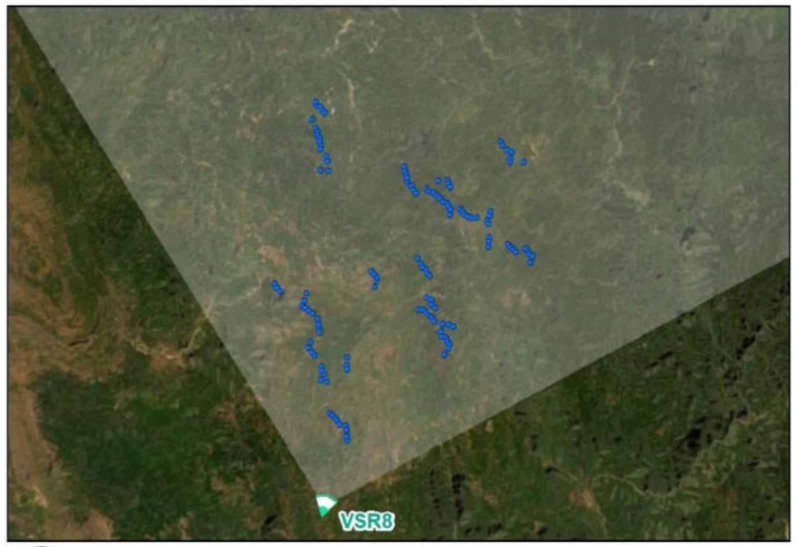
Figure 9-20: Photomontage for VSR8

Coordinate system	VSR8
WGS84-UTM 48N	
X 722913 Y 1676582	Ban Chalernxay



VSR view direction: 15°

WTG nearest 6.8 km
WTG farther 39.5 km
WTGs in the field of view (FoV) 124
WTGs visible only considering terrain surface
⇒ at tip height 41
⇒ at hub height 29

The view is taken along a road near the village of Ban Chalernxay in the Xanxay's district. The sensitivity level is therefore considered to be High.

Due to topography and distance, only the upper portion of the rotor of few turbines will be visible, forming a clearly discernible, but not dominant, element of the view. The magnitude is therefore considered as Small.

Sensitivity	Magnitude	Significance
Medium	Small	**Minor**

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Figure 9-21: Photomontage for VSR9 (1)

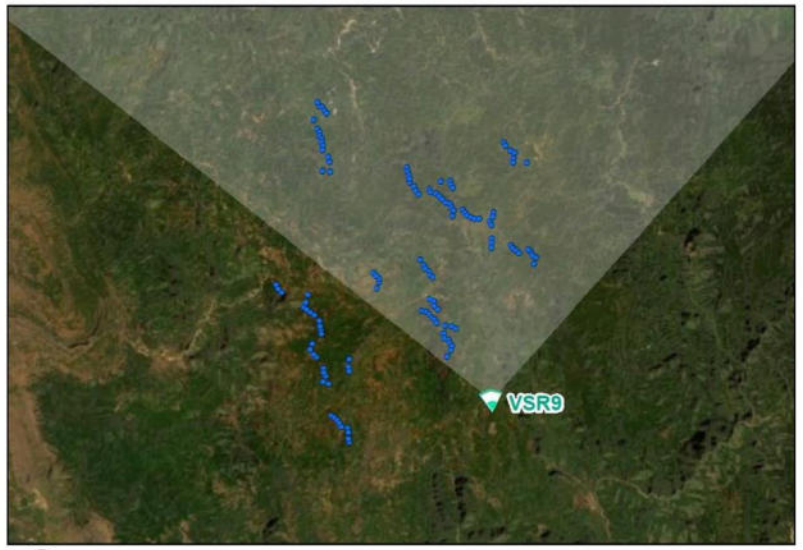
Coordinate system

WGS84-UTM 48N

X 738830 Y 1687061

VSR9 (1 of 2)

Ban Maithavone



VSR view direction: 355°

WTG nearest 5.9 km

WTG farther 33.4 km

WTGs in the field of view (FoV) 99

WTGs visible only considering terrain surface

⇒ at tip height 27

⇒ at hub height 11

The view is taken in the local community of Ban Maithavone near a farm. The sensitivity level is therefore considered to be Medium.

Due to topography and distance, only the upper portion of the rotor of few turbines will be visible, forming a clearly discernible, but not dominant, element of the view. The magnitude is therefore considered as Small.

Sensitivity	Magnitude	Significance
Medium	Small	**Minor**

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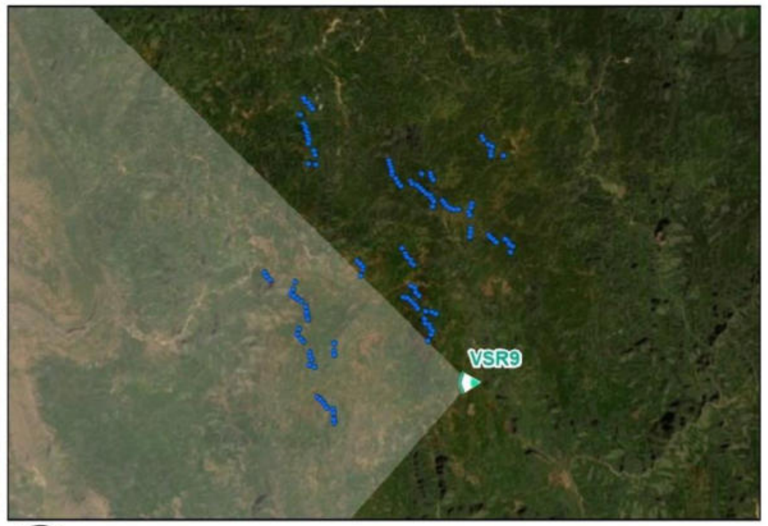
Figure 9-22: Photomontage for VSR9 (2)

Coordinate system
WGS84-UTM 48N
X 738830 Y 1687061

VSR9 (2 of 2)

Ban Maithavone



VSR view direction: 268°

WTG nearest 5.9 km
WTG farther 23.5 km
WTGs in the field of view (FoV) 35
WTGs visible only considering terrain surface
⇒ at tip height 1
⇒ at hub height 0

The view is taken from the local community of Ban Maithavone near a farm. The sensitivity level is therefore considered to be Medium.

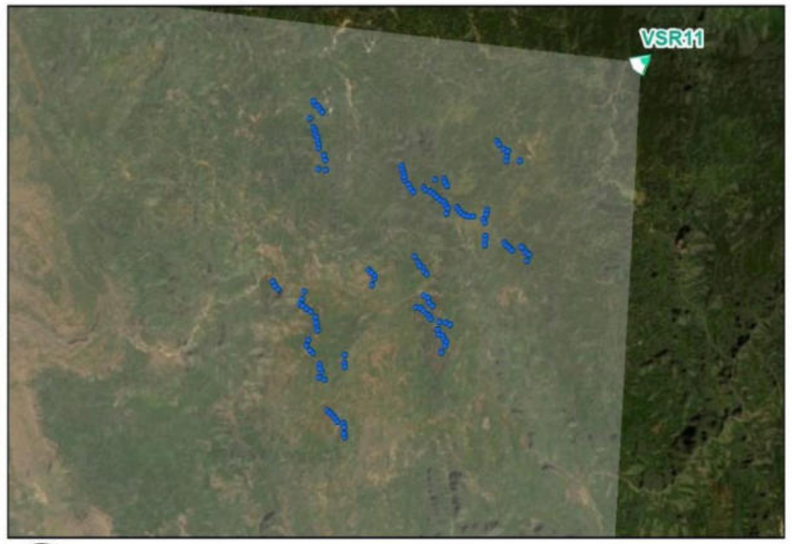
Due to topography and distance, only the upper portion of the rotor of few turbines will be visible, forming a clearly discernible, but not dominant, element of the view. The magnitude is therefore considered as Small.

