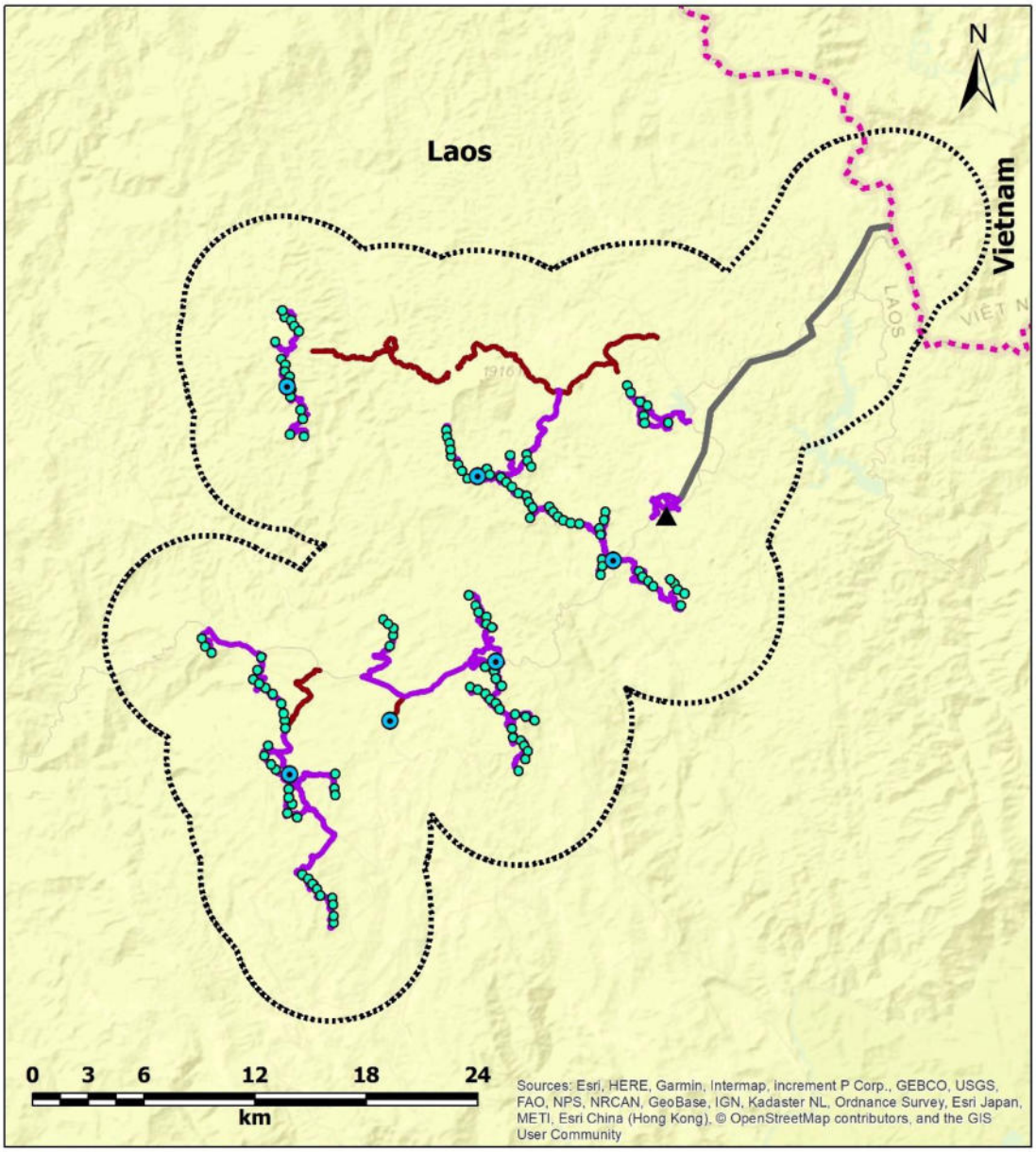
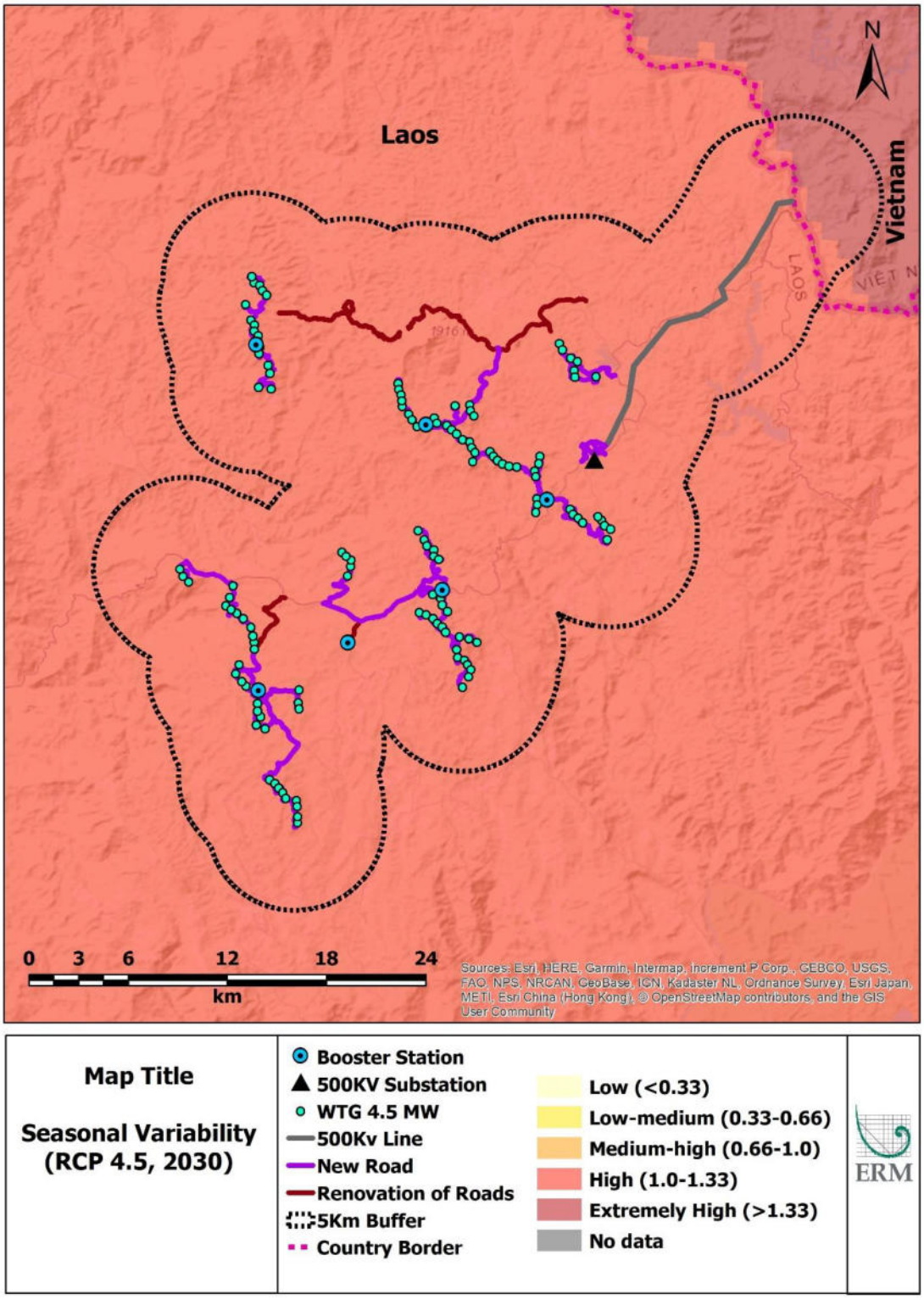
Figure 9-80: Water Stress RCP 8.5/2040



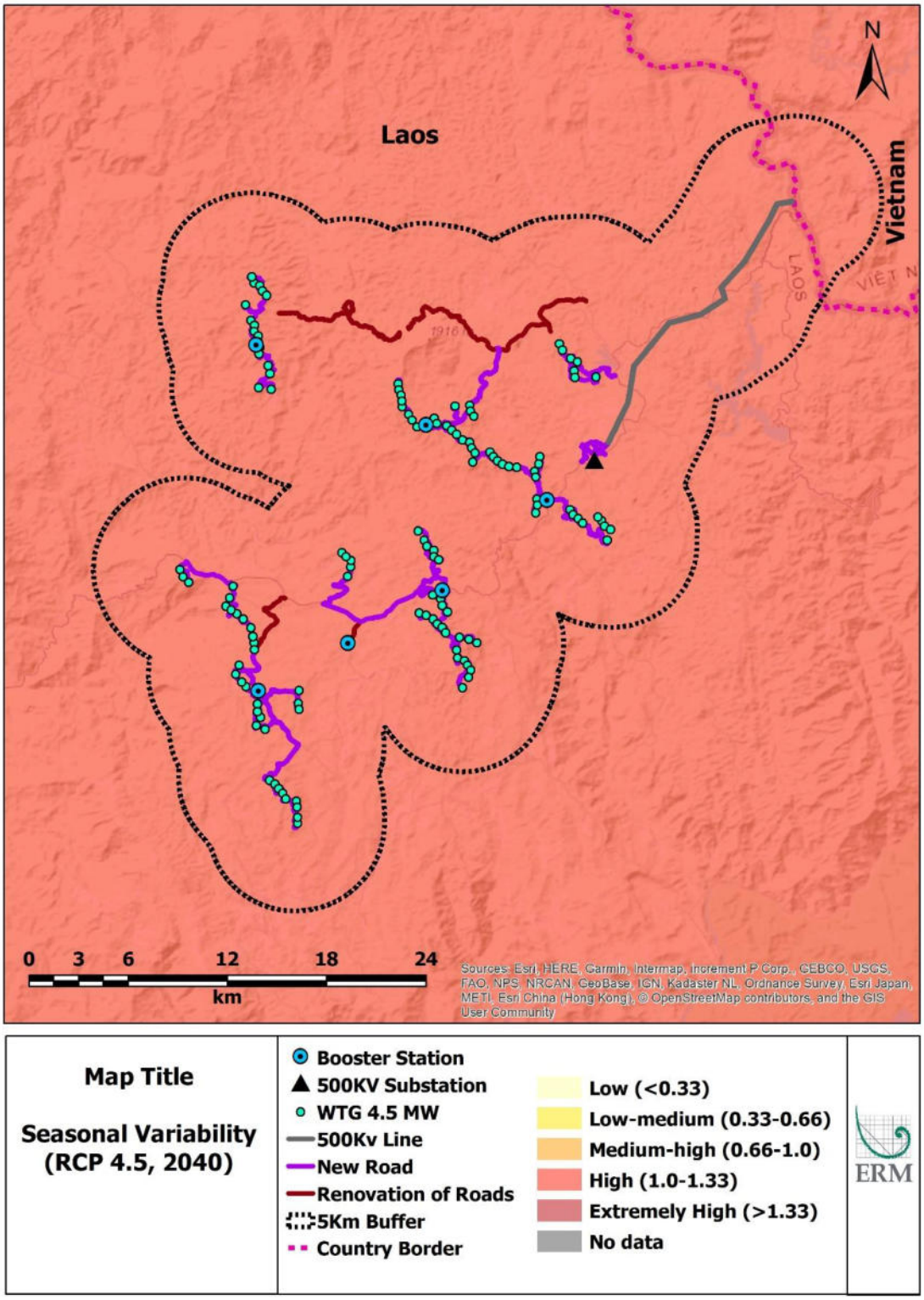
Source: WRI-Aqueduct Water Risk Atlas

Figure 9-81: Seasonal Variability RCP 4.5/2030



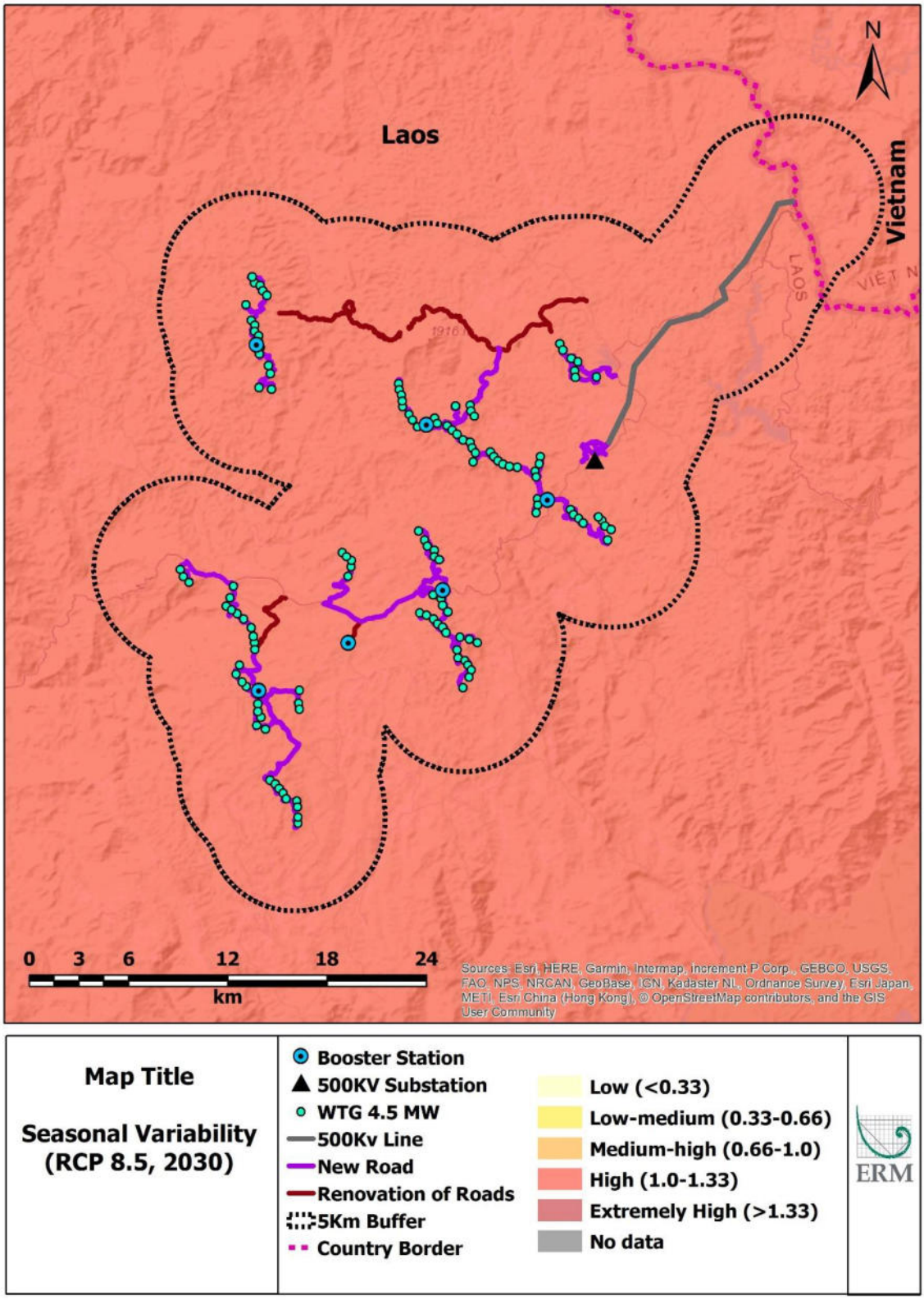
Source: WRI-Aqueduct Water Risk Atlas

Figure 9.1: Seasonal Variability RCP 4.5/2040



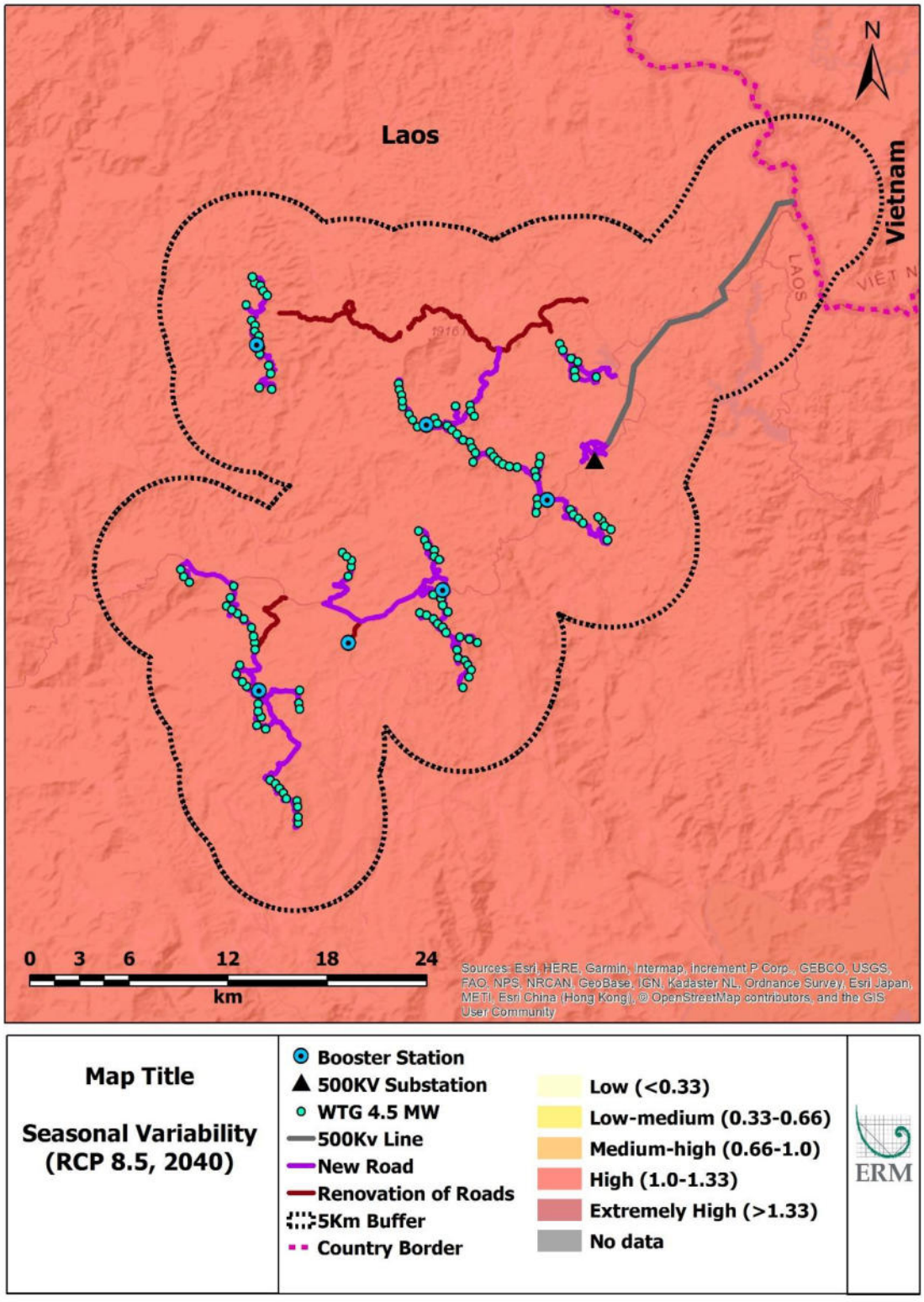
Source: WRI-Aqueduct Water Risk Atlas

Figure 9-82: Seasonal Variability RCP 8.5/2030



Source: WRI-Aqueduct Water Risk Atlas

Figure 9-83: Seasonal Variability RCP 8.5/2040



Source: WRI-Aqueduct Water Risk Atlas

Riverine Floods

Floods are defined as logging of excess water resulting in submergence of dry lands. Floods can be categorized as inland and coastal in nature. Inland flooding may be caused due to heavy rainfall, resulting in high run-off leading to water accumulation in low lying areas, or overtopping of water bodies such as rivers, streams, lakes, ponds and tanks.

Floods are likely to result in wide spread local as well as regional level destruction. This can be caused due to submergence, washing away and damage to infrastructure, buildings, structures, sewerage systems, damage to power transmission and power generation, loss of agricultural land and crops, contamination of fresh water sources, propagation of water borne diseases and loss of life.

- Baseline

Sekong and Attapeu province are reported to be among the most flood vulnerable provinces in Lao PDR[110]. However, a review of flood hazard data based on likelihood of damaging and life threatening floods (floods with depth of inundation >0.5 m) (***Figure 9-84***) indicated the flood hazard to be Very Low in Sanxay District in Attapue, and Dak Cheung District in Sekong province where the project is located.

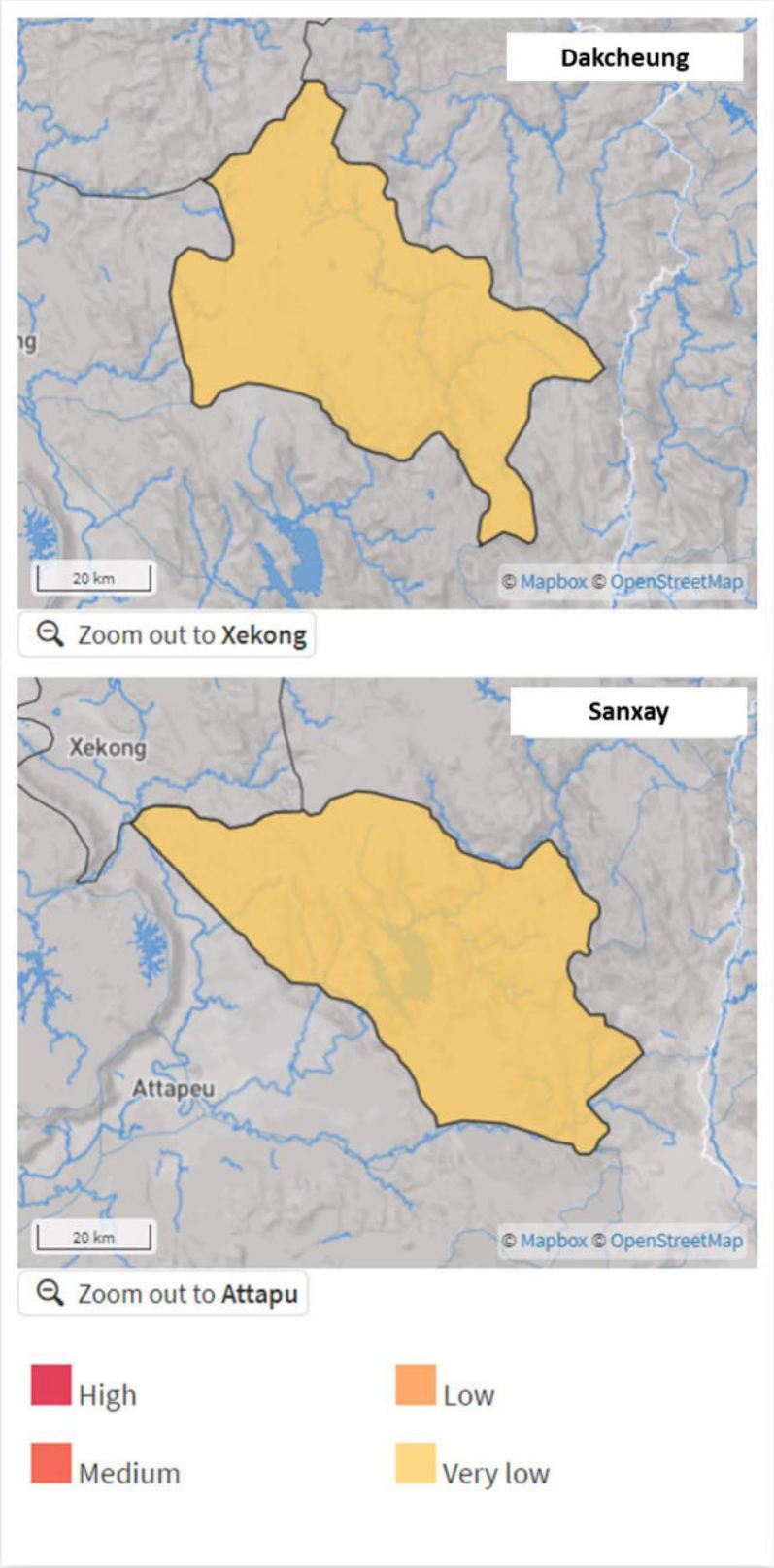
Furthermore, a review of flood hazard map(s) representing the depth of inundation under a flood with 100 year return period (***Figure 9-85***) indicated no inundation in project area.

A review of satellite imagery in and around the study area does not show any rivers flowing through the study area, except Nam Pagnou River, in eastern parts of the project area. The 500 kv transmission line is proposed to cross over the Nam Pagnou River. No other major assets are observed to be located in areas near to the Nam Pagnou River. The wind turbines are also observed to be located on the ridges. Hence, river floods are not likely to impact project assets.

Accordingly, considering the site setting (locations of assets), absence of major rivers, and no reported inundation within study area, riverine floods are not likely to have impact on the project. Hence, no hazard due to riverine flood is considered.

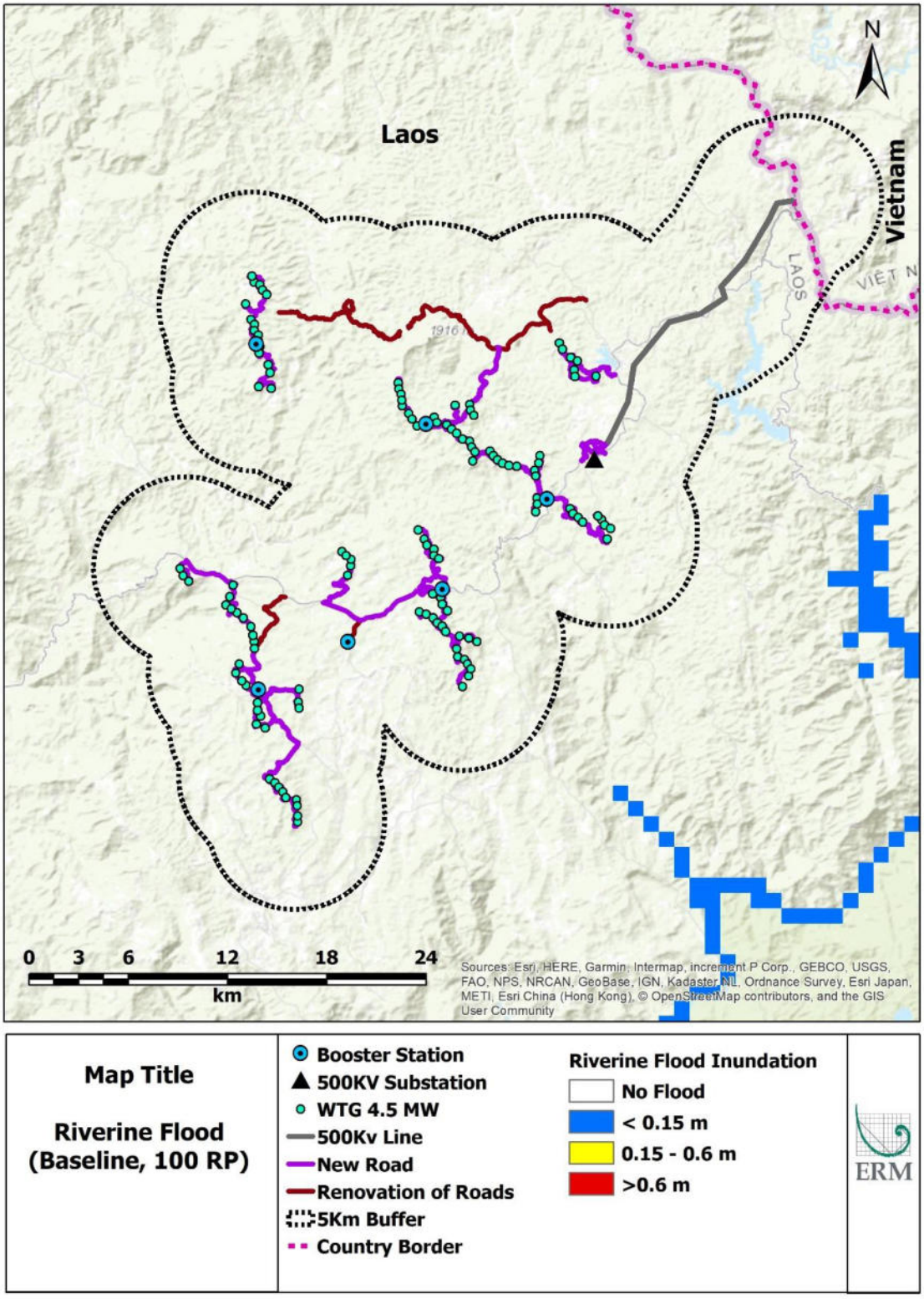
[110] https://www.adpc.net/igo/category/ID416/doc/2013-ptk8Nb-ADPC-Publication_LNAReportWEB_(2).pdf

Figure 9-84: Baseline Riverine Flood Hazard



Source: Think Hazard

Figure 9-85: Baseline Riverine Flood Hazard



Source: WRI-Aqueduct Flood Tool

- Climate Change

Climate change projections for extreme precipitation (rainfall) indices of 1 day maximum rainfall, 5 day maximum rainfall, and number of days with heavy rainfall (>10mm) indicated increasing trend under all climate change scenarios, except RCP 4.5 in 2030. Extreme precipitation under RCP 4.5 indicated slight decrease in 2030. The increase in extreme precipitation is observed to be intensified with time and radiative forcing (RCP). Accordingly, highest increase in extreme precipitation is projected to be in 2050 under RCP 8.5 scenario.

Similarly, precipitation during cyclones originating in north-east Pacific Ocean is projected to increase by up to 19.4% by 2050 under RCP 8.5 scenario. Therefore, any change in topography during development of project and increased intensity of precipitation may lead to localised surface flooding, mountain floods, or flash floods in future.

Table 9-95: Climate Change Projections for Extreme Precipitation

Parameter	Absolute Values					Percentage Change (%)			
	Baseline	RCP 4.5		RCP 8.5		RCP 4.5		RCP 8..5	
		2030	2050	2030	2050	2030	2050	2030	2050
1-Day (mm)	67.1	-0.9	3.7	0.5	6.0	-1.5	5.6	0.8	9.1
5-Day (mm)	169.8	-6.9	6.9	1.7	11.9	-4.1	4.06	1.0	7.1
>10 mm (Days)	35	-0.3	1.21	0.6	2.1	-0.9	3.4	1.6	5.8
Cyclonic Precipitation* (mm)	N.D.	N.D.	N.D.	N.D.	N.D.	10.1	14.8	11.1	19.4

(: Changes in cyclonic precipitation are based on the studies conducted by Kunston et. Al.(2020)[111] providing projections for basin wise occurrences in cyclones and associated variables such as wind speed, frequency, and precipitation. For the purpose of this assessment a linear relationship is assumed between global average temperature rise and occurrences of cyclone. Accordingly, the projections for cyclones were adjusted from projections for 2°C scenario.).*

As discussed earlier, considering the absence of major rivers in the study area, and Site setting, riverine floods are not likely to impact the project components. Moreover, review of flood hazard maps (inundation under 100 year return period flood) for climate change scenarios indicated no flooding within the study area. Hence, no hazard due to riverine floods is considered.

Table 9-96: Summary of Riverine Flood Hazard under Baseline and Climate Change Scenario

Baseline	RCP 4.5		RCP 8.5	
	2030	2050	2030	2050
No Hazard	No Hazard	No Hazard	No Hazard	No Hazard

[111] https://journals.ametsoc.org/view/journals/bams/101/3/bams-d-18-0194.1.xml

Landslides

As per United States Geological Survey (USGS), a landslide is defined as the movement of a mass of rock, debris, or earth down a slope. Several factors are responsible for occurrence of landslides. Some of these are poor mechanical stability, heavy rainfall events, geological formation, earthquake, vibration (mechanical) and slope, and could be influenced largely by human activities at a local level. Some of the human activities which are likely to cause or aggravate landslides are deforestation, cultivation, construction, vibration from heavy machinery and traffic, blasting and mining activities, and large and unstable earthwork/ excavation.

It should be noted that the global data bases in general do not capture landslide events due to human activities, and these datasets are limited to the landslides occurred due to two major reasons: earthquakes and precipitation. However, earthquakes are not affected by climate change only landslides due to precipitation were evaluated under the present assessment.

For the purpose of present assessment, the landslide hazard was evaluated based on the data for rainfall triggered landslide hazard from World Bank Data Catalog and landslide hazard susceptibility data from NASA.

- Dalia Kirschbaum and Thomas Stanley have developed new map of global landslide susceptibility. The map is part of a broader effort to establish a hazards monitoring system that combines satellite observations of rainfall from the Global Precipitation Measurement (GPM) mission with an assessment of the underlying susceptibility of terrain. Steep slopes are the most important factor that make a landscape susceptible to landslides. Other key factors include deforestation, the presence of roads, the strength of bedrock and soils, and the location of faults. While other scientists have previously developed global and continental landslide susceptibility maps, Kirschbaum and Stanley used improved versions of certain datasets. They used a more robust version of elevation data collected by the Shuttle Radar Topography[112]. The new global landslide susceptibility map is intended for use in disaster planning situational awareness, and for incorporation into global decision support systems[113].

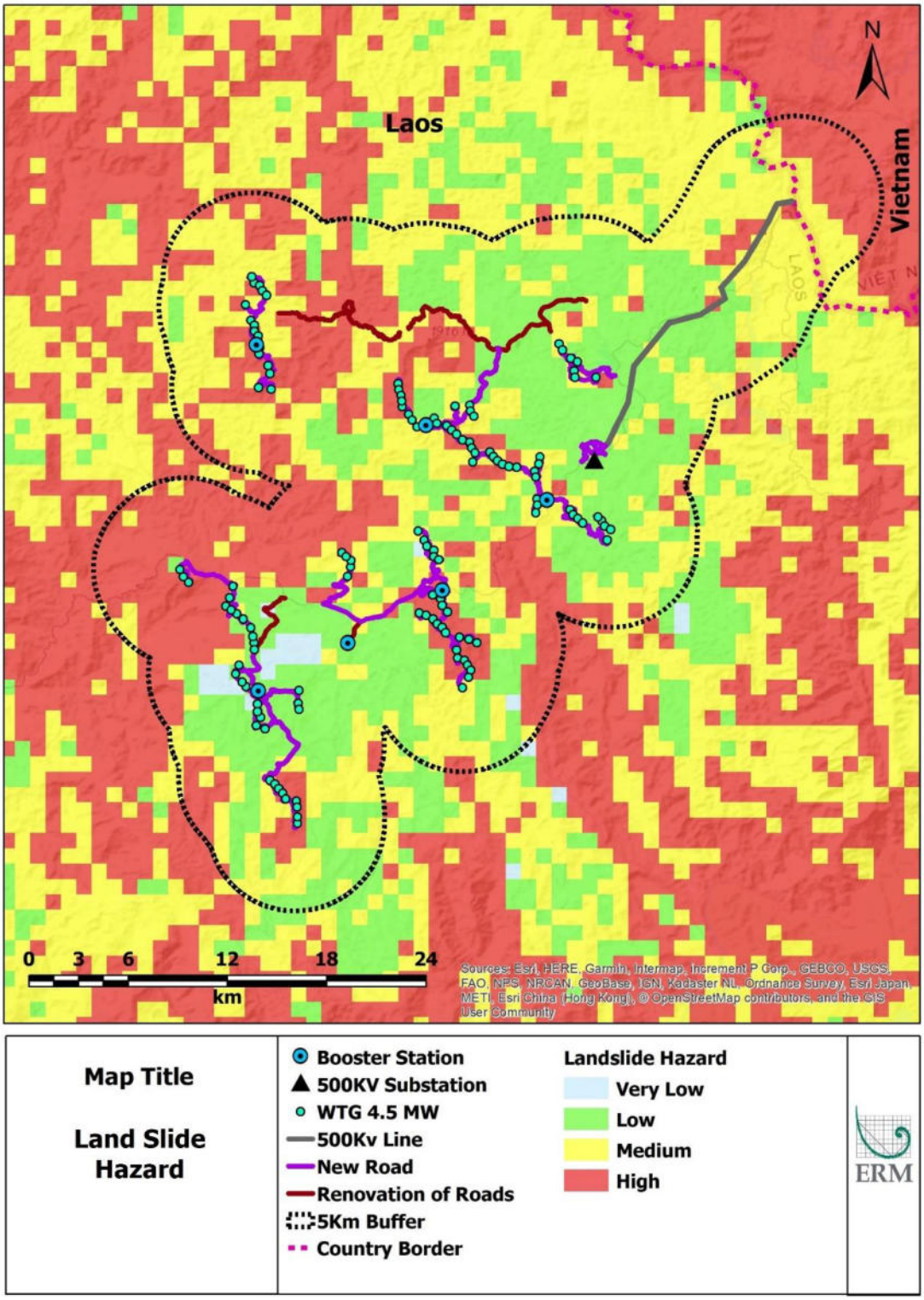
The World Bank Data Catalog provides data landslides hazard due to precipitation. The data is in the form of raster images with land slide hazard classified in four classes: Very low, Low, Medium, and High.

- Baseline

Landslide susceptibility within study area is reported to vary between Medium to Very High as presented in ***Figure 9-86***. This indicates that the project area is susceptible to landslides owing to factors such as land cover, soil type, and slope. Moreover, the landslide hazard map as presented in ***Figure 9-87 i***ndicate the hazard due to landslides triggered by precipitation to vary between Low-High within Study area. Accordingly, overall hazard due to landslides triggered by precipitation is considered to be '**High**'.

