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PODGORICA

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STUDY

on Environmental Impact Assessment of Gvozd Wind Plant in the Municipality of Nikšić

Executive Director

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Podgorica, January 2022

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C o n t e n t

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Introduction

The Spatial Plan of Montenegro defines the incitement of the use of renewable energy sources: hydro potential, solar energy, wind and biomass, wherever acceptable in terms of energy, economy and space. Therefore, it is necessary to promote an appropriate combination of energy production methods, which should be chosen based on the principles of sustainable development, giving priority to energy from renewable sources.
Montenegro's international obligations regarding renewable energy sources are:

- Directive 2003/30 / EC (8 May 2003) on promoting biofuels and other renewable fuels for transport.
- Directive 2009/28 / EC (23 April 2009) on promoting energy from renewable energy sources, which complements Directive 2001/77 / EC and Directive 2003/30 / EC. On 18 October 2021, Montenegro committed to the said directives within the EnCT at the 10th Ministerial Meeting of the Energy Community (Budva). Under this Directive, a national target for energy from renewable sources has been defined, which recommends using energy from these sources by 2020 in the amount of 33%.

The Municipality of Nikšić has natural potential that could be used for energy production at the local level. This potential includes solar power, hydropower, the sustainable use of wood biomass, and the possibility of using residues from agriculture, livestock and waste. Wind power is significant, but its considerable use as an energy source is limited by low power concentration per unit area, frequent changes in direction, speed and strength, as well as changes in air temperature and composition. Plants that use wind energy are primarily a substitute for other fuel types, i.e. they do not represent a reliable force in the system. Based on the data from the meteorological stations, possible locations for wind energy use are the areas around Nikšić (Ilino brdo, Vučje, etc.), the southwestern region, the mountain range, and the passes above the sea and the coastal zone. It is assumed that the wind energy potential of 1-2 MWh/m2 per year is very favorable in these areas. According to the estimates and studies, apart from the coastal zone, significant wind potential is present in the hills around Nikšić. This area is characterized by an average wind speed of 5.5-6.5 m/s. Additionally, the existing road and electricity network infrastructure provide a sound basis for developing projects on wind power.
The planning basis for the construction of Wind Power Plant Gvozd in the Municipality of Nikšić is provided by the SUP Nikšić and the Local Study for the Location 'Gvozd', Nikšić (handler: the Agency for Design and Planning, Nikšić, 2018).
The importance of building a wind power plant and its well-being for the community can be expressed through the following parameters:

- economic development, technological development,
- diversification of production and security of electricity supply,
- increase in domestic production and reduction in energy imports,
- export of produced electricity after construction of SS (400) / 110/35 kV Brezna (Phase 2),
- no feed-in tariffs,
- reduction of CO2 emissions,
- employment of local contractors for the construction of the wind power plant,

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- employment of local population for the construction and maintenance of the wind power plant,
- improvement of local infrastructure,
- land lease fee,
- educational visits and organized school visits.

1. General information

Information on the project leader

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Contact person:	Julija Prelević Tel.: 069/069-026 e-mail.: ralexrrb@t-com.me Svetozara Markovića br. 3, Podgorica

Main project information

Title:	**Wind Power Plant Gvozd**
Location:	Local Study for the Location 'Gvozd', Nikšić

Information on the organization and persons who participated in the development of the Study

Handler:	Institute for Development and Research in the Field of Safety, Podgorica
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2. Location description

The subject of this Study on Environmental Impact Assessment is the construction of the Wind Power Plant Gvozd within the scope of the Local Study for the Location 'Gvozd', Nikšić.
The project covers parts of the cadastral municipalities of Gradačka Poljana, Ćeranića Gora, Konjsko, Lukovo, Rubeža and Nikšić.

Figure 2.1. Area covered by the Local Study for the Location 'Gvozd'

Within the space shown in the picture, the construction of a new Gvozd WPP is planned in the area of Krnovo, south of the constructed wind turbines of Krnovo WPP, at the following locations:

- Obešenjak,
- Oštrajca,
- Jeinjak,
- Grakala and
- Vlaško brdo.