Sensitivity	Magnitude	Significance
Medium	Small	**Minor**

Environmental and Social Impact Assessment – Landscape and Visual Component

Figure 9-23: Photomontage for VSR11

Coordinate system	VSR11
WGS84-UTM 48N	
X 754164 Y 1719633	Boundary Laos/Vietnam



VSR view direction: 230°

WTG nearest 15.3 km
WTG farther 46.9 km
WTGs in the field of view (FoV) 133
WTGs visible only considering terrain surface
⇒ at tip height 79
⇒ at hub height 57

The view is taken along a road near the border between Laos and Vietnam. The sensitivity level is therefore considered to be Low.

Due to topography and distance, not all wind turbines are visible at this location and do not constitute a perceptible change in landscape character. The magnitude is therefore considered Negligible.

Sensitivity	Magnitude	Significance
Low	Negligible	**Negligible**

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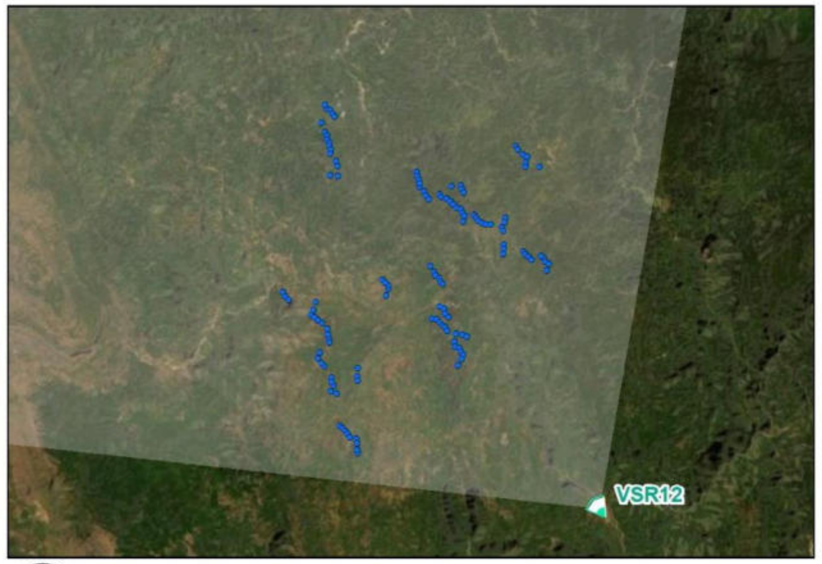
Figure 9-24: Photomontage for VSR12

Coordinate system	**VSR12**
WGS84-UTM 48N	**Ban Saoksavang**
X 747981 Y 1677805	



VSR view direction: 323°

WTG nearest 19.0 km
WTG farther 46.2 km
WTGs in the field of view (FoV) 133
WTGs visible only considering terrain surface
⇒ at tip height 0
⇒ at hub height 0

The view is taken in the settlement of Ban Souksavang along a road. The sensitivity level is therefore considered to be Medium.

Turbines are unlikely to be visible from this viewpoint. Hence, a perceptible change to landscape character from the Project is unlikely to occur. The magnitude is therefore considered to be Negligible.

Sensitivity	Magnitude	Significance
Medium	Negligible	**Negligible**

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ERM

Figure 9-25: Photomontage for VSR13 (1)

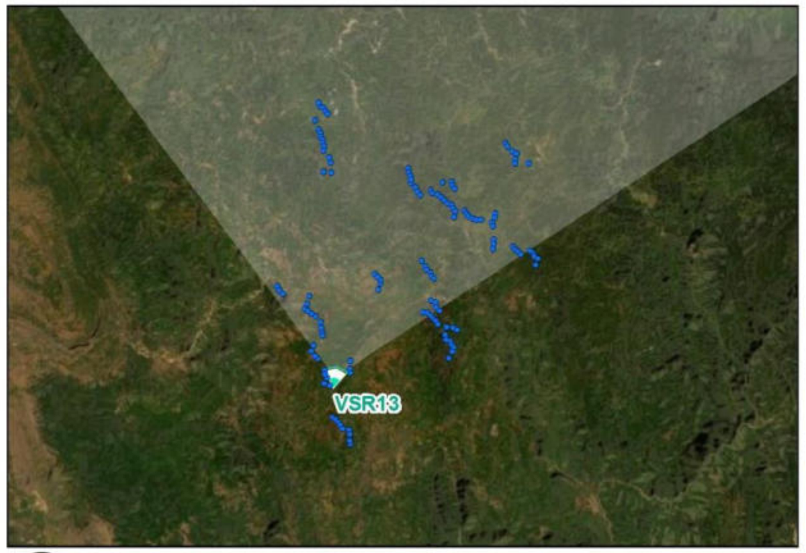
Coordinate system

WGS84-UTM 48N

X 723589 Y 1689411

VSR13 **(1 of 3)**

Along a road



VSR view direction: 10°

WTG nearest 1.7 km

WTG farther 28.0 km

WTGs in the field of view (FoV) 95

WTGs visible only considering terrain surface

⇒ at tip height 47

⇒ at hub height 23

The view is taken along a road near a old farm. The sensitivity level is therefore considered to be Low.

Due to the topography and the distance, at this point not all wind turbines are visible. The magnitude is considered medium.

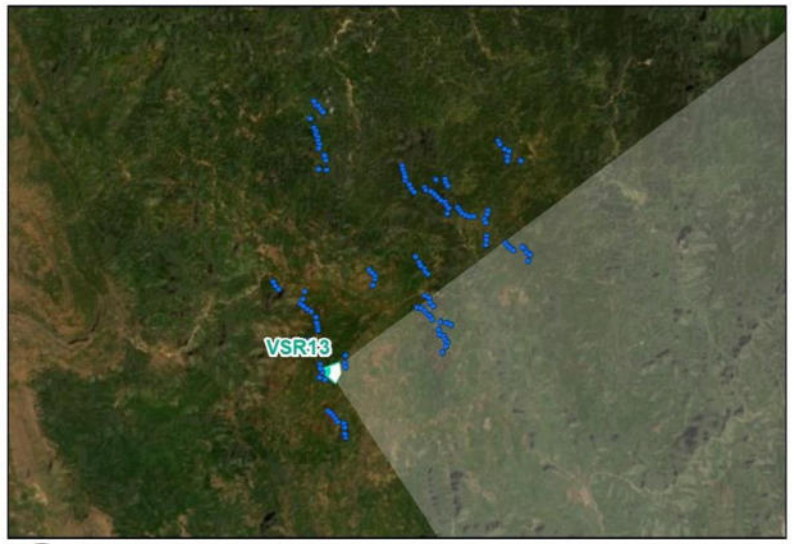
Sensitivity	Magnitude	Significance
Low	Medium	**Minor**

Environmental and Social Impact Assessment – Landscape and Visual Component

ERM

Figure 9-26: Photomontage for VSR13 (2)

Coordinate system WGS84-UTM 48N X 723589 Y 1689411	**VSR13** (2 of 3) **Along a road**



VSR view direction: 100°

WTG nearest 1.5 km
WTG farther 22.7 km
WTGs in the field of view (FoV) 30
WTGs visible only considering terrain surface
⇒ at tip height 24
⇒ at hub height 21

The view is taken along a road near a old farm. The sensitivity level is therefore considered to be Low.