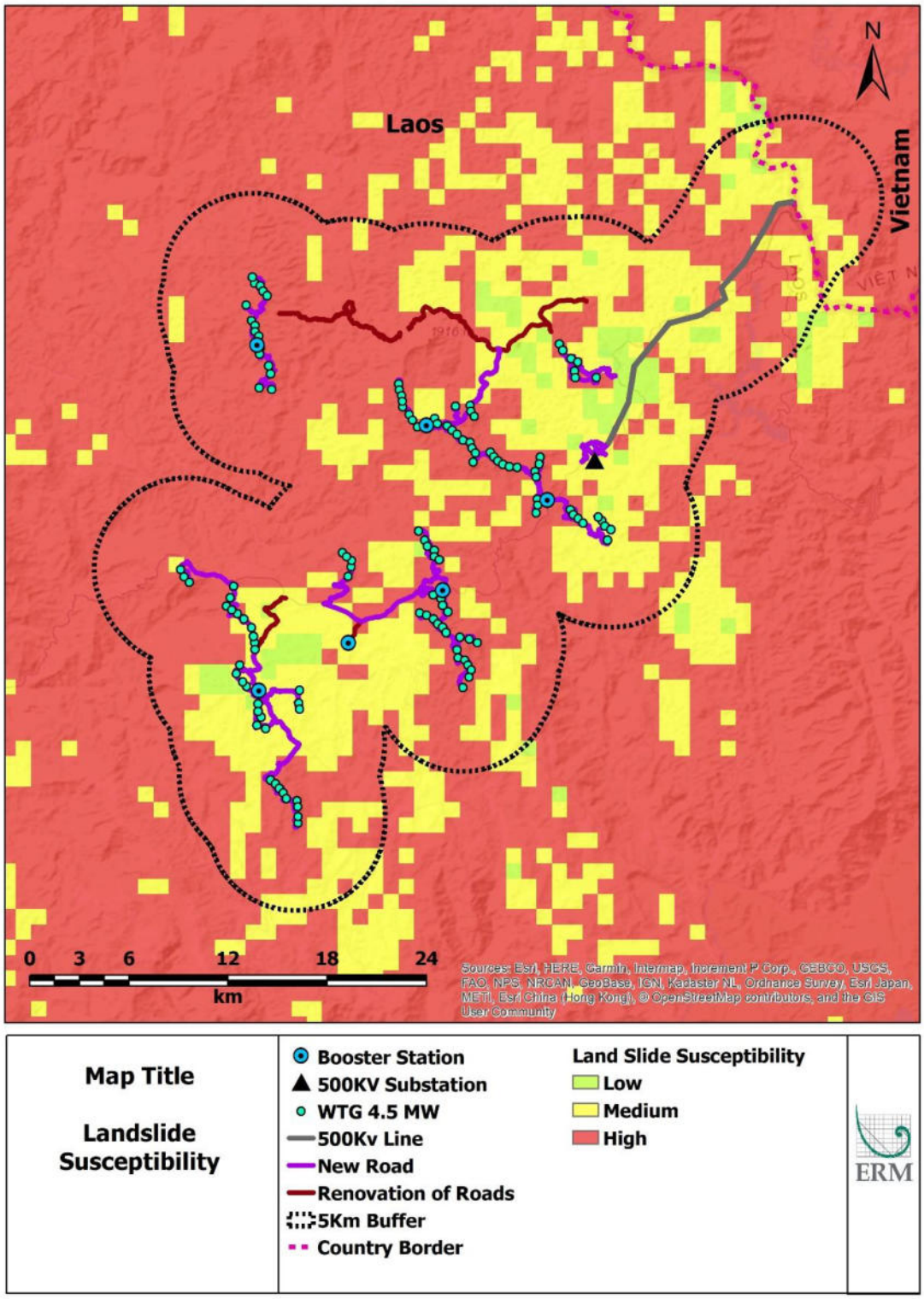
[112] https://earthobservatory.nasa.gov/images/89937/a-global-view-of-landslide-susceptibility
[113] https://link.springer.com/article/10.1007/s11069-017-2757-y

Figure 9-86: Baseline Landslide Hazard



Source: Word Bank Data Catalog

Figure 9-87: Landslide Susceptibility



Source: NASA

- Climate Change

As landslides due to rainfall are triggered during extreme precipitation, changes in landslide hazard were evaluated qualitatively based on the projected changes in one day maximum precipitation. Future hazard due to landslides was estimated only for those locations where baseline hazard due to landslides was reported. For other locations, no hazard due to landslides due to precipitation was considered.

Climate change projections for extreme precipitation (rainfall) indices of 1 day maximum rainfall, 5 day maximum rainfall, and number of day with heavy rainfall (>10mm) indicated increasing trend under all climate change scenarios, except RCP 4.5 in 2030. Extreme precipitation under RCP 4.5 indicated slight decrease in 2030. The increase in extreme precipitation is observed to get intensified with time and radiative forcing (RCP). Accordingly, highest increase in extreme precipitation is projected to be in 2050 under RCP 8.5 scenario.

Similarly, precipitation during cyclones originating in north-east Pacific Ocean is projected to increase by up to 19.4% by 2050 under RCP 8.5 scenario. Therefore, any change in topography during development of project and increased intensity of precipitation may lead to localised surface flooding in future.

Table 9-97: Climate Change Projections for Extreme Precipitation

Parameter	Absolute Values					Percentage Change (%)			
	Baseline	RCP 4.5		RCP 8.5		RCP 4.5		RCP 8..5	
		2030	2050	2030	2050	2030	2050	2030	2050
1-Day (mm)	67.1	-0.9	3.7	0.5	6.0	-1.5	5.6	0.8	9.1
5-Day (mm)	169.8	-6.9	6.9	1.7	11.9	-4.1	4.06	1.0	7.1
>10 mm (Days)	35	-0.3	1.21	0.6	2.1	-0.9	3.4	1.6	5.8
Cyclonic Precipitation* (mm)	N.D.	N.D.	N.D.	N.D.	N.D.	10.1	14.8	11.1	19.4

(*: Changes in cyclonic precipitation are based on the studies conducted by Kunston et. al.(2020)[114] providing projections for basin wise occurrences in cyclones and associated variables such as wind speed, frequency, and precipitation. For the purpose of this assessment a linear relationship is assumed between global average temperature rise and occurrences of cyclone. Accordingly, the projections for cyclones were adjusted from projections for 2°C scenario.).

Such increase in extreme precipitation may exacerbate the landslide hazard in future under climate change scenario. Moreover, changes in topography during the project development may locally exacerbate the landslide susceptibility. Hence, the hazard due to landslides triggered by precipitation is considered to remain '**High**' under all climate change scenarios.

Table 9-98: Summary for Landslide Hazard under Baseline and Climate Change Scenario

Baseline	RCP 4.5		RCP 8.5	
	2030	2050	2030	2050
High	High	High	High	High

[114] https://journals.ametsoc.org/view/journals/bams/101/3/bams-d-18-0194.1.xml

Extreme Heat

Extreme temperature or extreme heat conditions usually happen gradually and not recognised easily as that of other extreme events such as cyclones, and floods. However, these can pose a significant threat to health and safety, increase energy demand for cooling, and destroy crops.

Typically, heat wave conditions can be characterised by temperatures exceeding 35°C. Moreover, with higher humidity extreme heat like conditions can occur at lower temperatures[115].

For the purpose of this assessment, extreme heat hazard under baseline conditions was evaluated based on the two parameters as given below.

- Occurrences of events with daily maximum temperature greater than 35°C.
- Extreme heat hazard category as evaluated by Think Hazard based on the wet bulb globe temperature.

The Wet Bulb Globe Temperature (WBGT) is a measure of the heat stress in direct sunlight, which takes into account: temperature, humidity, wind speed, sun angle and cloud cover (solar radiation). It differs from the heat index, which takes into consideration temperature and humidity and is calculated for shady areas. The WBGT has an obvious relevance for human health, but it is relevant in all kinds of projects and sectors as heat stress affects personnel and stakeholders, and therefore the design of buildings and infrastructure. In general, the WBGT is a relevant enough proxy to quantify the strain on physical infrastructure (energy, water, transport), such as increased demands for water and electricity, which may also affect decisions related to infrastructure[116,117]. Extreme heat was evaluated based on baseline and projected temperature.

- Baseline

Evaluation daily temperature data from NASA Power Viewer, indicated the daily maximum temperature to vary between 13.4-39°C with average maximum temperature of 28.2°C. Average annual temperature is reported to be 22.8°C under the baseline scenario. Moreover, on average the daily maximum temperature is reported to exceed 35°C, 18 times per year.

The extreme heat hazard as evaluated by Think Hazard indicated a Medium hazard in Sanxay District in Attapeu, and Dak Cheung District in Sekong province (Figure 9-88) where the Project is located.

Accordingly, the extreme heat hazard under baseline conditions is evaluated to be '**Medium**'.

The heat hazard was also evaluated to assess the impact of extreme heat conditions on wind turbines. The wind turbines are reported to be designed for operational temperature range of -20 to 45°C and -30 to 40°C.

Considering an environmental lapse rate of ~6.5°C/1000 m, the temperature at the turbine (160 m above ground level or abgl) is expected to be ~1.03°C lower than the near surface temperature discussed above. Accordingly, the maximum temperature at the level of turbine likely to vary between 12.4-38°C, with average maximum temperature of 27.2°C under baseline conditions. Whereas, minimum temperature is estimated to vary between 4.2-24.6°C, with average minimum temperature of 9.6°C.

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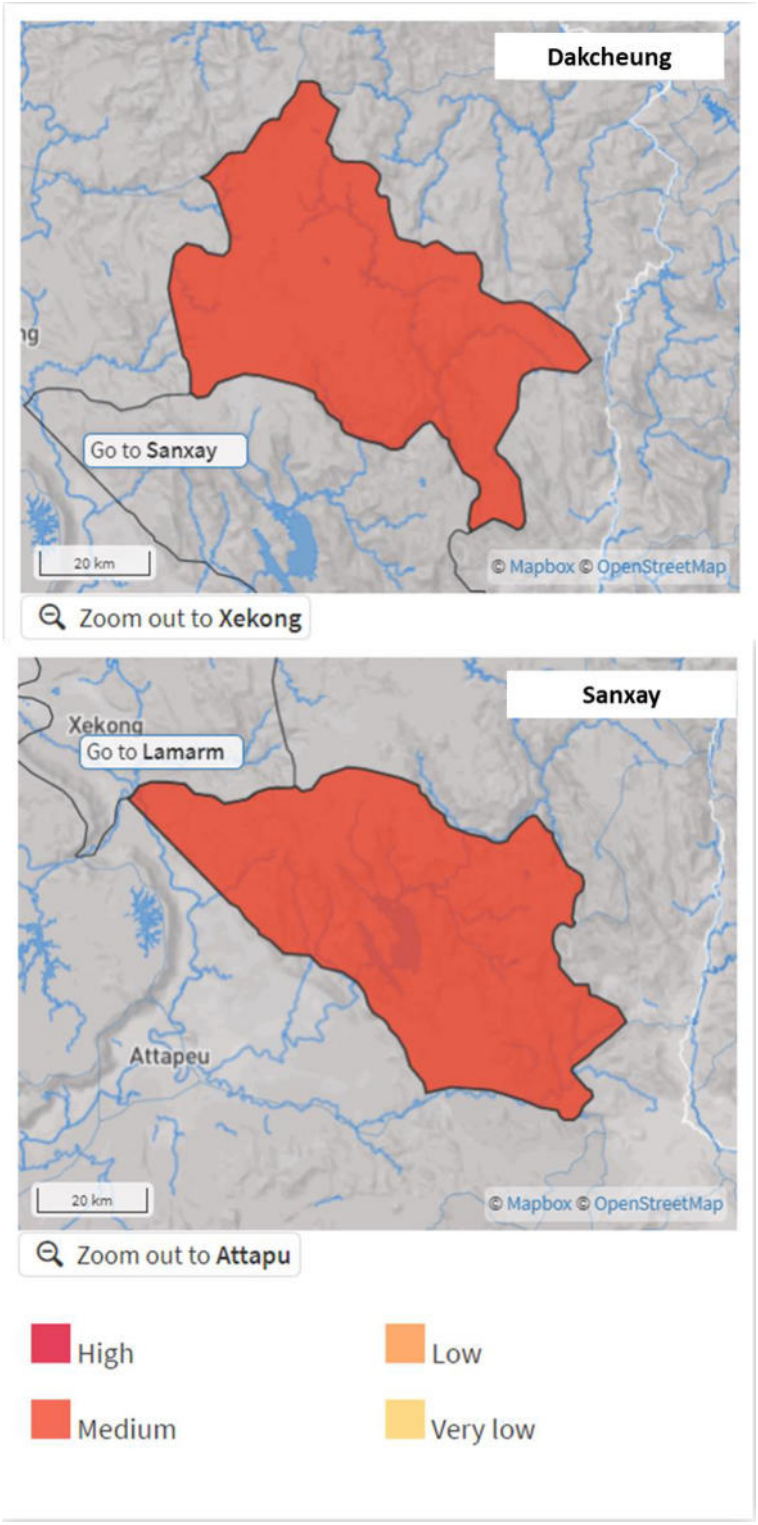
[115] https://thinkhazard.org/en/report/5770-bangladesh-chittagong-chittagong/EH

[116] https://www.weather.gov/tsa/wbgt#:~:text=The%20WetBulb%20Globe%20Temperature%20(WBGT,is%20calculated%20for%20shady%20areas.

[117] https://thinkhazard.org/static/documents/thinkhazard-methodology-report_v2_0.pdf

Accordingly, based on the available information the reported baseline maximum and minimum temperature are reported to be within designed operational temperature ranges of the turbine.

Figure 9-88: Baseline Extreme Heat Hazard



Source: Think Hazard

- Climate Change

Climate change projections for temperature related parameters of average, average maximum, and warm spell duration indicated an increasing trend under all climate change scenarios as presented in ***Table 9-99.***

Table 9-99: Climate Change Projections for Temperature Parameters

Parameter	Baseline	Change from Baseline			
		RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
Average Temperature (°C)	23.9	0.9	1.5	1.0	1.9
Average Maximum Temperature (°C)	27.6	0.9	1.5	1.1	1.9
WSDI (Warm spell duration index) (days)	12	32	62	35	73

Furthermore, the climate change projections for maximum daily temperature indicated an increase trend as presented in ***Table 9-100.***

Table 9-100: Climate Change Projections for Maximum Temperature

RCP 4.5		RCP 8.5	
2030	2050	2030	2050
0.9°C	1.5°C	1°C	1.9°C

Source: World Bank Climate Change Knowledge Portal

Considering the projected increase in average, average maximum temperature, maximum temperature, and WSDI, the heat hazard is likely to increase in the future under all climate change scenarios. Accordingly, the extreme heat hazard under all climate change scenario is considered to be '**High**'.

Table 9-101: Summary of Extreme Heat Hazard under Baseline and Climate Change Scenarios

Baseline	RCP 4.5		RCP 8.5	
	2030	2050	2030	2050
Medium	High	High	High	High

Similar to the baseline scenario, the heat hazard was also evaluated to assess the impact of extreme heat conditions on wind turbine. Considering the projected change in maximum temperature, the maximum temperature at the level of turbine is likely to vary between 13.3-38.9°C, with average maximum temperature of 28.1°C under baseline conditions. This indicates that the maximum temperature is likely to remain within the design operational temperature range of the turbine.

Cyclone and Wind

As per American Meteorological Society, a cyclone is a large scale air mass that rotates around a strong centre of low atmospheric pressure. Tropical cyclones are formed over oceans due to conducive an coinciding conditions such as warm sea surface temperatures, atmospheric instability, high humidity in

the lower and middle levels of troposphere, Coriolis force to develop low pressure centre, and low vertical wind shear. Cyclones bring high wind speeds and heavy downpour with them, which are likely to cause disruption to infrastructure, structures, flooding, and other damage to build and natural environment.

For the purpose of this assessment, cyclone hazard was evaluated based the historical cyclone tracks data from International Best Track Archive for Climate Stewardship (IBTrACS) from NOAA. This database provides the cyclone tracks data since 1980 to present.

- Baseline

Cyclone hazard was evaluated based on the highest storm category recorded within 100 km distance of Site Area as presented in ***Figure 9-89. Table 9-102***presents the number of storms reported under each category.

Table 9-102: Historical Cyclones Recorded within 100km Distance of the Site Location (1981-Present)

Category of Cyclone	Sustained Wind Speed (km/h)	Count
Tropical Storm	<119	
Category 1	119-153	16
Category 2	154-177	5
Category 3	178-208	1
Category 4	209-251	0
Category 5	>251	0
Total		**22**

Accordingly, considering all but one of the historical occurrences of cyclones is below category 3, the hazard rating due to cyclones is considered to be Medium**'**.

Maximum wind speed recorded at nearest location (Attapeu) located ~50 km west of the Site location indicated the variation of maximum wind speed to be between 1.0 - 23 m/s with an average of 2.4 m/s under baseline. Accordingly, the based on maximum wind speed likely to be experienced in the region, the wind hazard is considered to be '**High**'.

Further, the wind hazard was also evaluated to assess the impact of wind speed on the wind turbine. The wind turbines are reported to be designed for operational wind speed range of 2.5-26 m/s. for GW-165-4.0 MW type of turbine, and 2.5-24 m/s for GW-155-4.5 MW type of turbine.

The wind speed at the level of wind turbine is estimated based on the relationship presented in equation below

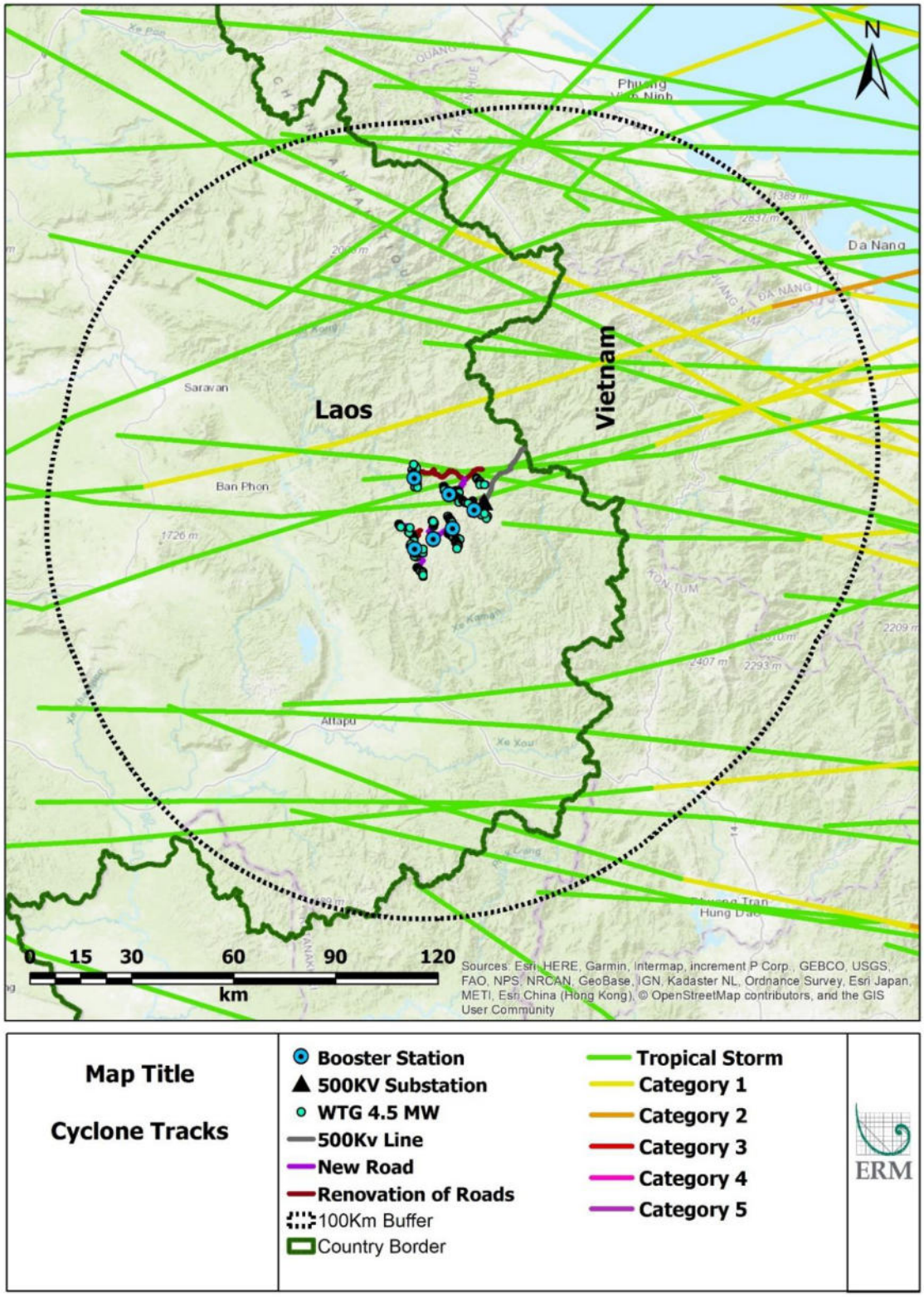
$$\frac{v}{v_o} = \left(\frac{H}{H_0}\right)^{\propto}$$

Where,

$\propto$: coefficient of friction (0.4) for Villages, hamlets and small towns, farming land with many or tall sheltering hedgerows, forest areas and very rough and uneven terrain Landscape

Accordingly, the maximum wind speed at the level of turbine (160 m-abgl) is estimated to be between 3.03-69.7 m/s. This indicates that the power generation may be interrupted during high wind conditions under the baseline scenario.

Figure 9-89: Historical Cyclone Tracks



Source: NOAA-IBTrACS

- Climate Change

Tropical cyclones or Typhoons occur in most of the tropical oceans and present significant threat to coastal communities and infrastructure. Every year, about 90 cyclones or Typhoons are reported to occur globally. Further, this number is reported to remained pretty constant since the period of geo stationary satellites (1970s). However, changes in inter-annual and multi-decadal frequency within individual ocean basin are reported to be substantial.

A literature review indicated that the detection of trends in cyclone or Typhoon occurrences (frequency and intensity) is a challenge due to: i) Changes in observation technology, ii) variations in protocol for identification of cyclones or Typhoons in different ocean basins, and iii) limited availability of homogeneous data (30-40 years).

Global reanalysis of tropical cyclone or Typhoons intensity using homogenous satellite data indicated increasing trend in intensity of cyclones, with a suggestive link between cyclone or Typhoons intensity and climate change. However, these observations based on 30 years period, are reported to be insufficient to conclusively provide the evidence for a long-term trend.

Climate change studies suggested likely increase in peak wind intensity and near storm precipitation in future tropical cyclones, and decrease in overall frequency of cyclones. Spatial resolution of some of the earlier models used in AR4 is generally reported to be too coarse to simulate tropical cyclones. The recent advances in downscaling techniques are reported to indicate some level of success in simulating/ reproducing observed tropical cyclone characteristics. However, it should be noted that there exists limitations and high uncertainty in simulation of tropical storms.

IPCC's special report on 1.5°C scenario[118] noted similar remarks stating that the limited period of 30-40 years of observations is not enough to conclusively distinguish anthropogenic induced changes with decadal changes in overall cyclone frequencies. Further studies conducted for detection of Category 4 and 5 cyclones over recent decades indicated increasing trend. However, these changes in frequency are reported to vary from one ocean basin to another. Studies conducted with higher degree of warming indicated a decreasing trend in total number of tropical cyclones while increase in Category 4-5 cyclones.

The recent study by Knuston et. al. (2020)[119] indicated the following likely changes for occurrences of tropical cyclone over North-West Pacific:

- Overall frequency of tropical cyclone by -30 to 20% with median change of -10%,
- Changes in frequency of category 4-5 cyclone between -30 to 40% with median change of -5%.
- Intensity of cyclone indicated change between 2.5 to 10% with median of 5% increase under 2°C scenario by end of the century

Considering the projected in maximum sustained wind speeds the hazard due to cyclone under all climate change scenarios is considered to remain '***High'***.

Climate change projections for maximum wind speed (non-cyclonic) indicated increase in RCP 4.5 climate change scenarios for 2030 and 2050. Also, it is observed the percent change in sustained wind speed and wind will be increase for all climate change scenarios for Ground level.

[118] https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap3_FINAL-1.pdf

[119] Tomas Knuston, Suzana J, Camargo, Jhonny C. L. Chan, Kerry Emanuel, Chang-Hoi Ho, James Kossin, Mrutyunjay Mohapatra, Masaki Satoh, Masato Sugi, Kevin Walsh, and Ligiang Wu (2020. Tropical Cyclones and Climate Change Assessment: Part II: Projected Responses to Anthropogenic Warming. J. Bulletin of American Meteorological Society. 101 (3). 303-322. https://journals.ametsoc.org/view/journals/bams/101/3/bams-d-18-0194.1.xml

Table 9-103: Projected Changes in Maximum Wind Speeds under Climate Change Scenarios at Ground Level

Parameter	Absolute Values					Percentage Change (%)			
	Baseline	RCP 4.5		RCP 8.5		RCP 4.5		RCP 8..5	
		2030	2050	2030	2050	2030	2050	2030	2050
Average Maximum Wind Speed (m/s)	7.3	7.2	7.1	7.4	7.5	-1.9	-3.0	1.6	2.2
Maximum sustained wind at 2^0 Change of Temperature (source: *Knuston et al. (2020)*)	ND	ND	ND	ND	ND	3.0	4.4	3.3	5.8

Accordingly, considering the projected increase in cyclonic (sustained) wind speeds the overall hazard due to wind speeds is considered to remain '**High**'.

Table 9-104: Summary for Cyclone and Wind Hazard under Baseline and Climate Change Scenario

Baseline	RCP 4.5		RCP 8.5	
	2030	2050	2030	2050
High	High	High	High	High

Wild Fire

Wildfires are uncontrolled fires in areas of combustible vegetation. Of the various types of wildfires, forest fires are the most detrimental. The natural causes of wildfires are ascertained to be dry (and hot) climate, lightning, and volcanoes. The most common human causes of wildfire are listed as arson or sabotage, discarded cigarettes, power-line arcs, and sparks from equipment. The key parameters determining the occurrence and spread of wildfires are availability of flammable materials, fuel density, moisture content, ambient temperature, and weather conditions (wind speed).

The impacts of wildfires on the built and natural environment can be significant. In addition, controlling a wild forest fire can be extremely difficult task due to scale, intensity, and accessibility issues. Key impacts of wildfires include economic, environmental and ecological, infrastructural, heritage, and human health.

Wildfire risk was assessed based on the wildfire density data from the UNEP- Global Risk Data Platform, which was available at a resolution of ~2 km. ***Figure 9-90*** presents the average number of fires recorded in the Project area over a period of 1997-2010.

Regional level historical wildfire events are presented in ***Table 9-105.***

Table 9-105: Regional Level Historical Wildfire Events

Province	No of Events	Affected	Deaths	Houses Destroyed	Houses Damaged	Losses in Kip
01 Vientiane Mun.	126	347,549	12	145	13,203	2,303,468,583,001
02 Phongsaly	44	55,846	1	30	108	542,809,351,700
03 Luangnamtha	40	60,725	0	1,369	13	17,394,266,400
04 Oudomxay	89	82,007	2	119	656	86,227,761,020
05Bokeo	44	42,651	0	11	106	40,382,531,930
06 Luang Prabang	95	23,327	11	38	112	11,625,514,400
07 Huaphanh	57	350,944	6	28	4,581	4,549,943,990
08 Xayabury	120	35,656	33	1,776	1,286	140,864,951,548
09 Xiengkhuang	45	3,538	6	94	1	7,990,152,000
10 Vientiane	50	75,948	4	92	4,256	2,622,337,860
11 Borikhamxay	76	332,410	5	10,688	796	51,132,082,097
12 Khammuane	126	1,089,765	5	0	1,906	56,241,239,624
13 Savannakhet	67	366,842	4	39	24,165	3,624,720,000
14 Saravane	47	190,917	2	176	78	1,148,560,844
15 Sekong	26	27,224	18	766	4,049	637,776,280,981
16 Champasack	120	338,351	4	16	385	202,024,213,560
17 Attapeu	33	73,146	0	69	222	1,233,024,000
Total	1,205	3,496,846	115	15,456	55,923	4,111,115,514,955

- Baseline

One of the factors impacting the occurrences of wildfires is the availability of fuel. In simple words anything that can burn such as trees, grass, and shrubs can be considered as fuel. As these combustible material accumulate, the probability of occurrence of wildfire also increase. In the right conditions this fuel allows fire to burn hotter and spread on larger area, making it difficult to manage, resulting in catastrophic damages[120].

Lao PDR in general is reported to have ~56.2% of the area under the forest cover, followed by grass and shrub land covering ~23.9% and cropland 18.5%. Regional land cover distribution for Kindia, Mamou, Faranah, and Kankan is presented in ***Table 9-106***.

[120] https://www.doi.gov/wildlandfire/fuels

Table 9-106: Regional Land Cover Distribution in Lao

Region	Forest	Cropland	Grass/ Shrub-land
Attapeu	73.9%	17.5%	8.1%
Sekong	80.1%	9.6%	10.%

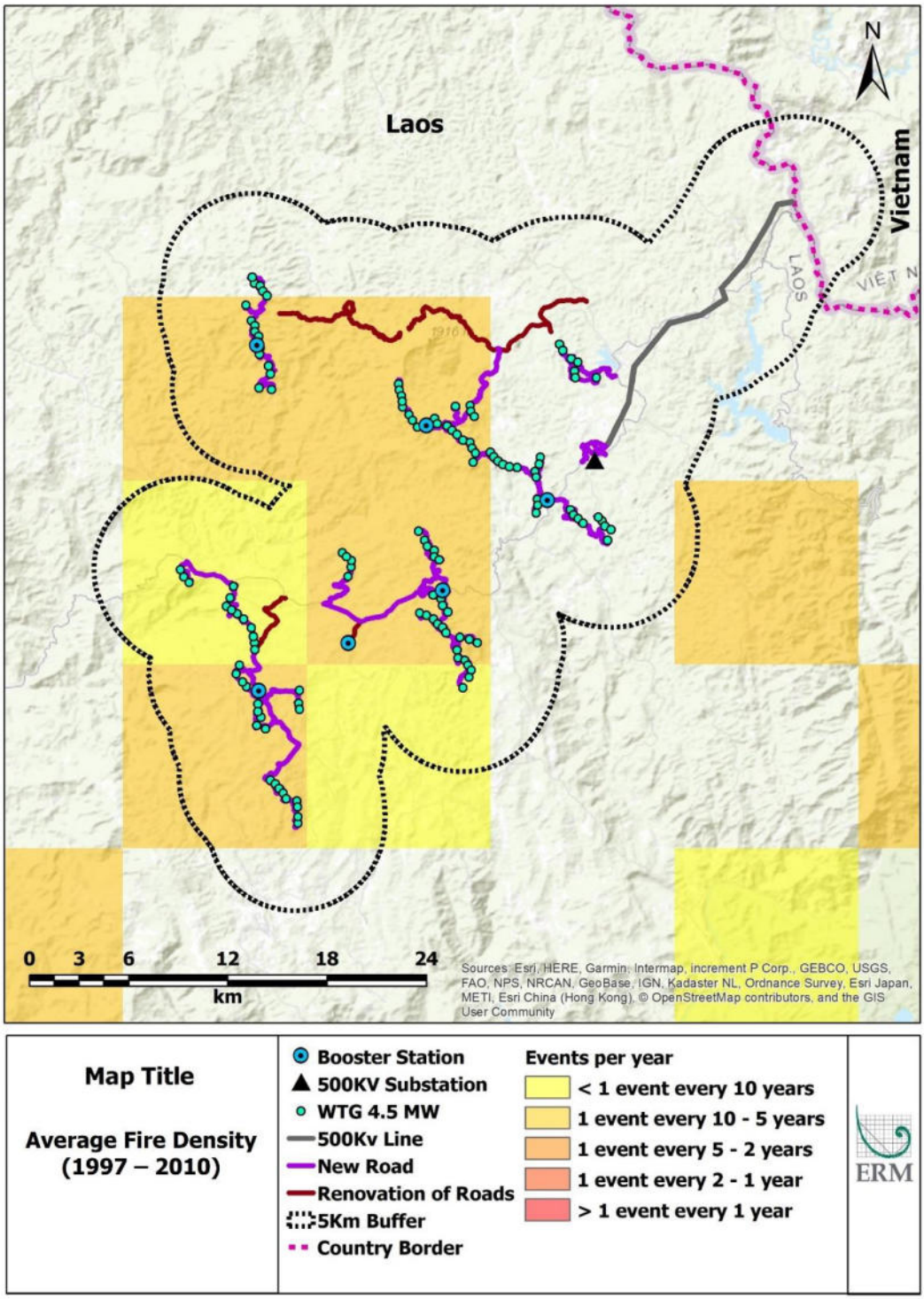
This indicates that, provided the availability of right weather conditions, the project location may be vulnerable to forest fires (wildfires).

The baseline wildfire hazard was evaluated based on frequency of occurrence, as presented in ***Figure 9-90***. Baseline wildfire hazard was reported to vary 'Low' to 'Medium' at the Project site.

Considering, the fact that a forest fire can be triggered due to multiple reasons including natural (e.g. lightning strikes) or anthropogenic (accidental or intentional burning). Frequency of fire incidences only, may not be a good indicator for climate related physical risk assessment.

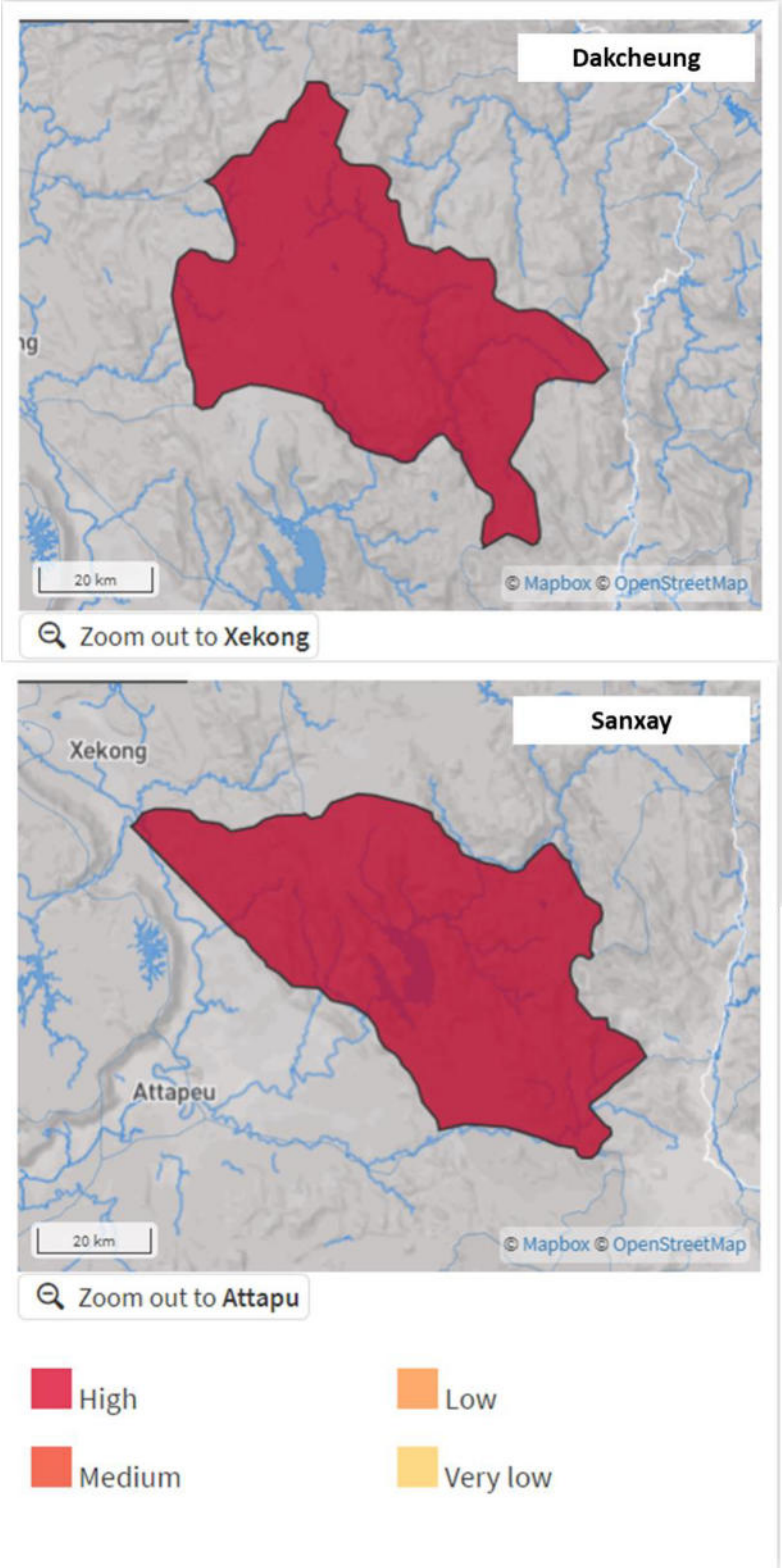
Therefore, for the purpose of this assessment, the wildfire hazard is evaluated based on the frequency of occurrence of weather which can support the significant wildfire as reported by ThinkHazard (***Figure 9-91***). Accordingly, based on prevailing weather supporting the occurrences of wildfire, the wildfire hazard is consider to be '**High**'.

Figure 9-90: Wild Fire Frequency



Source: UNEP- GRID

Figure 9-91: Baseline Wild Fire Hazard



Source: Think Hazard

- Climate Change

The climate change projections indicate increased maximum temperature and longer warm spells as presented in ***Table 9-107***. Therefore, the wildfire hazard is considered to remain '**High**' under all climate change scenarios

Table 9-107: Climate Change Projections for Temperature Parameters

Parameter	Baseline	Change from Baseline			
		RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
Average Temperature (°C)	3.9	0.9	1.5	1.0	1.9
Average Maximum Temperature (°C)	27.6	0.9	1.5	1.1	1.9
WSDI (days)	12	32	62	35	73

Table 9-108: Summary of Wildfire Hazard under Baseline and Climate Change Scenario

Baseline	RCP 4.5		RCP 8.5	
	2030	2050	2030	2050
High	High	High	High	High

Lightning and Thunderstorms

Thunderstorms are usually created by heating of the ground surface resulting in upward atmospheric motion that transport moisture along with air. Thunderstorms may lead to high wind conditions with gust speed exceeding 25 m/s, lightning strikes, extreme rainfall and flash floods, and hail showers[121].

