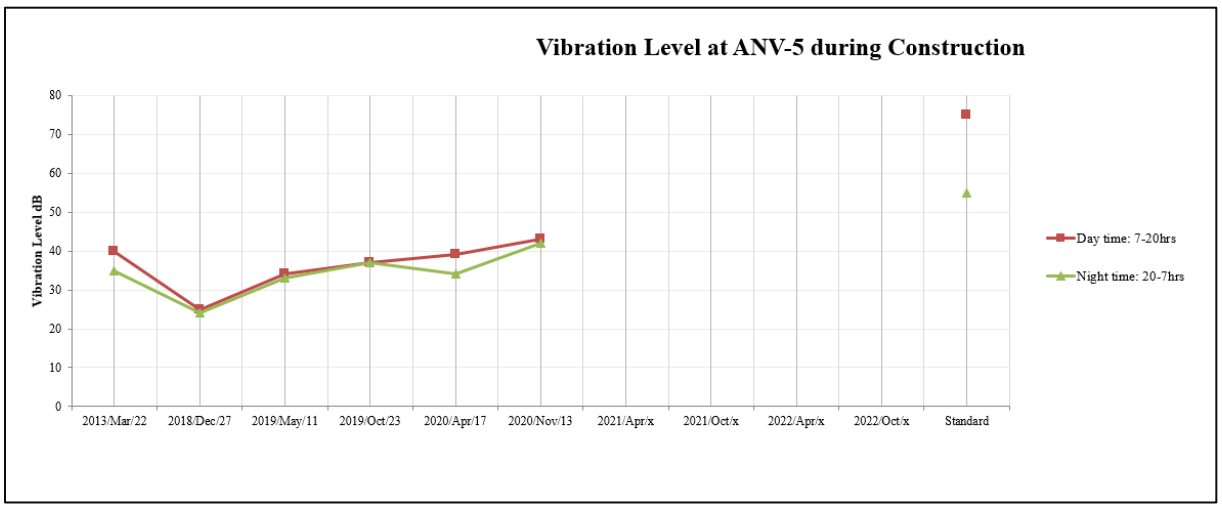


5.2 Seasonal Monitoring of Noise and Vibration

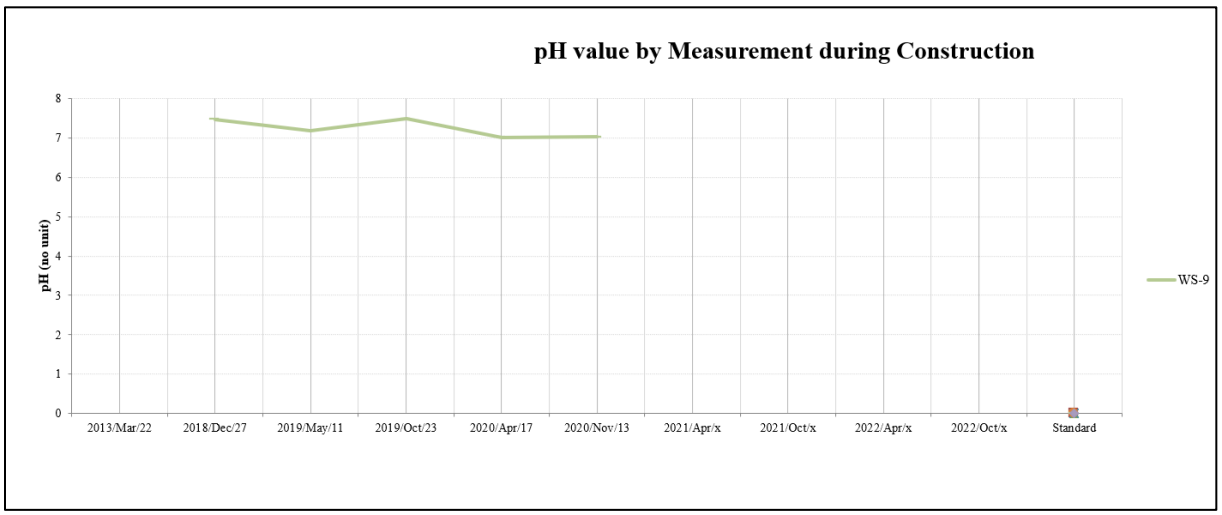


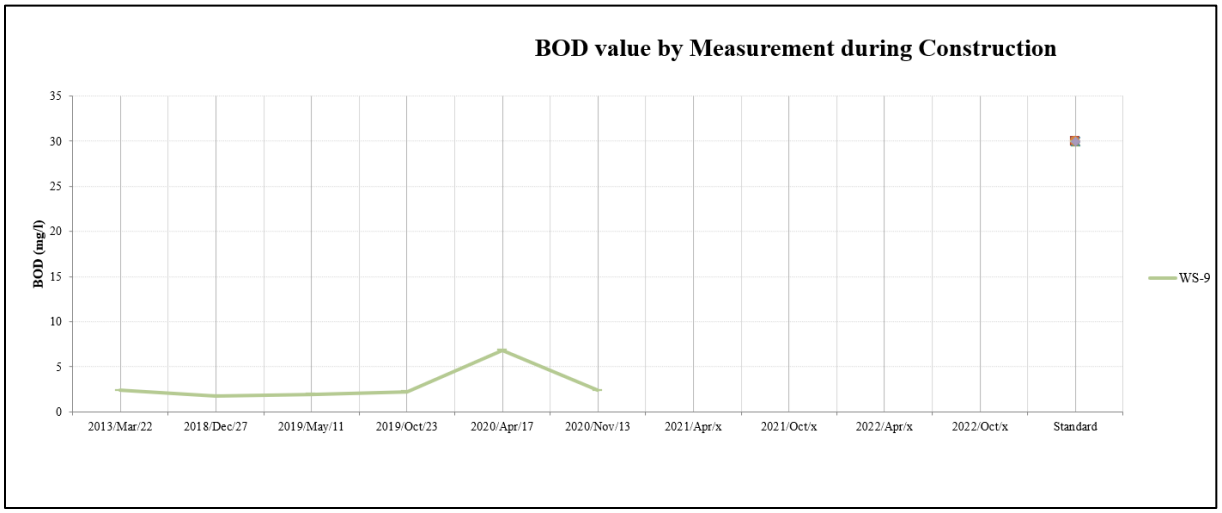


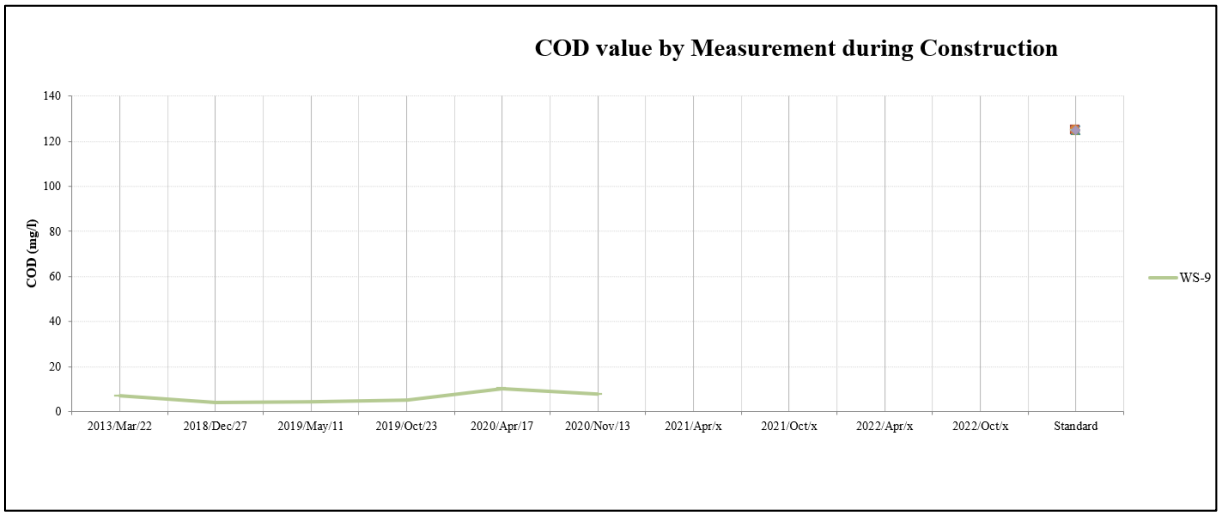


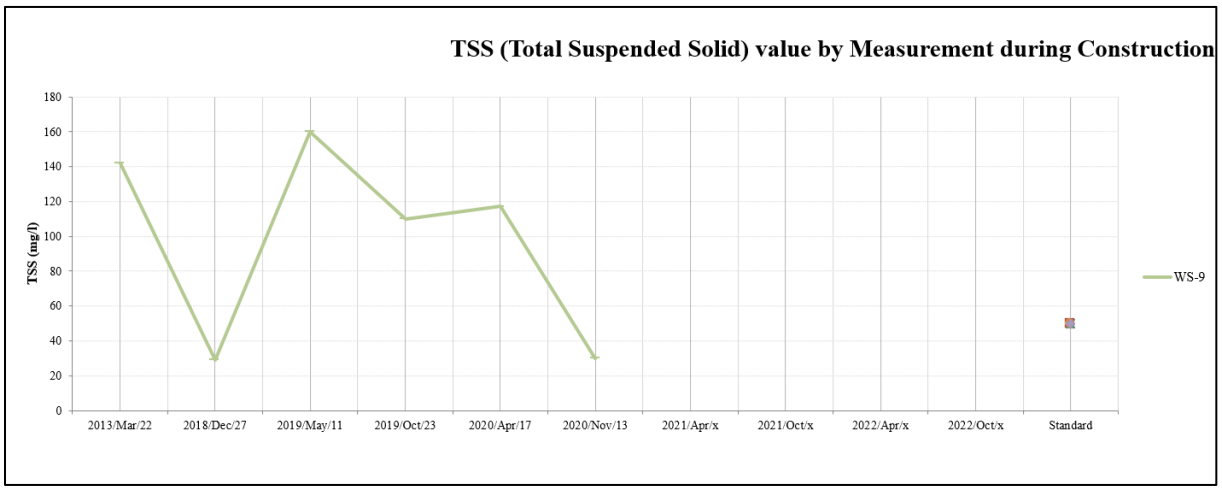


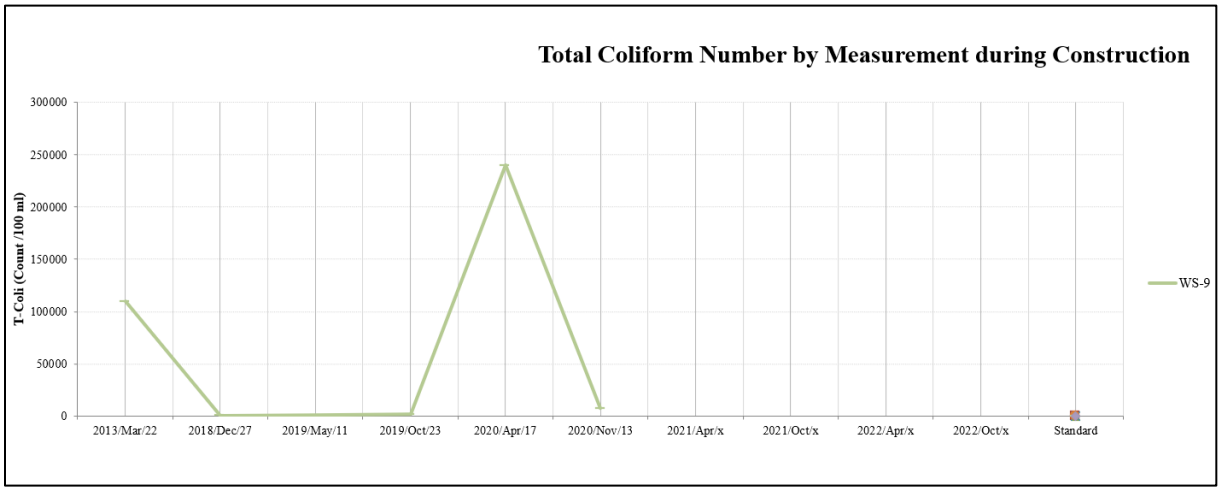
5.3 Seasonal Monitoring of Water Quality




BOD value by Measurement during Construction
BOD (mg/l)
35
30
25
20
15
10
5
0
2013/Mar/22
2018/Dec/27
2019/May/11
2019/Oct/23
2020/Apr/17
2020/Nov/13
2021/Apr/x
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
WS-9


COD value by Measurement during Construction
COD (mg/l)
140
120
100
80
60
40
20
0
2013/Mar/22
2018/Dec/27
2019/May/11
2019/Oct/23
2020/Apr/17
2020/Nov/13
2021/Apr/x
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
WS-9


TSS (Total Suspended Solid) value by Measurement during Construction
TSS (mg/l)
180
160
140
120
100
80
60
40
20
0
2013/Mar/22
2018/Dec/27
2019/May/11
2019/Oct/23
2020/Apr/17
2020/Nov/13
2021/Apr/x
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
WS-9


Total Coliform Number by Measurement during Construction
T-Coli (Count /100 ml)
300000
250000
200000
150000
100000
50000
0
2013/Mar/22
2018/Dec/27
2019/May/11
2019/Oct/23
2020/Apr/17
2020/Nov/13
2021/Apr/x
2021/Oct/x
2022/Apr/x
2022/Oct/x
Standard
WS-9