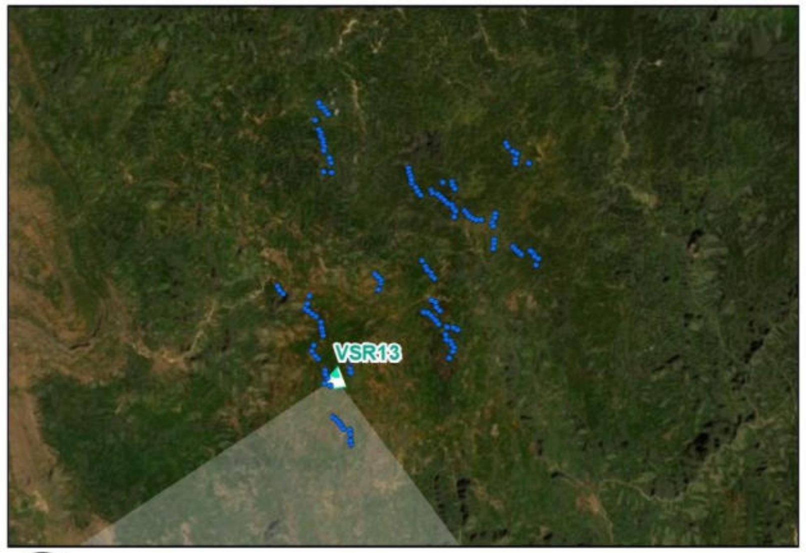
Due to the topography and the distance, at this point not all wind turbines are visible. The magnitude is considered medium.

Sensitivity	Magnitude	Significance
Low	Medium	**Minor**

Environmental and Social Impact Assessment – Landscape and Visual Component

Figure 9-27: Photomontage for VSR13 (3)

Coordinate system	**VSR13** (3 of 3)
WGS84-UTM 48N	
X 723589 Y 1689411	**Along a road**



VSR view direction: 190°

WTG nearest 0.8 km
WTG farther 6.5 km
WTGs in the field of view (FoV) 11
WTGs visible only considering terrain surface
⇒ at tip height 2
⇒ at hub height 0

The view is taken along a road near a old farm. The sensitivity level is therefore considered to be Low.

Due to the topography and the distance, at this point not all wind turbines are visible. The magnitude is considered medium.

Sensitivity	Magnitude	Significance
Low	Medium	**Minor**

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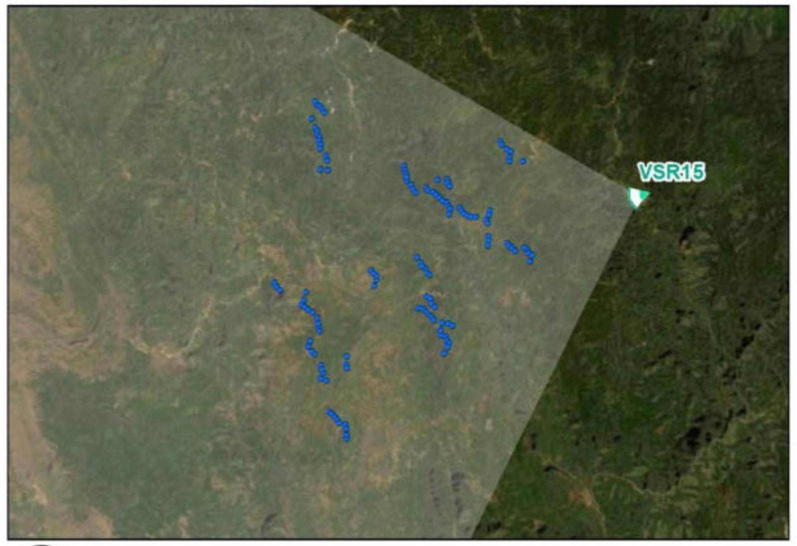
Figure 9-28: Photomontage for VSR15

Coordinate system
WGS84-UTM 48N
X 753565 Y 1706637

VSR15

Sekamarn 3 Hydropower



VSR view direction: 253"

WTG nearest 11.9 km
WTG farther 37.0 km
WTGs in the field of view (FoV) 133
WTGs visible only considering terrain surface
⇒ at tip height 0
⇒ at hub height 0

The view is taken from the reservoir of the Sekamarn 3 Hydropower Dam. The sensitivity level is therefore considered to be Low.

Turbines are unlikely to be visible from this viewpoint. Hence, a perceptible change to landscape character from the Project is unlikely to occur. The magnitude is therefore considered to be Negligible.

Sensitivity	Magnitude	Significance
Medium	Negligible	**Negligible**

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Figure 9-29: Photomontage for VSR16

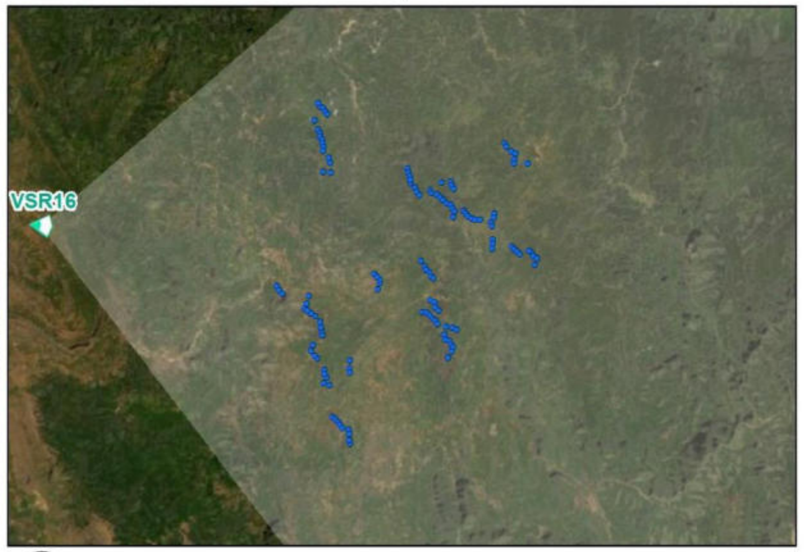
Coordinate system

WGS84-UTM 48N

X 695340 Y 1703968

VSR16

Ban Chavik - Nalaiy



VSR view direction: 96"