In the vicinity of the project is the previously constructed Krnovo Wind Power Plant (shown in Figure 2.2.).

An overview of the placed wind generators (marked in black) with the newly planned ones (marked in red) is given in the following figure.

Figure 2.2. Topographic position of planned wind turbines (marked in red)

The nearest inhabited place within the area of Gvozd WPP is the village of Gvozd, which is located on the south side of the Municipality of Šavnik, approximately 9 km north of the area of Gvozd WPP. In comparison, Nikšić is about 12 km southwest of the scope.
The project area consists of the wider northern part, where the planned wind turbines, substations and transmission lines are located, and the southern part that includes the transmission line corridor.

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The plan is the construction of 16 new wind turbines, underground and overhead lines connecting them with the planned and existing substation, reconstruction of existing and construction of new roads within the northern part of the area that predominantly consists of agricultural land, forests and other natural areas.

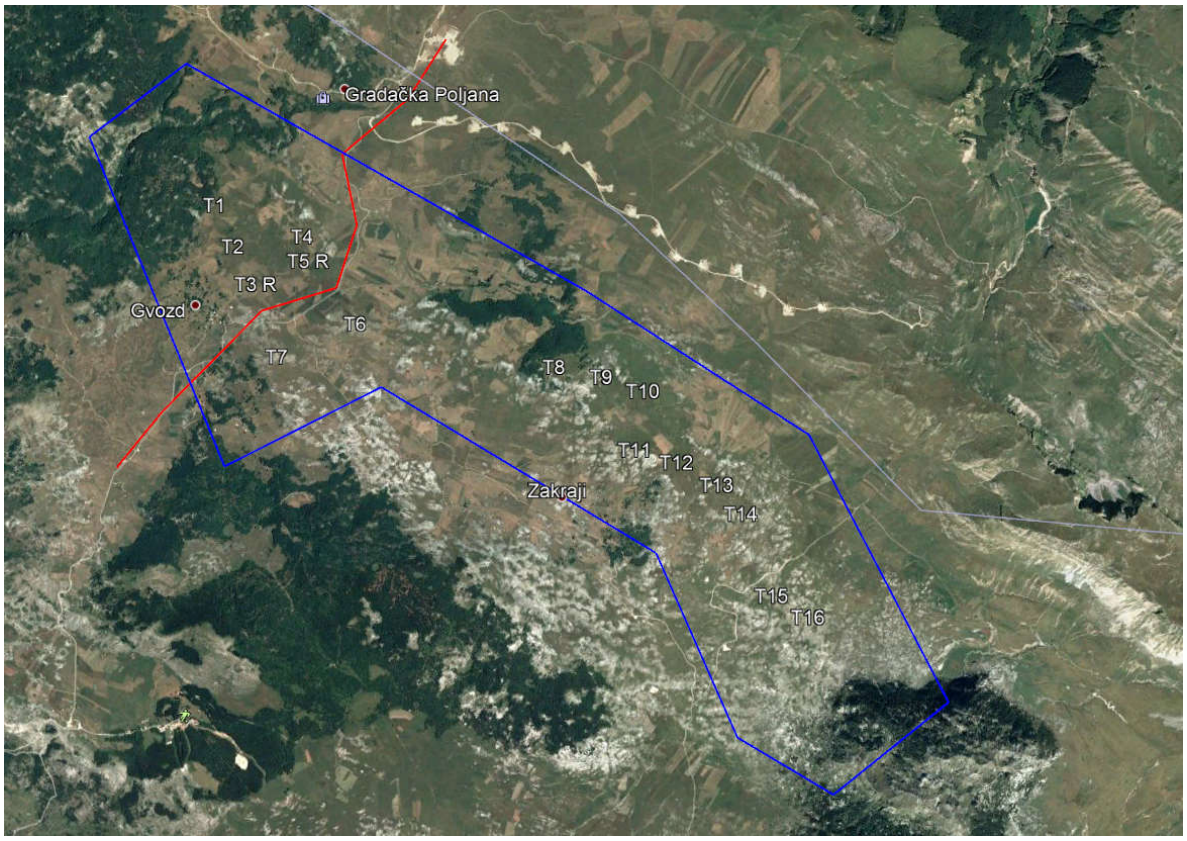

Figure 2.3. Situation of Gvozd WPP on orthophoto map (T1-T16)