As per National Severe Storm Laboratory (NSSL), lightning is a giant spark of electricity in the atmosphere between clouds, the air, or the ground. The process triggers instant release of energy of the order of 1 Gigajoule. Lightning can be caused in three (3) mechanisms; viz within the same thunder cloud, between two (2) thunderclouds or between a thundercloud and ground.

Lighting can cause damage to natural and built environment. Objects struck by lightning experience heat and magnetic forces of great magnitude. It can affect trees, by vaporizing the sap resulting in bursting of bark, damage to tall buildings and structures and several injuries or loss of life.

For the purpose of present assessment, thunderstorms and lightning were evaluated based on the lightning flash data from NASA.

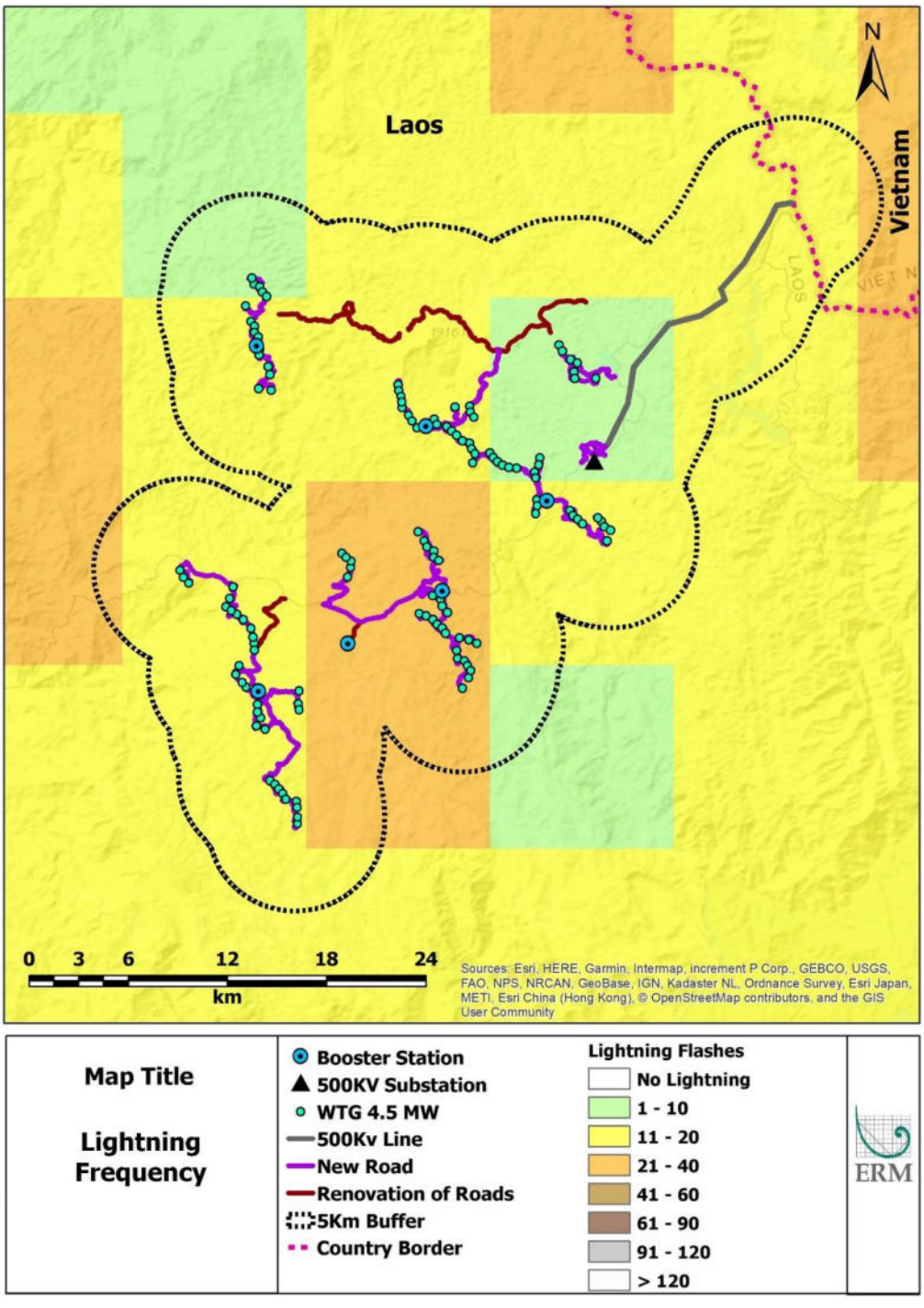
- Baseline

A lightning map based on NASA lightning flash data as presented in ***Figure 9-92*** indicates average lightning frequency to vary between less than 10 to up to 60 flashes/km^2/year in the Study Area.

[121] https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/

In the absence of standards to categorize the thunderstorm/ lightning hazard, hazard categorization has not been conducted. However, these hazards are evaluated to present the historical events and provide an understanding on different types of hazards likely to be experienced at the study areas.

Figure 9-92: Lightning Frequency



Sorce: NASA-GHRC

- Climate Change

There are no direct projections available for lightning. However, as lightning usually occurs during thunderstorms, any changes in occurrences of thunderstorm are considered as measure for changes in lightning in future.

A literature review indicates that predicting changes in thunderstorm is difficult task, and hence generally changes in frequency of large scale environmental conditions conducive to thunderstorms are used as an indirect measure. One such factor is convective available potential energy (CAPE), which is a measure of maximum kinetic energy obtainable by an air parcel lifted adiabatically from near surface. CAPE is also reported to be important large scale indicator for the potential lightning.

The literature review also indicates tropical and subtropical CAPE extremes increasing sharply with warming across ensembles of global climate models participating in Coupled Model Intercomparison Project 5 (CMIP5). Projections for CAPE available from literature indicated an increase of 250-500J/kg in CAPE by end of century under RCP 8.5 scenario. Such increase in CAPE in future is likely to increase the frequency of days with conditions conducive to the formation of thunder storms by ~25 days/ year.

Hence, increase in thunderstorm and lightning activity can be expected in future under climate change scenarios. In addition, the development of windfarms may further exacerbate the lightning strikes in the area.

9.6.2.3 Existing Controls

Water Availability

- Whenever the project is required to pump water from the stream in the Project area for construction, a water use plan will be required and notified to the local people. This should be coordinated with the State agency of the district and provincial levels.
- Provide clean water for use for consumption to construction workers.

Riverine Floods

- When a rainstorm warning is received, consider suspending operations and transfer personnel to safe location.
- Review meteorological information regularly, and take precautions against possible floods, landslides, mudslides, and other disasters.
- Ensure an Emergency Response Plan is in place covering floods, landslides, wildfires, cyclones, and thunderstorms.

Landslides

- Review meteorological information regularly, and take precautions against possible floods, landslides, mudslides, and other disasters.
- Ensure an Emergency Response Plan is in place covering floods, landslides, wildfires, cyclones, and thunderstorms.
- Avoid undertaking earthwork during heavy rainfall that can cause erosion; perform backfilling and compacting work after completing the construction; replantation in suitable areas where possible.
- Extreme Heat
- Ensure designed operation temperature range ~30-40°C

Cyclone and Wind Speed

- Ensure designed operational wind turbines at wind speed ranges between ~24 to 26 m/s.
- Ensure an Emergency Response Plan is in place covering floods, landslides, wildfires, cyclones, and thunderstorms.
- Design to consider wind turbine's impeller lock process for wind speeds.

Wild Fire

- Ensure an Emergency Response Plan is in place covering floods, landslides, wildfires, cyclones, and thunderstorms.

Lightning and Thunderstorms

- Ensure lightning protection grounding of the wind turbine. A metal air termination system is installed at the blade tip. A copper conductor is used to reliability connect the air termination system to the lightening lead on hub.
- Ensure an Emergency Response Plan is in place covering floods, landslides, wildfires, cyclones, and thunderstorms.
- Ensure design according to IEC-61400-24 to achieve Grade I lightning protection to wind turbine the cross-sectional area of blade lighting protection copper conductor should not be less than 50mm^2.

9.6.2.4 Significance of Risks

Water Availability

- There is no significant risk due to reduced or non-availability of water is expected. However, it may impact the water requirement of domestic usage including drinking and sanitation by the employees and workers at the Site.
- Water availability may impact the water required by the nearby communities for their domestic and agricultural purposes.

Riverine Floods

- No significant risk due to riverine floods is expected.

Landslides

- Landslides may damage physical infrastructure including wind turbines, transmission towers, and substations. This may also result in disruption of operations at the Site.
- Landslides can also pose a significant threat to health and safety of the employees and workers working at the Site.
- Disruption of access routes to and from the Site.

Extreme Heat

- Extreme temperature may result in reduced wind power generation,
- Wind power generation is reported to decline with increase in temperature. Therefore, occurrences of extreme temperature may result in reduced power generation efficiency of the turbines.
- Extreme temperature may also result in damage to electronic components.
- Higher temperatures can also reduce the efficiency of the power transmission
- Extreme temperature may also impact the H&S of the employees due to risk of heat stress. Higher temperature will also result in increased demand for water.

Cyclone and Wind

- Damage to physical assets including wind turbines, transmission towers, and transmission lines due to high wind speeds.
- Suspension of power generation if the wind speeds exceed maximum (cut-off) wind speeds resulting in loss of power generation.
- Threat to the safety of employees, workers working in the open, or at heights (construction or maintenance of wind turbines and transmission lines).

Wild Fire

- Wild fire can result in damage to the physical assets
- It can also pose a significant risk to safety of employees and workers due to fire as well as smoke.

Lightning

- Damage to electrical components due to lightning strike
- Grid failure due to lightning strike
- Damage to electrical components due to lightning strike
- Cost for replacement of assets
- People working in the open during thunder storm may be considered as most vulnerable
- Lightning strikes on human being may result in death or serious injuries

9.6.2.5 Additional Mitigation, Management, and Monitoring Measures

Water Availability

- The water availability related issues should be monitored and tracked closely.
- Implement water saving technologies for domestic water usage within project.

Riverine Floods

- Site to implement identified control/ response measure.
- Monitor flood situation at the Site. If any significant floods events affecting the physical infrastructure, operations, and health and safety are observed in future, detailed studies may be considered for flood mitigation measures.

Landslides

- Undertake detailed geotechnical studies to identify areas prone to landslides
- Based on the geotechnical studies identify and implement appropriate design considerations and control measures
- Regular geotechnical field inspection to check for any signs of risks of landslides
- Prepare emergency response plan for landslide events

Extreme Heat

- Worker's resting areas, on-site offices, worker's quarters should be constructed with heat resisting material to keep the indoor temperature lower.

- A heat stress management plan should be prepared as part of standard operations and safety procedures.
- Train workers to identify the symptoms of heat stress and first aid.
- Make appropriate considerations while designing the cooling systems (if required).

Cyclone and Wind

- Include cyclone and wind as one of the hazard in emergency management plan

Wild Fire

- Include wildfire as one of the hazard in emergency management plan
- Develop and maintain fire lines around the important assets
- Develop and maintain vegetation clearances with respect to prevailing standards and regulations
- Lightning
- Include lightning as one of the hazard in emergency management plan

9.6.2.6 Residual Impact Significance

Table 9-109 presents the summary of hazards under various climate change scenarios and implications of the hazard on various project components.

Table 9-109: Hazard Receptor Matrix

Hazard	Hazard Category (Acute or Chronic)	Hazard Level				Summary of Applicable Planned/ Existing Control Measures							Recommendations
		RCP 4.5		RCP 8.5									
		2030	2050	2030	2050		Wind Turbine (WTG)	Transmission line and Towers	Sub stations	Other Buildings	Employees	Communities	
Water Availability	Chronic	Low	Low	Low	Low	■ Prepare water use plan and inform the local people and coordinate with the State agency of district and provincial levels for inspecting whether the water pumping point is appropriate or not[122]. ■ Provide clean water for use for consumption to construction workers[122].	■ No Implications	■ No Implications	■ No Implications	■ No Implications	■ Reduced availability for domestic usage including sanitation and drinking	■ Reduced availability for domestic and agricultural use	■ The water availability related issues should be monitored and tracked closely ■ Implement water saving technologies for domestic water usage within project. •
Riverine Floods	Acute	None	None	None	None	■ Consider cutting off outdoor power supply and suspending operations. Ensure personnel transferred to the safe place[122] ■ Review regularly meteorological information, and take precautions against possible floods, landslides, mudslides, and other disasters[123]. ■	■ No Implications	■ No Implications	■ No Implications	■ No Implications	■ No Implications	■ No Implications	■ Implement identified control measures
Landslides	Acute	High	High	High	High	• Keep an eye on meteorological	■ Physical damage to	■ Physical damage to	■ Physical damage to	■ Physical damage to	■ Health and Safety	■ Physical damage to	■ Implement identified

[122] Environmental Consultancy Company (2020). 600 MW Monsoon Wind Farm Project Dakcheung District, Sekong Province and Sanxay District, Attapeu Province Environmental and social Impact assessment Report.
[123] Goldwind International for rainstorm and flood emergency disposal plan

Hazard	Hazard Category (Acute or Chronic)	Hazard Level				Summary of Applicable Planned/ Existing Control Measures							Recommendations
		RCP 4.5		RCP 8.5									
		2030	2050	2030	2050		Wind Turbine (WTG)	Transmission line and Towers	Sub stations	Other Buildings	Employees	Communities	
						information, and take precautions against possible floods, landslides, mudslides and other disasters[122]. • Avoid undertaking earthwork during heavy rainfall that will easily cause erosion; perform backfilling and compacting work after completing the construction; plant the grass on suitable places or leave the places for the plants to grow and become green[122];	assets/ foundations	assets/ foundations ■ Disruption of supply chains	assets/ foundations	assets/ foundations	■ Disruption of access routes	infrastructure and buildings ■ Health and safety	control measure ■ Prepare emergency response plan for landslide events •
Extreme Heat	Acute	High	High	High	High	■ Designed operation temperature range ~30-40°C[124]	■ Reduced Efficiency ■ Damage to electronic monitoring/ controlling component ■ Loss of production ■ Costs for replacement of damaged assets	■ Reduced transmission efficiency	■ Overheating of components resulting in damage or reduced efficiency	• Increase in cooling demand	■ Reduced comfort levels ■ Threat of heat stress/ heat stroke • Increased water demand	■ Reduced comfort levels ■ Threat of heat stress/ heat stroke • Increased water demand	• Worker's resting areas, on-site offices, worker's quarters should be constructed with heat resisting material to keep the indoor temperature lower. • A heat stress management plan should be prepared as part of standard operations and safety procedures.

[124] Information of the proposed WTG, Technical Document, 600MW Monsoon On-Shore Wind Farm Project.

Hazard	Hazard Category (Acute or Chronic)	Hazard Level				Summary of Applicable Planned/ Existing Control Measures						Recommendations
		RCP 4.5		RCP 8.5								
		2030	2050	2030	2050		Wind Turbine (WTG)	Transmission line and Towers	Sub stations	Other Buildings	Employees	Communities	
													• Train workers to identify the symptoms of heat stress and first aid. • Make appropriate considerations while designing the cooling systems (if required).
Cyclone and Wind Speed	Acute	High	High	High	High	• Operate wind turbines at wind speed ranges between ~24 to 26 m/s[124]. • Projects in combination with the practical situation of the site of the project and the project office, cyclone early warning information, based on the local meteorological department to detailed ferreting cyclone hazards, to identify the hazards and take appropriate measures, plan, supervision and control[125]. • Check the wind turbine's impeller lock situation on site[125]. • During the cyclone, people stay in permanent residence	■ Damage due to high wind speed ■ Suspension of power generation if the upper limit for wind speed exceeds ■ Lost production • Cost for replacement of assets	■ Damage, uprooting of transmission towers ■ Short-circuiting in transmission lines • Cost for replacement of assets	■ Structural damage due to heavy rainfall • Cost for replacement of assets	■ Damage/ collapse of non-permanent structures • Cost for replacement of assets	■ High wind speed can lead to threat towards safety of workers working at heights for installation or maintenance of wind turbines, transmission line during high wind conditions. The threat can be in the form of fall or injury to the eyes from the debris (sand/ dust) carried by the winds. •	• Health and Safety	■ Implement identified control measure • Include cyclone and wind as one of the hazard in emergency management plan

[125] Goldwind International typhoon emergency plan

Hazard	Hazard Category (Acute or Chronic)	Hazard Level				Summary of Applicable Planned/ Existing Control Measures							Recommendations
		RCP 4.5		RCP 8.5									
		2030	2050	2030	2050		Wind Turbine (WTG)	Transmission line and Towers	Sub stations	Other Buildings	Employees	Communities	
						and are prohibited from staying in temporary rooms[125] • Before the cyclone comes, should pay attention to the safety of the electric field. Important equipment such as computer and air conditioning must be off[122]							
Wildfire	Acute	High	High	High	High	• No Existing Plans Available	■ Physical damage to assets	■ Physical damage to assets	■ Physical damage to assets	■ Physical damage to assets	■ Health and Safety ■ Disruption of access routes	Physical damage to infrastructure and buildings Health and safety	■ Include wildfire as one of the hazard in emergency management plan ■ Develop and maintain fire lines around the important assets ■ Develop and maintain vegetation clearances with respect to prevailing standards and regulations
Lightning	Acute					• Check the lightning protection grounding of the wind turbine[126]. • A metal air termination system is installed at blade tip. A copper conductor is used to reliability	■ Damage to electrical components due to lightning strike ■ Lost production	■ Grid failure ■ Cost for replacement of assets	■ Damage to electrical components due to lightning strike ■ Cost for replacement of assets	■ Damage to electrical components due to lightning strike ■ Cost for replacement of damaged good	■ People working in the open during thunder storm may be considered as most vulnerable ■ Lightning strikes on human being may result in	■ People working in the open during thunder storm may be considered as most vulnerable ■ Lightning strikes on human being may result in	■ Implement identified control measures ■ Include lightning as one of the hazard in emergency

[126] WTG Specifications, 600MW On-Shore Wind Farm Project, Tendering Document

Hazard	Hazard Category (Acute or Chronic)	Hazard Level				Summary of Applicable Planned/ Existing Control Measures						Recommendations
		RCP 4.5		RCP 8.5								
		2030	2050	2030	2050		Wind Turbine (WTG)	Transmission line and Towers	Sub stations	Other Buildings	Employees	Communities	
						connect the air termination system to the lightening lead on hub. • According to IEC-61400-24 to achieve Grade I lighting protection to wind turbine the cross-sectional area of blade lighting protection copper conductor should not be less than 50mm^2 ■ If any worker wants to go out, do not carry umbrellas. At the same time, the lightning protection measures.	■ Cost for replacement of assets				death or serious injuries	death or serious injuries	management plan •

EP-4 requires to identify potential impacts of project development on exacerbation of climate related risks as presented in ***Table 9-110***.

Table 9-110: Impact of Project on Exacerbation of Climate Related Physical Risks

Hazard	Hazard Category (Acute or Chronic)	Implications
Landslides	Acute and Chronic	■ Change in land use pattern and excavations may further exacerbate the landslide hazard
Lightning	Acute	■ The wind turbine tower may exacerbate the lightning strikes
Wildfire	Acute	■ Any short-circuiting between over-head power lines during high wind conditions (particularly during dry periods) may trigger wildfire.

9.7 Unplanned Events

This chapter presents the probable impacts of unplanned events associated with construction and operation of the Project. The unplanned events are those that potentially arise from technical failure, human error, or as a result of natural phenomena.

The assessment of unplanned impacts considers the probability of events occurring and an estimate of the severity of consequences. The assessment of the severity of impacts due to fire and explosion is based on the worst case scenario, where it is assumed that safety devices and associated measures fail to operate properly resulting in the incidents.

9.7.1 Scope of Impact Assessment of Unplanned Events

This assessment addresses the following unplanned events:

- Blade throw;
- Fire and explosion including Unexploded ordnance (UXO);
- Spillage of fuel, oil, and hazardous materials;
- Traffic accidents;
- Natural unplanned events such as landslides and floods; and
- Transmission line snapping, and transmission tower/pylon collapse;

9.7.2 Impact Assessment Methodology

To evaluate potential impacts from unplanned events, a risk-based approach is used to define:

- the most likely unplanned events leading to environmental, social and/or community health impacts; and
- those unplanned events with the most significant potential environmental, social and/or community health impacts overall. Impact significance for unplanned events is therefore determined by evaluating the combination of likelihood and consequence.

9.7.2.1 Assess the Scale of Consequence

Indicative levels of consequence for potential impacts from unplanned events can be defined for the physical, biological, and social environment as provided in *Error! Reference source not found.*.

Table 9-111: Indicative Levels of Consequence for Potential Impacts from Unplanned Events

	Incidental (A)	Minor (B)	Moderate (C)	Major (D)	Severe (E)
Physical Environment	Impacts such as localised or short term effects or environmental media, meeting all environmental standards	Impacts such as widespread, short-term impacts to environmental media, meeting all environmental standards	Impacts such as widespread, long-term effects on environmental media, meeting all environmental standards	Impacts such as significant, widespread and persistent changes in environmental media OR Exceedance of environmental standards	Exceedance of environmental standards and fine/ prosecution
Biological Environment	Impacts such as localised or short term effects on habitat or species	Impacts such as localised, long term degradation of sensitive habitat or widespread,	Impacts such as localised but irreversible habitat loss or widespread, long-	Impacts such as significant, widespread and persistent	Impacts such as persistent reduction in ecosystem function on a

	Incidental (A)	Minor (B)	Moderate (C)	Major (D)	Severe (E)
		short-term impacts to habitat or species	term effects on habitat or species	changes in habitat or species	landscape scale or significant disruption of a sensitive species.
Social Environment	Slight, temporary, adverse impact on a few individuals	Temporary (<1 year), adverse impacts on community which are within international health standards	Adverse specific impacts on multiple individuals that can be restored in <1 year OR One or more injuries, not lost-work injuries.	Adverse long-term, multiple impacts at a community level, but restoration possible. OR One or more lost-work injuries to a member of the public including permanently disabling injuries.	Adverse long-term, varied and diverse impacts at a community level or higher – restoration unlikely. OR Fatalities of public.

9.7.2.2 Assessing the Likelihood

For the purposes of assessment, the likelihood of an unplanned event occurring can be classified as follows:

1 - Remote, not known in the industry;

2 - Very unlikely, known of in the industry;

3 - Unlikely, may occur once or more in life of the Project;

4 - Likely, may occur once or twice per year;

5 - Expected, may occur more than twice per year.

9.7.2.3 Assessing the Significance

The consequences and likelihood of potential unplanned events are combined to determine the overall impact significance using the risk matrix shown in *Error! Reference source not found.*.

For potential impacts that are determined to have an impact significance of Moderate or Major, risk reduction measures are identified; these can include measures that reduce the likelihood of the event from occurring (i.e. preventive barriers), those that reduce the consequences on sensitive receptors/resources if the event were to occur (i.e. mitigation or recovery measures), and those that affect the likelihood and consequence.

Table 9-112: Risk Matrix for Potential Unplanned Events

		Likelihood of Occurrence				
		Incidental (1)	**Minor (2)**	**Moderate (3)**	**Major (4)**	**Severe (5)**
Consequence	**Incidental (A)**	Negligible	Negligible	Negligible	Negligible	Negligible
	Minor (B)	Negligible	Minor	Minor	Minor	Moderate
	Moderate (C)	Minor	Minor	Moderate	Moderate	Major
	Major (D)	Moderate	Moderate	Major	Major	Major
	Severe (E)	Major	Major	Major	Major	Major

9.7.3 Assessment of Potential Impacts

Based on the Project activities, the potential unplanned events that were considered to have the highest potential environmental and social risks during all phases of the Project were shown in ***Table 9-113.*** Noted that for the commissioning and operational phases, only indicative project activities were listed. A more comprehensive evaluation of potential impacts would be conducted once sufficient detailed design information is available.

Table 9-113: Unplanned Events Leading to Potential Impacts

Project Phase	Activity	Potential Receptors Affected
Site Preparation and Construction	Small scale leakage and spill incidents from site-preparation / construction activities	Users of surface water and groundwater in nearby communities
	Traffic collisions	Users of the public roadways utilised by the Project.
	Fire and explosion	Nearby communities
	Presence of Explosion of Unexploded Ordnances (UXOs)	Nearby communities
	Natural Hazards - Flooding and Landslides	Nearby communities Forest, habitats, flora, and fauna in the vicinity of the site.
Commissioning and Operation	Small scale leakage and spill incidents from activities on site	Users of groundwater in nearby communities
	Traffic collisions	Users of the public roadways utilised by the Project
	Fire and explosion	Nearby communities Forest, habitats, flora, and fauna in the vicinity of the site.
	Presence of Explosion of Unexploded Ordnances (UXOs)	Nearby communities
	Blade ejection failure	Nearby communities
	Transmission line snapping, and transmission tower/pylon collapse	Nearby communities
	Natural Hazards - Flooding and Landslides	Nearby communities Forest, habitats, flora, and fauna in the vicinity of the site.

Potential impacts from these events are described in detail in the following sections. These potential impacts had been classified using the risk-based impact assessment methodology for unplanned events ***Section 9.7.2***. It should be noted that this methodology was different than that applied to potential impacts from planned activities, as the assessment of potential impacts from unplanned events must consider likelihood as well. Because a risk-based assessment methodology had been used, worst-case scenarios had been considered.

A summary of potential Project-related hazards, contributing causes, and consequences for the Project workforce, nearby communities and/or surrounding environment were summarised in ***Table 9-114***.

In order to reduce Project risk from the key potential unplanned events, the standard mitigation hierarchy should be applied. For the purposes of this assessment mitigation measures were discussed in the following sections where the pre-mitigation significance of the unplanned event is greater than Minor.

Unlike impacts from planned activities, mitigation of unplanned events should consider both pre-event preventative actions (that reduce the likelihood of the cause of the potential impact) and post-event mitigation that reduces the magnitude of the consequence.

Table 9-114: Potential Impacts from Unplanned Events and Pre-mitigation Risk Ranking

No.	Unplanned Event	Cause	Consequence	Risk Ranking
				Pre-mitigation
Site Preparation / Construction				
1.	Small scale leakage and spill incidents from site preparation/ Construction activities	Corrosion, dropped objects, or other damages to storage oil tanks/mobile gas stations; failure to secure valves; failure to maintain large mobile construction plant.	Workers and Communities – No available onsite fuel storage so likelihood of spillage of oil, lubricant to ground water and soil contamination is Low. The effects on surrounding communities utilizing groundwater resources is Low.	3B (Minor)
			Environment – No available onsite fuel storage so likelihood of spillage of oil, lubricant to ground water and soil contamination is Low.	3B (Minor)
2.	Road traffic transporting personnel or materials involved in a collision	Wet/dark conditions, driver distraction, fatigue, other dangerous drivers, variable road conditions; rural areas with pedestrian road users	Workers and Communities – Traffic accidents that involved community members, resulting in injury or fatality. Accidents might require use of local medical emergency services in the Project area and could temporarily decrease access to these services for local residents.	4E (Major)
		As above with livestock in the road	Workers and Communities – Traffic accident with livestock leading to death of livestock and loss/reduction in community member's livelihood.	4C (Moderate)
3.	Fire and explosion	Leakage and spill incidents of flammable materials, malfunctioning equipment and failure to operate large mobile construction vehicle Presence of UXO could lead to injuries and fatalities	Workers and Communities – Based on the liquid fuel storage volumes the potential exists for exposure to ignited due to malfunctioned equipment and resulting in potentially severe injuries to employees and spread to nearby communities' members.	3D (Major)
			Environment: – Based on the liquid fuel storage volumes potential for ignition of leakage or spill of oil/chemicals due to human errors and malfunctioned short-circuit equipment, accidents might lead to uncontrollable wildfire, loss of crops and habitat, causing injury and life-threatening of local community.	3D (Major)

No.	Unplanned Event	Cause	Consequence	Risk Ranking
				Pre-mitigation
4.	Presence of Explosion of Unexploded Ordnances (UXOs)	Risk of Explosion of Unexploded Ordnances (UXOs) could lead to injuries and fatalities	Workers and Communities – Based on risk of explosion of Unexploded Ordnances (UXOs) due to left behind from the war resulting in potentially severe injuries to employees and spread to nearby communities' members.	3D (Major)
			Environment: – Based on risk of explosion of Unexploded Ordnances (UXOs) due to left behind from the war might lead to uncontrollable explosion, loss of crops and habitat, causing injury and life-threatening of local community.	3D (Major)
4	Natural Hazards Flooding & Landslide	Heavy rainfall that exceeds the capacity of the natural drainage system may cause flash flood event. Clearing vegetation for site preparation increases the rate of run-off and flood risks to downstream area. Landslide occurs in combination of many causes such as intense rainstorm, steep slopes (over 20₀) and vegetation removing that weakens soil bearing capacity.	Workers and Communities: Flood and Landslide can result in loss of human life, damage to property, destruction of crops, and loss of livestock that affects to livelihood. Flood and landslide may affects to substation and power components that lead to loss of electricity supply locally. Environment: A large-scale flood and landslide could result in damage/death of local flora and fauna.	4D (Major)
Commissioning and Operation				
5.	Small scale spill from activities on-site	Corrosion, dropped objects or other damage to small storage vessels; failure to secure valves; failure to maintain equipment.	Workers and Communities – There would be use of oil, fuel across the site during commissioning and operation phase of the Project for operation & maintenance (O&M) services. As a result, there was a risk that small volumes of oil and fuel could be spilled on-site.	3C (Moderate)
			Environment - There would be use of oil, fuel across the site during commissioning and operation phase of the Project for operation & maintenance (O&M) services. As a result, there was a risk that small volumes of oil and fuel could be spilled on-site that leads to soil contamination and water quality degradation.	3C (Moderate)
6.	Fire and explosion	Leakage and spill incidents of flammable materials, malfunctioning equipment, short-circuit power, Damage of transmission lines or Lightning strike.	Workers and Communities – A large-scale fire could result in injuries to people in the surrounding communities, or in the worst-case fatalities. Explosions of	2E (Major)

No.	Unplanned Event	Cause	Consequence	Risk Ranking Pre-mitigation
			malfunctioned equipment could result in rapid spread of fire and projectile spread of debris. This could result in injuries to people in the surrounding communities, or in the worst-case fatalities.	
			Environment: – A large-scale fire could result in damage/death of local flora and fauna. Accidents might lead to uncontrollable wildfire, loss of crops and habitat given the environment settings at the Project area.	3C (Moderate)
	Presence of Explosion of Unexploded Ordnances (UXOs)	Risk of Explosion of Unexploded Ordnances (UXOs) could lead to injuries and fatalities	Workers and Communities – Based on risk of explosion of Unexploded Ordnances (UXOs) due to left behind from the war resulting in potentially severe injuries to employees and spread to nearby communities' members.	2E (Major)
			Environment: – Based on risk of explosion of Unexploded Ordnances (UXOs) due to left behind from the war might lead to uncontrollable explosion, loss of crops and habitat, causing injury and life-threatening of local community.	3C (Moderate)

No.	Unplanned Event	Cause	Consequence	Risk Ranking
				Pre-mitigation
7.	Blade ejection failure	Root connection; catastrophic structural buckling or separation; leading edge, trailing edge, or other bond separation; lightening damage; erosion; failure at outboard aerodynamic device; reduction in stiffness of blades (up to 10%); superficial structural or delamination/laminate wrinkling that eventually become permanent damage; and over speeding due to failure of SCADA to rectify the failure or high wind/cyclonic/meteorological conditions[127]	Workers and Communities – Blade ejection failure could result in rapid spread of fire and projectile spread of debris given the heights of wind turbines. This could result in injuries to surrounding communities, or in the worst-case fatalities. Given the residential area living far from Project boundary and out of the setback-distance of blade throw risks, the likelihood and severity of surrounding communities is Moderate. DMS will be conducted in May to confirm that there are no structures within the 300m setback area (safety buffer zone). The nearest sensitive receptor Dak Tiem Primary & Lower Secondary School located approximately 560 m from turbine (WA102) and Dak Tiem Village located approximately 570 m from turbine (WA102)	3C (Moderate)
			Environment – As above with local flora and fauna.	3C (Moderate)
8.	Accidental transmission line snapping and tower swaying/collapsing	Wind/cyclonic/meteorological conditions, catastrophic structural separation, corrosion	Workers and Communities –. Electrocutions that involved community members, resulting in injury or fatality, livestock leading to death of livestock and loss/reduction in community member's livelihood	3D (Major)
9.	Natural Hazards Flooding & Landslide	Heavy rainfall that exceeds the capacity of the natural drainage system may cause flash flood event. Clearing vegetation for site preparation increases the rate of run-off and flood risks to downstream area. Landslide occurs in combination of many causes such as intense rainstorm, steep slopes (over 20$_0$) and vegetation removing that weakens soil bearing capacity.	Workers and Communities: Flood and Landslide can result in loss of human life, damage to property, destruction of crops, and loss of livestock that affects to livelihood. Flood and landslide may affects to substation and power components that lead to loss of electricity supply locally. Environment: A large-scale flood and landslide could result in damage/death of local flora and fauna.	4D (Major)

[127] Robinson et al. Study and development of a methodology for the estimation of the risk and harm to persons from wind turbines. 2013. Prepared by MMI Engineering Ltd for the Health and Safety Executive 2013

9.7.3.1 During Site Preparation and Construction

Leakage and Spill Incidents

Background

There would be many large mobile plant items that would be powered by diesel oil and would contain relatively small reservoirs of lube oil and hydraulic oil, with the potential for environmental damage if the materials are lost to ground. Mobile plant will include:

- Cranes;
- Pipe-laying cranes and plant;
- Excavators;
- Heavy goods vehicles;
- Fork-lift trucks; and
- Fuel trucks.
- During site preparation and the early stages of construction any accidental release of oils would be to unpaved areas. Hence, the oil would seep into the ground and potentially groundwater if the release was not responded to immediately. Lube oils were not expected to be readily biodegradable. However, any release was likely to be small and if there was immediate response, the residual amount released would result in negligible damage to the environment.

Significance (Before Mitigation)

The significance is provided in ***Table 9-114***.

Mitigation Measures

All preventative and mitigation measures proposed to reduce the likelihood and severity of accidental onshore spills are summarised in ***Table 9-115***.

Table 9-115: Preventative and Mitigation Measures of Leakage and Spills Incidents

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	Design the site to include good site management practices to ensure that the products are properly stored on site (e.g. secondary containment, double walled tanks, over filling alarm system).	EPC Contractor	Before site preparation
Prevent	The Project will implement the SEP and a robust stakeholder engagement programme on emergency response. Engagement on emergency response will provide regular information on safety drills and guidance to residents in the event of an unplanned event	IEAD	Before site preparation
Prevent	Ensure good inspection and maintenance procedures for large mobile construction plant to minimize small leaks and spills.	EPC Contractor	During site preparation and construction

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Mitigate	Prepare an Emergency Preparedness and Response Plan to cover accidental and emergency situations. This Plan will detail: ■ Planning coordination: including procedures for informing local communities about emergency response, documentation and first aid / medical treatment; ■ Emergency equipment: including equipment in the project design and any additional emergency equipment; and ■ Training: employees and contractors will be trained in emergency response procedures. ■ Auditing: audit records will be maintained on how the Plan is being implemented.	IEAD	Planning stage (construction and operations)
Mitigate	Implement Emergency Preparedness and Response Plan and monitor contractors to ensure consistent implementation.	EPC Contractor/IEAD	During construction, commissioning and operations

Residual Impacts

Because the majority of the mitigation presented was preventative, the primary goal of these measures was to reduce the likelihood of the unplanned event from occurring. However, if the event occurred, the consequence of the oil spills could potentially remain as severe. In these cases, the mitigation measured described in the previous section would apply to minimize impacts.

		Impact Significance
Without Mitigation Measures	Workers and Communities	3B Minor
	Environment	3B Minor
With Mitigation Measures	Workers and Communities	2B Minor
	Environment	2B Minor

Monitoring and Auditing

- Monthly monitoring the implementation of all proposed mitigation measures specified in Emergency Preparedness and Response Plan should be conducted properly;
- Daily inspection of any secondary containment of oil/chemical on site and ensure good maintenance procedures to minimize small leaks and spills.

Traffic Accidents

Background

Receptors for increased road safety risks during Project site preparation and construction included drivers, passengers, and non-motorized travelers on public roads. Although existing road users were likely to be accustomed to existing safety risks associated with poor road conditions, these receptors were unlikely to have experience driving or sharing the road with heavy trucks, of the type likely to be used during Project site preparation and especially construction.

Site preparation would require a number of vehicle trips to deliver construction equipment and supplies, as well as daily trips of employee. Additionally, the Project Site is located in mountainous area, the traffic conditions is quite unfavorable.

Based on this analysis, it was assumed that road safety risks increase roughly in proportion with increased vehicular traffic congestion. Road safety risks would also increase due to degraded road infrastructure conditions.

Significance (Before Mitigation)

The significance is provided in ***Table 9-114***.

Mitigation Measures

Active mitigation measures that would be used to further mitigate potential road safety risks were provided in ***Table 9-116***. These measures included development of a Transportation Management Plan that would address scheduling of road activity, monitoring conditions of public roads, and active traffic controls at the Project site entrance.