WTG nearest 23.4 km

WTG farther 47.9 km

WTGs in the field of view (FoV) 133

WTGs visible only considering terrain surface

⇒ at tip height 0

⇒ at hub height 0

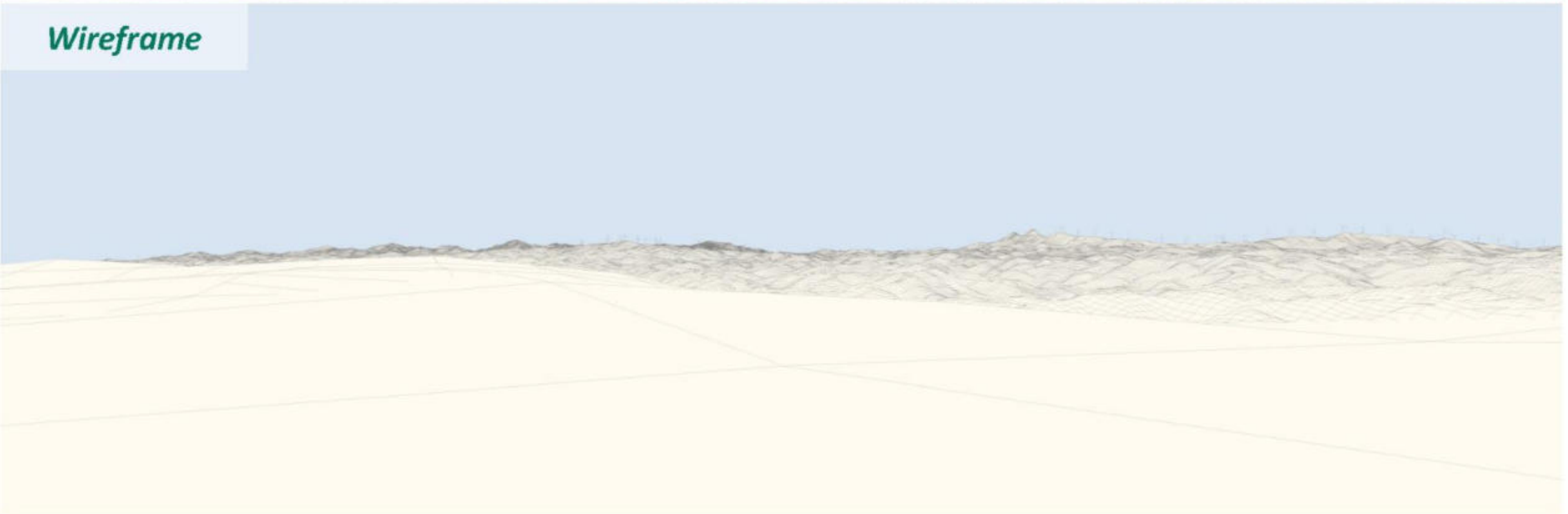
The view is taken near a river where local people spend time after work. The sensitivity level is therefore considered to be Medium.

Turbines are unlikely to be visible from this viewpoint. Hence, a perceptible change to landscape character from the Project is unlikely to occur. The magnitude is therefore considered to be Negligible.

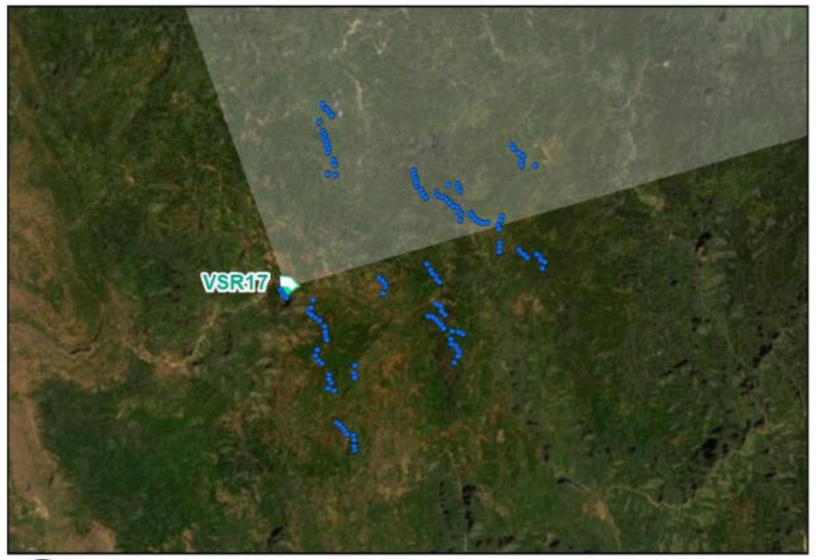
Sensitivity	Magnitude	Significance
Medium	Negligible	**Negligible**

Environmental and Social Impact Assessment – Landscape and Visual Component

Figure 9-30: Photomontage for VSR17 (1)



Coordinate system	**VSR17** (1 of 3)
WGS84-UTM 48N	
X 718596 Y 1698390	**School**



VSR view direction: 27°

WTG nearest 11.5 km
WTG farther 26.3 km
WTGs in the field of view (FoV) 55
WTGs visible only considering terrain surface
⇒ at tip height 49
⇒ at hub height 42

The view is taken from the school in Daktiem village. The sensitivity level is therefore considered to be Medium.

The turbines are visible at a short distance affecting part of the view. The magnitude is therefore considered as Medium-Large.

Sensitivity	Magnitude	Significance
Medium	Medium-Large	Moderate-Major

Environmental and Social Impact Assessment – Landscape and Visual Component

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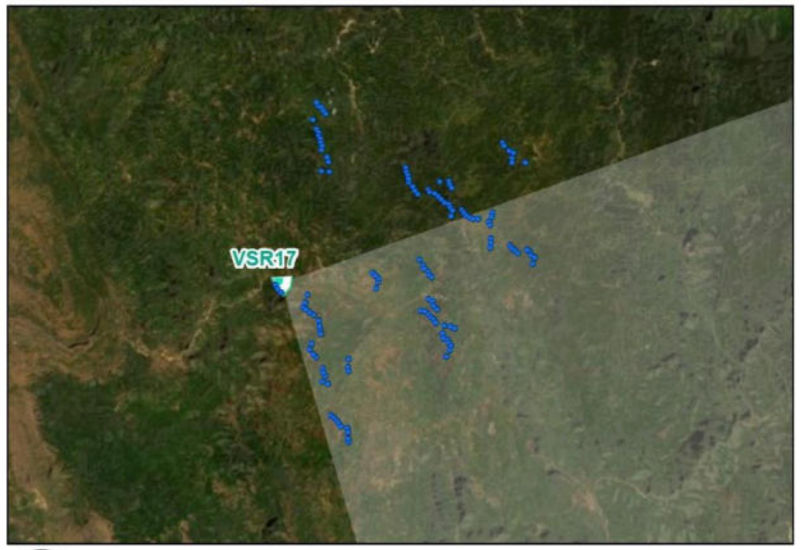
Figure 9-31: Photomontage for VSR17 (2)

Coordinate system WGS84-UTM 48N X 718596 Y 1698390	**VSR17 (2 of 3)** **School**



VSR view direction: 117°

WTG nearest 2.8 km
WTG farther 24.6 km
WTGs in the field of view (FoV) 82
WTGs visible only considering terrain surface
⇒ at tip height 82
⇒ at hub height 73

The view is taken from the school in Daktiem village. The sensitivity level is therefore considered to be Medium.