Table 9-116: Preventative and Mitigation Measures of Traffic Accident

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	Developed and implemented a Traffic Management Plan. This should include measures such as: ■ Active traffic controls (e.g. flaggers to direct traffic at the Project site entrance); and ■ Schedule construction deliveries and employee shift changes to minimize traffic congestion and delay	EPC Contractor	Site preparation and construction
Prevent	Design an H&S plan and good safety practices for the transportation (e.g. alcohol policy, good driving practice).	EPC Contractor	Construction
Prevent	Upgrade the access road to the Project site	IEAD	Site Preparation
Prevent	The Project will implement the SEP and a robust stakeholder engagement programme on emergency response. Engagement on emergency response will provide regular information on safety drills and guidance to residents in the event of an unplanned event.	IEAD	Before site preparation
Mitigate	Develop an Emergency Preparedness and Response Plan.	IEAD	Prior to site preparation
Mitigate	Implement an Emergency Preparedness and Response Plan and monitor contractors to ensure consistent implementation	IEAD	Construction

Residual Impacts

Because the majority of the mitigation presented as preventative, the primary goal of these measures was to reduce the likelihood of the unplanned event from occurring. However, if the event occurred, the consequence of the traffic accidents could potentially remain as severe. In these cases, the mitigation measures described in the previous section would apply to minimize impacts.

		Impact Significance
Without Mitigation Measures	Workers and Communities	4E Major
	Communities (livestock)	4C Moderate
With Mitigation Measures	Workers and Communities	3E Major
	Communities (livestock)	2B Minor

Monitoring and Auditing

- Monthly monitoring the implementation of all proposed mitigation measures specified in the Traffic Management Plan (TMP) should be conducted;
- Regular road condition monitoring along the transportation route to understand road quality during construction phase

Fire and Explosion

Background

Onsite fuel requirement during construction phase will be diesel. Fuels will be provided for daily requirements and transported to the site by fuel specialized trucks. The onsite delivery of fuel or lubricant will be at designated location that will have an impervious base. So, risk of fire and explosion at the site will be reduced.

In addition to the failure of malfunctioning and/or outdated machinery and equipment could be also led to the risk of fires and explosions.

Large scale fires, or worst-case explosions, could potentially release smoke and fumes in the broader area generating health issues associated with inhalation of toxic substances and uncontrollable wildfire that would contribute to a loss of crops and habitats and impacts on the economics of the area (e.g. community and workers jobs and incomes).

Table 9-117: Social Impact Sensitivity Criteria

Sensitivity	Definition
Low	Villagers have low vulnerability/sensitivity; consequently has a high ability to adapt to changes brought by the project
Medium	Some, but few areas of vulnerability/sensitivity; retaining an ability to at least adapt in part to change brought by the project
High	Profound or multiple levels of vulnerability/vulnerability/sensitivity that undermine the ability to adapt to changes brought by the project

Table 9-118: Social Impact Magnitude Criteria

Magnitude	Definition
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the AoI and/or persists over many years. The impact may be experienced over a regional or national area.
Medium	Early evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may potentially be regional in scale.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Negligible	Change remains within the range commonly experienced within the household or community
Positive	In the case of positive impacts, it is generally recommended that no magnitude be assigned, unless there is ample data to support a more robust characterisation. It is usually sufficient to indicate that there will be a positive impact, without characterising the exact degree of positive change likely to occur.

The potential economic displacement and impacts to livelihoods are assessed in accordance with the criteria set out in ***Table 9-118*** and ***Table 9-117***

Significance (Before Mitigation)

The significance is provided in ***Table 9-114***.

Mitigation Measures

All preventative and mitigation measures proposed to reduce the likelihood and severity of accidental fire and explosion are summarized in ***Table 9-119***.

Table 9-119: Preventative and Mitigation Measures of Fire and Explosion

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	Implement on-site prevention measures such as (i) Equip the site with proper equipment (such as fire extinguishers, proper communication equipment) and regularly inspect and maintain them; (ii) Prepare the Fire prevention and Fighting Plan that ensure compliance and Fighting; (iii) Conduct firefighting training to the emergency support team, contractors and workers on site and camping areas	EPC Contractor/IEAD	Site preparation And construction
Prevent	The Project will implement the SEP and a robust stakeholder engagement programme on emergency response. Engagement on emergency response will provide regular information on safety drills and guidance to residents in the event of an unplanned event.	IEAD	Site preparation and construction
Mitigate	Develop an Emergency Preparedness and Response Plan and monitor contractors to ensure consistent implementation. The	EPC Contractor/IEAD	Site preparation

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
	Emergency response plan should include: ■ Immediately pull the nearest fire alarm if a fire occurs, report the event to shift supervisor or foreman immediately for emergency response; ■ When the emergency alarm sounds, all employees shall stop all activities and move to emergency assembly places immediately; ■ Limit the fire areas by utilizing the appropriate firefighting equipment, if the fire is small and controllable; and ■ Follow the procedure included in the Emergency Response and Evacuation Plan to take actions		
Mitigate	Implement an Emergency Preparedness and Response Plan and monitor contractors to ensure consistent implementation	EPC Contractor/IEAD	During construction & Operation

Residual Impacts

Because the majority of the mitigation presented was preventative, the primary goal of these measures was to reduce the likelihood of the unplanned event from occurring. However, if the identified events occurred, the consequences remained the same level. In these cases, the post-event measures described in the previous section would apply to minimize impacts.

		Impact Significance
Without Mitigation Measures	Workers and Communities	3D Major
	Environment	3D Major
With Mitigation Measures	Workers and Communities	2C Minor
	Environment	2C Minor

Monitoring and Auditing

A monthly audit program shall be established to check the implementation of emergency response and evacuation plan, staff training, equipment inspection, and firefighting drills.

Unexploded Ordnances (UXOs)

Background

Risks of presence of Unexploded Ordnances (UXOs) still left after UXO Clearance (currently being conducted by the Lao government) should also be considered. UXO Clearance will be conducted after notice to proceed, it will be part of pre-site clearing activities.

A map[128] of UXO presence in Laos is provided in . The Project is located in Sekong and Attapeu province in the south of Laos which are shown are high risk areas for potential presence of UXO due to bombing campaigns between 1965 and 1975.

[128] https://www.uxolao.org

During the site visit in November to December 2021, the field team observed that there was ongoing UXO clearance in the region. UXO clearance are rolled out in areas where there are planned developments and land use such as area near towns to accommodate town expansion and expansion of agricultural land.

Based on the KII with local authorities and FGDs with villagers, in general, there are concerns about UXO; however, living with UXO has become a part of their lives that they are no longer alarmed about it. For example, villagers would farm in new and un-surveyed piece of land without notifying relevant authority to conduct UXO survey and clearance. They only notify the authority when UXO are encountered. Additionally, it was informed that the last incident of injury due to explosion of UXO was a long time ago (precise year could not be obtained).

Table 9-120: Social Impact Sensitivity Criteria

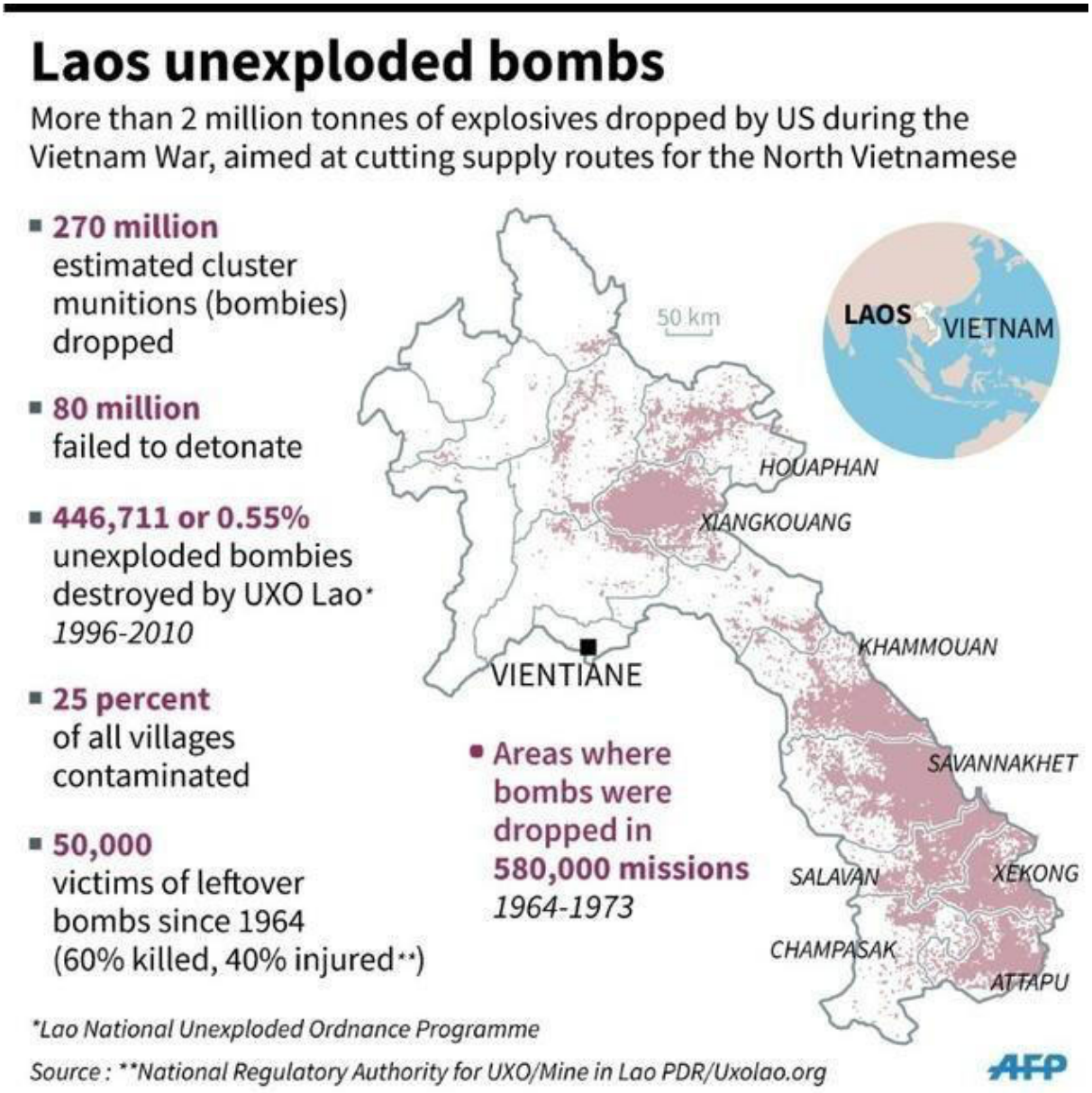
Sensitivity	Definition
Low	Villagers have low vulnerability/sensitivity; consequently has a high ability to adapt to changes brought by the project
Medium	Some, but few areas of vulnerability/sensitivity; retaining an ability to at least adapt in part to change brought by the project
High	Profound or multiple levels of vulnerability/vulnerability/sensitivity that undermine the ability to adapt to changes brought by the project

Table 9-121: Social Impact Magnitude Criteria

Magnitude	Definition
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the AoI and/or persists over many years. The impact may be experienced over a regional or national area.
Medium	Early evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may potentially be regional in scale.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Negligible	Change remains within the range commonly experienced within the household or community
Positive	In the case of positive impacts, it is generally recommended that no magnitude be assigned, unless there is ample data to support a more robust characterisation. It is usually sufficient to indicate that there will be a positive impact, without characterising the exact degree of positive change likely to occur.

The potential economic displacement and impacts to livelihoods are assessed in accordance with the criteria set out in Table 9-121 and ***Table 9-120.***

Figure 9-93: Info Map of Potential UXO Presence in Laos



Significance (Before Mitigation)

The significance is provided in ***Table 9-114***.

Mitigation Measures

All preventative and mitigation measures proposed to reduce the likelihood and severity of accidental fire and explosion are summarized in ***Table 9-122***.

Table 9-122: Preventative and Mitigation Measures of Fire and Explosion

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	Contact relevant authority bodies and conduct the UXO clearance including development of a chance find procedure and a specific emergency response procedure for UXO.	IEAD	Site preparation
Prevent	Implement on-site prevention measures such as (i) Equip the site with proper equipment (such as fire extinguishers, proper communication equipment) and regularly inspect and maintain them; (ii) Prepare the Fire prevention and Fighting Plan that ensure compliance and Fighting; (iii) Conduct firefighting training to the emergency support team, contractors and workers on site and camping areas	EPC Contractor/IEAD	Site preparation And construction
Prevent	The Project will implement the SEP and a robust stakeholder engagement programme on emergency response. Engagement on emergency response will provide regular information on safety drills and guidance to residents in the event of an unplanned event.	IEAD	Site preparation and construction
Mitigate	Develop an Emergency Preparedness and Response Plan and monitor contractors to ensure consistent implementation. The Emergency response plan should include: ■ Immediately pull the nearest fire alarm if a fire occurs, report the event to shift supervisor or foreman immediately for emergency response; ■ When the emergency alarm sounds, all employees shall stop all activities and move to emergency assembly places immediately; ■ Limit the fire areas by utilizing the appropriate firefighting equipment, if the fire is small and controllable; and ■ Follow the procedure included in the Emergency Response	EPC Contractor/IEAD	Site preparation

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
	and Evacuation Plan to take actions		
Mitigate	Implement an Emergency Preparedness and Response Plan and monitor contractors to ensure consistent implementation	EPC Contractor/IEAD	During construction & Operation

Residual Impacts

Because the majority of the mitigation presented was preventative, the primary goal of these measures was to reduce the likelihood of the unplanned event from occurring. However, if the identified events occurred, the consequences remained the same level. In these cases, the post-event measures described in the previous section would apply to minimize impacts.

		Impact Significance
Without Mitigation Measures	Workers and Communities	3D Major
	Environment	3D Major
With Mitigation Measures	Workers and Communities	2C Minor
	Environment	2C Minor

Monitoring and Auditing

A monthly audit program shall be established to check the implementation of emergency response and evacuation plan, staff training, equipment inspection, and firefighting drills.

Natural Hazards (Flood and Landslide)

Background

Landslide susceptibility within the study area is reported to vary between Medium to Very High. This indicates that the project area is susceptible to landslides owing to factors such as land cover, soil type, and slope. In addition, it indicates the hazard due to landslides triggered by precipitation to vary between Low-High within Study area. Accordingly, overall hazard due to landslides triggered by precipitation is considered to be 'High'.

Sekong and Attapeu province are reported to be among the most (flood) vulnerable provinces in LaoPDR[129]. However, review of flood hazard data based on likelihood of damaging and life threatening floods (floods with depth of inundation >0.5 m) indicated the flood hazard to be Very Low in Sanxay district in Attapeu, and Dak Cheung district in Sekong province where the project is located. Further, review of flood hazard map(s) representing the depth of inundation under a flood with 100 year return period indicated no inundation in project area.

Accordingly, considering the site setting (locations of assets), absence of major rivers, and no reported inundation within study area, riverine floods are not likely to have impact on the project. Hence no hazard due to riverine flood is considered.

Significance (Before Mitigation)

The significance is provided in ***Table 9-114***.

Mitigation Measures

All preventative and mitigation measures proposed to reduce the likelihood and severity of accidental flood events are summarized in ***Table 9-123***Table 9-129***.***

[129] https://www.adpc.net/igo/category/ID416/doc/2013-ptk8Nb-ADPC-Publication_LNAReportWEB_(2).pdf

Table 9-123: Preventative and Mitigation Measures of Natural Hazards

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	Incorporation of siting and safety engineering criteria to prevent failures due to natural disasters.	IEAD	Prior to Construction
Prevent	The Project will implement the SEP and a robust stakeholder engagement programme on emergency response.	IEAD	During site preparation and construction
Prevent	Implement periodic routine inspection and maintenance procedures (in line with international best practice)	O&M Contractor/IEAD	During site preparation and construction
Prevent	Install warning system, signal boards, flood prevention systems.	IEAD	Prior to Construction
Mitigate	Develop an Emergency Preparedness and Response Plan.	IEAD	Prior to Construction
Mitigate	Implement an Emergency Preparedness and Response Plan and monitor contractors to ensure consistent implementation	EPC Contractor/ IEAD	During Site preparation and construction

Residual Impacts

It is noted that the likelihood of occurrence of natural hazards (Flood and Landslide) will not be increased by the project. The project should ensure however, that the introduction of hard surface areas does not increase the potential for flash flood etc. where possible. The project could also provide mitigation measures to minimize impacts and damage caused by Flood and Landslide.

		Impact Significance
Without Mitigation Measures	Communities	4D Major
With Mitigation Measures	Communities	3C Moderate

Monitoring and Auditing

No specific monitoring program is required.

9.7.3.2 During Commissioning and Operation

Leakage and Spill Incidents

Background

There would be use of oil, fuel including hydrocarbons, across the site during commissioning and operation phase of the Project for operation & maintenance (O&M) services. As a result, there was a risk that small volumes of oil and fuel could be spilled on-site. The risk of these spills reaching the environment would be minimal in paved areas.

Significance (Before Mitigation)

The significance is provided in ***Table 9-114***.

Mitigation Measures

All preventative and mitigation measures proposed to reduce the likelihood and severity of accidental onshore spills are summarised in ***Table 9-124***.

Table 9-124: Preventative and Mitigation Measures of Leakage and Spills Incidents

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	Implement good site management practices to ensure that the products are properly stored on site and in areas where spills will not easily reach the environment (e.g. in paved areas with secondary containment).	EPC Contractor/IEAD	Prior to commissioning
Prevent	The Project will implement the SEP and a robust stakeholder engagement programme on emergency response.	IEAD	During commissioning and operation
Mitigate	Prepare an Emergency Preparedness and Response Plan to cover accidental and emergency situations. This Plan will detail: ■ Planning coordination: including procedures for informing local communities about emergency response, documentation and first aid / medical treatment; ■ Emergency equipment: including equipment in the project design and any additional emergency equipment; and ■ Training: employees and contractors will be trained in emergency response procedures. ■ Auditing: audit records will be maintained on how the Plan is being implemented.	EPC Contractor/IEAD	Before commissioning and operation
Mitigate	Implement Emergency Preparedness and Response Plan and monitor contractors to ensure consistent implementation.	IEAD	During commissioning and operation

Residual Impacts

Because the majority of the mitigation presented was preventative, the primary goal of these measures was to reduce the likelihood of the unplanned event from occurring. However, if the event occurred, the consequence of the hydrocarbon spills could potentially remain as severe. In these cases, the post event measures described in the previous section would apply to minimize impacts.

		Impact Significance
Without Mitigation Measures	Workers and Communities	3C Moderate
	Environment	3C Moderate
With Mitigation Measures	Workers and Communities	2C Minor
	Environment	2B Minor

Monitoring and Auditing

- Monthly monitoring the implementation of all proposed mitigation measures specified in Emergency Preparedness and Response Plan should be conducted properly;
- Daily inspection of any secondary containment of oil/chemical on site and ensure good maintenance procedures to minimize small leaks and spills.

Fire and Explosion

Background

Damage of the wind turbine generators (WTGs) and their auxiliary components, transmission line due to lighting strikes, electrical arcs or flashovers and malfunctioned equipment which resulting fires and even explosions as WTGs materials were informatively construed as flammable materials.

Large scale fires, or worst-case explosions, could potentially release smoke and fumes in the broader area generating health issues associated with inhalation of toxic substances and uncontrollable wildfire that would contribute to a loss of crops and habitats and impacts on the economics of the area (e.g. community and workers jobs and incomes).

Significance (Before Mitigation)

The significance is provided in ***Table 9-114***.

Mitigation Measures

All preventative and mitigation measures proposed to reduce the likelihood and severity of accidental fire and explosion are summarized in ***Table 9-125***.

Table 9-125: Preventative and Mitigation Measures of Fire and Explosion

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	The Project will implement the SEP and a robust stakeholder engagement programme on emergency response.	IEAD	During commissioning and operation
Prevent	Implement routine inspection and maintenance procedures (in line with international best practice) for any hazardous substances' storage vessels and WTGs.	EPC Contractor/IEAD	During commissioning and operation
Prevent	Install warning system, signal boards, lighting protection system where risks of fire and explosion exposed	IEAD	Prior commissioning
Mitigate	Implement Emergency Preparedness and Response Plan with forest fire protection and monitor contractors to ensure consistent implementation Provide regularly safety and fire prevention & fighting drills.	IEAD	During commissioning and operation

Residual Impacts

Because the majority of the mitigation presented was preventative, the primary goal of these measures was to reduce the likelihood of the unplanned event from occurring. However, given the likelihood of the event is well-known in the industry and have been occurring sporadically, hence, the possibility of such incident still remains the same. In these cases, the mitigation measures described

in the previous section would potentially apply to minimize the severity on communities and surrounding environment.

		Impact Significance
Without Mitigation Measures	Workers and Communities	2E Major
	Environment	2D Moderate
With Mitigation Measures	Workers and Communities	2D Moderate
	Environment	2C Minor

Monitoring and Auditing

A monthly audit program shall be established to check the implementation of emergency response and evacuation plan, staff training, equipment inspection, and firefighting drills.

Unexploded Ordnances (UXOs)

Background

Risks of presence of Unexploded Ordnances (UXOs) still left after UXO Clearance (currently being conducted by the Lao government) should also be considered. UXO Clearance will be conducted after notice to proceed, it will be part of pre-site clearing activities.

A map[130] of UXO presence in Laos is provided in . The Project is located in Sekong and Attapeu province in the south of Laos which are shown are high risk areas for potential presence of UXO due to bombing campaigns between 1965 and 1975.

During the site visit in November to December 2021, the field team observed that there was ongoing UXO clearance in the region. UXO clearance are rolled out in areas where there are planned developments and land use such as area near towns to accommodate town expansion and expansion of agricultural land.

Based on the KII with local authorities and FGDs with villagers, in general, there are concerns about UXO; however, living with UXO has become a part of their lives that they are no longer alarmed about it. For example, villagers would farm in new and un-surveyed piece of land without notifying relevant authority to conduct UXO survey and clearance. They only notify the authority when UXO are encountered. Additionally, it was informed that the last incident of injury due to explosion of UXO was a long time ago (precise year could not be obtained).

Significance (Before Mitigation)

The significance is provided in ***Table 9-114***.

Mitigation Measures

All preventative and mitigation measures proposed to reduce the likelihood and severity of accidental fire and explosion are summarized in ***Table 9-125***.

Table 9-126: Preventative and Mitigation Measures of Fire and Explosion

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	The Project will implement the SEP and a robust stakeholder engagement programme on emergency response.	IEAD	During commissioning and operation

[130] https://www.uxolao.org

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	Implement routine inspection and maintenance procedures (in line with international best practice) for any hazardous substances' storage vessels and WTGs.	EPC Contractor/IEAD	During commissioning and operation
Prevent	Install warning system, signal boards, lighting protection system where risks of fire and explosion exposed	IEAD	Prior commissioning
Mitigate	Implement Emergency Preparedness and Response Plan with forest fire protection and monitor contractors to ensure consistent implementation Provide regularly safety and fire prevention & fighting drills.	IEAD	During commissioning and operation

Residual Impacts

Because the majority of the mitigation presented was preventative, the primary goal of these measures was to reduce the likelihood of the unplanned event from occurring. However, given the likelihood of the event is well-known in the industry and have been occurring sporadically, hence, the possibility of such incident still remains the same. In these cases, the mitigation measures described in the previous section would potentially apply to minimize the severity on communities and surrounding environment.

		Impact Significance
Without Mitigation Measures	Workers and Communities	2E Major
	Environment	2D Moderate
With Mitigation Measures	Workers and Communities	2D Moderate
	Environment	2C Minor

Monitoring and Auditing

A monthly audit program shall be established to check the implementation of emergency response and evacuation plan, staff training, equipment inspection, and firefighting drills.

Blade Ejection Failure

Background

A failure of the rotor blade could result in the "throwing" of a rotor blade, which might affect public safety. Assessment of reports and case studies in the open domain had revealed an increasing trend to determine the distance at which a rotor bade could be thrown. Therefore, it became strictly necessary to define setback distances and/or buffer zones to minimize the risk of damage or injury from components failure.

Significance (Before Mitigation)

The significance is provided in ***Table 9-114***.

Mitigation Measures

All preventative and mitigation measures proposed to reduce the likelihood and severity of accidental blade throw are summarized in ***Table 9-127***.

Table 9-127: Preventative and Mitigation Measures of Blade Ejection Failure

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	Establish safety zone at least 300 m away from the WTGs with fences if possible. It was recommended that the minimum setback distances required to meet noise and shadow flicker limits be maintained with respect to sensitive residential receptors to provide further protection.	IEAD	Prior commissioning
Prevent	The Project will implement the SEP and a robust stakeholder engagement programme on emergency response.	IEAD	During commissioning and operation
Prevent	Implement periodic routine inspection and maintenance procedures (in line with international best practice).	EPC Contractor/IEAD	During commissioning and operation
Prevent	Install warning system, signal boards, lighting prevention system around the 270 m radius of danger zone where the WTGs located. Equipped vibration sensors for the warning of any imbalances in rotor blades.	IEAD	Prior commissioning
Mitigate	Develop an Emergency Preparedness and Response Plan.	EPC Contractor/IEAD	Prior commissioning
Mitigate	Implement an Emergency Preparedness and Response Plan and monitor contractors to ensure consistent implementation	IEAD	During commissioning and operation

Residual Impacts

Because the majority of the mitigation presented was preventative, the primary goal of these measures was to reduce the likelihood of the unplanned event from occurring. However, given the likelihood of the event is well-known in the industry and have been occurring sporadically, hence, the possibility of such incident still remains the same. In these cases, the mitigation measures described in the previous section would potentially apply to minimize the severity on communities and surrounding environment.

		Impact Significance
Without Mitigation Measures	Workers and Communities	3C Moderate
	Environment	3C Moderate
With Mitigation Measures	Workers and Communities	2B Minor
	Environment	2B Minor

Monitoring and Auditing

A quarterly audit program shall be established to check the implementation of regular technical inspection of the WTGs and blades' safety. Any identify gaps or areas of opportunity will be followed up after the inspection until resolved. The auditing records will be kept onsite for future review and supervision.

Transmission Line Snapping and Transmission Pylon Collapse

Background

During operation, there was a possibility of lines or transmission towers/parts snapping/swaying due to the tower failing and resulting in injuries and/or fatalities. Additionally, any contacts (both intentional and unintentional) with the exposing snapped transmission line can result in electrocution.

The risk was mainly influenced by poor foundation quality, tower member theft, material corrosion due to poor coating and poor quality or damaged fittings exposing the system to failure. The receptor sensitivity was considered high as there were households and livelihood activities within the transmission line RoWs in the Project area. Impacts on community health and wellbeing could lead in injuries and fatalities.

In the rural areas, due to the fact that the transmission line routing was mostly designed far from the existing communities the receptor sensitivity is considered low but with medium significance.

Significance (Before Mitigation)

The significance is provided in ***Table 9-114***.

Mitigation Measures

All preventative and mitigation measures proposed to reduce the likelihood and severity of accidental transmission line snapping and transmission pylon collapse are summarized in ***Table 9-128.***

Table 9-128: Preventative and Mitigation Measures of Transmission Line Snapping and Transmission Pylon Collapse

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	Establish a good practice and should comply with electricity safety related regulation or international standard, whichever, more stringent, in the design and installation of transmission line and transmission pylons	IEAD	Prior commissioning
Prevent	The Project will implement the SEP and a robust stakeholder engagement programme on emergency response.	IEAD	During commissioning and operation
Prevent	Implement periodic routine inspection and maintenance procedures (in line with international best practice)	O&M Contractor/IEAD	During commissioning and operation
Prevent	Install warning system, signal boards, lighting prevention system, anti-climbing devices on the tower.	IEAD	Prior commissioning
Mitigate	Develop an Emergency Preparedness and Response Plan.	EPC Contractor/IEAD	Prior commissioning
Mitigate	Implement an Emergency Preparedness and Response Plan and monitor contractors to ensure consistent implementation	EPC Contractor	During commissioning and operation

Residual Impacts

Because the majority of the mitigation presented as preventative, the primary goal of these measures was to reduce the likelihood of the unplanned event from occurring. However, if the event occurred, the consequence of the transmission line snapping and transmission pylon collapse events could

potentially remain as severe. In these cases, the post-event measures described in the previous section would apply to minimize impacts.

		Impact Significance
Without Mitigation Measures	Communities	3D Major
With Mitigation Measures	Communities	2D Moderate

Monitoring and Auditing

A quarterly audit program shall be established to check the implementation of regular technical inspection of the transmission lines and transmission pylons' safety.

Natural Hazards (Flood and Landslide)

Background

Landslide susceptibility within study area is reported to vary between Medium to Very High. This indicates that the project areas is susceptible to landslides owing to factors such as land cover, soil type, and slope. Moreover, it indicates the hazard due to landslides triggered by precipitation to vary between Low-High within Study area. Accordingly, overall hazard due to landslides triggered by precipitation is considered to be 'High'.

Sekong and Attapeu province are reported to be among the most (flood) vulnerable provinces in Lao PDR[131]. However, review of flood hazard data based on likelihood of damaging and life threatening floods (floods with depth of inundation >0.5 m) indicated the flood hazard to be Very Low in Sanxay district in Attapeu, and Dak Cheung district in Sekong province where the project is located. Further, review of flood hazard map(s) representing the depth of inundation under a flood with 100 year return period indicated no inundation in project area.

Accordingly, considering the site setting (locations of assets), absence of major rivers, and no reported inundation within study area, riverine floods are not likely to have impact on the project. Hence no hazard due to riverine flood is considered.

Significance (Before Mitigation)

All preventative and mitigation measures proposed to reduce the likelihood and severity of accidental flood events are summarized in ***Table 9-129.***

Table 9-129: Preventative and Mitigation Measures of Natural Hazards

Type of Control (i.e. Prevent/ Mitigate)	Management Control	Responsibility - Organisation	Timing
Prevent	Incorporation of siting and safety engineering criteria to prevent failures due to natural disasters.	IEAD	Prior commissioning
Prevent	The Project will implement the SEP and a robust stakeholder engagement programme on emergency response.	IEAD	During commissioning and operation
Prevent	Implement periodic routine inspection and maintenance procedures (in line with international best practice)	O&M Contractor/IEAD	During commissioning and operation
Prevent	Install warning system, signal boards, flood prevention systems.	IEAD	Prior commissioning

[131] https://www.adpc.net/igo/category/ID416/doc/2013-ptk8Nb-ADPC-Publication_LNAReportWEB_(2).pdf

Mitigate	Develop an Emergency Preparedness and Response Plan.	IEAD	Prior commissioning
Mitigate	Implement an Emergency Preparedness and Response Plan and monitor contractors to ensure consistent implementation	EPC Contractor/ IEAD	During commissioning and operation

Residual Impacts

It is noted that the likelihood of occurrence of natural hazards (Flood and Landslide) will not be increased by the project. The project should ensure however, that the introduction of hard surface areas does not increase the potential for flash flood etc. where possible. The project could also provide mitigation measures to minimize impacts and damage caused by Flood and Landslide.

		Impact Significance
Without Mitigation Measures	Communities	4D Major
With Mitigation Measures	Communities	3C Moderate

Monitoring and Auditing

No specific monitoring program is required.

9.8 Cumulative and Transboundary Impact Assessment

9.8.1 Approach

The approach to the CIA was as follows:

- Identify the spatial and temporal boundaries of the CTIA (considering the combination of potential effects of multiple impacts on biodiversity from existing, proposed and anticipated projects);
- Identify 'Valued Social and Environmental Components' ("VECs") in consultation with affected communities and key stakeholders;
- Identify developments and external natural and social stressors that may affect the VECs;
- Assess the combined impact of the development of the Project, and determine its effects on VECs in both Lao PDR and Vietnam; and
- Identify appropriate measures to management cumulative impacts.

The CIA has been broadly aligned (as and where relevant) with the specific IFC guidance on the topic of bird/bat collision risk for wind farm projects, as outlined in the "*Tafila Region Wind Power Project CEA*" (Cumulative Effects Assessment) (IFC, 2017[132]), being the first of its kind in the Eastern Europe, Middle East and North Africa region.

9.8.1.1 Boundaries of the CIA

Temporal boundaries of the CIA included the following:

- Past activities associated with historic cultivation practices by local communities, based on historical imagery in Google Earth™ and literature dating back to the 2000's (approximately 20 years);
- The state of the environment and land uses based on the current status quo; and

[132] IFC (International Finance Corporation). 2017. Tafila Region Wind Power Projects: Cumulative Effects Assessment. Available online at: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/tafila+region+wind+power+projects+-+cumulative+effects+assessment

- Activities associated with other projects that may take place in the near future (within the next 0-5 years. based on potential institutional planning and authorization timeframes).

Note that the temporary boundary of the CIA could be considered potentially up to 25 years (i.e. the project operational life span, as estimated), which aligns with the timeframe considered initial in the IFC Tafila project, which was defined as "…*the time during which the proposed mitigation, monitoring, and management measures will be implemented*" (IFC, 2017). However, even IFC (2017) acknowledge that this is likely to be unrealistic as the actual impacts on the VECs are not known, and instead temporal boundaries should be determined on the basis of monitoring.

Spatial boundaries of the CIA were defined as follows:

- The Monsoon WF Project development area and AoI defined for the biodiversity impact assessment (including wind farm, access roads and transmission line route to the border with Vietnam);
- The EAAAs for volant and non-volant species identified for the baseline biodiversity assessment and CHA to account for ecologically important/sensitive ecosystems, habitats and species that may be affected by the WF project;
- The corridor of contiguous Wet Evergreen Forest to the north-east of the WF to the border with Viet Nam;
- Protected Areas, Important Bird Areas and Key Biodiversity Areas within a 20km radius of the Monsoon WF project area;
- Several villages (23 villages in Dak Cheung district of Sekong province, and 8 villages in Sanxay district of Attapeu province) likely to be affected by impacts to local livelihoods; and
- The administrative boundaries of Dak Cheung and Sanxay districts, as representative of all areas that could be indirectly affected by changes in ecosystem goods and services.

9.8.1.2 Identification of VECs related to Biodiversity

VECs or Valued Social and Environmental Components were identified through the ESIA process based on the outcomes of the baseline biodiversity and social assessment findings, stakeholder and expert consultations and the Critical Habitat Assessment (CHA, ***Appendix T***). Priority VECs identified for the spatial and temporary boundaries of the CIA were selected on the basis of risk, rather than predicted impact (aligning with the IFC 2017 approach), and are summarized in Table 9-130 below.

Table 9-130: VECs Selected for the CIA from a Biodiversity Impacts Perspective

VECs Identified	Rationale	Relevance to CIA?
1 Conservation important bird & bat species (globally/nationally threatened and restricted-range species)	Avifauna are typically at particular risk of increased mortalities caused by wind farms (turbines and power lines), with threatened species considered to be of noteworthy conservation importance.	Yes – several RDL species of birds identified, only LC bats. Several other transmission lines associated with other hydropower projects are planned in the AoI.
2 Large migratory or congregatory populations of bird/bat species	*Migratory species and large species congregations can be at risk of particularly high collision incidences with wind farms and species barrier effects can be particularly significant.*	*No - no large migratory or congregatory populations known for the local area.*
3 Large, contiguous forest compartments	Known to provide key habitat value for endangered species and function as important species movement corridors.	Yes – contiguous and largely natural forest compartments exist.

VECs Identified	Rationale	Relevance to CIA?
4 Remaining natural and modified forest (including disturbed/fragmented habitat)	Important for IUCN RDL faunal species and plants.	Yes – contiguous and largely natural forest compartments exist.
5 River valleys	*Represent important aquatic ecosystems and key wildlife corridors.*	*No – onshore wind farms typically pose negligible risks to aquatic ecosystems, in this case the project transmission line interactions with river ecosystems will be limited.*
6 Critical habitats	Critical habitats identified in the CHA are of high biodiversity value both in terms of the vegetation type and habitat supporting key species of conservation importance, and impacts to these areas will be ecologically significant.	Yes - 'critical habitat' associated with the EAAAs as identified in the CHA.
7 Network of Protected Areas, Important Bird Area and Key Biodiversity Areas	These are key areas for supporting and conserving biodiversity where impacts can be particularly significant to biodiversity conservation goals.	Yes – several PAs and KBAs are located in the AoI.
8 Natural resources used by local communities	Local rural communities in the area are known to be strongly dependent on the natural resources provided by forest ecosystems in particular, including NTFPs and wildlife	Yes – community engagements identified local communities' strong reliance on forest products to sustain rural livelihoods. From a social perspective, this was the most important VEC identified for local communities.
9 Other socio-cultural aspects	Additional socio-cultural aspects that were initially identified included: sense of place, tourism & recreation, current land use (farming for example), cultural/traditional lifestyles, visual amenity, air quality/climate, and employment opportunities.	*No - given that the WF will have a limited impact on these aspects and that local communities did not highlight these as being particularly important,*

9.8.1.3 Project Risks and Impacts to Biodiversity

In order to contextualize and inform the CIA, a summary of the key findings of the biodiversity impact assessment undertaken for the ESIA for Monsoon WF (ERM, 2022) has been included below:

1. Collision risk for bats and birds is considered to be 'low' to 'insignificant' based on the baseline surveys and collision modelling undertaken;
2. There are no known populations of key migratory or congregatory bird/bat species identified for the Project area that could be significantly impacted;
3. General nuisance disturbances and impacts to fauna from dust, noise, vibrations, etc. are expected to be of limited significance and can be readily mitigated;
4. Impacts to aquatic biodiversity will be minimal and easy to mitigate through appropriate road crossing design and construction across small streams;
5. Interactions of the transmission lines with streams/rivers will be negligible;
6. There will be moderately significant, permanent impacts to the natural forest vegetation communities and habitats, with possible indirect impacts on forest-dependent species;
7. Linear infrastructure (roads and transmission lines) are likely to have the most notable impacts on forests, particularly the lesser-impacted and more contiguous sections of Montane Forest to the north and the Wet Evergreen Forest habitat in the north-east (associated with the planned transmission line alignment towards Vietnam); and

8. Increased efficiency of access to more remote forest areas has been highlighted as a key induced and possible unintended consequence of the WF project, and this may result in increased pressure on forest resources (particularly hunting of endangered wildlife).