The turbines are visible at a short distance affecting part of the view. The magnitude is therefore considered as Medium-Large.

Sensitivity	Magnitude	Significance
Medium	Medium-Large	**Moderate-Major**

Environmental and Social Impact Assessment – Landscape and Visual Component

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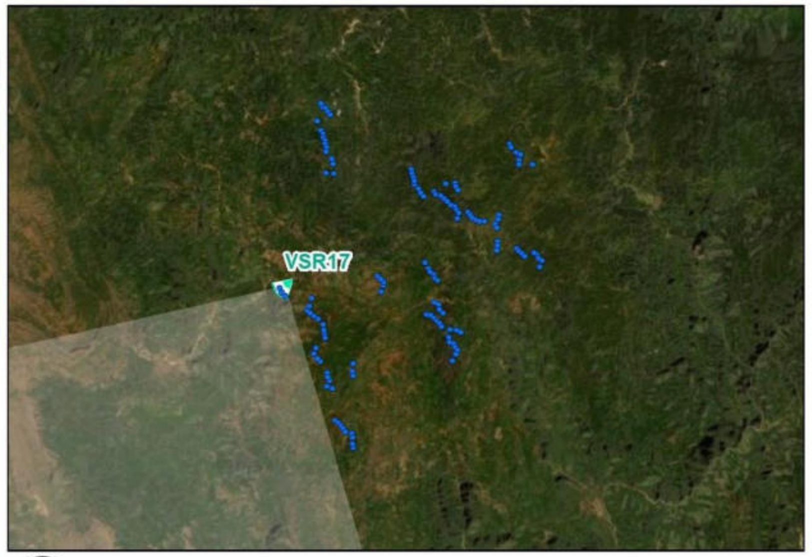
Figure 9-32: Photomontage for VSR17 (3)

Coordinate system
WGS84-UTM 48N
X 718596 Y 1698390

VSR17 (3 of 3)
School



VSR view direction: 228°

WTG nearest 0.5 km
WTG farther 0.9 km
WTGs in the field of view (FoV) 3
WTGs visible only considering terrain surface
⇒ at tip height 3
⇒ at hub height 3

The view is taken from the school in Daktiem village. The sensitivity level is therefore considered to be Medium.

The turbines are visible at a short distance affecting part of the view. The magnitude is therefore considered as Medium-Large.

Sensitivity	Magnitude	Significance
Medium	Medium-Large	Moderate-Major

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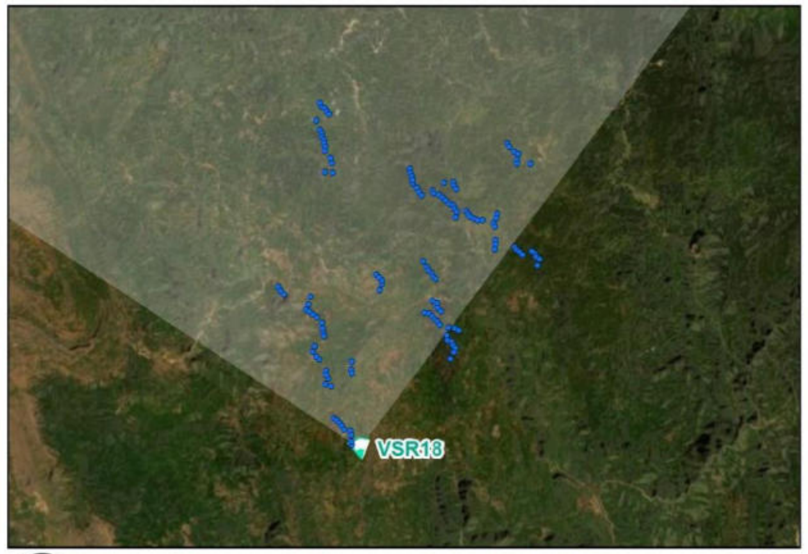
Figure 9-33: Photomontage for VSR18

Coordinate system	**VSR18**
WGS84-UTM 48N	
X 725898 Y 1682732	



VSR view direction: 350°

WTG nearest 1.0 km
WTG farther 33.5 km
WTGs in the field of view (FoV) 114
WTGs visible only considering terrain surface
⇒ at tip height 4
⇒ at hub height 3

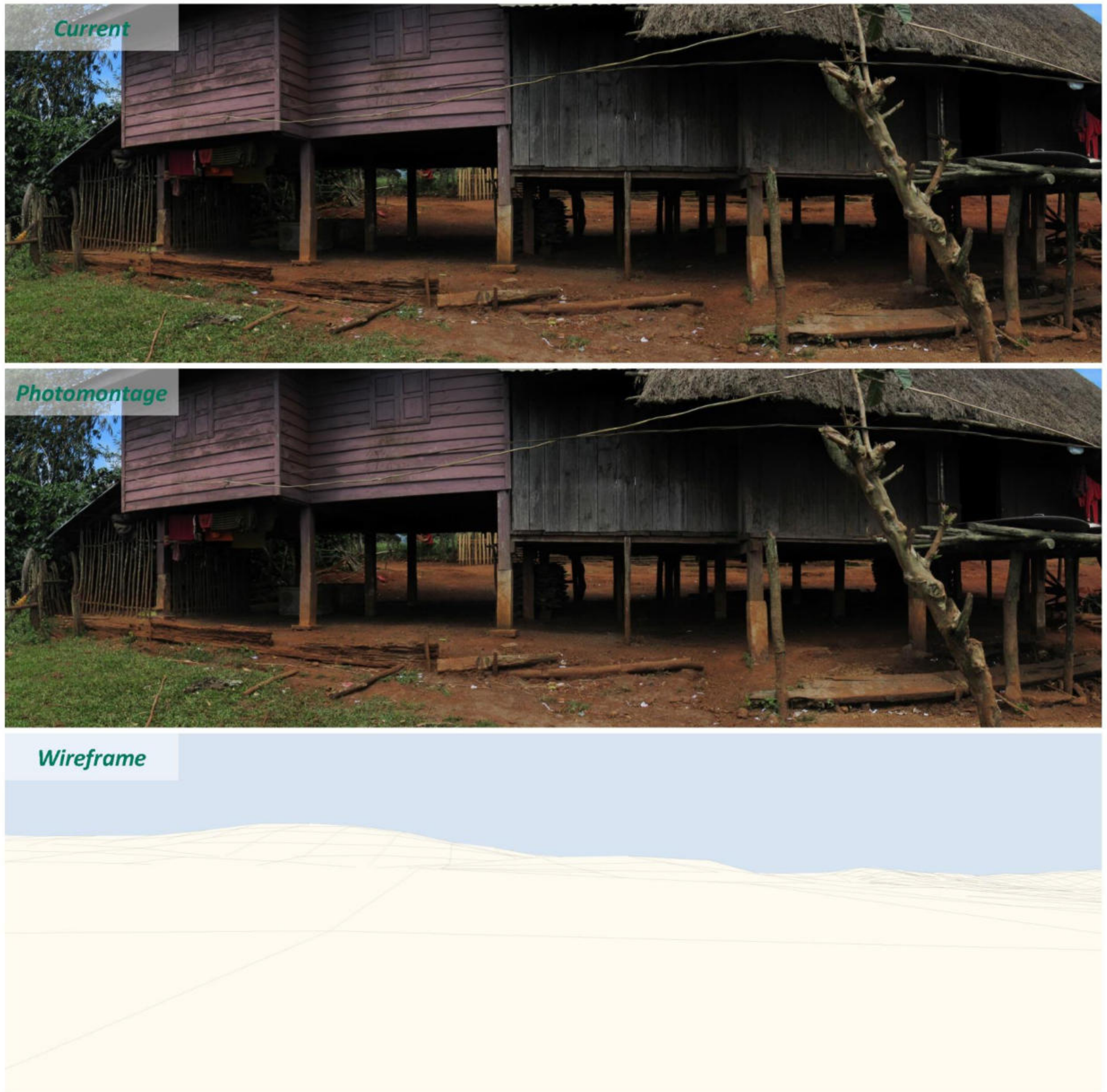
The view is taken along a road near a village. The sensitivity level is therefore considered to be Medium.