Residual impacts to forest habitat (and potentially RDL species) associated with access road and transmission line infrastructure are considered to be moderately significant and will be difficult to mitigate without avoiding impacts altogether. Despite attempts made to avoid impacts to forest habitat through project design and realignment considerations, and the recommendation of good practice controls and site-specific mitigation, the following residual impacts of particular significance are likely to be associated with the WF project:

1. Transformation and/or modification of areas of natural (lesser impacted, contiguous) forest vegetation, providing key habitat for RDL forest-dependent species and also classified as 'critical habitats' (direct and indirect impacts); and
2. Loss of RDL and range-restricted species through increased hunting/harvesting pressure due to increased efficiency of access to more remote areas in the project area (induced impact).

These residual impacts are likely to result in a net biodiversity loss unless adequately mitigated through an appropriate biodiversity compensation strategy. It has been recommended that a biodiversity offset be pursued to ensure that residual biodiversity impacts are compensated.

For a full description and detailed analysis of the biodiversity risks and impacts related to the Monsoon WF project, the reader is referred specifically to ***Section 9*** of the ESIA.

9.8.1.4 Other Biodiversity Stressors and Threats Identified in the AoI

Other known developments (existing and planned) in and around the Project area have been identified.

Wind farm projects:

Based on the stakeholder engagement undertaken, no other existing wind farms have been identified in Dak Cheung and Sanxay districts. A rapid scan of the AoI in GIS using Google Earth™ satellite imagery, combined with a brief literature review, confirmed that there are no other existing wind farm projects in the AoI, and this was also highlighted in the baseline biodiversity assessments completed for the study area.

Impact Energy Asia Limited (IEA) has signed a Memorandum of Understanding (MoU) with the Government of Lao PDR (GoL) in relation to the development and implementation of a new 1,000 MW wind farm planned in Dak Cheung, Xekong Province ('Xekong Wind Farm' project). The new Xekong WF would be adjacent to the Monsoon Project, and IES (Impact Electrons Siam Limited) has announced that exclusive rights have been obtained from the Government of Lao PDR to conduct a feasibility study and preliminary EIA.

The WF Project Area is likely to be considerably larger in size to Monsoon WF, with a larger number of WTGs required to generated the power required. The estimated project area includes 2 properties, 494 km^2 and 324 km^2 in extent, respectively. Based on the capacity of 1000 MW, the WF will have a combined total of 238 WTGs, with two main clusters of 83 WTGs and 150 WTGs located within the western and eastern properties, respectively. The site will be accessed via Lao Highway 16B, which is generally paved up to the western-most property.

The planned Xekong WF will be located a short distance north of Monsoon WF (see map in Figure below).

Hydropower projects:

Several hydropower projects, with associated linear transmission lines, are identified in both Dak Cheung and Sanxay districts. A map showing the existing hydropower project transmission line closest to the WF project is indicated on the map in ***Figure 9-95***.

Figure 9-94: The Boundaries of the Planned 'Xekong WF'

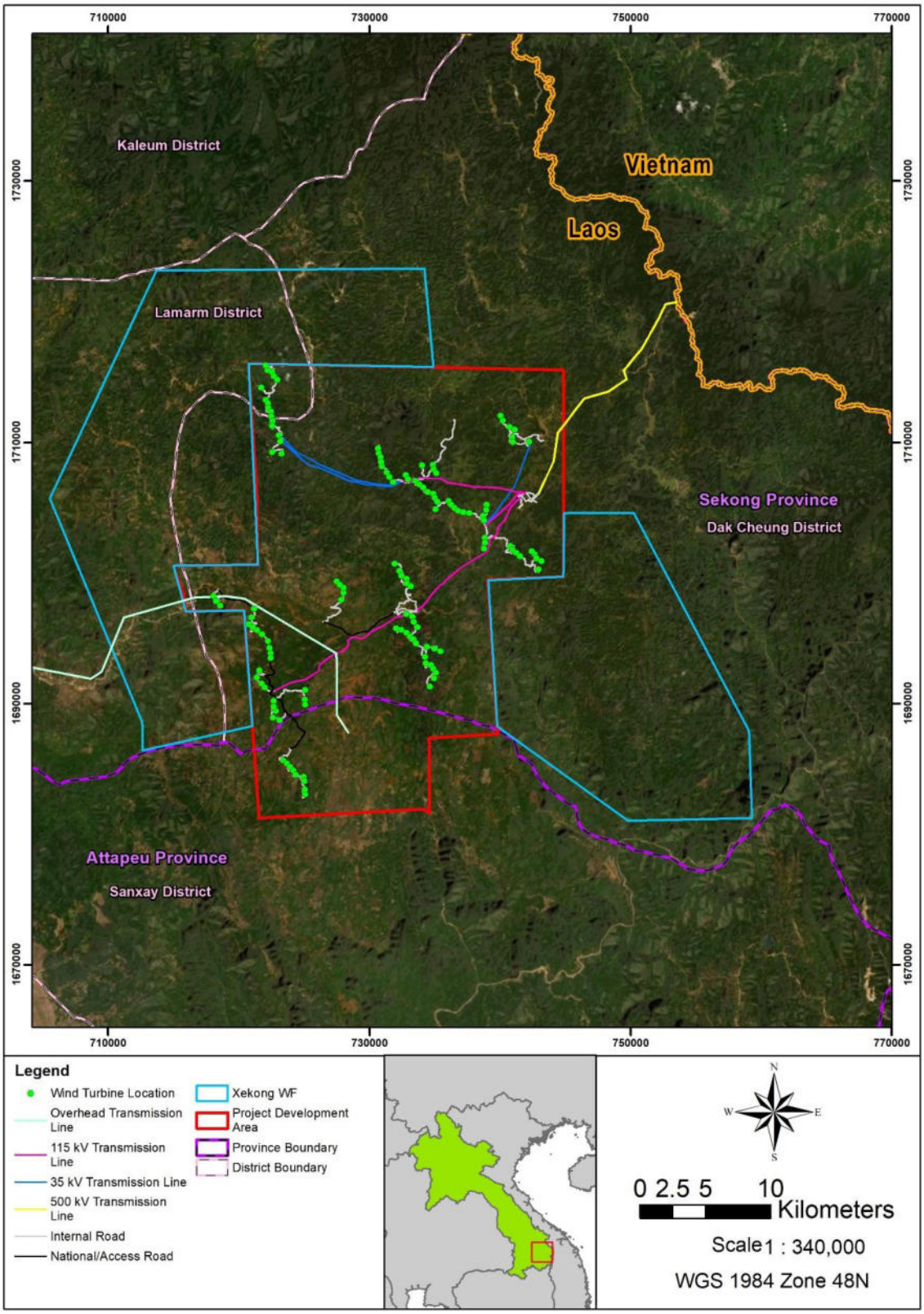
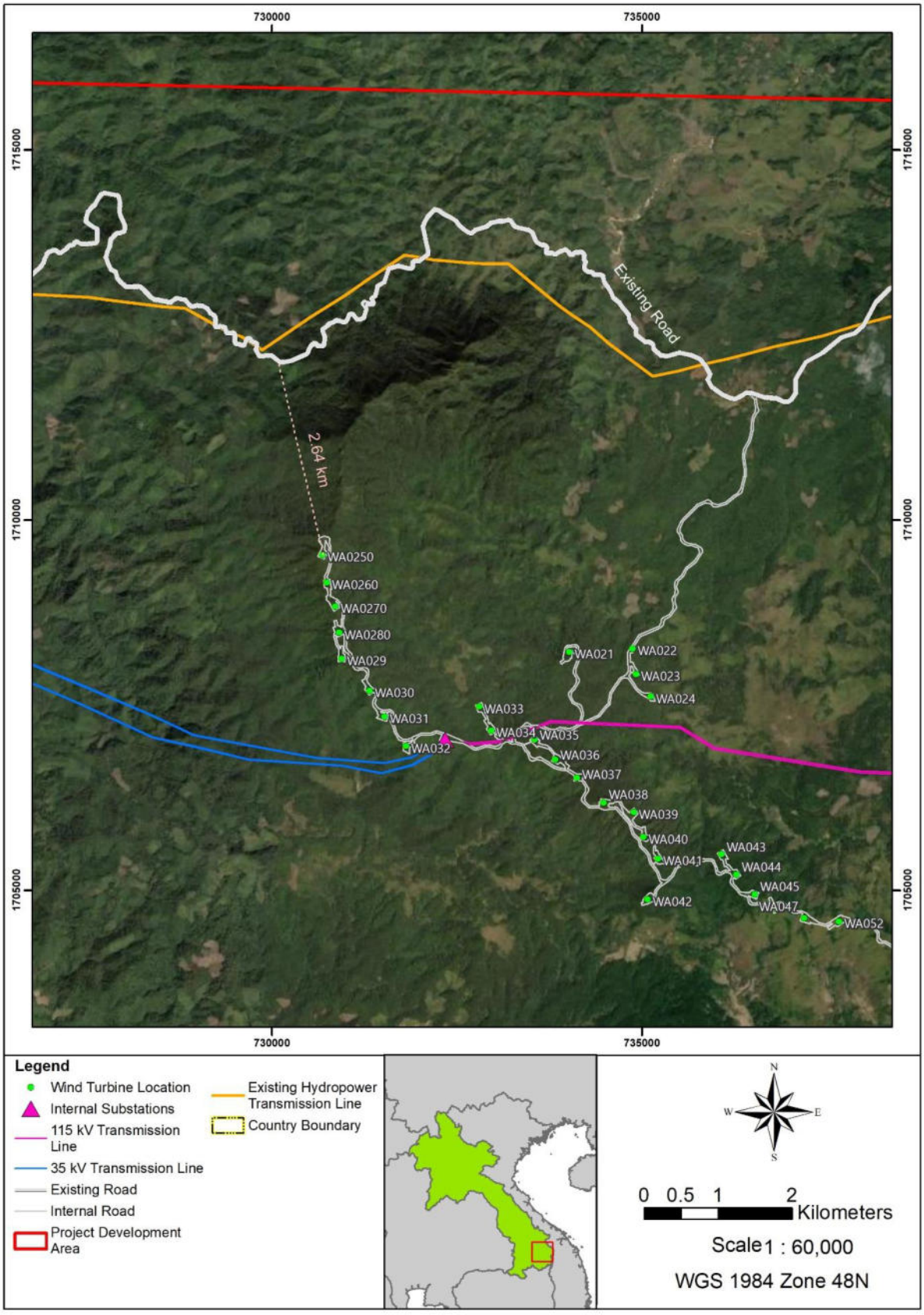


Figure 9-95: The existing Hydropower Transmission Line and Main Access Road in relation to Monsoon WF



Agriculture:

Agricultural projects include livestock husbandry, a coffee plantation project and fruit tree plantation in Dak Cheung District, with no formal agricultural projects identified in Sanxay District.

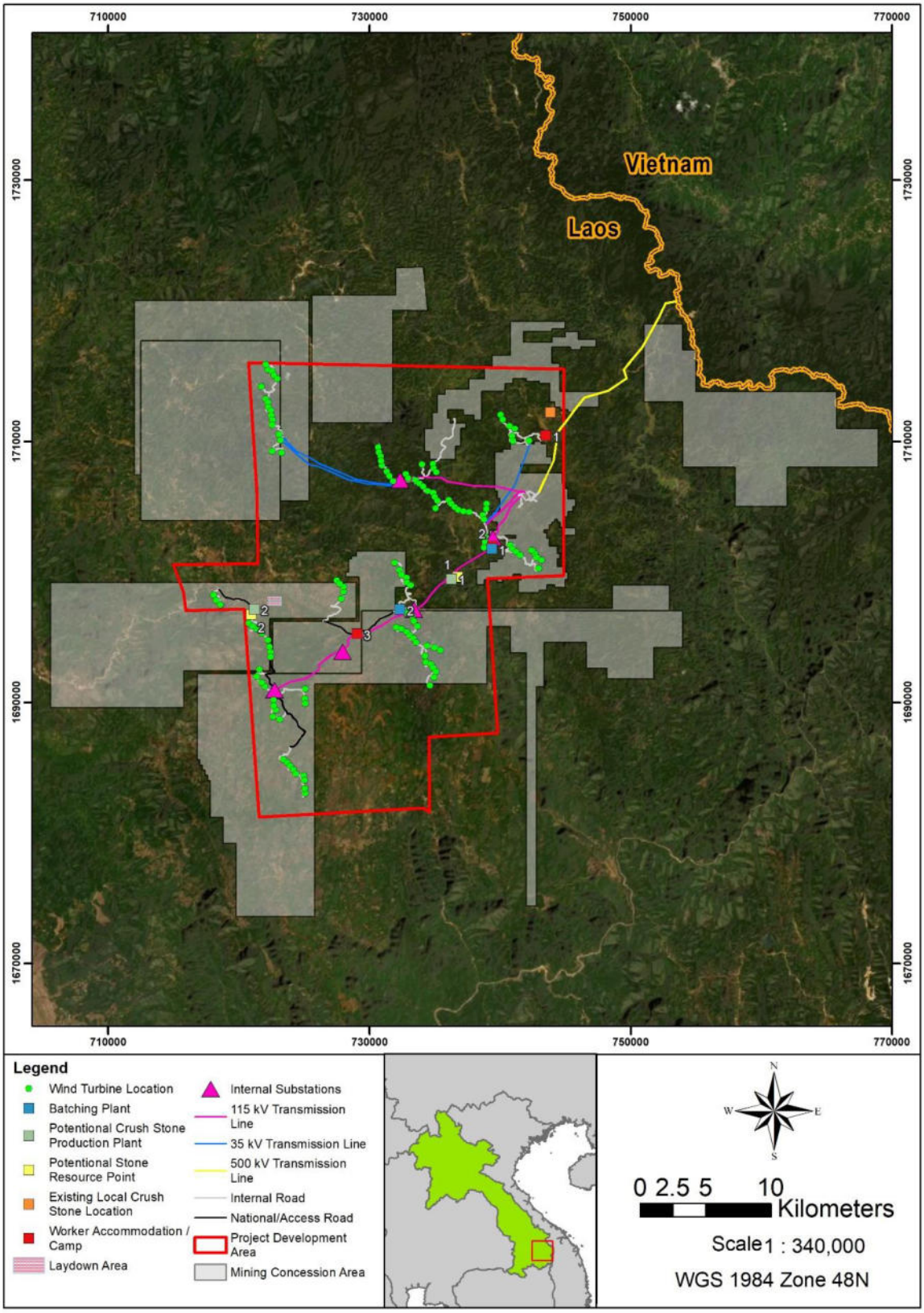
Road upgrades:

A number of road upgrade / improvement projects are identified in both Dak Cheung and Sanxay districts.

Mining projects:

A potential bauxite mining project has been identified in Sanxay District, within Sekong and Attapeu provinces. A map showing the mining area where mining rights has been granted is shown indicated on the map in Figure 9-96, suggesting that a large area of the project area and surrounding areas up to the border with Vietnam may potentially be subject to surface mining.

Figure 9-96: Areas where Bauxite Mining is planned in Sekong and Attapeu Province, in relation to Monsoon WF



9.8.1.5 Other land uses and biodiversity threats

Other potential land uses and threats to biodiversity (past, present and future) have also been identified through a rapid scan of the projects AoI in GIS using Google Earth™ satellite imagery, supplemented by a desktop literature review of the current and past state of biodiversity threats in Laos (with future predictions where possible). This indicated that the key threats to biodiversity (not including those associated with the Monsoon WF project) are associated with human interactions with forest habitat and resource use, which in rural areas (where the project is located) revolve around "multi-livelihood" strategies that involve a mixture of subsistence and income-earning activities that combine hunting and gathering with agriculture, horticulture, livestock farming and forestry (National University of Laos, 2008). The most significant threats to biodiversity are likely to include:

- Over-extraction or unsustainable harvesting of wood and NTPs (Non-timber Forest Products) from natural forests;
- Forest habitat loss, degradation and fragmentation mainly through cultivation activities;
- Soil erosion and soil loss; and
- Over-hunting and illegal wildlife trade.

9.8.2 Cumulative Impact Assessment

Based on the key impacts of the Monsoon WF on local biodiversity (in terms of the ESIA), together with available information on other projects, past/present/future threats and impacting land uses in the AoI defined, the focus of the cumulative assessment for biodiversity impacts was on the following impacts viewed in aggregation:

- Avifauna collision risk;
- Forest loss and degradation;
- Habitat fragmentation and reduced connectivity;
- Regional loss of RDL species of plants and animals; and
- Reduction in ecosystem goods and services used by local communities (social aspect).

9.8.2.1 Cumulative Impact 1: Avifauna collisions

Description

No other existing wind farms have been identified in Dak Cheung and Sanxay districts, which could contribute cumulatively to population level impacts to avifauna (birds & bats) at a regional level[133]. Indeed, no other wind farms have been identified in Lao. There are wind farms in Vietnam, but none are within 50km of the project.. The planned Xekong WF is of relevance as this project will be located a short distance north of the Monsoon WF. The Xekong WF Project Area will have an estiamted

[133] **SPECIAL NOTE**: In terms of bird/bat collision risk, the specific IFC guidance on this topic, as outlined in the Tafila Region Wind Power Project CEA (Cumulative Effects Assessment) (IFC, 2017) is based on an approach to cumulative assessment that considers the ecological risk posed to priority bird and bat VECs, identifies fatality thresholds for each species and then proceeds to identify key mitigation and monitoring requirements. However, the project for the Tafila Region is in the context of multiple wind farm sites having potential cumulative impacts on avifauna in the region, which is different to the case for Monsoon WF in southern Lao PDR, which will be the first for the region. The approach to identifying key ecological risks for avifauna species to determine fatality thresholds therefore has little relevance to the Monsoon project from a cumulative impacts perspective, especially given that the collision modelling for the project suggests that bird/bat collision risk will be low to insignificant overall, with minimal possible effect on populations and with no migratory species at risk. Also, fatality threshold targets for priority bird/bat species will be challenging to determine, given that lack of available or suitably accurate information on regional size and status of most populations. Similarly, limited quantitative data on vegetation and habitat status and extents limits the ability to easily set targets or thresholds for forest habitat in the region. Despite these clear limitations, available data on forest losses at the national and regional level have been reviewed as far as possible and used to better frame and contextualize possible cumulative forest habitat impacts.

maximum power output capacity of 1000 MW and is likely to be considerably larger in size to Monsoon WF, with a larger number of WTGs required to generate the power required.

Given that the Xekong WF project is still in the feasibility and planning stages, with no detailed environmental impact assessment yet released for review, the lack of detail on this potential future project hinders the degree to which cumulative impacts can be assessed. Nevertheless, one can assume that based on the project's proximity to the Monsoon WF and similar habitats that will be impacted, that the same or highly similar environmental receptors will likely be affected and impacts are likely to be similar but perhaps of a higher magnitude due to the greater extent of the project and larger number of WTGs. Several hydropower projects have also been identified with associated electrical transmission lines for these projects (with the closest one being to the immediate west of the Monsoon WF site) and these projects may result in piece-meal impacts which could also interfere more broadly with avifauna. Whilst the cumulative impacts of onshore wind power on avifauna (birds and bats) have received limited consideration (Bennun et al., 2021), at a species population level migratory species of birds that typically forage over large range may experience significant cumulative mortalities. This could be relevant to some of the larger raptor species known to exist in the region and which move over distances, and which may present a risk of turbine and power line collisions leading to possible injury/fatality. However, based on the results of bird/bat collision risk modelling for the Monsoon WF project, there were no significant collision risks to key bird and bat species identified, particularly at the population level. Unfortunately, little to no population data exist for most bat species globally, which hinders understanding of the impacts of wind energy projects on long-term population viability (Bennun et al., 2021), however the Monsoon WF project ESIA determined risks to bats to be negligible, particularly given that only species of LC could be at risk and collision risk was determined to be of low significance.

Impact rating

Since large populations of migratory or congregatory birds/bats have not been reported for the area, there is unlikely to be a significant cumulative risk to migratory species or large congregations of birds/bats. At the species level, there could be minor risk of injury/fatality for some of the larger raptor species, however cumulatively the impact can still be regarded as relatively **minor**.

Mitigation of cumulative impact 1:

Given the low avifauna collision risk modelled for Monsoon WF and the probable similar additional risk posed cumulatively by other projects in the region, the project-level mitigation recommended for the Monsoon WF (ERM, 2022) is considered adequate also from a cumulative impacts perspective. This includes the following

- Long-term monitoring of bird and bat activity, including carcass monitoring, to further the understanding of collision risks for avifauna.
- Sharing of monitoring data between different projects can help in developing regional inventories, identifying trends and developing thresholds and targets for protecting key species of conservation importance. Without this long-term data and trends analysis, conservation actions (even collaborative efforts) will be difficult to implement since these typically cannot be actioned easily over very broad areas.
- Where monitoring indicates impacts are greater than predicted and have potential to have population level effects, an adaptive management approach will be undertaken whereby specific mitigation options would then be implemented for turbines and power lines aimed at deterring birds/bats and reducing collision risk.

Furthermore, the following additional mitigation is recommended:

- In time, fatality thresholds could be developed to better inform the adaptive management approach but would require long-term monitoring data to establish any statistically significant trends.

It would be advisable that other wind farms and linear electrification projects (planned and future) take a similar approach and any future WF projects planned for the region should approach mitigation based on the lessons learned from the Monsoon WF project and possibly may need to apply the methodology applied for the Tafila Region Wind Power Project CEA (Cumulative Effects Assessment) (IFC, 2017) and take cognizance of the findings of this assessment.Given that other wind farms and electrification projects are planned in the region (some of which are in close proximity to the Monsoon WF site), a strategic assessment and combined CIA should ideally be done for the region that takes into account the combined impact of multiple planned wind farms and suggesting adaptive management/mitigation and monitoring strategies that encourage the sharing of data as far as possible. Alternatively or in addition, information on cumulative effects should also be fed back to the IFC's cumulative assessment project for the Sekong River Basin region in Lao PDR, that considers the management and assessment of cumulative impacts of renewable energy development in the Sekong River Basin, Lao PDR (IFC, 2019: '*Final Inception and Scoping Report of the Cumulative Impact Assessment and Management of Renewable Energy Development in the Sekong River Basin, Lao PDR*').

9.8.2.2 Cumulative Impact 2: Regional loss of important forest habitat

Description

A patchy mosaic of fragmented evergreen forest communities interspersed with cultivation and transitional shrub land and grassland (transitioning to young/seral forest) characterizes much of the AoI, still with some relatively large, contiguous forest compartments being retained in the more remote areas that have not been affected as much by local farming, timber harvesting and other human activities. The impact of further cumulative forest habitat loss and fragmentation due to Monsoon WF and other developments in the region, should therefore be evaluated in light of the existing level of loss/transformation that has occurred. Putting into context the existing loss of forest that has taken place regionally, there may be as little as 25% or less natural forest remaining based on the literature reviewed[134], with forest ecosystems being under significant threat. Any further large-scale transformation of natural forest habitat, especially within the less impacted and more contiguous forest compartments, should be considered significant (also in light of the fact that the rate of regeneration of forests is typically a slow process requiring decades). Forest habitat is also considered 'critical habitat' for supporting RDL plant and animal species in the region, and further losses to this type due to the cumulative impacts of development and subsistence harvesting and farming, could eventually reach significant and unsustainable levels.

Whilst the WF project when viewed in isolation may not exacerbate forest loss significantly other linear projects such as new transmission lines associated with hydropower projects and road upgrades planned, are also unlikely to contribute to habitat loss at the regional level. Other more intensive development activities such as mining[135] and agriculture (existing or planned in the two districts), will likely have larger impact to forests in comparison to Monsoon WF (and probably the

[134] The WWF (World Wildlife Fund, 2021) has estimated the transformation of natural forest habitat in the ecoregion having already reached levels as high as 75%, which implies that only 25% of reference forest habitat could remain at the regional level. The National University of Laos (2008) also describe the evergreen forests of the Annamite Mountain region as being "weakly represented". Tong (2009) presents some fairly detailed statistics on forest loss at a national level for Lao PDR, with earlier studies from 2002 revealing an average loss of 91, 200 ha per annum of forest over a 20-year period, reducing the overall national forest area to roughly 41%. Forest quality has also deteriorated appreciably, with dense forest cover declining from 29% to 8% between 1992 and 2005. This is not to mention the rise in forest fragmentation, with large forest compartments declining from 88% to 54% over the same period. This trend in forest loss and degradation is unlikely to have slowed down, and the situation by 2022 is likely to have deteriorated further, possibly quite substantially. Comparatively though, the loss of forest in Lao PDR is still appreciable less than that which has occurred in nearby countries such as Thailand, Vietnam and China, where substantially greater losses have been reported.

[135] Surface mining in particular is known to be associated with significant biodiversity risks and impacts, being comparatively both extensive and intensive operations that are inherently destructive to both terrestrial and aquatic ecosystems, with significant long-term and even permanent impacts known also for surface and ground water quality and quantity.

adjacent Xekong WF when considered in collaboration), although currently these avoid some of the better-quality habitat areas.

Impact rating

In comparison to the direct impacts of the Monsoon WF (which are comparatively small), the mining of bauxite in the project area is likely to result in a larger impact to forest ecosystems and habitats. It would be reasonable to assume that, where the mining company seeks international finance, it will need to meet obligations under no net loss or net gain. Where this does not happen then a cumulative effect on biodiversity is possible, depending on the location and impacts associated with the mine. This is however outside of the direct control of the Monsoon WF project.

Mitigation of cumulative impact 2

The project-level mitigation recommended for the Monsoon WF (ERM, 2022) is considered adequate from a cumulative impacts perspective. This includes the following

- Offsetting the anticipated forest habitat losses at Monsoon WF would function to compensate for the project specific impacts that would otherwise contribute to regional forest habitat loss. It has been recommended that the offset approach consider aligning with existing projects in the region, either through co-funding opportunities or ensuring that offset interventions complement existing forest conservation projects where possible.
- It is also acknowledged that there are already several projects co-funded by WWF and other international agencies (KfW for example) within the region that are aimed at improving sustainable forest utilization, forest protection and restoration of degraded forest habitats.

It is further recommended that:

- Other planned development projects in the region (including the adjacent Xekong WF and planned mining) should adopt a similar approach where significant residual impacts remain, if cumulative forest losses at the regional level are to be appropriately addressed. This will require a concerted effort from the Government of Lao PDR from an environmental compliance monitoring and enforcement perspective.
- Encouraging the sharing of long-term vegetation, habitat and species monitoring data (from baseline surveys through to operational monitoring) can be useful in furthering the understanding of regional trends in forest habitat degradation and the relative impact on forest-dependent species. Without this long-term data and trends analysis, conservation actions (even collaborative efforts) will be difficult to implement since these typically cannot be actioned easily over very broad areas
- Ultimately, development and land utilization projects need to ensure that they align with the goals and objectives of many of Government of Lao PDR's sustainable development strategy and policies, including:
    - The Forest Strategy 2020, with a rather ambitious target to recover a forest cover of 70% by 2020 (recently being revised to be achieved by 2025 in the forthcoming Forest Strategy 2030); and
    - The National Biodiversity Strategy and Action Plan for Lao PDR (NBSAP[136]), and its 2016-2025 Action Plan, with a goal is to "*enhance the role of biodiversity as a national heritage and as a substantial contributor to poverty alleviation, as well as sustainable and resilient economic growth*".

[136] Ministry of Natural Resources and the Environment. (2016). National Biodiversity Strategy and Action Plan (NBASAP) for Lao PDR 2016-2025. Vientiane Lao PDR. Available online at: https://www.cbd.int/doc/world/la/la-nbsap-v2-en.pdf

9.8.2.3 Cumulative Impact 3: Forest habitat fragmentation and reduced connectivity

Description

Multiple activities and stressors can create a combination of barriers to wildlife movement. Whilst the Monsoon WF project itself is unlikely to result in significant reductions in habitat connectivity that could affect local wildlife, what is important from a cumulative impacts perspective is the collective reduction in forest habitat, increased patchiness of natural forest cover, and the reduction in contiguous forest communities that function as important wildlife corridors[137]. When considered in the context of the existing levels of habitat loss and fragmentation of forests, the WF project will have some fragmenting effects on habitat, particularly in the more remote habitats to the north and north-east, however species will still be able to move across these areas to access the remaining large forest compartments. There are also no identified large new 'greenfield' road development project in the AoI, with some road improvement projects planned which are unlikely to result in any new significant risks to species movement and habitat fragmentation. Transmission lines will also have a very minor effect.

Impact rating

Overall, the cumulative risk of linear electrification and road upgrade/developments in the AoI can be considered **low/minor**. Mining development in the AoI is likely to affect habitat and has the potential to possibly disrupt wildlife movement unless carefully planned and managed.

Mitigation of cumulative impact

- Combating cumulative forest fragmentation follows a similar approach as for Cumulative Impact 2 (forest habitat loss), addressed above.
- Avoid severing key wildlife movement corridors through the construction of impermeable barriers such as fences, walls, and other hard infrastructure.
- Support local and regional endeavors to restore landscape connectivity where possible, through innovative approaches to reforestation and wildlife corridor creation, for example.

9.8.2.4 Cumulative Impact 4: Regional loss of RDL species

Description

Cumulative impacts to the availability of forest habitat and increased habitat fragmentation (discussed above) could indirectly affect populations of key species of conservation importance that are forest-dependent in the region. Local communities in the area have also been identified as being strongly reliant on the forest ecosystems in the region[138] and the illegal wildlife trade has also grown in the region, placing pressure on endangered species at risk of local extinctions and depleting wildlife densities (COMBO, 2022[139]), with the species targeted for commercial trade and most at risk being

[137] Since the important faunal species identified for the area are predominantly forest-dependent, forest habitat fragmentation (as a result of the cumulative effect of existing land degradation and transformation by farming and the additional bisecting of forests by the new access roads and transmission line corridors) will result in reduced connectivity and may inhibit the movement of key species between habitats.

[138] Locals extract wood for construction, tool making and fuel and Non-Timber Forest Products ("NTFPs") such as plants for traditional medicine and food and wildlife for use as a source of protein. Since few rural households typically do not have surplus rice, vegetables or livestock to sell, much of the annual trade income for villagers is derived from the sale of natural resources found in the forest and sold at local markets. Wildlife hunting is a key activity for subsistence, recreation and to sell at markets (fueled by a considerable demand for animal products from neighboring countries) and overhunting of wildlife is considered a key threat (National University of Laos, 2008; COMBO, 2022).

[139] COMBO: The Conservation, Mitigation and Biodiversity Offsets Programe, (2020). Available online at: https://www.comboprogram.org/Where-we-work/Lao-PDR

mostly soft-shelled turtles, monitors, snakes, pangolins, macaques, bears, otters, civets, mousedeer, muntjaks and all flying squirrels (National University of Laos, 2008). The majority of these have been recorded in the project area, are known from existing records or are predicted to occur. Many of the species under greatest hunting pressure, according to National University of Laos (2008) are also considered ecological "keystone" species, with important contributions to long-term forest health. There is therefore reason to believe that significant pressure already exists, posed by the illegal wildlife trade in the region.

Impact rating

Local villagers interviewed during the ESIA commented that they have noticed a decline in wildlife in the area of the Monsoon WF over the years. Over the project development area this is a pre-existing effect, the impacts of which are linked to ease of access and proximity to settlements. Most of the wind farm area is already subject to significant levels of biodiversity loss. Improved access to more remote areas will inadvertently make such habitats more susceptible to hunting and harvesting pressures, and this would apply to other development projects collectively in the region as well. Trans-border impacts associated with illegal wildlife trade, particularly for threatened species hunted in Lao PDR and transported for sale in Vietnam, also need to be considered. This impact, cumulatively speaking, could be potentially of relatively **moderate to high significance**.

Mitigation of cumulative impact 4

- Mitigation is proposed to manage existing access to more remote areas, whilst supporting local communities continued access to important trails connecting with Dak Cheung, and sustainable and legal use of forests;
- Ultimately, this requires a sensitive approach given that communities are strongly dependent on forest resources. Monsoon WF would need to work closely with communities in mitigating impacts, ensuring a transparent process is followed that is also inclusive. This is quite clearly articulated in the ESIA, particularly the sections on residual biodiversity impacts and recommendations around offset strategy.
- Other developments in the regions that could increase access to more remote forest habitats should adopt a similar approach.
- Addressing the illegal trade in threatened species requires a concerted effort from the Government of Lao PDR, in collaboration with the authorities in Vietnam, which realistically is outside of the scope of what this assessment and project can achieve.

9.8.2.5 Cumulative Impact 5: Reduction in ecosystem goods and services used by local communities

Description

Cumulative transformation of forest habitat will likely also lead to a reduction in the ecosystem services, such as the provision of timber and non-timber forest products. The physical footprint of the wind farm is relatively small, particularly when compared to projects such as mining, and therefore in isolation will be unlikely to significantly reduce ecosystem services. The main pathway for effects related to the wind farm would be if improved access to more intact parts of the project area lead to unstainable harvesting of forest resources. Future mining-related biodiversity impacts may be greater in comparison to the small scale/magnitude of impacts associated with the Monsoon WF and other wind farms, linear road upgrades and transmission lines in the region, and may also affect the quantity and quality of water.

Impact rating

Stakeholder engagement conducted for the CIA highlighted that local communities consider the natural resources associated with forests and wildlife to still be abundant in the region, despite obvious historical impacts, however the local people have witnessed a decreasing trend in the availability of key resources due to encroachment into forests, deforestation and cultivation activities and increased wildlife poaching (from both inside and outside of the local communities). The potential risk cumulatively should be considered at least **moderately significant** for the region and protecting and ensuring the sustainable use of the harvestable resources provided by forest ecosystems in supporting local livelihoods is considered regionally important.

Mitigation of cumulative impact 5

- Mitigating the cumulative loss of ecosystem services, provided particularly by the forest ecosystems to be impacted by Monsoon WF and bearing in mind the existing impacts to these ecosystems, requires a transparent and inclusive approach that considers the needs of the local communities in the area (as already discussed under Cumulative Impact 4).
- It is recommended that future development projects work together with communities to better understand their needs and reliance on key ecosystems goods and services, to identify key areas to protect and where conservation or even offset efforts should focus to maximize the delivery and support of ecosystems providing these services and to better understand trends in declining services and their causal factors.
- Alignment with existing community-driven projects that encourage conservation and sustainable use of forests will be key for the Monsoon WF project and other development projects in the region.

9.8.2.6 Cumulative Impact 6: Contribution to clean energy sector and move away from non-renewables (positive impact)

Description

Whilst the focus of much of the assessment has been on the identification and assessment of 'negative' impacts on biodiversity associated with the project and cumulative effects of other activities, wind energy projects such as this do typically have positive effects as well. One such effect is the potential to create more sustainable, renewable and clean energy and shift away from traditional approaches to energy production involving fossil fuels that are unsustainable, non-renewable and polluting. Cumulatively speaking, together with the numerous hydropower projects operating or planned in the region, renewable energy projects can be seen as having a positive biodiversity impact through their role in moving towards a low carbon economy, and reducing the effects global climate change may have on the region[140].

Impact rating

Replacing traditional approaches in the energy sector with less impactful solutions such as wind energy is documented to have a net positive impact on both global climate and biodiversity. The potential averted biodiversity loss that could be anticipated to occur in the project area or further afield from typical fossil-fuel extraction, processing and power-generation projects could be significant. However, this would typically need to be evaluated at national and global scales (possibly regional), which is beyond the scope of what this assessment can achieve. Such benefits are also inherently difficult to predict and quantify.

Mitigation of cumulative impact 6

- None required.

[140] WWF, 2018. Wildlife in a Warming World: The effects of climate change on biodiversity in WWF's Priority Places. Available online at: https://www.wwf.org.uk/sites/default/files/2018-03/WWF_Wildlife_in_a_Warming_World.pdf

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

10.1 Introduction and Objectives

Through a systematic assessment, the ESIA has identified a number of significant environmental and social impacts, which may potentially result from the construction, and operation of the Project. In order to manage and mitigate these impacts, a range of measures have been developed to eliminate or reduce the adverse environmental and social impacts to acceptable levels and as low as reasonably practicable. These mitigation measures and the actions needed for implementation of these measures are presented in this Environmental and Social Management Plan (ESMP).

The key objectives of this Environmental and Management Plan (ESMP) are to:

- Demonstrate commitment to compliance with applicable laws, regulations and executed Project agreements through documented plans and procedures;
- Collate the various mitigation and management measures developed throughout the ESIA into a single point;
- Define monitoring requirements to determine the efficacy of all mitigation and management measures;
- Provide clear roles and responsibilities of all stakeholders as to what impacts have been identified, how they will be mitigated and managed, and through what means;
- Provide input into the overall suite of management measures, which will be incorporated and implemented through the Environmental and Social Management System (ESMS), which was developed;
- Ensure meaningful consultation and timely disclosure of information to affected people and during monitoring of project implementation; and
- Establish and maintain GRM processes suitable for affected people as well as for project workers.
- This section provides information and instruction on how environmental and social commitments of the Project will be managed from pre-construction through to the Construction and Operation phases. The ESMP is a living document, which:
- Incorporates the environment and social mitigation measures identified as a result of the ESIA process into a comprehensive framework to facilitate and ensure appropriate management throughout the Project cycle;
- Provides a framework for incorporating commitments into the Project plans and procedures for activities that have risks, as identified in the impact assessment;
- Presents responsibilities for meeting ESMP requirements including the provision of training;
- Provides a framework for the implementation of specific management plans by the EPC; and
- Defines the monitoring/verification and reporting program (including corrective actions).

10.2 Purpose of the ESMP

The purpose of this ESMP is to specify the standards and controls required to manage and monitor environmental and social impacts during construction and operation phase. To achieve this, the ESMP identifies potential adverse impacts from the planned activities and outlines mitigation measures required to reduce the likely negative effects on the physical, natural and social environment. When there are gaps between the local regulatory requirements and ADB's SPS, the Client will identify stakeholder engagement activities to enhance the formal regulatory process, and where appropriate, commit to supplemental actions. This emphasizes the importance of managing social and environmental performance throughout the lifecycle of the Project.

The ESMP consists of three primary components:

- The Construction Environmental and Social Management and Monitoring Plan (CESMMP), primarily for the construction contractors;
- The Operation Environmental and Social Management and Monitoring Plan (OESMMP), primarily for the facility operators; and
- The Project Owners Environmental and Social Management and Monitoring Plan for those plans and mitigation measures that are not covered by the CESMMP and OESMMP, such as the Initial Biodiversity Action Plan, Resettlement Plan.

10.3 Structure of the ESMP

The structure of this ESMP includes:

- ESMP Implementation – including responsibilities, ESMP Staffing, and Management of Change;
- Training – including program and capacity;
- ESMP Audit, Reporting, and Corrective Action and Monitoring; and
- Outline of the ESMP including the construction and operational phase mitigation and management measures.

10.4 ESMP Implementation

This section addresses the implementation of the ESMP, including responsibilities, staffing, and management of change.

10.4.1 Implementation Responsibilities

IEAD as the Project Proponent is responsible for the overall Project monitoring, ensuring compliance with environmental policy and obligations in the ESMP. IEAD has overall responsibility for ESMP implementation. IEAD may assign some of these responsibilities to the Contractors, Operator, and the Project Engineer, but IEAD retains ultimate responsibility for the effective implementation of the ESMP.

The organisation chart during construction phase and operation phase is shown in ***Figure 10-1*** and ***Figure 10-2***.

Figure 10-1: The Organisation Chart during Construction Phase

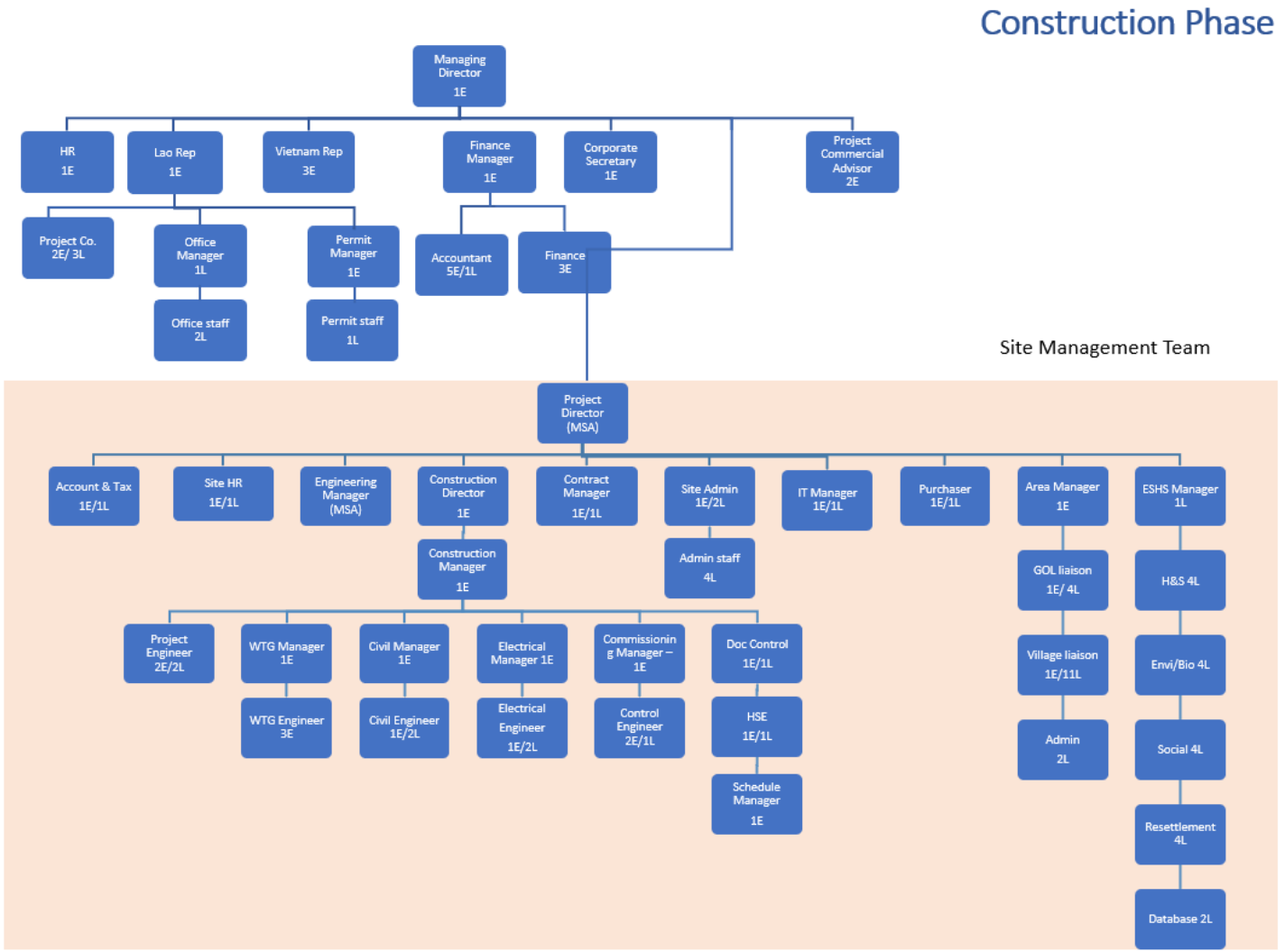
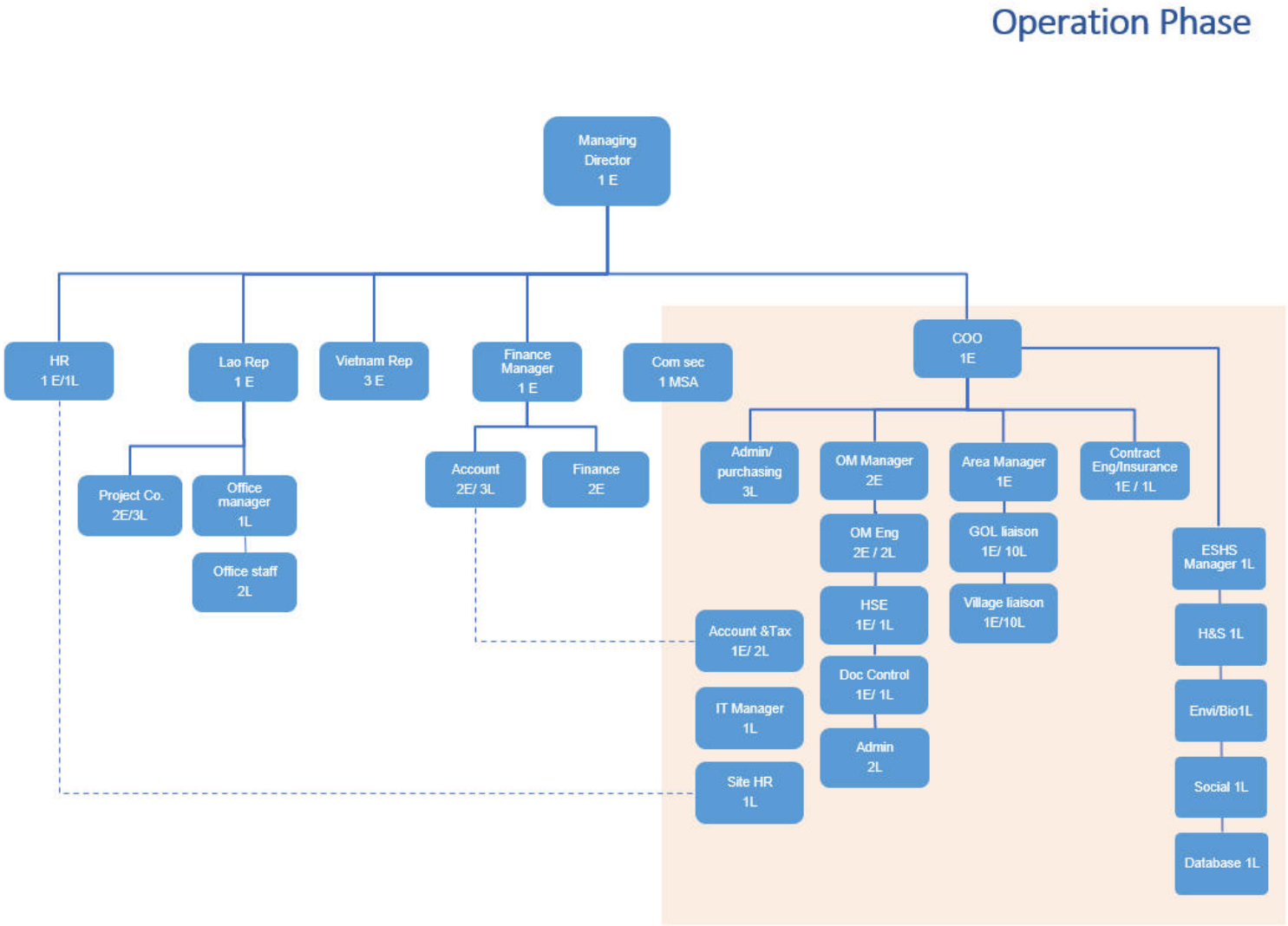


Figure 10-2: The Organisation Chart during Operation Phase



10.4.2 ESMP Staffing

As indicated above, IEAD, the Project Engineer, the Construction Contractors, and Facility Operator will all have dedicated Environmental, Social, Health and Safety (ESHS) teams to support the implementation, monitoring, and/or oversight of mitigation measures.

10.4.2.1 IEAD

IEAD should have an ESHS section with at least an ESHS Manager who reports directly to the Project Manager, if not the Managing Director.

During the construction phase, the ESHS Section should include at a minimum the following staff:

- ESHS Manager – the IEAD Project Team needs a dedicated ESHS Manager who preferably reports directly to the Managing Director. This person should have at an advanced degree in the environmental or social sciences or civil/environmental engineering with at least 15 years of experience in managing environmental and social risks for large infrastructure projects, including at least some experience with wind farm projects and some experience with ESMS. This person should have good working knowledge and applied experience with international standards (e.g., WB, EIB, IFC, and ADB). This person should have experience in construction phase monitoring. This person would be approximately 80% office/ 20% field based.
- Senior Environmental, Health & Safety (H&S), and Social Specialists - there should be at least one senior environmental specialist, one senior biodiversity specialist, one senior social/resettlement specialist, one senior stakeholder engagement specialist, and one senior health & safety specialist who report to the ESHS Manager. These staff should have at least a bachelor's degree in environmental science, engineering, or social sciences, as applicable; with at least 10 years of experience in managing environmental and social risks for large infrastructure projects. These staff should have a good working knowledge and applied experience with international standards (e.g., WB, EIB, IFC, and ADB). They should have experience with construction inspections and monitoring. These staff would be approximately 60% office/ 40% field based.
- Database, Information Management Specialists, and the database systems of affected people including inventory of assets, detailed recording of compensation payments, tracking of benefits provided to affected people, maps and generating all necessary data for monitoring and reporting.
- Staff Environmental, H&S, and Social Specialists - there should be at least one staff environmental specialist, one terrestrial biodiversity specialist, one aquatic biodiversity specialist, one H&S specialist, one social /resettlement specialist, and two stakeholder engagement specialists/Community Liaison Officers (CLO) who report to the Senior Specialists, respectively. The number of health and safety specialist may need to increase depending on the number of active construction sites and travel time between them. These staff should have at least a bachelor's degree in environmental science, engineering or social sciences, as applicable; with at least 5 years of experience in addressing environmental and social risks for infrastructure projects. These staff should have a working knowledge and some applied experience with international standards (e.g., WB, EIB, IFC, and ADB). They should have experience with construction inspections and monitoring. These staff would be approximately 40% office/ 60% field based, with the exception that the stakeholder engagement specialists/CLOs would be 100% field based.
- International Advisors – the IEAD Project Team should have several international ESHS advisors, who can provide guidance to the team, and especially the ESHS Manager, on pro-actively managing the Project's environmental and social risks during construction and initial operations. These Advisors should have at least 15 years of experience applying international standards and have extensive experience with developing and implementing ESMSs and providing construction oversight. These advisors should include the following:

- International Resettlement Implementation Advisor - the IEAD Project Team should have an international resettlement advisor, who can provide guidance to the team, and especially the ESHS Manager and Social/Resettlement Specialist, on overseeing RAP implementation and livelihood restoration.

- International Biodiversity Advisor - who can provide guidance to the team, and especially the ESHS Manager and the Biodiversity Specialist, on pro-actively managing the Project's biodiversity risks during construction and initial operations.

- International Health and Safety Advisor - who can provide guidance to the team, and especially the ESHS Manager and H&S Specialist, on pro-actively managing the Project's occupational and community health and safety risks during construction and initial operations.

During the operations phase, the IEAD ESHS Section should include at a minimum the following staff:

- ESHS Manager – the IEAD Project Team needs a dedicated ESHS Manager who preferably reports directly to the Managing Director. Education and experience should be similar to requirements listed above.
- ESHS Specialists - there should be at least one environmental specialist, one biodiversity specialist, one health and safety specialist, and one social/stakeholder engagement specialist who report to the ESHS Manager. Education and experience should be similar to requirements listed for senior specialists above. These staff would alternate at the project site or one of them could be based there permanently to provide oversight on the Project Operator.

10.4.2.2 Constructor Contractor

Each Construction Contractor will have an ESHS Team to prepare and implement the CESMMP. Each Contractor's ESHS Team will need to include a manager, who reports to their respective Construction Site Manager.

The contractor's ESHS Team will also have a senior environmental specialist, senior social/stakeholder specialist, and a senior OH&S specialist, as well as at least one staff level qualified and experienced specialists for each discipline (i.e., one environmental, one OH&S, and one social/stakeholder specialists), one each at each of the major work fronts.

The transmission line contractor's ESHS Team will have one environmental specialist, one social/stakeholder specialist, and one OH&S specialist.

Each contractor's ESHS manager will prepare monthly reports for IEAD on the status of mitigation measure implementation, any ESHS-related incidents (e.g., spills, grievances, injuries), and the Project's overall ESHS performance.

10.4.2.3 Project Engineer

The Project Engineer,. The ESHS Team will be led by a manager (advanced degree in applicable subject and 10 years of experience who reports directly to the Project Engineer. The ESHS Team will have an environmental specialist, a social/stakeholder engagement specialist, a full-time Sediment and Erosion Control/Slope Stability Inspector, and an OH&S specialist all with appropriate education (BA/BS in applicable subject) and construction oversight experience (minimum 5 years of experience). The ESHS Team shall prepare monthly reports for IEAD on the Project's ESHS performance.

10.4.2.4 Facility Operator

The Facility Operator will have an ESHS staff to implement the OESMMP and to monitor the Project's environmental and social performance. The ESHS staff shall include at least a qualified and experienced ESHS manager, supported by an environmental specialist, a biodiversity specialist, an H&S specialist, and two stakeholder/community relations specialists. The ESHS manager shall prepare monthly reports for IEAD on the Project's ESHS performance.

10.4.3 Management of Change

The need may arise to modify the ESMP as work methods change or are amended or new work methods are added. This is part of and consistent with Adaptive Management approach. The ESMP shall not be weakened, all changes shall maintain or strengthen the level of environmental and social protection. The process below establishes Management of Change requirements for any and all changes to the ESMP.

The Owner may propose changes to the ESMP when it is reasonably likely that the current ESMP is not sufficient to prevent:

- Serious health and safety incidents
- Environmental and social impacts greater than those disclosed in the ESIA;
- New impacts not disclosed in the ESIA;
- Violation of Laos law;
- Non-conformance with Lenders requirements

The ADB can also propose changes to the ESMP if it is clear from the Owners reports or the ADB inspections that the risks identified above may occur. In the event of non-conformance with Lender policies and requirements, the Lender's may withhold disbursements.

The Owner will notify the ADB of any proposed changes to the ESMP and obtain their approval before implementing any changes. The Owner will respond to any changes proposed by the ADB and obtain their approval. The Owner will maintain a current copy of the ESMP. The Owner will ensure that each ESHS manager/officer has ready access to the current version of the ESMP through a document control system that prevents inappropriate reference to the wrong version of the plan.

10.5 Training Program and Capacity Building

10.5.1 Construction Phase

Prior to commencement of major civil works at site, a suitably qualified in-house/ external expert will be appointed by the EPC contractor to develop and deliver a training program on implementation of the ESMP, monitoring and reporting will be conducted in line with the applicable reference framework for the Project. The training will include the following topics:

- Environment, Health and Safety Policy of the EPC contractor;
- Environment and fundamentals of environmental pollution in relation to the Project;
- EHS management plans prepared by the EPC Contractor;
- Do's and Don'ts for the construction workers;
- Safety procedures and guidelines;
- Internal reporting and response system;
- Hazardous chemicals and waste handling;

UXO Awareness and Chance Find Procedure;In addition, specific training will be provided to the team involved in environmental and social monitoring and reporting, which will include:

- Applicable environmental and social guidelines and standards;
- Sampling site selection guidelines in line with environmental monitoring plan;
- Sample collection, storage, transportation and analysis procedures;
- Solid and hazardous waste management;
- Quality assurance and quality control;

- Environmental monitoring report preparation

The training will help in capacity building and implementation of the ESMP during the construction phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental and social performance of the Project. The timeframe for reporting and verification during the construction phase will be agreed between IEAD, ADB, and the EPC.

10.5.2 Operation Phase

Prior to the commencement of Project operation, a suitably qualified in-house/ external environmental expert will be engaged to develop and deliver a training program on operation phase environmental and social monitoring and reporting. The topics will be mostly same as that during the construction phase. However, it will also include following modules, which are specific to the operation phase:

- Hazardous chemicals and waste management;
- Occupational health and safety programs, including Emergency Response Plan for both employee and nearby communities;

The training will help in capacity building and implementation of the ESMP during the operation phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental and social performance of the Project. The timeframe for reporting and verification during the construction phase will be agreed between IEAD and ADB.

10.6 ESMP Audit, Reporting, and Corrective Actions

It would be expected that a monitoring, review and auditing program would be implemented during construction and operation phases to monitor implementation of the Project's EHS requirements and environment and social commitments. The inspections and audits will be done by the project identified EHS staff in coordination with O&M contractors and other external agencies identified. The entire process of monitoring and audits should being documented.

IEAD will develop and implement a programme of reporting through all stages of the project cycle. Delegated personnel shall require to fully complying with the reporting program in terms of both timely submissions of reports as per acceptable level of detail. Reporting will be done in form of environmental checklist, incident record register, environmental and social performance reports (weekly, monthly, and quarterly, half-yearly, or yearly etc.). According to ADB's Safeguard Policy requirements, the reporting for Environment and Social Performance should be conducted and submitted to ADB on semi-annual basis.

10.7 Outline of the ESMP

In order to minimize adverse impacts during different phases of project lifecycles, mitigation measures, monitoring plan and responsible for its implementation are given in this section. At the time of developing ESMP, the local ESIA was approved. The ESMP will include mitigation measures proposed in local ESIA as well as responsibilities to supervise and implement the ESMP, which is presented in ***Table 10-1*** and

Table 10-2***,*** for construction and operational phases respectively.

Standalone management plans will be required for the Project. These will include :

- Community Health and Safety Management Plan
- Occupational Health and Safety Management Plan
- Traffic Management Plan
- Worker's Camp Management Plan
- Construction Material Sourcing Plan
- Air Quality Management Plan
- Water Quality Management Plan
- Hazardous Materials Management Plan
- Waste Management Plan
- Noise and Vibration Management Plan
- Spoil Management Plan
- Soil Erosion and Sediment Control Management Plan
- Site Restoration Management Plan
- Local Content and Influx Management Plan (including Labour Management Plan and Local Procurement Management Plan)
- Cultural Heritage Management Plan
- Emergency Preparedness and Response Plan
- Stakeholder Engagement Plan and Grievance Redress Mechanism
- Resettlement Plan
- Community and Ethnic Group Development Plan Initial Biodiversity Action PlanUnexploded Ordinance Survey and Clearance Plan

Table 10-1: Outline of Project Construction Environmental and Social Management and Monitoring Plan (CESMMP)

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
8.3.2	**Topography**							
	Potential impacts to topography, as a result of construction activities and physical presence of the Project	■ Avoid carrying out earthwork during heavy rainfall, which will lead to erosion	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ After completing construction work, earth filling and compacting must be performed	N.A	EPC Contractor	Site Audit	After Construction	Audit Reports	Included in EPC costs.
		■ Prepare and implement a Site Restoration Management Plan.	N.A	EPC Contractor, HSE Team	ESMS	Prior to Construction	Site Restoration Management Plan.	Included in EPC costs.
		■ Conduct area clearance or cutting of trees in the Project footprint / Concession Area only	N.A	EPC Contractor	Site Audit	During Pre-Construction	Audit Reports	Included in EPC costs.
		■ Define the operation area clearly by designing the use of road and temporary space for the installation of the WTG in each point in order to minimize the impact to the topography of the area	N.A	EPC Contractor, HSE Team	Site Audit	During Pre-Construction	Audit Reports	Included in EPC costs.
		■ After the construction, conduct restoration of the area and return the landscape to the original condition as much as possible	N.A	EPC Contractor, HSE Team	Site Audit	After Construction	Audit Reports	Included in EPC costs.
		■ Assign staff to regularly conduct inspection and audit of the construction area	N.A	EPC Contractor, HSE Team	Site Audit	During Pre-Construction and Construction	Audit Reports	Included in EPC costs.
		■ Provide appropriate slope protection and drainage controls	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
8.3.3	**Geology and Soil**							
	Potential impacts on soil due to soil erosion and compaction, due to earthworks and use of heavy machinery.	■ Prepare and implement and Spoil Management Plan and Soil Erosion and Sediment Control Management Plan prior to construction. ■ Update the Spoil Management Plan following the results of POPs analysis in soil. If POPs are identified in soil, spoil must be treated as hazardous waste.	N.A	EPC Contractor, HSE Team	ESMS	Prior to Construction	Spoil Management Plan and Soil Erosion and Sediment Control Management Plan	Included in EPC costs.
		■ In areas that are high risk for erosion, where high risk is defined as land that floods at least three times annually; arrange earthwork in the dry season and avoid the rainy season, where possible, as the main cause of soil erosion along the side of water canal and non-asphalted roads during rainy season is rainfall	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ Undertake the earthwork within the Project footprint	N.A	EPC Contractor	Site Audit	During Pre-Construction and Construction	Audit Reports	Included in EPC costs.
		■ The stockpiling of the construction materials must be kept at least 30 m from rivers and waterways with the intention that they do not impede or concentrate the overland flow during rainfall events or cause the creation of ponding	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Ensure that the construction materials are stored in designated areas or in a secured place, and are not causing obstruction or located in areas of potential soil erosion	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Construct a suitable drainage system specifically in areas of high potential soil erosion	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Monitoring / auditing conducted to inspect erosion control measures	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Avoid earthworks in existing forest areas as much as possible	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Replantation to be conducted as soon as possible after completion of forest clearance or backfilling work. The success of revegetation work will depend on species selection, planting into soil rather than spoil, protection from livestock grazing, and watering as required by seasonal conditions. This will be included in the restoration plan	N.A	EPC Contractor	Site Audit	After Construction	Audit Reports	Included in EPC costs.
		■ Avoid digging and removal of stockpiling of soil at the sides of the stream or canal in order to prevent sedimentation and erosion into the water sources	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Conduct backfilling and compacting using heavy machinery to prevent the collapse of the soil as soon as possible after earthworks	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Undertake erosion protection for WTG foundations and transmission towers that are located in a slope area	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Undertake construction of a water drainage system at both sides of the access road to facilitate draining of water	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ A Waste Management Plan (WMP) for the Project should be developed and implemented. The WMP should include the following: - Good housekeeping practices for waste storage and handling referencing good international industry practice (GIIP); - A waste inventory developed in the planning stage, in discussion with the engineers, to establish the types of wastes (hazardous and non-hazardous) expected from the construction and to identify appropriate disposal routes; - Construction materials should be managed in a way to avoid over-ordering, poor storage and maintenance, mishandling as well as improper operation procedures; - Construction wastes should be separated into reusable items and materials to be disposed of or recycled whenever possible; - Waste suitable for reuse should be stored on site and reintroduced to the construction process as and when required; - The WMP should identify disposal routes (including transport options and disposal sites) for all wastes generated during the construction phase and should comply with applicable local regulations; - A hazardous waste management system covering waste classification (including hazardous chemical waste), separation, collection, storage, transfer and disposal should be set up and operated. The waste management system should comply with applicable regulation of the Laotian law or GIIP, depending on which has a higher standard; - Hazardous waste should be stored in such a way as to prevent and control accidental release to the environment (e.g. secondary containment, sealed containers); - As the Project is responsible for its waste management to the point where it foresees that waste is appropriately disposed in a benign manner, it should see to that waste is collected regularly by reputable waste collectors. This also means taking permanent responsibility for waste streams that cannot be reused,	N.A	EPC Contractor, HSE Team	ESMS	Prior to Construction	Waste Management Plan (WMP)	Included in EPC costs.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		recycled, and ensuring that the recycling processes do not in themselves generate intractable waste; - Recyclables such as scrap steel, metals, plastics, and paper items should be collected for recycling wherever possible; - Disposal of construction waste in or off the construction site should be prohibited; - Chain of custody documents should be used for construction waste and hazardous waste to monitor disposal; and - Waste segregation should be practiced at the labour camp with an emphasis placed on reducing, reusing and recycling of waste streams as appropriate.						
		■ The access route for movement of heavy machinery will be designated to avoid the soil compaction in other areas.	N.A	EPC Contractor, HSE Team	Site Audit	Prior to Construction	Audit Reports	Included in EPC costs.
		■ Conduct monitoring of Total Suspended Solids (TSS) at nearby water sources.	Monitoring of Total Suspended Solids (TSS) at nearby water sources.	EPC Contractor, HSE Team	Site Audit	Prior to Construction	Audit Reports	Included in EPC costs.
		■ Conduct pre-construction soil sampling at 5 locations to identify the potential presence of Persistent Organic Pollutants (POPs), which may include PCBs, dibenzofurans, and dioxins. If POPs are identified in the soil, the spoil will be treated as hazardous waste and will need to be managed and disposed of according to country requirements and Project hazardous waste management plan.	Soil sampling at 5 locations to identify the potential presence of Persistent Organic Pollutants (POPs), which may include PCBs, dibenzofurans, and dioxins.	EPC Contractor, HSE Team	Site Audit	Prior to Construction	Audit Reports	Included in EPC costs.
8.3.4	**Air Quality**							
	Fugitive dust emission causing degradation in ambient air quality from land preparation and civil work. Potential impacts on air quality due to improper transportation of	■ Reduce the speed of vehicles: to mitigate the potential occurrence of dust from the transportation of construction materials to the project construction site, it is required to limit and control the speed of vehicles arriving to and leaving the affected villages area at not exceeding 20 km/hour	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ The roads within the project area should be paved. If the road isn't paved, it is required to regularly spray water at least two times per day, especially roads that pass through villages and access roads to the construction sites	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
	personnel and material by land.	■ In the construction area, areas located near the communities, it is required to build a 2 m height of fence around the site to reduce dust dispersion from soil digging, removing, dumping, and filling works if the construction site is within 500 m of communities	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ The construction contractor must regularly undertake maintenance of vehicles and heavy machinery of all types which are used in the construction of the project	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Vehicles transporting construction materials must be properly covered, particularly the transportation of soil, sand, and gravel to the construction site	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Conduct pre-construction soil sampling at 5 locations to identify the potential presence of Persistent Organic Pollutants (POPs), which may include PCBs, dibenzofurans, and dioxins. If POPs are identified in the soil, the spoil will be treated as hazardous waste and will need to be managed and disposed of according to country requirements and Project hazardous waste management plan	Soil sampling at 5 locations to identify the potential presence of Persistent Organic Pollutants (POPs), which may include PCBs, dibenzofurans, and dioxins	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Have a wheel washing facility on exit from the site for vehicles to prevent the vehicles from carrying mud or sediment to outside construction site and communities	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Training should be organized and staff and workers to be prohibited from burning rubbish and wastes that will cause potential air pollution	N.A	EPC Contractor, HSE Team	Site Audit	Prior to Construction	Audit Reports	Included in HSE Team costs.
		■ Prioritise materials to be supplied by local suppliers (Laos suppliers)	N.A	EPC Contractor	Site Audit	Prior to Construction	Audit Reports	Included in EPC costs.
		■ Water sprays should be applied at land preparation area, access roads and any other exposed surfaces which could be source of dust are to be watered	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Construction material at the storage area will be covered to minimize dust dispersion during construction	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ No open burning of and materials including cleared vegetation. Cleared vegetation will either be composed or reused for stabilization purposes	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Vehicles transporting materials within or outside the construction site will not to be overloaded	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ Vehicle engines need to be properly maintained to ensure minimization in vehicular emissions	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Use of modern equipment and vehicles meeting appropriate emissions standards, and regular preventative maintenance	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Minimizing stockpiling by coordinating excavations, spreading, and regrading and compaction activities. Stockpile is to be covered if materials are stored over a period exceeding a week or two weeks	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ No waste is to be burnt	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Prepare and Implement and Air Quality Management Plan prior to construction.	N.A	EPC Contractor, HSE Team	ESMS	Prior to Construction	Air Quality Management Plan	Included in EPC costs.
		■ Conduct air quality monitoring as per recommendations in the local ESIA (2020)	Monitoring the air quality at sensitive area (e.g. TSP, PM-10, SO_2, NO_2 and CO_2) as per the requirements of the Local EIA (EIA, 2022).	HSE Team / Third Party	Monitoring results	During Construction – monthly.	Air Quality Management Plan	Estimated in local EIA (2020) at 20,000 USD for 3 years.
8.3.5	**Ambient Noise**							
	Impact to noise due to site preparation, installation of WTGs, and transmission lines, and vehicle use.	■ Conduct noise monitoring as per the recommendations in the local EIA report (EIA, 2022).	Use standard equipment for noise and vibration measurement. For the determination of measurement points, it is required to take the place of heavy work, area of heavy transportation, village areas surrounding the project.	HSE Team / Third Party	Monitoring results	During Construction – monthly.	Audit Reports	Estimated in local EIA (EIA, 2022) at 20,000 USD for 3 years.
		■ During construction of the Project good-practice, construction noise mitigation and management measures should be implemented to reduce noise levels and minimise any impacts as far as practicable. A range of mitigation and management measures are available and those that are considered feasible, reasonable, and practical to implement the specific tasks should be considered, for example:	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		- Avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		- Ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the site; and/or	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		- Ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		- Prepare and Implement and Noise and Vibration Management Plan	N.A	EPC Contractor, HSE Team	ESMS	Prior to Construction	Noise and Vibration Management Plan	Included in EPC costs.
		■ During the construction design, choose appropriate machines for each task and adopt efficient work practices to minimise the total construction period and the number of noise sources on the site. Select the quietest item of plant available where options that suit the design permit	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Ensure the appropriate personal protective equipment (PPE) and necessary response supplies are available at the construction site, in good condition, and workers are trained in their proper use and maintenance.	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ EPC contractor shall place the machine with high noise level to avoid sensitive receptor. The machine layout plan will be prepared by EPC Contractor and the noise monitoring at sensitive receptors shall be conducted as per ***Table 9-23***.	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ High noise-generating construction works and activities should be limited to the daytime period (7 AM to 10 PM), and work should be avoided on Sundays or public holidays if possible. In the case that Project activities necessarily have to be conducted on Sundays or public holidays, the Project will consult with village heads for approval	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		Any works that are required during the night-time period (10 PM to 7 AM) should be justified and task-specific noise mitigation and management measures should be implemented to reduce noise impacts to acceptable levels. These additional measures should consider the potential for sleep disturbance impacts that could occur during the night-time period due to “peak” or “maximum” noise level events e.g. metal on metal contact, or general clangs and bangs. In the case that Project activities necessarily have to be conducted during night-time period, the Project will consult with village heads for approval	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Works associated with transmission line and access road construction often require activities in closer proximity to receptors that are not affected by construction works at wind turbines or permanent facilities. In these circumstances, task-specific noise mitigation and management measures should be implemented (when works are close to receptors) to reduce noise impacts to acceptable levels	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Construction road traffic and heavy vehicle movements have the potential to generate high “peak” or “maximum” noise level events and these should be limited during the night-time period and avoided if possible. Where possible, significant noise-generating vehicle movements should be limited to the daytime period. Where it is not possible for this to occur drivers should be instructed to arrive and depart as quietly as possible. Whilst on-site and in close proximity to receptors the drivers should be instructed to implement good-practice noise management measures to reduce peak noise levels and minimise any impacts as far as practicable. During the works, instruct drivers to travel directly to site and avoid any extended periods of engine idling at or near residential areas, especially at night	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ If any validated noise complaints are received, the problem source and any potential noise-reducing measures should be identified and evaluated for implementation during the works. If the noise complaint cannot be validated, no further mitigation or management measures are required	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
8.3.6	**Surface Water Quality**							
	Potential impacts during construction phase from civil construction, and waste management on nearby water sources	■ Control of sedimentation and water turbidity: the project must avoid undertaking construction and installation near water sources, where possible; and proper drainage management plan diverting upstream clean runoff from disturbed areas should be implemented. Install sediment retention ponds or other measures to manage dirty runoff	N.A.	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ No washing vehicles of all types and construction equipment at rivers or streams in the project area	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Toilets for workers should be provided. A proper wastewater treatment system should be installed for batching plants and camp sites and complies with the environmental engineering techniques and will be located far from the river to avoid and reduce contaminated water released into the river	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ EPC contractor will implement systematic sewage treatment measures as follows: - The implementation of conventional sewage and toilet sewage separation (Independent sewer, drainage pipe system), to minimize the need for sewage treatment; - EPC contractor will hire local professional environmental companies or contractors (If any) to design local sewage treatment facilities to meet the local sewage discharge standards; - After the completion of the sewage treatment design and construction, EPC contractor will test and monitor the discharged sewage to confirm/satisfy the discharge standard; - Experienced environmental engineers will be assigned to manage and monitor sewage discharge to avoid the complication with the requirement of the contract.	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ A drainage system ould be installed and collected wastewater into the wastewater treatment system	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ In case it is necessary for the project to pump water from the stream in the Project area, the Project should prepare and implement a water use plan. This plan	N.A	EPC Contractor, HSE Team	Water Use Plan	Prior to Construction	Water Use Plan	Included in EPC costs.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		must be communicated and agreed with the local people and with the District and Provincial Authorities						
		■ A Waste Management Plan will be prepared for the Project	N.A	EPC Contractor, HSE Team	ESMS	Prior to Construction	Waste Management Plan (WMP)	Included in EPC costs.
		■ A Drainage management plan will be prepared for the Project that should be included diversion of clean runoff from “dirty” or disturbed areas, containment, treatment and reuse of wastewater from batching plants	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ As groundwater or surface water will be utilised, the Project should prepare and implement a Water Use Plan. This plan must be communicated and agreed with the local people and with the District and Provincial Authorities	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Conduct pre-construction surface water monitoring (5 sampling locations) in the same locations as surface water sampling for the baseline, but to identify and analyses presence of POPs	surface water monitoring (5 sampling locations) in the same locations as surface water sampling for the baseline, but to identify and analyses presence of POPs	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Construction workers will be given training about water conservation and encouraged for optimal use of water	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Optimum use of water during sprinkling on roads for dust settlement, concrete mixing for WTG foundation, etc.	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Regular inspection for identification of water leakages and preventing wastage of water from water tankers	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Recycling and reusing water to the extent possible	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Conduct water quality monitoring as per the recommendations of the local EIA Report (EIA, 2022)	Conduct monitoring for temperature, pH, Dissolved oxygen (DO), Biological Oxygen Demand (BOD5), Total Suspended Solid (TSS), Total and Total Dissolved, Oil and Grease, and Faecal coliforms	HSE Team / Third Party	Monitoring results	During Construction – every 3 months.	Audit Reports	Estimated in local EIA (EIA, 2022) at 20,000 USD for 3 years (combined with Water Monitoring).