The turbines are visible at a short distance affecting part of the view. The magnitude is therefore considered as Medium-Large.

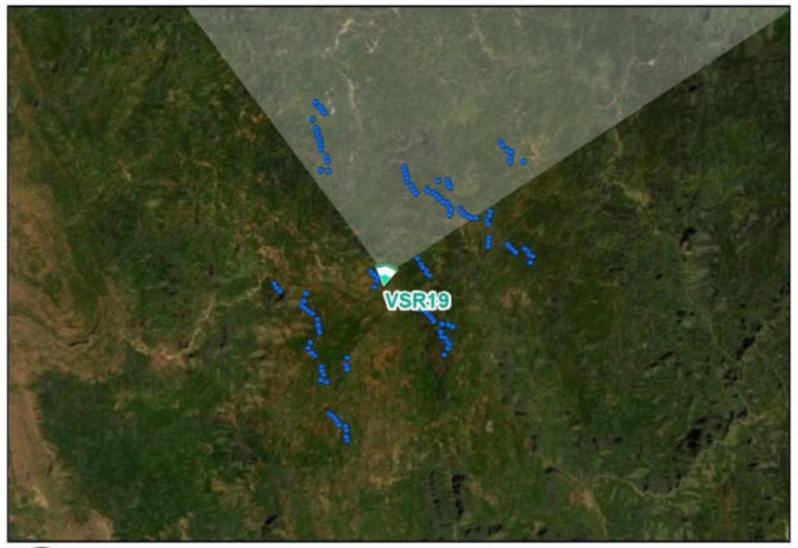
Sensitivity	Magnitude	Significance
Medium	Medium-Large	**Moderate-Major**

Environmental and Social Impact Assessment – Landscape and Visual Component

Figure 9-34: Photomontage for VSR19 (1)



Coordinate system	**VSR19** (1 of 3)
WGS84-UTM 48N	
X 728863 Y 1699044	**Dakyen**



VSR view direction: 10"

WTG nearest 8.4 km
WTG farther 18.2 km
WTGs in the field of view (FoV) 51
WTGs visible only considering terrain surface
⇒ at tip height 3
⇒ at hub height 0

The view is taken in the settlement of Dakyen. The sensitivity level is therefore considered to be Medium.

The closest turbine are visible clearly discernible but partially hidden by the vegetation and affecting part of the view. The magnitude is therefore considered as Medium.

Sensitivity	Magnitude	Significance
Medium	Medium	**Moderate**

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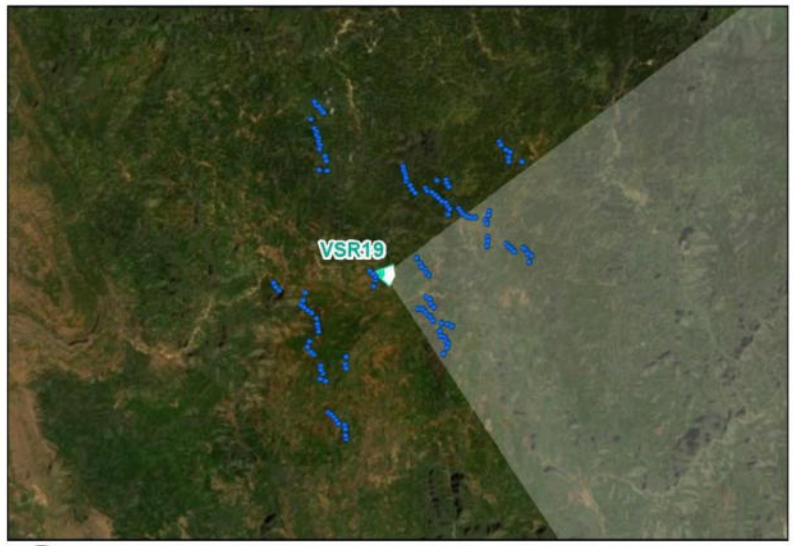
Figure 9-35: Photomontage for VSR19 (2)

Coordinate system	VSR19 (2 of 3)
WGS84-UTM 48N	
X 728863 Y 1699044	Dakyen



VSR view direction: 100"

WTG nearest 3.5 km
WTG farther 14.4 km
WTGs in the field of view (FoV) 46
WTGs visible only considering terrain surface
⇒ at tip height 15
⇒ at hub height 7

The view is taken in the settlement of Dakyen. The sensitivity level is therefore considered to be Medium.

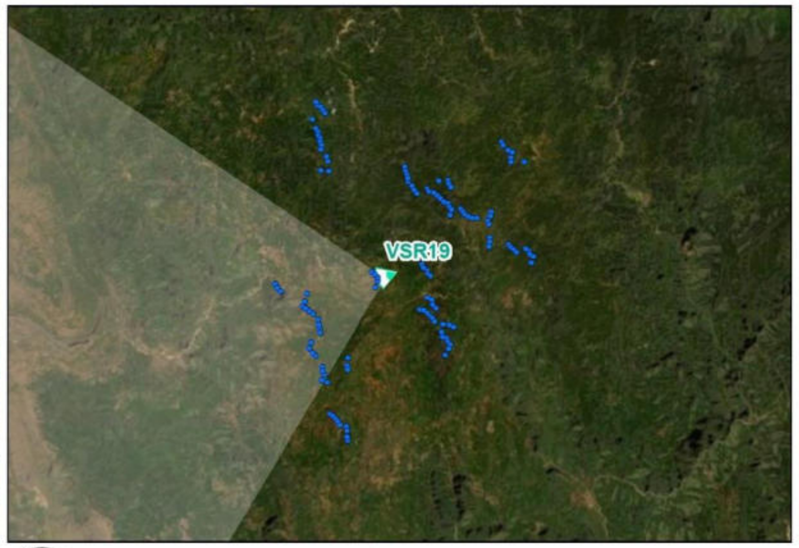
The closest turbine are visible clearly discernible but partially hidden by the vegetation and affecting part of the view. The magnitude is therefore considered as Medium.

Sensitivity	Magnitude	Significance
Medium	Medium	**Moderate**

Environmental and Social Impact Assessment – Landscape and Visual Component ERM

Figure 9-36: Photomontage for VSR19 (3)

Coordinate system	VSR19 (3 of 3)
WGS84-UTM 48N	
X 728863 Y 1699044	Dakyen



VSR view direction: 250"

WTG nearest 0.8 km
WTG farther 11.9 km
WTGs in the field of view (FoV) 30
WTGs visible only considering terrain surface
⇒ at tip height 26
⇒ at hub height 20

The view is taken in the settlement of Dakyen. The sensitivity level is therefore considered to be Medium.

The closest turbine are visible clearly discernible but partially hidden by the vegetation and affecting part of the view. The magnitude is therefore considered as Medium.

Sensitivity	Magnitude	Significance
Medium	Medium	**Moderate**

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9.3.7.3 Additional Mitigation, Management, and Monitoring Measures

Recommended Mitigation Measures – Landscape Value

In order to mitigate the landscape impacts, there are different actions that should be considered, especially during the construction phase, such as:

- Demarcate construction boundaries and minimize areas of surface disturbance;
- Where possible, locate laydown areas and construction camps in areas that are already disturbed or cleared of vegetation;
- For the construction site maintenance, conduct good housekeeping on site to avoid litter and minimize waste;
- Use existing tracks/roads for access, where possible; and
- Within the environmental management system, prepare a restoration management plan including replanting indigenous species, and landscaping and rehabilitating construction yards.

Recommended Mitigation Measures – Visual

The following identifies mitigation measures to be applied for visual impacts, including:

- Where possible, locate laydown areas and construction camps in areas that are already disturbed or cleared of vegetation;
- For the construction site maintenance, conduct good housekeeping on site to avoid litter and minimize waste;
- Minimize night lighting while guaranteeing the minimum safety level;
- Use of materials that will minimize light reflection should be used for all Project components;
- Bright patterns and obvious logos should be avoided on WTG;
- 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; and
- Existing vegetation should be retained to the greatest extent possible. Vegetation should be retained along roads, and other Project infrastructure.

9.3.7.4 Residual Impact Significance

With the implementation of both the embedded control as well as the suggested additional mitigation measures, residual impact significance during construction and operation are expected to be **moderate** for landscape and **negligible** to **moderate** for visual, depending on the receptor (as provided in ***Table 9-34*** and ***Table 9-35*** respectively).

Table 9-34: Landscape Value Impacts (Construction and Operation Phase)

Significance of Impact			
Impact	• Landscape value impacts during construction and operation.		
Impact Nature	**Negative**	Positive	Neutral
	Potential impacts to landscape value would be considered to be negative		
Impact Type	**Direct**	Indirect	Induced

Significance of Impact					
	Impacts to landscape value would be direct impacts site preparation and clearance and presence of WTGs and transmission lines				
Impact Duration	**Temporary**	Short-term	**Long-term**	**Permanent**	
	The construction phase of the Project is expected to be completed in 30 months, which would be considered long-term. Operational impacts are permanent.				
Impact Extent	**Local**	Regional	International		
	The impact will only be localized within the Area of Influence of the Project.				
Impact Scale	Impact scale is considered localized and small.				
Frequency	Impacts could occur during the construction and operation phase.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
	Based on the characteristic above, the impact is likely to be medium.				
Receptor Sensitivity	Low	**Medium**	High		
	The value of the landscape is considered to be Medium.				
Impact Significance	Negligible	Minor	**Moderate**	Major	
	The medium sensitivity and magnitude are assessed as moderate.				
Residual Impact Magnitude	Positive	Negligible	Small	**Medium**	
Residual Magnitude Significance	Negligible	Minor	**Moderate**	Major	
	Upon considering the mitigation measure, the residual impact is assessed to be Moderate.				

Table 9-35: Visual Impacts (Construction and Operation Phase)

Significance of Impact					
Impact	• Visual impacts during construction and operation.				
Impact Nature	**Negative**	Positive	Neutral		
	Potential impacts to visual would be considered to be negative				
Impact Type	**Direct**	Indirect	Induced		
	Impacts to visual would be direct impacts site preparation and clearance and presence of WTGs and transmission lines				
Impact Duration	**Temporary**	Short-term	**Long-term**	**Permanent**	
	The construction phase of the Project is expected to be completed in 30 months, which would be considered long-term. Operational impacts are permanent.				
Impact Extent	**Local**	Regional	International		
	The impact will only be localized within the Area of Influence of the Project.				
Impact Scale	Impact scale is considered localized and small.				
Frequency	Impacts could occur during the construction and operation phase.				
Impact Magnitude	Positive	**Negligible**	**Small**	**Medium**	**Large**
	Based on the characteristic above, the impact is likely to be negligible to Large depending on the receptor				
	Low	**Medium**	High		

Significance of Impact				
Receptor Sensitivity	The receptors are Low to medium sensitivity.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	The moderate to major impacts are for VSR , 7, 17, 18, and 19.			
Residual Impact Magnitude	Positive	Negligible	Small	**Medium**
Residual Magnitude Significance	**Negligible**	**Minor**	**Moderate**	Major
	Upon considering the mitigation measure, the residual impact is assessed to be Moderate, at worst.			

9.3.8 Impacts Associated with Shadow Flicker

Shadow flicker is "*the flickering effect caused when rotating wind turbine blades periodically cast shadows through constrained openings such as the windows of neighboring properties*".[6] Its occurrence in a specific location can be modelled and assessed[7] taking into account the relative positions of the sun throughout the year (dependent on the latitude of the site), the wind turbine layout and orientation, and the presence of sensitive receptors (e.g., inhabitants of residential buildings).

9.3.8.1 Scope of Assessment

The likelihood and duration of the flicker effect depends upon a number of factors, including:

- Direction of the property relative to the turbine;
- Turbine height and rotor diameter;
- Time of day and year;
- Distance from the turbine (the further the observer is from the turbine, the less pronounced the effect will be);
- Wind direction (that affects potential wind turbine orientation); and
- Weather conditions (presence of cloud cover, fog, and humidity reduces the occurrence of shadow flicker as the visibility itself of the turbine is reduced).

In general, shadow flicker occurs during clear sky conditions, when the sun is low on the horizon. As the angle of the sun on the horizon changes throughout the year, the locations experiencing the phenomenon changes, so specific shadow receptors can be affected in different periods.

The theoretical number of hours of shadow flicker experienced annually at a given location can be calculated using modelling packages incorporating the sun path, topographic variation over the wind farm site, and wind turbine details, such as rotor diameter and hub height.

When assessing shadow flicker impacts, the worst case and/or real case impacts are determined by:

- ***Worst Case Scenario***: the astronomical maximum possible shadow flicker duration is defined as the shadow flicker duration which occurs when the sun is always shining during daylight hours

[6] https://www.gov.uk/government/news/wind-turbine-shadow-flicker-study-published

[7] It should be noted that modelling methods tend to be conservative and typically result in an over-estimation of the number of hours of shadow flicker likely to be experienced at the identified receptors.

(i.e., the sky is always clear), the wind turbine is always rotating and the rotor plane is always perpendicular to the line from the WTG to the sun;

- ***Real Case Scenario***: the expected shadow flicker duration is when the average sunshine hour probabilities and wind statistics of the particular region are taken into account.