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
8.3.7	**Landscape Values and Visual Amenity**							
	Impacts from installation of WTG and transmission lines on visual amenity and landscape value	■ Demarcate construction boundaries and minimize areas of surface disturbance	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Where possible, locate laydown areas and construction camps in areas that are already disturbed or cleared of vegetation	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ For the construction site maintenance, conduct good housekeeping on site to avoid litter and minimize waste	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Use existing tracks/roads for access, where possible	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Within the environmental management system, prepare a restoration management plan including replanting indigenous species, and landscaping and rehabilitating construction yards	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Where possible, locate laydown areas and construction camps in areas that are already disturbed or cleared of vegetation	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Minimize night lighting while guaranteeing the minimum safety level	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Use of materials that will minimize light reflection should be used for all Project components	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Bright patterns and obvious logos should be avoided on WTG	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
		■ Existing vegetation should be retained to the greatest extent possible. Vegetation should be retained along roads, and other Project infrastructure.	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in EPC costs.
8.4	**Biodiversity**							
	Impacts to forest vegetation and habitat: *includes direct and indirect transformation and/or disturbance and loss of ecosystem services*					Prior to construction		

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ ECoW accompanied by an ecologist to undertake micro-siting of construction camps, batching plants, turbines, substations and roads during pre-construction surveys to avoid least-impacted natural forest patches as far as possible..	Natural forest habitat	HSE Team	Site Audi	Prior to construction	Audit Reports	Included in HSE Team costs
		■ Avoid locating construction camps, laydown areas, batching plants, etc. within natural forest habitat and where possible, locate temporary works 500m or more from the least-impacted forest patches.	Natural forest habitat	EPC Contractor / HSE Team	Site Audit	Prior to construction	Audit Reports	Included in EPC / HSE Team costs
		■ Compile and implement Construction Method Statement for working in natural habitats.	Natural forest habitat	EPC Contractor / HSE Team	Site Audit	Prior to construction During construction	Audit Reports Construction Method Statement for working in natural forests	Included in EPC / HSE Team costs
		■ Compile and implement a post-construction rehabilitation plan for temporary areas used during construction.	N.A	EPC Contractor / HSE Team	Site Audit	Post-construction	Audit Reports Post-construction Rehabilitation Plan	Included in EPC / HSE Team costs
		■ Use existing access roads wherever possible.	N.A	EPC Contractor	Site Audit	During construction	Audit Reports	Included in EPC costs
		■ Limit the clearing of natural vegetation to the absolute minimum necessary to complete the works.	N.A	EPC Contractor	Site Audit	During construction	Audit Reports	Included in EPC costs
		■ Demarcate the construction zone clearly using suitable measures.	N.A	EPC Contractor	Site Audit	Prior to construction	Audit Reports	Included in EPC costs
		■ Develop and implement appropriate access management plans and suitable control measures to restrict access and unnecessary disturbance of natural habitat	Natural forest habitat	EPC Contractor / HSE Team	Site Audit	Prior to construction	Audit Reports Access Management Plan	Included in EPC / HSE Team costs
		■ Rehabilitate edges of natural habitat impacted and exposed to disturbance.	Natural forest habitat	EPC Contractor / HSE Team	Site Audit	Post-construction	Audit Reports	Included in EPC / HSE Team costs
		■ Adhere to applicable national laws regarding impacts to the environment and ensure any relevant permitting/licensing processes are followed.	Natural forest habitat	EPC Contractor / HSE Team	Site Audit	Prior to construction	Audit Reports	Included in EPC / HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ Where known species of protected/Red Data Listed plant species occur and are at risk of being destroyed, prepare and implement a protected plant rescue and translocation plan and programme. This includes all CH-qualifying species, CR/EN species and any species potentially 'new to science',	Natural forest habitat	HSE Team	Site Audit	Prior to construction	Audit Reports Protected plant rescue and translocation plan	Included in HSE Team costs
	Impacts to watercourses (streams/rivers)	■ Avoid locating pylons supporting transmission lines within stream/river beds, rather place these away from the stream banks and ensure the line is suspended across the stream/river channel for the entire span of the stream/river. Place pylons above known river floodlines or flood risk areas.	Watercourses (stream/river crossings)	IEAD	Site Audit	Design phase	Audit Reports	Included in design costs
		■ Implement relevant construction standards to minimise risk of erosion and sedimentation (e.g. DEFRA, 2009).	Watercourses (stream crossings) DEFRA (Department of Environmental, Food and Rural Affairs). (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Available online[141])	EPC Contractor / HSE Team	Site Audit	Prior to construction	Audit Reports	Included in EPC / HSE Team costs
		■ Remediate any soils, watercourses or habitats where spills take place.	Remediate any soils, watercourses or habitats where spills take place.	Watercourses (stream crossings)	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Implement best practice stream crossing design and construction, taking into account the sizing of any pipe culverts and placement on the channel bed and not at height. This is to be informed by good practice guidelines for the design of river crossings, such as SEPA (2010).	Watercourses (stream crossings) SEPA: Scottish Environmental Protection Agency. (2010). Engineering in the Water Environment: Good Practice Guide: River Crossings. Second Edition. November 2010. (Available online[142])	EPC Contractor / HSE Team	Site Audit	Prior to construction	Audit Reports	Included in EPC / HSE Team costs

[141] https://www.assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf
[142] https://www.sepa.org.uk/media/ 151036/wat-sg-25.pdf

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ Compile and implement appropriate Construction Method Statement for working in watercourses (for implementation at all stream crossings). This is to be informed by good practice guidelines on construction methods, such as SEPA (2009).	Watercourses (stream crossings) SEPA: Scottish Environmental Protection Agency. (2009). Engineering in the Water Environment: Good Practice Guide: Temporary Construction Methods. First Edition. March 2009. (Available online[143])	EPC Contractor / HSE Team	Site Audit	Prior to construction	Audit Reports Construction Method Statement for working in watercourses (streams)	Included in EPC / HSE Team costs
		■ Compile and implement a suitable post-construction rehabilitation plan for stream beds and banks modified but not entirely transformed by construction activities. Any bare soil surfaces need to be revegetated as soon as practically possible to reduce erosion risk.	Watercourses (stream crossings)	EPC Contractor / HSE Team	Site Audit	Post-construction	Audit Reports	Included in EPC / HSE Team costs
		■ Roads to cross streams at right-angles only.	Watercourses (stream crossings)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Only one road crossing to be constructed at a time as the construction front progresses.	Watercourses (stream crossings)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Avoid any unnecessary crossings of streams/rivers and stick to only the planned crossings agreed to.	Watercourses (stream crossings)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Install sufficient drainage works under all access roads, to reduce freshwater habitat fragmentation, avoid flooding land and damaging nearby waterbodies.	Watercourses (stream crossings)	EPC Contractor / HSE Tea	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
	Impacts to fauna (wildlife): *includes direct impacts, collisions, reduced habitat connectivity, barriers to species movement and increased hunting pressure*	■ Sweep through areas prior to construction to flush animals from habitats likely to be directly affected. The ECoW will need to be accompanied by relevant faunal ecologists/experts to advise on the approach and methods to flushing out wildlife sensibly without causing additional impacts.	Fauna (wildlife)	EPC Contractor / HSE Team / Faunal ecologists or experts	Site Audit	Prior to construction	Audit Reports	Included in EPC / HSE Team costs
		■ Monitor impact of vehicle traffic on local wildlife, including recording collisions leading to fatality/injury or near collisions and the circumstances leading up to incidents and investigate further ways to reduce risk of impact.						

[143] https://www.sepa.org.uk/media/150997/wat_sg_29.pdf

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ Access controls to be implemented along access roads which enter areas of natural habitat, with a particular focus on restricting uncontrolled access to the lesser-impacted primary forest habitat.	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Schedule habitat clearance, grading and road construction activities outside of CH-qualifying and CR/EN species' breeding periods where known.	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	Prior to construction	Audit Reports	Included in EPC / HSE Team costs
		■ Enforce good conduct by construction workers, including prohibition of hunting, trapping, fishing, and general harassment of wild animals, subject to a penalty of immediate dismissal or similar.	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Implement safe transmission and distribution lines, with anti-electrocution measures (insulation and spacing of conductors) that eliminate electrocution risk for birds. Allow for a minimum spacing of 1m between power cables to safeguard known bat species from electrocution risk. ■ Install bird deterrents such as bird flight diverters (hanging or spiral diverters) along all transmission and distribution line routes, or at the very least in the vicinity of natural forest habitat and between larger forest patches where birds are likely to move locally144, with spacing according to GIIP guidance (e.g. APLIC, 2012). An adaptive management approach is recommended to refine measures where necessary based on collisions/mortalities recorded in long-term annual monitoring.	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	Prior to construction	Audit Reports	Included in EPC / HSE Team costs
		■ Shepherding protocol to be prepared and implemented where road construction takes place, to check areas to be worked in prior to construction and remove or shepherd wildlife to safety in adjoining forest or habitat. Species considered to be dangerous or poisonous/venomous to be handled by professionals. Workers are to be trained in the identification of common dangerous/poisonous/venomous wildlife such as snakes, spiders, etc. and measures to avoid hazards	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	Prior to construction	Audit Reports	Included in EPC / HSE Team costs

■ 144 Note that installing flight diverters along the entire length of all powerlines may not be feasible practically (e.g. close to the border with Vietnam) and in this case it is recommended that a more pragmatic approach, such as the approach taken by 'LIFE ENERGY' in Slovakia's lowlands, whereby the most dangerous sections of TL are identified through field assistant monitoring and flight diverters installed ion the hazardous sections.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		associated with these species, as part of the EPC contractors site inductions and training plan.						
		■ Develop and implement a post-construction fatality monitoring protocol for birds/bats.	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	Prior to completion of construction	Audit Reports , Monitoring Reports	Included in EPC / HSE Team costs
		■ Limit vehicle speed to 15km/hr on site for all contractor and subcontractor vehicles, as well as any non-Project vehicles allowed on access roads, to reduce risk of vehicular collisions with wildlife.	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Place appropriate limits on the number of vehicle movements to and from the wind farm (e.g. maximum of 5 vehicles allowed within a 1-hour window).	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Restrict vehicles to the use of only authorised access roads	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Restrict activities to daytime hours when visibility is good and to limit risk of impact to nocturnal species of fauna.	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Aim lights downwards and away from forest habitats. Use appropriate lighting that minimises ecological effects on wildlife and also limits attraction of insects e.g. use of long-wavelength (warm white, orange, red and infra-red) light instead of short-wavelength (UV, cool white, blue and green LEDs).	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Maintain vehicles and equipment in good working condition.	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Maintain connectivity around or across linear infrastructure (roads primarily) through use of appropriate animal crossings suitable for small mammals and slow-moving reptiles such as tortoises in particular.	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Sequencing of construction activities to avoid construction activities and multiple teams at multiple sites, to reduce the impact spread and rather concentrate temporary impacts at key points and	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	Prior to construction	Audit Reports	Included in EPC / HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		advance to new areas only once construction at the previous site has been completed.						
		■ Avoid placing impermeable fences that could interfere with species movement.	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	During construction	Audit Reports	Included in EPC / HSE Team costs
		■ Any temporary excavations, fences or stockpiles of soil and materials must be removed from site once construction is complete.	Fauna (wildlife)	EPC Contractor / HSE Team	Site Audit	Post-construction	Audit Reports	Included in EPC / HSE Team costs
	Invasive Alien Plant impacts	■ Compile and implement a suitable Invasive Alien Plant (IAP) species control plan and programme to eradicate dense colonies of alien plants and control the spread of minor species and weeds. This plan must include wash stations to remove seeds from vehicle tyres and underbody.	N.A	EPC Contractor / HSE Team	Site Audit	Prior to construction	Audit Reports	Included in EPC / HSE Team costs
		■ Monitor IAPs using a suitable plan.	N.A	EPC Contractor / HSE Team	Site Audit	Post-construction	Audit Reports Monitoring Plan for IAPs	Included in EPC / HSE Team costs
8.5.2	**Economic Opportunities**							
	Job creation and training from the project	A Local Content and Influx Management Plan will be prepared to maximise the local employment and training opportunities afforded to the affected villagers. ■ The responsibilities and management practices associated with the management of labour during construction and operation of the Project. ■ A hiring policy that reinforces the Project's preference to employ local workers and undertake procurement from local businesses, where possible. The policy will be a tiered system where the hiring preference will be as follows: – Villagers from within the AoI; – Villagers from the Dakcheung District or Sanxay District; and – Villagers from the Sekong Province or Attapeu Province. ■ A training program targeting skills required for affected villagers to participate in unskilled, and potentially semi-skilled, work for the Project.	N.A	HSE Team / EPC Contractor	ESMS	Prior to construction	Local Content and Influx Management Plan	Included in EPC costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ A communications strategy to notify affected villagers of employment and procurement opportunities in advance. This will enable villagers and businesses to be prepare for the application process (e.g. contracting requirements, assistance with application, etc.).						
		■ A Community Development Plan (CEGDP), which incorporates the Ethnic Group Development Plan (as the majority of the affected villagers are ethnic minorities) will be prepared to guide the implementation of suitable programs to support affected villagers.	N.A	IEAD	ESMS	Prior to Construction	Community Development Plan	Included in EPC costs
		■ The management of increased access within the Dak Cheung and Sanxay Districts, and restriction to high biodiversity areas, will be managed via the ESMS.	N.A	HSE Team / EPC Contractor	ESMS	Prior to Construction	Local Content and Influx Management Plan	Included in EPC costs
8.5.3	**Economic Displacement and Livelihoods**							
	Impacts to livelihoods and economy from the Project	■ The Project layout (including access road and transmission line routes) has been optimised to avoid physical displacement of villagers. Agricultural land and NTFP collection area were also considered in the design process, and while unable to be avoided, the Project has minimised the magnitude of land acquisition and resettlement.	N.A	HSE Team	N.A	During Design Phase	N.A	N.A
		■ A Resettlement Plan will be developed in response to the Project causing economic displacement and impacts to livelihoods. The Resettlement Plan will be prepared in consultation with the Government of Laos, and will define persons entitled to compensation, principles of compensation, methods of valuing affected assets, resettlement process and tools, grievance process, institutional arrangement for resettlement planning and implementation.	N.A	HSE Team	ESMS	Prior to Construction Construction	Local Content and Influx Management Plan	Included in HSE Team costs
8.5.4	**Community Health and Safety**							
	Impacts to communities from construction of the Project facilities	A Stakeholder Engagement Plan (SEP) will be prepared: The SEP will describe how Project stakeholders will be engaged throughout the Project lifecycle. The SEP will establish a systematic approach to stakeholder engagement that will help the Project build and maintain a constructive	N.A	HSE Team / EPC Contractor	ESMS	Prior to construction	SEP	Included in EPC costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		relationship with stakeholders. It will also ensure that Project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format. An example of a program to be implemented as part of the SEP is a community environmental and safety awareness program, which seeks to enable villagers to understand and identify construction risks, and how to stay safe.						
		A Community Health and Safety Management Plan will be prepared**:** Sets out the agreed controls and mitigation measures to protect the health and safety villagers in the AoI The Plan will also include provisions for: ■ Fencing and/or security to prevent community members from accessing the construction site; ■ Identifying and being aware of traffic hazards involving villagers; ■ Requirements for construction workers to notify villager heads of key construction activities such as: - Deliveries of wind turbines and other large objects; - High volumes of truck movements; and ■ Activities potentially causing noise, vibrations and/or dust. ■ Potential presence of UXO including chance find procedure	N.A	HSE Team / EPC Contractor	ESMS	Prior to construction	Community Health and Safety Management Plan	Included in EPC costs
		■ An Occupational Health and Safety Management Plan will be prepared**:** Sets forth the agreed controls and mitigation measures to protect the health and safety of workers. This will include: - Screening of migrant workers prior to entering Laos to ensure they are fit to undertake their relevant tasks/roles. - Safety audits which will occur during the construction and operation of the Project, to ensure safety procedures are complied with. - Induction and Training requirements for all workers, including site-specific induction and training to highlight safety risks and mitigations, and task-specific training (e.g. complying with speed limits, etc.).	N.A	HSE Team / EPC Contractor	ESMS	Prior to construction	Occupational Health and Safety Management Plan	Included in EPC costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		- Measures to mitigate against the spread of COVID-19 amongst workers, and from workers to other villagers.						
8.5.5	**Worker Influx**							
	Influx of workers can affect local communities with increase in diseases and safety issues.	■ A number of legislative requirements exist to protect local and migrant workers, which all employers must comply with	N.A	EPC Contractor, HSE Team	Site Audit	During Construction and Operation	Employment Contracts	Included in HSE Team costs
		■ Local Content and Influx Management Plan: - Set out the responsibilities and management practices associated with the management of labour during construction and operation of the Project. This will include the Workers Code of Conduct, which identifies behavioural standards and cultural awareness requirements for all workers (including security personnel) to comply with - Workers Code of Conduct, and the Project will establish advisory services on safe sex for workers as well as health care provision (incorporated within typical health checks and on an as needs basis).	N.A	EPC Contractor, HSE Team	Site Audit	During Construction and Operation	Employment Contracts	Included in HSE Team costs
		■ The EPC Contractor plans to have a healthcare facility at each camp, which includes a nurse/doctor to treat workers directly whenever possible (specified in the EPC contractor contracts). These healthcare personnel workers will be recruited from outside the AoI to avoid impacting existing providers. This will reduce pressure on the local healthcare facilities.	N.A	EPC Contractor	Site Audit	During Construction	N.A	Included in EPC costs
		■ Prepare a Workers' Camp Management Plan: The operation of the workers' accommodation facility will be governed by the Workers' Camp Management Plan, and will include aspects such as details of the services and facilities available, hygiene standards, and healthcare provision for Project workers. The audit requirements of the accommodation facilities will also be outlined.	N.A	EPC Contractor, HSE Team	ESMS	Prior to Construction	SEP	Included in EPC costs
8.5.7	**Ethnic Groups**							
	Impacts to ethnic groups from the construction	■ The Project places a strong emphasis on respecting the cultures and customs of the villagers, and has been	N.A	HSE Team	Site Audit	During Construction and Operation	Audit Reports	Included in HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
	and operation of the Project	participating in various rituals as part of granting access and permission to undertake technical studies to support the ESIA. This will be formalised as part of a management plan to apply to all workers.						
		■ Promote ethnic cultures through Project activities in collaboration with the Project affected communities	N.A	IEAD	Site Audit	During Construction and Operation	Engagement records	Included in HSE Team costs
		■ Implement CEGDP to improve the livelihoods of ethnic groups including providing ethnic women with economic development opportunities	N.A	IEAD	Site Audit	During Construction and Operation	Development programs	Included in HSE Team costs
		■ Implement measures to remove obstacles for ethnic minorities to participate in Project activities and decision-making, including impact mitigation and benefits	N.A	IEAD	Site Audit	During Construction and Operation	Audit Reports	Included in HSE Team costs
		■ Provide a grievance redress mechanism and appeal process for the Project-affected persons that is culturally appropriate.	N.A	IEAD	Site Audit	During Construction and Operation	Grievance Mechanism	Included in HSE Team costs
		■ The Local Content and Influx Management Plan will include the Workers Code of Conduct that will include cultural awareness requirements for all workers	N.A	EPC Contractor	Site Audit	During Construction	N.A	Included in EPC costs
8.5.8	**Cultural Heritage**							
	Impacts to local culture(tangible and intangible)	A cultural heritage Management Plan will be prepared to guide the workers on the protection of cultural heritage sites, structures and values that may be impacted by the Project. In the first instance, the cultural heritage protocol will require: ■ Pre-construction survey. This will build on existing field data, to identify the presence of tangible and intangible cultural heritage resources ■ Project design to avoid and minimize impacts to cultural heritage resources. Workers camps, spoil disposal sites, laydown areas and other ancillary facilities will be located away from any cultural heritage sites. ■ Further consultation with the villagers and seek permission from the village leaders, elders and the broader community to enter and utilise the sacred areas that overlap with the Project footprint. Document the consent process and the consent itself.	N.A	HSE Team / EPC Contractor	ESMS	Prior to Construction	Cultural Heritage Management Plan	Included in EPC costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ The Project will perform required rituals or provide budget for the villages to perform rituals prior to accessing Phou Koungking and Dak Bong cemetery ■ The Project will plan Project activities to avoid activities that involve the use of large equipment and machinery which may cause noise and dust disturbance to the nearby villages during their ceremonies and festivals.. ■ Sacred sites, burial grounds in the forest, cemeteries, sacred trees and will be marked and labelled prohibited for entry (no-go zones) by workers ■ Establish a Chance Finds Procedure that will guide workers in the event that potential cultural heritage is encountered.						
8.6.1	**Climate Change**							
	Impacts on climate change	■ During construction phase, avoid burning in area clearance activities that may lead to occurrence of fire which may, in turn, lead to burning of forests	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
		■ Land preparation and construction work to avoid cutting of trees or removal of plant species within and outside of the concession area	N.A	EPC Contractor	Site Audit	During Pre-Construction	Audit Reports	Included in HSE Team costs
		■ Ensure the maintenance of construction machinery and equipment to keep them in good conditions to ensure efficiency, as lower efficiency machineries generally emit higher CO_2	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
		■ Avoid emissions of CO_2 in excessive of specified standards	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
		■ Issue the rules to prevent staff and workers from burning waste within construction area	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
		■ The planned area for vegetation clearance plan linked to the construction works need to be clearly determined and demarcated by landmark to avoid accidental clearance. Site clearance plan should be prepared to identify areas that will be retained with natural vegetation within the Site's boundaries.	N.A	EPC Contractor	Site Audit	During Pre-Construction	Audit Reports	Included in HSE Team costs
		■ Clearing vegetation outside of designated areas will be prohibited for Project staff, workers, all contractors and personnel engaged or associated with the Project, with sanctions, including fines and dismissal, and	N.A	EPC Contractor	Site Audit	During Pre-Construction	Audit Reports	Included in HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		prosecution under the relevant laws for clearing vegetation						
		■ The Project should consider carbon offsetting for lost vegetation to the Project forest clearing such as re-forestation in other areas	N.A	EPC Contractor	Site Audit	During Pre-Construction	Audit Reports	Included in HSE Team costs
		■ Use high fuel-efficient machineries and engines, lowest sulphur diesel commercially available and develop and implement preventive maintenance plan for machines, and engines to ensure combustion efficiency	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
		■ Develop vehicle maintenance plan and transport planning for construction to avoid unnecessary trips	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
		■ Ensure that construction work is done within designated construction areas and avoid trees removal outside of construction area	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
		■ Develop rules to prevent burning of waste within the construction area by Project workers	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
8.6.2	**Risks from Climate Change**							
	Water Availability	■ Whenever the project is required to pump water from the stream in the Project area for construction, a water use plan will be required and notified to the local people. This should be coordinated with the State agency of the district and provincial levels	N.A	EPC Contractor	Site Audit	During Construction	Engagement Records	Included in HSE Team costs
		■ Provide clean water for use for consumption to construction workers	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
		■ The water availability related issues should be monitored and tracked closely	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
		■ Implement water saving technologies for domestic water usage within project	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
	Riverine Floods	■ When a rainstorm warning is received, consider suspending operations and transfer personnel to safe location	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC and HSE Team costs
		■ Review meteorological information regularly, and take precautions against possible floods, landslides, mudslides, and other disasters	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC and HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ Monitor flood situation at the Site. If any significant floods events affecting the physical infrastructure, operations, and health and safety are observed in future, detailed studies may be considered for flood mitigation measures	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC and HSE Team costs
	Landslides	■ Review meteorological information regularly, and take precautions against possible floods, landslides, mudslides, and other disasters	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
		■ Ensure an Emergency Response Plan is in place covering floods, landslides, wildfires, cyclones, and thunderstorms	N.A	EPC Contractor, HSE Team	ESMS	Prior to Construction	ERP	Included in EPC and HSE Team costs
		■ Avoid undertaking earthwork during heavy rainfall that can cause erosion; perform backfilling and compacting work after completing the construction; replantation in suitable areas where possible	N.A	EPC Contractor	Site Audit	During Construction	Audit Reports	Included in HSE Team costs
	Extreme Heat	■ Worker's resting areas, on-site offices, worker's quarters should be constructed with heat resisting material to keep the indoor temperature lower.	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC and HSE Team costs
		■ A heat stress management plan should be prepared as part of standard operations and safety procedures.	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC and HSE Team costs
		■ Train workers to identify the symptoms of heat stress and first aid.	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC and HSE Team costs
		■ Make appropriate considerations while designing the cooling systems (if required).	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC and HSE Team costs
	Wild Fire	■ Ensure lightning protection grounding of the wind turbine. A metal air termination system is installed at the blade tip. A copper conductor is used to reliability connect the air termination system to the lightening lead on hub	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC and HSE Team costs
		■ Develop and maintain fire lines around the important assets	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Report	Included in EPC and HSE Team costs
		■ Develop and maintain vegetation clearances with respect to prevailing standards and regulations	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Report	Included in EPC and HSE Team costs
	Lighting and Storms	■ Ensure design according to IEC-61400-24 to achieve Grade I lighting protection to wind turbine the cross-	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Design information	Included in EPC and HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		sectional area of blade lighting protection copper conductor should not be less than 50mm^2						
8.7	**Unplanned Events**							
	General	■ The Project will implement the SEP and a robust stakeholder engagement program on emergency response. Engagement on emergency response will provide regular information on safety drills and guidance to residents in the event of an unplanned event	N.A	EPC Contractor, HSE Team	ESMS	Prior to construction	SEP	Included in EPC costs
		Prepare and implement an Emergency Preparedness and Response Plan (EPRP) to cover accidental and emergency situations. This Plan will include leaks and spill, collisions, natural hazards, and fire and explosions (including UXO) and will also detail: ■ Planning coordination: including procedures for informing local communities about emergency response, documentation and first aid / medical treatment; ■ Emergency equipment: including equipment in the project design and any additional emergency equipment; and ■ Training: employees and contractors will be trained in emergency response procedures. ■ Auditing: audit records will be maintained on how the Plan is being implemented.	N.A	EPC Contractor, HSE Team	ESMS	Prior to construction	EPRP	Included in EPC costs
	Leaks and Spills	■ Design the site to include good site management practices to ensure that the products are properly stored on site (e.g. secondary containment, double walled tanks, over filling alarm system)	N.A	EPC Contractor, HSE Team	Site Audit	Prior to Construction	Audit Reports	Included in HSE Team costs
		■ Ensure good inspection and maintenance procedures for large mobile construction plant to minimize small leaks and spills	N.A	EPC Contractor, HSE Team	Site Audit	During Pre-Construction	Audit Reports	Included in EPC and HSE Team costs
		■ Monthly monitoring the implementation of all proposed mitigation measures specified in Emergency Preparedness and Response Plan should be conducted properly	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC costs
		■ Daily inspection of any secondary containment of oil/chemical on site and ensure good maintenance procedures to minimize small leaks and spills.	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
	Vehicle Collisions	Developed and implemented a Traffic Management Plan (TMP). This should include measures such as: ■ Active traffic controls (e.g. flaggers to direct traffic at the Project site entrance); and ■ Schedule construction deliveries and employee shift changes to minimize traffic congestion and delay	N.A	EPC Contractor, HSE Team	ESMS	Prior to construction	TMP	Included in EPC costs
		■ Design an H&S plan and good safety practices for the transportation (e.g. alcohol policy, good driving practice).	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC costs
		■ Upgrade the access road to the Project site	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC costs
		■ Monthly monitoring the implementation of all proposed mitigation measures specified in the Traffic Management Plan (TMP) should be conducted	N.A	EPC Contractor, HSE Team	ESMS	Prior to construction	TMP	Included in EPC costs
		■ Regular road condition monitoring along the transportation route to understand road quality during construction phase	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC costs
	Fire and Explosions	■ Contact relevant authority bodies and conduct the UXO clearance	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Engagement Records	Included in EPC costs
		■ Implement on-site prevention measures such as (i) Equip the site with proper equipment (such as fire extinguishers, proper communication equipment) and regularly inspect and maintain them; (ii) Prepare the Fire prevention and Fighting Plan that ensure compliance and Fighting; (iii) Conduct firefighting training to the emergency support team, contractors and workers on site and camping areas	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC costs
	Natural Hazards	■ Incorporation of siting and safety engineering criteria to prevent failures due to natural disasters.	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC costs
		■ Implement periodic routine inspection and maintenance procedures (in line with international best practice)	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC costs
		■ Install warning system, signal boards, flood prevention systems.	N.A	EPC Contractor, HSE Team	Site Audit	During Construction	Audit Reports	Included in EPC costs

Table 10-2: Outline of Project Operational Environmental and Social Management and Monitoring Plan (OESMMP)

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
8.3.5	**Ambient Noise**							
	Impact to noise due to site preparation, installation of WTGs, and transmission lines, and vehicle use.	■ Noise monitoring should be conducted regularly, particularly during the night time, to check compliance with the noise criteria, and where exceedance are detected, additional mitigation measures should be implemented	Use standard equipment for noise and vibration measurement. To be conducted in nearest receptor.	HSE Team / Third Party	Monitoring results	During Operation – monthly at start of operations.	Audit Report	Estimated in local EIA (EIA, 2022) at 50,000 USD for 25 years.
8.3.6	**Surface Water Quality**							
	Potential impacts during construction phase from civil construction, and waste management on nearby water sources	■ Toilets for workers should be provided. A proper wastewater treatment system should be installed for batching plants and camp sites and complies with the environmental engineering techniques and will be located far from the river to avoid and reduce contaminated water released into the river	N.A	HSE Team (IEAD)	Site Audit	During Operation	Audit Report	Included in HSE Team costs.
		■ A drainage system should be installed and collected wastewater into the wastewater treatment system	N.A	HSE Team (IEAD)	Site Audit	During Operation	Audit Report	Included in HSE Team costs.
		■ In case it is necessary for the project to pump water from the stream in the Project area, the Project should prepare and implement a water use plan. This plan must be communicated and agreed with the local people and with the District and Provincial Authorities	N.A	HSE Team (IEAD)	Water Use Plan	Prior to Operation	Water Use Plan	Included in HSE Team costs.
		■ A Waste Management Plan will be prepared for the Project	N.A	HSE Team (IEAD)	Site ESMS	Prior to Operation	WMP	Included in HSE Team costs.
8.3.7	**Landscape Values and Visual Amenity**							
	Impacts from installation of WTG and transmission lines on visual amenity and landscape value	■ Minimize night lighting while guaranteeing the minimum safety level	N.A	HSE Team (IEAD)	Site Audit	During Operation	Audit Report	Included in HSE Team costs.
		■ Use of materials that will minimize light reflection should be used for all Project components	N.A	HSE Team (IEAD)	Site Audit	During Operation	Audit Report	Included in HSE Team costs.
		■ The replacement of wind turbines with visually different wind turbines can result in visual clutter, therefore wind turbines with the same or a visually similar model should be used for replacements	N.A	HSE Team (IEAD)	Site Audit	During Operation	Audit Report	Included in HSE Team costs.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
8.3.8	**Shadow flicker**							
	Impact of operation of WTGs causing shadow flicker to nearby receptors	■ Visual Screening (Natural) – Continuously assess identified and any potentially sensitive receptors, where shadow flicker modelling indicates the amount could exceed 30 hours per year and 30 minutes per day, to ascertain the extent of existing natural visual screening in place. If not existing, the occurrence of shadow flickering during operation could be further investigated, and if confirmed, natural screening could be implemented to minimize the effect.	N.A	HSE Team	Site Audit	During Operation	Grievance Mechanism / Engagement Reports	Included in HSE Team costs.
		■ Visual Screening (Architectural/Structural) - If grievances will be received or if natural visual screening at potentially sensitive receptors are found to be insufficient, investigations to implement architectural/structural screening, such as the installation of blinds, window shades, window tinting, awnings or fences, at affected receptors could be evaluated to further minimize the effect of shadow flicker.	N.A	HSE Team	Site Audit	During Operation	Grievance Mechanism / Engagement Reports	Included in HSE Team costs.
		■ Control - Use of turbine control strategies which shut down turbines when shadow flicker is likely to occur.	N.A	HSE Team	Site Audit	During Operation	Grievance Mechanism / Engagement Reports	Included in HSE Team costs.
8.4	**Biodiversity**							
	Impacts to forest vegetation and habitat: *includes direct and indirect transformation and/or disturbance and loss of ecosystem services*	■ Develop and implement appropriate access management plans and suitable control measures to restrict access and unnecessary disturbance of natural forest habitat. This may include the use of secure access gates with guard control on access roads to limit unauthorized vehicle and pedestrian access. IEAD would need to work together with the appointed EPC Contractor to develop access control plans.	Natural forest habitat	IEAD / EPC Contractor	Site Audit	During operation	Audit Reports	Included in HSE Team costs.
		■ Compile biodiversity action plan (BAP) with offset strategy to compensate for residual forest impacts.	Natural forest habitat	IEAD / Biodiversity Specialist	Site Audit	Pre-operation	Audit Reports Biodiversity Action Plan & Offset Plan	Unknown at this stage.
		■ Compile and appropriate biodiversity offset plan and implement biodiversity offset. See BAP for the initial	Offset site(s)	IEAD / contractor	Site Audit	Construction Operation	Audit Reports	Unknown at this stage.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		offset strategy further recommendations and guidance on developing the offset plan.						
		■ Monitor biodiversity offset implementation success according to an offset monitoring plan to be developed as part of the offset planning process (above) and informed by the biodiversity indicators and metrics recommended in the BAP Review and ipdate the BAP and offset plan annually based on the findings of monitoring.	Offset site(s)	IEAD / Independent specialist	Offset monitoring plan Site Audit	During and after offset implementation	Audit Reports Offset Monitoring Reports	Unknown at this stage.
	Impacts to watercourses (streams/rivers)	■ Monitor and maintain stream crossings as necessary to ensure continued access road operation, including clearing debris and/or sediment from culverts.	Watercourses (stream crossings)	HSE Team	Site Audit	During operation	Audit Reports	Included in HSE Team costs.
	Impacts to fauna (wildlife): *includes direct impacts, collisions, reduced habitat connectivity, barriers to species movement and increased hunting pressure*	■ Enforce good conduct by operational and maintenance support staff, including prohibition of hunting, trapping, fishing, possession or trading of wild plants or animals, subject to a penalty of immediate dismissal or similar.	Fauna (wildlife)	HSE Team	Site Audit	During Construction	Audit Report	Included in HSE Team costs.
		■ Prepare and implement a precautionary and adaptive management plan to be informed by long-term annual bat/bird carcass monitoring, to determine where additional mitigation may be necessary for specific turbines/clusters of turbines, such as: adjusting turbine cut-in speeds (increased) for site-specific and seasonal bat activity peaks, feathering of turbine blades, auditory deterrents and/or painting of alternate turbine blades to increase visibility for birds. An ecologist / biodiversity specialist will need to be appointed to develop the adaptive management plan based on the outcomes of operational bird/bat carcass monitoring.	Fauna (wildlife)	IEAD / biodiversity specialist	Monitoring	Pre-operation During operation	Operational Biodiversity Monitoring Plan Operational Biodiversity Monitoring Report Adaptive Management Plan	Unknown at this stage.
		■ Markers such as coloured balls to be attached to conductors to improve visibility for birds where necessary and technically feasible.	Fauna (wildlife)	IEAD	Site Audit	Pre-operation	Audit Report	Included in EPC costs
		■ Implement habitat enhancement for bats (e.g. creation of pools) and provision of bat-boxes in areas under IEAD control away from wind turbines, may serve to reduce the number of bats in the wind farm area and therefore reduce collision risks. The need for specific requirements will be informed by the outcomes of operational monitoring. Where deemed necessary, an ecologist / biodiversity specialist will need to be	Fauna (wildlife)	IEAD / biodiversity specialist	Site Audit	Pre-operation During operation	Audit Report	Unknown at this stage.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		appointed to advise on the location and type of habitat enhancement required.						
		■ Species encountered on the operational site that need to be removed, and which are considered dangerous or poisonous/venomous, are to be handled by professionals.	Fauna (wildlife)	HSE Team	Site Audit	During operation	Audit Report	Included in HSE Team costs.
		■ Limit vehicle speed to 15km/hr on site for all contractor and subcontractor vehicles, as well as any non-Project vehicles allowed on access roads, to reduce risk of vehicular collisions with wildlife. ■	Fauna (wildlife)	HSE Team	Site Audit	During operation	Audit Report	Included in HSE Team costs.
		■ Place appropriate limits on the number of vehicle movements to and from the wind farm (e.g. maximum of 5 vehicles allowed within a 1-hour window).	Fauna (wildlife)	HSE Team	Site Audit	During operation	Audit Report	Included in HSE Team costs.
		■ Creation of suitable alternative habitats or enhancement of existing ones to support displaced species. The need for specific requirements will be informed by the outcomes of operational monitoring. Where deemed necessary, an ecologist / biodiversity specialist will need to be appointed to advise on the location and type of habitat enhancement required.	Fauna (wildlife)	IEAD	Site Audit	During operation	Audit Report	Unknown at this stage.
		■ Restrict vehicles to the use of only authorised access roads.	Fauna (wildlife)	HSE Team	Site Audit	During operation	Audit Report	Included in HSE Team costs.
		■ Restrict any maintenance activities to daytime hours when visibility is good and to limit risk of impact to nocturnal species of fauna.	Fauna (wildlife)	HSE Team	Site Audit	During operation	Audit Report	Included in HSE Team costs.
		■ Aim operational lights downwards and away from forest habitats. Use appropriate lighting that minimizes ecological and physiological effects on wildlife whilst not attracting insects as far as possible. According to the research of Longcore et al. (2018145), filtered yellow-green and amber LEDs are recommended and predicted to have lower ecological and physiological effects on wildlife (compared with high pressure sodium	Fauna (wildlife)	HSE Team	Site Audit	During operation	Audit Report	Included in HSE Team costs.

145 Longcore T., Rodríguez, A., Witherington, B., Penniman, J.F., Herf, L. and Herf M. (2018). Rapid assessment of lamp spectrum to quantify ecological effects of light at night. J Exp Zool A Ecol Integr Physiol. 2018 Oct;329(8-9):511-521. doi: 10.1002/jez.2184. Epub 2018 Jun 12. PMID: 29894022.