The following section briefly describes the modelling package used, as well as the input criteria for assessing the shadow flicker throughout the different scenarios identified in the introduction.

Applicable Standards

In August 2015, the World Bank Group published the Environmental, Health and Safety (EHS) Guidelines for Wind Energy. These are technical reference documents containing examples of good industry practice.

The definition adopted in the EHS guidelines states that shadow flicker occurs when the sun passes behind the wind turbine and casts a shadow. As the rotor blades rotate, shadows pass over the same point causing an effect termed shadow flicker. Shadow flicker may become a problem when potentially sensitive receptors (e.g., residential properties, workplaces, learning and/or health care spaces/facilities) are located nearby, or have a specific orientation to the wind energy facility.

Key points identified in the guidelines include:

- Potential shadow flicker issues are more likely at higher latitudes where the sun is lower in the sky and therefore shadows are longer, which extends the radius where potentially significant shadow flicker impact will be experienced.
- If it is not possible to locate the wind turbines where neighboring receptors experience no shadow flicker effects, it is recommended that the predicted duration of shadow flicker effects experienced at a sensitive receptor should not exceed 30 hours per year and 30 minutes per day on the worst affected days, based on a worst-case scenario.
- Recommended prevention and control measures to avoid significant shadow flicker impacts include siting wind turbines appropriately to avoid shadow flicker being experienced or to meet limits placed on the duration of shadow flicker occurrence, as set out in the paragraph above, or programming turbines to shut down at times when shadow flicker limits are exceeded.

Globally, several countries have identified national guidelines to evaluate and assess the potential impacts related to shadow flickering. As the shadow flickering is affected by the angle of the sun at the horizon, it is considered to be more relevant at higher latitudes, leading northern and southern countries to publish specific technical guidelines. In the relatively few cases where the real case impact is regulated, the limit value for dwellings is 8 or 10 hours per year.

Table 9-36 outlines the most relevant guidelines currently in place worldwide and that are able to inform and influence international best practice and standards.

Table 9-36: Relevant National Standards

Country	Reference	Relevant Notes
England	■ Planning for Renewable Energy - A companion guide to PPS22 (Planning policy statement 22) – Office of the Deputy Prime Minister 2004 ■ Onshore Wind Energy Planning Conditions Guidance notes – Renewables Advisory Board and BERR (Business Enterprise and Regulatory Reform) 2007	■ Shadow flicker has been proven to occur only within a distance of 10 rotor diameters from the turbines. ■ Shadow flicker only occurs inside buildings where the flicker appears through a narrow window opening.

Country	Reference	Relevant Notes
	■ UK Government Department for Communities and Local Government (March 2012) ■ National Planning Policy Framework ■ UK Government Department for Communities and Local Government (July 2013) Planning practice guidance for renewable and low carbon energy	
Northern Ireland	■ Best Practice Guidance to Planning Policy Statement 18 'Renewable Energy' – Northern Ireland Department of the Environment 2009	■ Shadow flicker only occurs inside buildings through narrow window openings. ■ The potential for shadow flicker at distances greater than 10 rotor diameters is very low. ■ It is recommended that shadow flicker at neighboring residential buildings and offices should not exceed 30 hours per year.
Ireland	■ Ireland Government Department of Environment (2013) Wind Energy Development ■ Guidelines	■ Shadow flicker only occurs inside buildings through narrow window openings. ■ The potential for shadow flicker at distances greater than 10 rotor diameters is very low. ■ It is recommended that shadow flicker at neighboring residential buildings and offices should not exceed 30 hours per year.
Germany	■ Länderausschuss für Immissionsschutz (2002) Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergieanlagen (WEA-Schattenwurf-Hinweise) (Guideline for Identification and Evaluation of the Optical Emissions of Wind Turbines)	■ Worst case scenario limited to a maximum of 30 hours per year and 30 minutes per day. ■ Real case limited to 8 hours per day (a limitation driven by sensor equipment and if worst case limit would be exceeded). ■
Australia	■ Environment Protection and Heritage Council (EPHC) (2010) National Wind Farm Development Guidelines	■ Worst case: 30 hours/year. ■ No daily limit. ■ Real case: 10 hours/year (only required if worst case exceeds 30 hours/year).
Canada	■ Natural Forces Wind Inc (June 2013) Gaetz Brook Wind Farm Shadow Flicker Assessment Report	■ Worst case: 30 hours/year and 30 min/day.
USA	■ National Association of Regulatory Utility Commissioners (NARUC) Grants & Research Department (January 2012) Wind Energy & Wind Park Siting and Zoning Best Practices and Guidance for States	■ Worst case: 30 hours/year and 30 min/day.
Denmark	■ Danish Government – Miljøministeriet Naturstyrelsen (2015) Vejledning om planlægning for og tilladelse til opstilling af vindmøller, 19-20	■ Real case: 10 hours/year
Netherlands	■ Nederlandse overheid – Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (2017)	■ Wind turbines shall be equipped with an automatic shadow flicker control system, which stalls the turbine if shadow flicker occurs at sensitive receptors and the distance

Country	Reference	Relevant Notes
	Regeling algemene regels voor inrichtingen milieubeheer, Art. 3.12	between the turbine and the sensitive receptor is less than 12 times the rotor diameter and if on average the shadow flicker occurs more than 17 days per year for more than 20 minutes per day. ■ Receptors like office buildings are not mapped as sensitive receptors.

Currently, **Laos has not defined national legislation or guidelines to assess shadow flickering** and there are no international guidelines on standards to be followed for the real case scenario. Among the above mentioned national standards, there are a few differences in the exact implementation of the shadow flicker regulation. Some countries and jurisdictions only consider the worst case scenario, relatively few countries also consider the real case impact.

The table shows that not all countries have guidelines or regulations for assessing and limiting shadow flicker impacts. In countries lacking regulations for shadow flicker, the German guideline is often applied as best practice.

As per this consideration, this study considered the IFC guidelines as a reference, integrating the results with a real case scenario modeling in order to assess the effect raised by the inclusion of more local conditions. Based on the analysis of the different national standards, it is proposed to take into consideration the most conservative ones that place the annual limits at 8 or 10 hours (Germany, Australia, and Denmark).

Receptors

Some internationally adopted reference standards (A.D. Clarke 1991)[8] exclude the occurrence of flickering shadows beyond a distance of 10 times the rotor size (in this case 1,710m).

This approach has been criticized recently in 2017 by ClimateXChange (Scotland's centre of expertise connecting climate change research and policy) and LUC (landuse.co.uk), and suggested that the Scottish guidance should not include a reference to 10 times the rotor diameter.

Considering the receptor distribution and the characteristics of the local landscape, in order to apply a more conservative approach, it was assumed to consider a 2 km study area to map the receptors, beyond the more standard approach suggested by A.D. Clarke.

A total of 2,513 potential shadow flicker receptors (***Figure 9-37***) were identified in a desktop study using topographical maps, aerial photographs, and on site field visits. The project is located in a forested area (***Figure 9-38***).

There are sparsely populated settlements or small communities, where the land is mainly dedicated to agricultural activities. The largest residential area is Dak Chueng in the North East area.

[8] Clarke A.D. 1991: A case of shadow flicker / flashing: assessment and solution. Techno Policy Group, Open University. Milton Keynes, UK