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		lamps, while blue-rich lighting would have greater effect). Also, as a general rule insects are more sensitive or attracted to short-wavelength (UV, cool white, blue and green LEDs)_than long-wavelength light which is recommended (warm white, orange, red and infra-red).						
		■ Maintain vehicles and equipment in good working condition.	Fauna (wildlife)	HSE Team	Site Audit	During operation	Audit Report	Included in HSE Team costs.
		■ Implement access controls including the use of gates, security cameras and security guards at sites of key infrastructure such as substations and the main access roads to turbine clusters, to limit unauthorized vehicle and pedestrian access as far as possible.	Fauna (wildlife)	HSE Team	Site Audit	During operation	Audit Report	Included in HSE Team costs.
		■						
		■ Support local villagers with the training, tools and finances needed to startup small-scale animal operations, such as chicken farms, etc. to support local livelihoods, to alleviate some of the local hunting pressures. A social specialist will need to be appointed to advise on the approach and measures.	Fauna (wildlife)	IEAD	Site Audit	During operation	Audit Report	Unknown at this stage.
	Invasive Alien Plant impacts	■ Compile and implement a suitable Invasive Alien Plant (IAP) species control plan and programme to eradicate dense colonies of alien plants and control the spread of minor species and weeds. An ecologist / biodiversity specialist will need to be appointed to develop the IAS control plan and programme.	N.A	HSE Team	Site Audit	Post-construction During operation	Audit Report	Included in HSE costs.
8.5.2	**Economic Opportunities**							
	Job creation and training from the project	A Local Content and Influx Management Plan will be prepared to maximise the local employment and training opportunities afforded to the affected villagers. ■ The responsibilities and management practices associated with the management of labour during construction and operation of the Project.	N.A	IEAD	N.A	Prior to operation	Local Content and Influx Management Plan	Included in HSE Team costs
		■ A hiring policy that reinforces the Project's preference to employ local workers and undertake procurement from local businesses, where possible. The policy will be a	N.A	HSE Team	N.A	Prior to operation	Hiring Policy	Included in HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		tiered system where the hiring preference will be as follows: 1. Villagers from within the AoI; 2. Villagers from the Dakcheung District or Sanxay District; and 3. Villagers from the Sekong Province or Attapeu Province. ■ A training program targeting skills required for affected villagers to participate in unskilled, and potentially semi-skilled, work for the Project. ■ A communications strategy to notify affected villagers of employment and procurement opportunities in advance. This will enable villagers and businesses to be prepare for the application process (e.g. contracting requirements, assistance with application, etc.).						
		■ A Community and Ethnic Group Development Plan (CEGDP), which incorporates the Ethnic Group Development Plan (as the majority of the affected villagers are ethnic minorities) will be prepared to guide the implementation of suitable programs to support affected villagers.	N.A	IEAD	ESMS	Prior to operation	CEGDP	Included in EPC costs
8.5.4	**Community Health and Safety**							
	Impacts to communities from construction of the Project facilities	■ A Stakeholder Engagement Plan (SEP) will be prepared: The SEP will describe how Project stakeholders will be engaged throughout the Project lifecycle. The SEP will establish a systematic approach to stakeholder engagement that will help the Project build and maintain a constructive relationship with stakeholders. It will also ensure that Project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format. An example of a program to be implemented as part of the SEP is a community environmental and safety awareness program, which seeks to enable villagers to understand and identify construction risks, and how to stay safe.	N.A	HSE Team	Site Audit	Prior to operation	SEP	Included in HSE Team costs
		■ A Community Health and Safety Management Plan will be prepared**:** Sets out the agreed controls and	N.A	HSE Team	ESMS	Prior to Operation	Community Health and Safety	Included in HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		mitigation measures to protect the health and safety villagers in the AoI					Management Plan	
		■ An Occupational Health and Safety Management Plan will be prepared**:** Sets forth the agreed controls and mitigation measures to protect the health and safety of workers. This will include: - Screening of migrant workers prior to entering Laos to ensure they are fit to undertake their relevant tasks/roles. - Safety audits which will occur during the construction and operation of the Project, to ensure safety procedures are complied with. - Induction and Training requirements for all workers, including site-specific induction and training to highlight safety risks and mitigations, and task-specific training (e.g. complying with speed limits, etc.). ■ Measures to mitigate against the spread of COVID-19 amongst workers, and from workers to other villagers.	N.A	HSE Team	ESMS	Prior to Operation	Operational Health and Safety Management Plan	Included in HSE Team costs
8.5.5	**Worker Influx**	•						
	Influx of workers can affect local communities with increase in diseases and safety issues.	■ A number of legislative requirements exist to protect local and migrant workers, which all employers must comply with	N.A	EPC Contractor, HSE Team	Site Audit	During Operation	Employment Contracts	Included in HSE Team costs
8.5.7	**Ethnic Groups**							
	Impacts to ethnic groups from the construction and operation of the Project	■ The Project places a strong emphasis on respecting the cultures and customs of the villagers, and has been participating in various rituals as part of granting access and permission to undertake technical studies to support the ESIA. This will be formalised as part of a management plan to apply to all workers.	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in HSE Team costs
		■ Promote ethnic cultures through Project activities in collaboration with the Project affected communities	N.A	IEAD	Site Audit	During Operation	Engagement records	Included in HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ Implement development programs to improve the livelihoods of ethnic groups including providing ethnic women with economic development opportunities	N.A	IEAD	Site Audit	During Operation	Development programs	Included in HSE Team costs
		■ Implement measures to remove obstacles for ethnic minorities to participate in Project activities and decision-making, including impact mitigation and benefits	N.A	IEAD	Site Audit	During Operation	Audit Report	Included in HSE Team costs
		■ Provide a grievance redress mechanism and appeal process for the Project-affected persons that is culturally appropriate.	N.A	IEAD	Site Audit	During Operation	Grievance Mechanism	Included in HSE Team costs
8.5.8	**Cultural Heritage**							
	Impacts to local culture(tangible and intangible)	A cultural heritage protocol will be prepared to guide the workers on the protection of cultural heritage sites, structures and values that may be impacted by the Project. In the first instance, the cultural heritage protocol will require: ■ Further consultation with the villagers who reside close to the sacred forest to ensure the communities have a good understanding of Project activities and potential impacts on the sacred forest. ■ Consultation with village leaders, and elders on ceremonies and rituals to be undertaken to seek permission from the ghost to enter the forest for construction and ongoing maintenance purposes. ■ Seek permission from the village leaders, elders and the broader community to enter the sacred forest. Document the consent process and the consent itself, taking a precautionary approach, to address the potential for ADB Indigenous People Safeguards to be triggered in terms of consent for Project impacts on IP cultural resources.	N.A	HSE Team	Site Audit	During Operation	Cultural Heritage Protocol	Included in HSE Team costs
8.6.1	**Climate Change**							
	Impacts on climate change	■ Replant trees in the areas where land clearance and levelling works are undertaken	N.A	EPC Contractor	Site Audit	During Operation	Audit Report	Included in HSE Team costs
		■ Participate in the protection of forests and green areas in Dakcheung District and Sanxay District. These forests and green areas in the two districts will help maintain the overall climate condition and meteorology in the Project area and in the localities	N.A	EPC Contractor	Site Audit	During Operation	Audit Report	Included in HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ Replantation in areas around the wind turbine towers, office building, and sub-station of the Project to allow the Project area	N.A	EPC Contractor	Site Audit	During Operation	Audit Report	Included in HSE Team costs
		■ It is proposed to undertake an annual GHG inventory to monitor the GHG emissions according to the applicable requirements (i.e. ADB SPS, EP III and IFC)	N.A	EPC Contractor	Site Audit	During Operation	Audit Report	Included in HSE Team costs
		■ Replant trees in area where clearance and levelling work were undertaken during pre-construction and construction	N.A	EPC Contractor	Site Audit	During Operation	Audit Report	Included in HSE Team costs
8.6.2	**Risks from Climate Change**							
	Riverine Floods	■ When a rainstorm warning is received, consider suspending operations and transfer personnel to safe location	N.A	EPC Contractor, HSE Team	Site Audit	During Operation	Audit Report	Included in EPC and HSE Team costs
		■ Review meteorological information regularly, and take precautions against possible floods, landslides, mudslides, and other disasters	N.A	EPC Contractor, HSE Team	Site Audit	During Operation	Audit Report	Included in EPC and HSE Team costs
		■ Ensure an Emergency Response Plan (ERP) is in place covering floods, landslides, wildfires, cyclones, and thunderstorms	N.A	EPC Contractor, HSE Team	ESMS	Prior to Operational	ERP	Included in EPC and HSE Team costs
		■ Monitor flood situation at the Site. If any significant floods events affecting the physical infrastructure, operations, and health and safety are observed in future, detailed studies may be considered for flood mitigation measures	N.A	EPC Contractor, HSE Team	Site Audit	During Operation	Audit Report	Included in EPC and HSE Team costs
	Landslides	■ Review meteorological information regularly, and take precautions against possible floods, landslides, mudslides, and other disasters ■ Regular geotechnical field inspection to check for any signs of landslide risks	N.A	EPC Contractor	Site Audit	During Operation	Audit Report	Included in EPC and HSE Team costs
		■ Ensure an Emergency Response Plan is in place covering floods, landslides, wildfires, cyclones, and thunderstorms	N.A	EPC Contractor, HSE Team	Site Audit	Prior to Operation	ERP	Included in EPC and HSE Team costs
	Extreme Heat	■ Ensure designed operation temperature range ~30-40°C	N.A	HSE Team Contractor	Site Audit	During Operation	Audit Report	Included in HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ Worker's resting areas, on-site offices, worker's quarters should be constructed with heat resisting material to keep the indoor temperature lower.	N.A	EPC Contractor, HSE Team	Site Audit	During Operation	Audit Report	Included in EPC and HSE Team costs
		■ A heat stress management plan should be prepared as part of standard operations and safety procedures.	N.A	EPC Contractor, HSE Team	Site Audit	During Operation	Audit Report	Included in EPC and HSE Team costs
		■ Train workers to identify the symptoms of heat stress and first aid.	N.A	EPC Contractor, HSE Team	Site Audit	During Operation	Audit Report	Included in EPC and HSE Team costs
		■ Make appropriate considerations while designing the cooling systems (if required).	N.A	EPC Contractor, HSE Team	Site Audit	During Operation	Audit Report	Included in EPC and HSE Team costs
	Cyclone and Wind Speed	■ Ensure designed operational wind turbines at wind speed ranges between ~24 to 26 m/s	N.A	HSE Team Contractor	Site Audit	During Operation	Audit Report	Included in HSE Team costs
		■ Design to consider wind turbine's impeller lock process for wind speeds	N.A	HSE Team Contractor	Site Audit	During Operation	Audit Report	Included in HSE Team costs
	Wild Fire	■ Ensure lightning protection grounding of the wind turbine. A metal air termination system is installed at the blade tip. A copper conductor is used to reliability connect the air termination system to the lightening lead on hub	N.A	EPC Contractor, HSE Team	Site Audit	During Operation	Audit Report	Included in EPC and HSE Team costs
		■ Develop and maintain fire lines around the important assets	N.A	EPC Contractor, HSE Team	Site Audit	During Operation	Audit Report	Included in EPC and HSE Team costs
		■ Develop and maintain vegetation clearances with respect to prevailing standards and regulations	N.A	EPC Contractor, HSE Team	Site Audit	During Operation	Audit Report	Included in EPC and HSE Team costs
	Lighting and Storms	■ Ensure design according to IEC-61400-24 to achieve Grade I lighting protection to wind turbine the cross-sectional area of blade lighting protection copper conductor should not be less than $50mm^2$	N.A	EPC Contractor, HSE Team	Site Audit	During Pre-Construction and Operation	Design information	Included in EPC and HSE Team costs
8.7	**Unplanned Events**							
	General	■ The Project will implement the SEP and a robust stakeholder engagement programme on emergency response. Engagement on emergency response will provide regular information on safety drills and guidance to residents in the event of an unplanned event	N.A	EPC Contractor, HSE Team	ESMS	Prior to Operation	SEP	Included in EPC and HSE Team costs
		■ Prepare and implement an Emergency Preparedness and Response Plan to cover accidental and emergency	N.A	EPC Contractor, HSE Team	ESMS	Prior to Operation	Emergency Response and	Included in EPC and HSE Team costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		situations. This Plan will include leaks and spill, collisions, natural hazards, and fire and explosions (including UXO) and will also detail: ■ Planning coordination: including procedures for informing local communities about emergency response, documentation and first aid / medical treatment; ■ Emergency equipment: including equipment in the project design and any additional emergency equipment; and ■ Training: employees and contractors will be trained in emergency response procedures. ■ Auditing: audit records will be maintained on how the Plan is being implemented.					Preparedness Plan (ERP)	
	Leaks and Spills	■ Implement good site management practices to ensure that the products are properly stored on site and in areas where spills will not easily reach the environment (e.g. in paved areas with secondary containment).	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
		■ Soil, absorbents and other materials contaminated by leaks or spills of hazardous material such as hydrocarbons shall be treated as hazardous waste and stored in hazardous waste containment areas awaiting the opportunity for disposal in accordance with the waste management plan.	N.A	HSE Team	ESMS	Prior to Operation	ERP	Included in EPC costs
		■ Monthly monitoring the implementation of all proposed mitigation measures specified in ERP should be conducted properly;	N.A	HSE Team	ESMS	Prior to Operation	ERP	Included in EPC costs
		■ Daily inspection of any secondary containment of oil/chemical on site and ensure good maintenance procedures to minimize small leaks and spills.	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
	Fire and Explosions	■ Implement routine inspection and maintenance procedures (in line with international best practice) for any hazardous substances' storage vessels and WTGs	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
		■ Install warning system, signal boards, lighting protection system where risks of fire and explosion exposed	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
		■ Provide regularly safety and fire prevention & fighting drills.	N.A	HSE Team	Site Audit	During Operation	ERP	Included in EPC costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ A monthly audit program shall be established to check the implementation of emergency response and evacuation plan, staff training, equipment inspection, and firefighting drills.	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
	Blade Ejection	■ Establish safety zone at least 270 m away from the WTGs with fences if possible. It was recommended that the minimum setback distances required to meet noise and shadow flicker limits be maintained with respect to sensitive residential receptors to provide further protection;	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
		■ Implement periodic routine inspection and maintenance procedures (in line with international best practice).	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
		■ Install warning system, signal boards, lighting prevention system around the 270 m radius of danger zone where the WTGs located. Equipped vibration sensors for the warning of any imbalances in rotor blades.	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
		■ A quarterly audit program shall be established to check the implementation of regular technical inspection of the WTGs and blades' safety. Any identify gaps or areas of opportunity will be followed up after the inspection until resolved. The auditing records will be kept onsite for future review and supervision.	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
	Transmission line snapping	■ Establish a good practice and should comply with electricity safety related regulation or international standard, whichever, more stringent, in the design and installation of transmission line and transmission pylons	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
		■ Implement periodic routine inspection and maintenance procedures (in line with international best practice)	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
		■ Install warning system, signal boards, lighting prevention system, anti-climbing devices on the tower.	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
		■ A quarterly audit program shall be established to check the implementation of regular technical inspection of the transmission lines and transmission pylons' safety.	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
	Natural Hazards	■ Incorporation of siting and safety engineering criteria to prevent failures due to natural disasters.	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs

ESIA Ref. No.	Potential Impact	Mitigation Measures	Specific Actions (parameters, locations, standards, thresholds)	Responsibility for ensuring commitment/monitoring implemented	Means of verifying that commitment has been met	Timing	Reporting requirements	Estimated cost
		■ Implement periodic routine inspection and maintenance procedures (in line with international best practice)	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs
		■ Install warning system, signal boards, flood prevention systems.	N.A	HSE Team	Site Audit	During Operation	Audit Report	Included in EPC costs

10.8 Environmental and Social Monitoring Program

Monitoring is a means of verifying overall effectiveness of the management and mitigation measures contained within the management plans listed above. Key objectives of the monitoring process are to:

- Confirm effectiveness of management and mitigation measures;
- Ensure compliance with Applicable Standards (Laos standards, ADB SPS, WGB EHS, and Guidelines);
- Monitoring the status of, and impacts on, identified sensitive receptors;
- Provide an early warning that any of the control measures or practices are failing to achieve their desired performance and ensure changes can be implemented to remedy these practices;
- Determine whether environmental and social changes are attributable to Project activities, or as a result of other activities or natural variation; and
- Provide a basis for continual review and improvements to Project design and execution.

10.8.1 Performance Indicators and Monitoring Schedule

Physical, biological and social environmental management components of particular significance have been identified as performance indicators. A comprehensive monitoring plan for each performance indicator has been prepared for all phases of the Project and is presented in ***Table 10-3.***

This includes the tentative parameters to be measured, methods to be utilised, sampling locations, frequency of measurements, detection limits, cost and responsibilities for implementation and supervision.

However, it is to be noted that the detailed and specific monitoring measures will be developed and included within the relevant management plans. The monitoring components of the various management plans will be refined and finalised during plan development.

Impact monitoring will be undertaken during the life of the Project to verify the predicted levels of residual impacts from the Project and the effectiveness of the various management plans.

10.8.2 Reporting Mechanism for Environmental and Social Monitoring Program

A robust reporting system will provide the Project with the necessary feedback mechanisms to ensure quality and timely implementation of the works. The reporting system will ensure regular flow of information from the Project site to the Project headquarters and, as necessary, to regulatory authorities and funding agencies. The reporting system will provide a mechanism to ensure that the measures proposed in the Project's ESMP are implemented.

Prior to the commencement of the construction activities, IEAD will finalise the format and frequency for reporting on the status and progress of environmental and social monitoring.

During construction and operation phases, it is recommended that the report shall be submitted to the relevant authorities and funding agencies on a regular basis. Frequency will be agreed with relevant authorities and funding agencies.

However, it is recommended that EPC submit the report to the relevant authorities and funding agencies on three-monthly basis during construction and on annually basis during operation.

The format will be designed to meet all the compliance conditions associated with the local and international requirements. The contractor will be required to submit the duly filled up reporting form on the agreed frequency to IEAD.

The monitoring measures for the Project are summarised in ***Table 10-3***.

Table 10-3: Environmental and Social Monitoring Programme

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
Construction Phase						
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and as specified in EPC Contractor Manual	Project activity areas and construction workers camp	Visual inspection of all active work areas	Daily	HSSE Team of EPC Contractor
Air quality	Impact to air quality due to dust emissions	Implementation of mitigation measures	Project activity areas and construction workers accommodation	As per Maintenance Regime Plan requirements	As Maintenance Regime Plan requirements	EPC Contractor
	Monitoring air quality	TSP, PM-10, PM-2.5, CO, SO_2 and NO_2 as per the requirements of the Local EIA (EIA, 2020)	Sensitive Receptors	As per Laos and WBG EHS standards	Monthly	Third Party
Noise	Monitoring ambient noise	Sound levels (dB)	Heavy work, area of heavy transportation, village areas surrounding the project.	As per Laos and WBG EHS standards	Monthly	Third Party
Water	Monitoring of effluents / discharges from construction sites/camps/batching plants	Observe and monitor the water quality from wastewater treatment system in order to meet the standard and capacity	Wastewater treatment system from construction sites/camps/batching plants	As per Laos and WBG EHS standards	Monthly	Third Party
Water	Monitoring surface water quality	Temperature, pH, Dissolved oxygen (DO), Biological Oxygen Demand (BOD5), Total Suspended Solid (TSS), Total and Total Dissolved, Oil and Grease, and Faecal coliforms	Nearby water courses	As per Laos and WBG EHS standards	Monthly	Third Party
Water	Monitoring surface water quality	Persistent Organic Pollutants (POPs), which may include PCBs, dibenzofurans, and dioxins.	5 sampling locations as per the baseline	As per Laos and WBG EHS standards	Once prior to construction commencement	Third Party
Soil	Monitoring soil quality	Persistent Organic Pollutants (POPs), which may include PCBs, dibenzofurans, and dioxins.	5 sampling locations at proposed WTG locations	As per Laos and WBG EHS standards	Once prior to construction commencement	Third Party
Occupational Health and Safety	Accidents or incidents due to construction activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction workers camp	As defined in construction phase Health & Safety Plan to be prepared by EPC contractor	As defined in H&S Plan	HSSE Team of EPC Contractor
Waste	Impact from non-hazardous wastes storage, transport and disposal	Implementation of Waste Management Plan (WMP)	Project activity areas and construction workers camp, transport assets and disposal areas	Compliance to the WMP	Unplanned audit twice a year	HSSE Team of EPC Contractor
	Impact from hazardous wastes storage, transport and disposal	Implementation of Waste Management Plan (WMP)	Project activity areas and construction workers camp, transport assets and disposal areas	Compliance to the WMP	Regular rotation of inspections across all sites with frequency of inspections (not exceeding monthly) proportionate to the size of the site/ number of workers/level of risk and Unplanned audit twice a year.	HSSE Team of EPC Contractor
Biodiversity	Impacts to forest habitat	Records of training, rehabilitation plan monitoring	Project activity areas	Compliance against protocols	Quarterly basis during construction	HSSE Team of EPC Contractor
	Impacts to watercourses	Spill records and clean-up, rehabilitation plan monitoring	Watercourse crossings by new access roads	Compliance against protocols	Monthly during construction	HSSE Team of EPC Contractor
	Impacts to fauna (wildlife)	Fauna Shepherding protocol and accidents	Project activity areas, access roads, workers camps, laydown areas	Compliance against protocols	Monthly	HSSE Team of EPC Contractor
	Invasive Alien Plant (IAP) impacts	Preparation and implementation of IAP control plan, IAP monitoring plan	Project activity areas and construction workers camps, laydown areas	Compliance against invasive management measures	Monthly	HSSE Team of EPC Contractor

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
Social	Local employment	Percentage of local (directly from the Project SAoI) employed during construction	Project activity areas	Compliance against the Local Content and Influx Management Plan	Start of construction and bi-monthly after.	HSSE Team of EPC Contractor
	Livelihood restoration target; Improvement of status of poor and vulnerable to national minimum standards	Villages within the SAoI	Compliance with compensation and livelihood restoration plan and CEGDP	Start of construction and bi-monthly after.	HSSE Team of EPC Contractor	Economic displacement and impacts to livelihood
	Stakeholder Engagement	Number or frequency of engagement	Villages within the SAoI	Compliance against the Stakeholder Engagement Plan	Monthly	HSSE Team of EPC Contractor
	Grievance Mechanism	Number and resolution of grievances	Neighbouring communities around the Project activity areas	Compliance of resolution duration of grievance with Grievance Mechanism	Weekly	HSSE Team of EPC Contractor
	Impact to traffic	Permit and code of conduct	Construction area and roads used for transport of workers and construction material	■ Unplanned Compliance audit against worker Code of Conduct ■ Proactively engage with village administration and district officials where the frequency or size of project transport has a potential to impact on local traffic.	Every 4 months. During large mobilization of vehicles or equipment.	HSSE Team of EPC Contractor
	Impact to existing facilities	State of Public infrastructures	Roads used for construction	Capacity to use the infrastructure safely	Monthly	HSSE Team of EPC Contractor
	Impacts to health and safety of the community	Worker training, grievances, accident log, implementation of Community H&S monitoring and surveillance programme, implementation of worker code of conduct, implementation of Local Content and Influx Management Plan	Project activity areas	Compliance against HSSE plans and Local Content and Influx Management Plan	■ Bi monthly review of training log; ■ Monitoring and review of accidents due to construction (daily monitoring and monthly review). ■ Community health and safety monitoring and surveillance program. ■ Daily monitoring of construction area, worker camp and surrounding; ■ Regular unplanned audit on worker code conduct; ■ Monthly visual inspection of first aid facilities and records. ■ Weekly review of grievance log.	HSSE Team of EPC Contractor
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints	Roads used for transport of workers and construction material	Incidents, accidents and community complaints	Based on occurrence and yearly	HSSE and/or Community Liaison Officer of EPC Contractor
	Public concerns	Complaints from community	Neighbouring communities around the Project activity areas	As per the grievance redress mechanism	Continuous	DoE

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
Operation Phase						
Noise	Monitoring ambient noise	Sound levels (dB)	At nearest receptor	As per Laos and WBG EHS standards	Monthly at start of operations	Third Party
Waste	Impact to soil, groundwater, surface water, biodiversity and human receptors	Implementation of Waste Management Plan (WMP)	Project activity areas and construction workers camp, transport assets and disposal areas	Compliance to the WMP	Unplanned audit yearly	DoE HSSE team
Social	Local employment	Percentage of local (directly from the Project Social AoI) employed during operation	Villages within the SAoI	Compliance against the Sourcing, Procurement and Recruitment Management Plan	Start of operation and yearly after.	DoE HSSE team
	Livelihood restoration target; Improvement of status of poor and vulnerable to national minimum standards	Villages within the SAoI	Compliance with compensation and livelihood restoration plan and CEGDPt	Bi-yearly	Third Party	Economic displacement and impacts to livelihood
	Grievance Mechanism (all impact)	Number and resolution of grievances	Neighbouring communities around the Project activity areas	Compliance of resolution duration of grievance with Grievance Mechanism	Weekly	DoE HSSE team
	Impacts to health and safety of the community	Compliance with operation plans	Project activity areas	Percentage of non-compliance against plans	■ Bi-yearly review of training log. ■ Bi-yearly review of compliance against community health and safety monitoring and surveillance programme. ■ Conduct regular unplanned audit of the worker code of conduct. ■ Bi-yearly unplanned audit of waste management activities. ■ Monthly visual inspection of first aid facilities and record, review of employment records and health insurance subscription records.	DoE HSSE team
	Impact to occupational health and safety	Accidents or incidents due to operation activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas	As defined in operation phase Health & Safety Plan	DoE HSSE team
Biodiversity	Impacts to fauna (wildlife): bird/bat collisions	Operational biodiversity monitoring plan, including bird/bat carcass monitoring focused on investigating fatalities during period of heightened bird/bat activity (seasonally relevant)	Wind turbines and transmission lines	Compliance against protocols	Annual (seasonal) Pre-operation During operation	Third party
	Impacts to forest habitat	Monitoring implementation of biodiversity offset plan	Biodiversity offset site(s)	Compliance against success criteria of offset plan	Annual	Third party
	Impacts to watercourses	Monitoring road culverts for debris/blockage	Watercourse crossings by access roads	Debris/blockages present to be cleared	Monthly during the rainy season	DoE HSSE team
	Invasive Alien Plant (IAP) impacts	IAP monitoring plan	Habitats adjacent to operational areas (WTs, roads, transmission line corridors, etc.)	Compliance against protocols	Twice annually	DoE HSSE team
	Monitor biodiversity offset implementation success.	Offset site(s)	Offset site(s)	Offset Monitoring Report	Annual	Third party

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
					During and after offset implementation	

11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Impact Assessment Conclusions

The Supplemental ESIA report has been prepared based on the technical information provided by IEAD, local EIA (EIA, 2022), existing studies and reports relevant to the Project, site visits, baseline environmental and social data collection and the stakeholder engagement.

Through this process, the assessment has been conducted of the potential environmental and social impacts attributable to the construction and operation phases of the Project. Qualitative and quantitative (where relevant) assessments of impacts have been presented, significance of each potential impact has been identified, and mitigation measures to minimise and reduce the impacts have been recommended. Cumulative impacts, particularly on community health and safety and biodiversity, have also been assessed. Table 11-1 presents a summary of residual impact significance and ***Table 11-2*** presents a summary of risks from climate change.

All impacts have been mitigated to **Moderate** at worst case, and have a range of mitigation, management and monitoring measures to ensure no significant impacts to the environment or people.

Table 11-1: Summary of Residual Impact Significance

Impact Type	Residual Impact Significance	
	Construction	Operation
Physical Environment Impact Assessment		
Impacts on Topography	**Moderate**	**Moderate**
Impacts on Geology and Soil	**Minor**	**Minor**
Impacts on Air Quality	**Minor**	**Scoped out of the assessment**
Impacts on Noise	**Minor**	**Minor**
Impacts to Surface Water Quality	**Minor**	**Negligible**
Impact to Water Resources	**Moderate**	**Minor**
Impacts to Landscape Values	**Moderate**	**Moderate**
Impacts to Visual	**Negligible to Moderate**	**Moderate**
Impacts Associated with Shadow Flicker	Not Applicable	**Minor**
Biological Environment Impact Assessment		
Physical destruction and/or disturbance of vegetation	**Moderate**	Not Applicable
Reduction in habitat for supporting key RDL (Red Data List) species	**Moderate**	Not Applicable
Illegal hunting/poaching and collection of forest resources	Minor	Negligible
Bird & bat collisions with wind turbines resulting in injury or mortality	Not Applicable	Negligible
Bird & bat collisions with transmission lines resulting in injury or mortality	Not Applicable	Negligible

Impact Type	Residual Impact Significance	
	Construction	Operation
Vehicular collisions with wildlife	Negligible	Negligible
Dust pollution caused by earthworks and vehicle/machinery operation	Negligible	Negligible
Water and soil pollution caused by potential accidental spills of hazardous substances	Negligible	Negligible
Soil erosion and sedimentation of watercourses	Negligible	Negligible
Disturbance and nuisance caused by increased noise, light and/or vibrations	Negligible	Negligible
Barriers or interference with species movement	**Minor**	**Minor**
Increased susceptibility of forest habitat to disturbance	**Minor**	**Minor**
Introduction of alien plant species and/or disturbance leading to invasion by alien plants and weeds	**Minor**	**Minor**
Reduced habitat connectivity caused by fragmentation of habitat	**Minor**	**Minor**
Loss of ecosystem services	Negligible	Negligible
Increased hunting/harvesting pressure due to enhanced accessibility to the area	**Moderate**	**Moderate**
Increased fire risk	Scoped out of the assessment	Scoped out of the assessment
Trophic cascade impacts	Scoped out of the assessment	Scoped out of the assessment
Social Impact Assessment		
Impacts on Economic Opportunities	**Positive**	**Positive**
Economic Displacement and Impacts to Livelihoods	**Moderate**	**Moderate**
Impacts on Community Health and Safety	**Negligible**	**Not Applicable**
Impacts Associated with Influx	**Minor**	**Not Applicable**

Impact Type	Residual Impact Significance	
	Construction	Operation
Impacts of Wind Farm Operation on Local Amenity	**Not Applicable**	**Negligible to Moderate**
Impact on Ethnic Groups	**Negligible**	**Not Applicable**
Impact on Cultural Heritage (Tangible and Intangible)	**Minor**	**Minor**
Climate Change Risk and Impact Assessment		
Impacts on Climate Change	**Negligible**	**Negligible**
Unplanned Events		
Leakage and Spill Incidents	**Minor**	**Minor**
Traffic Accidents	**Moderate** for workers and communities **Minor** for communities (livestock)	**Not Applicable**
Fire and Explosion	**Minor**	**Moderate** for workers and communities **Minor** for the environment
Unexploded Ordnances (UXOs)	**Minor**	**Moderate** for workers and communities **Minor** for the environment
Natural Hazards (Flood and Landslide)	**Moderate**	**Moderate**
Blade Ejection Failure	**Not Applicable**	**Minor**
Transmission Line Snapping and Transmission Pylon Collapse	**Not Applicable**	**Moderate**
Cumulative Impacts		
Cumulative Impact 1: *Avifauna collisions*	Not Applicable	**Minor**
Cumulative Impact 2: *Regional loss of important forest habitat*	**Moderate**	Not Applicable
Cumulative Impact 3: *Forest habitat fragmentation and reduced connectivity*	**Minor**	**Minor**
Cumulative Impact 4: *Regional loss of RDL species*	**Minor**	**Moderate**
Cumulative Impact 5: *Reduction in ecosystem services*	**Minor**	**Minor**
Cumulative Impact 6: *Contribution to clean energy sector and move away from non-renewables (positive impact)*	Not Applicable	**Positive**

Table 11-2: Risks from Climate Change

Hazard Type	Hazard Level	
	2030	2050
Water Availability	Low	Low
Riverine Floods	None	None
Landslides	High	High
Extreme Heat	High	High
Cyclone and Wind Speed	High	High
Lightning	No direct projections	No direct projections

11.2 Social and Engagement Considerations

In terms of social aspects, the major concerns raised through the supplemental stakeholder engagement were unfair and inappropriate compensation to agricultural land loss due to Project land acquisition and impacts of noise and shadow flicker. Despite some concerns, the supplemental engagement indicate that the Project has received factorable support from local people and other stakeholders. Local people appreciate that the Project will provide several benefits such as supporting economic growth in the region, potential employment (direct and indirect), provide assistance to the local communities to improve agricultural and livestock husbandry practice, particularly coffee plantation and processing and improve infrastructures and public services in the villages such as healthcare centres and school facilities.

11.3 Recommendations

For all the impacts identified in the study, mitigation measures have been proposed and included in the ESMP chapters, including the schedule for monitoring. If any impacts result in more severe significance that assess in this report, actions to be taken by the Project proponent or its contractors are also described.

The effective implementation of the ESMP and adherence with the Laos standards and WBG guidelines will assist in minimising the environmental impacts to acceptable levels. With continued engagement with local stakeholders and monitoring as proposed in the ESMP of impact significance, the environmental and social assessment of the Project ascertains that the Project is unlikely to cause any significant environmental and social impacts and will bring benefits to local stakeholders and increased access to reliable supply of electricity to the region.

Standalone management plans will be required for the Project. These will include:

- Community Health and Safety Management Plan
- Occupational Health and Safety Management Plan
- Traffic Management Plan
- Worker's Camp Management Plan
- Construction Material Sourcing Plan
- Air Quality Management Plan
- Water Quality Management Plan
- Hazardous Materials Management Plan
- Waste Management Plan

- Noise and Vibration Management Plan
- Spoil Management Plan
- Soil Erosion and Sediment Control Management Plan
- Site Restoration Management Plan
- Local Content and Influx Management Plan (including Labour Management Plan and Local Procurement Management Plan)
- Cultural Heritage Management Plan
- Emergency Preparedness and Response Plan
- Stakeholder Engagement Plan
- Resettlement Plan
- Community and Ethnic Group Development Plan
- Initial Biodiversity Action Plan
- Unexploded Ordinance Survey and Clearance Plan

The monitoring measures have been proposed during construction and operation of the Project (***Table 11-3***).

Table 11-3: Environmental and Social Monitoring Programme

Project Stage/ Affected Component	Parameters to be Monitored	Location	Frequency
Construction Phase			
General	General compliance with mitigation measures presented in the ESMP and as specified in EPC Contractor Manual	Project activity areas and construction workers camp	Daily
Air quality	Implementation of mitigation measures	Project activity areas and construction workers accommodation	As Maintenance Regime Plan requirements
	TSP, PM-10, SO_2, NO_2 and CO_2) as per the requirements of the Local EIA (EIA, 2022)	Sensitive Receptors	Monthly
Noise	Sound levels (dB)	Heavy work, area of heavy transportation, village areas surrounding the project.	Monthly
Water	Temperature, pH, Dissolved oxygen (DO), Biological Oxygen Demand (BOD5), Total Suspended Solid (TSS), Total and Total Dissolved, Oil and Grease, and Faecal coliforms	Nearby water courses	3 monthly
Occupational Health and Safety	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction workers camp	As defined in H&S Plan
Waste	Implementation of Waste Management Plan (WMP)	Project activity areas and construction workers	Unplanned audit twice a year

Project Stage/ Affected Component	Parameters to be Monitored	Location	Frequency
		camp, transport assets and disposal areas	
	Implementation of Waste Management Plan (WMP)	Project activity areas and construction workers camp, transport assets and disposal areas	Unplanned audit twice a year
Biodiversity	Records of training, rehabilitation monitoring	All Project activity areas	Quarterly
	Spill records and clean-up, rehabilitation monitoring	Watercourse crossings by new access roads	Monthly
	Fauna shepherding protocol and accidents	All Project activity areas, access roads, worker camps, laydown areas	Monthly
	IAP (Invasive Alien Plant) monitoring plan	All Project activity areas, access roads, worker camps, laydown areas	Monthly
Social	Percentage of local (directly from the Project SAoI) employed during construction	Project activity areas	Start of construction and bi-monthly after.
	Number or frequency of engagement	Villages within the SAoI	Monthly
	Number and resolution of grievances	Neighbouring communities around the Project activity areas	Weekly
	Permit and code of conduct	Construction area and roads used for transport of workers and construction material	Every 4 months. During large mobilization of vehicles or equipment.
	State of Public infrastructures	Roads used for construction	Monthly
	Worker training, grievances, accident log, implementation of Community H&S monitoring and surveillance programme, implementation of worker code of conduct	Project activity areas	■ Bi monthly review of training log; ■ Monitoring and review of accidents due to construction (daily monitoring and monthly review). ■ Community health and safety monitoring and surveillance program. ■ Daily monitoring of construction area, worker camp and surrounding; ■ Regular unplanned audit on worker code conduct; ■ Monthly visual inspection of first aid facilities and records.

Project Stage/ Affected Component	Parameters to be Monitored	Location	Frequency
			■ Weekly review of grievance log.
Community Health and Safety	Accidents, incidents and complaints	Roads used for transport of workers and construction material	Based on occurrence and yearly
	Complaints from community	Neighbouring communities around the Project activity areas	Continuous
Operation Phase			
Noise	Sound levels (dB)	At nearest receptor	Monthly at start of operations
Waste	Implementation of Waste Management Plan (WMP)	Project activity areas and construction workers camp, transport assets and disposal areas	Unplanned audit yearly
Social	Percentage of local (directly from the Project Social AoI) employed during operation	Villages within the SAoI	Start of operation and yearly after.
	Number and resolution of grievances	Neighbouring communities around the Project activity areas	Weekly
	Compliance with operation plans	Project activity areas	■ Bi-yearly review of training log. ■ Bi-yearly review of compliance against community health and safety monitoring and surveillance programme. ■ Conduct regular unplanned audit of the worker code of conduct. ■ Bi-yearly unplanned audit of waste management activities. ■ Monthly visual inspection of first aid facilities and record, review of employment records and health insurance subscription records.
	Accidents or incidents due to operation activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	As defined in operation phase Health & Safety Plan
Biodiversity	Operational biodiversity monitoring plan, including bird/bat carcass monitoring	Wind turbines and transmission lines	Annual (seasonal)
	Monitoring implementation of biodiversity offset plan	Biodiversity offset site(s)	Annual
	Monitoring road culverts for debris/blockage	Watercourse crossings by access roads	Monthly during the rainy season

Project Stage/ Affected Component	Parameters to be Monitored	Location	Frequency
	IAP monitoring plan	Habitats adjacent to operational areas (WTs, roads, transmission line corridors, etc.)	Twice annually

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