The construction of wind turbines is planned at two locations – the northwestern one, which includes the area between Gvozd and Obesenjak (UP1, UP2, UP3, UP4, UP5), and the southeastern/eastern one, which consists of the localities of Ostrajac, Jeinjak, Grakala and Vlaško brdo (UP 7-UP17). The old asphalt road Nikšić - Šavnik passes between these two areas, along which it is planned to build a 33 kV/110 kV (UP6) substation.

The construction of internal underground and overhead cable distribution of voltage level 33kV are planned within the wind power plant area, whose purpose is to connect individual wind turbines with the substation SS Gvozd within the location, as well as the 110kV transmission line to the substation "Nikšić" and SS Krnovo. In addition, the plan is to construct access roads to wind turbine locations and build infrastructure for the installation of individual wind turbines.

Table 2.1. Positions of planned wind turbines of Gvozd WPP

No.	Municipality	Cadastral municipality	Wind turbine code	Y (m)	X (m)
				Gauss-Krigerov coordinate system	

1	Nikšić	Gradačka poljana	T1	6 587 981	4 747 941
2	Nikšić	Gradačka poljana	T2	6 588 158	4 747 580
3	Nikšić	Gradačka poljana	T3	6 588 368	4 747 254
4	Nikšić	Gradačka poljana	T4	6 588 775	4 747 692
5	Nikšić	Gradačka poljana	T5	6 589 015	4 747 589
6	Nikšić	Ćeranića Gora	T6	6 589 279	4 746 932
7	Nikšić	Ćeranića Gora	T7	6 588 589	4 746 613
8	Nikšić	Ćeranića Gora	T8	6 591 071	4 746 608
9	Nikšić	Ćeranića Gora	T9	6 591 490	4 746 533
10	Nikšić	Ćeranića Gora	T10	6 591 863	4 746 424
11	Nikšić	Ćeranića Gora	T11	6 591 813	4 745 905
12	Nikšić	Ćeranića Gora	T12	6 592 183	4 745 809
13	Nikšić	Ćeranića Gora	T13	6 592 544	4 745 625
14	Nikšić	Ćeranića Gora	T14	6 592 765	4 745 380
15	Nikšić	Konjsko	T15	6 593 059	4 744 674
16	Nikšić	Konjsko	T16	6 593 383	4 744 502

The terrain is mountainous, with complex configurations, and the space is sparsely populated.
The planned wind power plant area includes the area of the mountain plateau with elevations. The land is mainly covered with pastures and forests, or it is barren, while meadows and fields with crops are rare. Part of the plan document, which represents the planned transmission line corridor, includes parts of Gvozd, Ivanje, Lukovo and Nikšić (Rubeža).
There are no permanent housing facilities in the planned wind power plant area, but there are facilities used for seasonal housing along with several shepherd's cabins made chiefly of wood, with low stone walls.
The coordinates of the existing facilities, with the shortest distances from the planned wind turbines, are shown in the following table.

Table 2.2. Positions of the existing facilities and the shortest distance from planned wind turbines

No.	Object	Coordinates		Distance to the nearest turbine (m)
		X	Y	
1	D1	6588052.0	4747032.0	386.2
2	D2	6588849.0	4748087.0	401.9
3	D3	6589463.0	4747832.0	509.7
4	D4	6589585.0	4747500.0	576.9
5	D5	6589528.0	4747199.0	365.1
6	D6	6589546.0	4746998.0	275.0
7	D7	6589125.0	4746715.0	266.1
8	D8	6588437.0	4746351.0	302.9
9	D9	6590067.0	4746232.0	1054.0
10	D10	6591894.0	4746880.0	457.1
11	D11	6592955.0	4745899.0	494.0
12	D12	6593680.0	4744938.0	527.5

According to the existing way of use, the immediate environment is a terrain of the same or similar characteristics, with slightly more residential facilities southwest of the planned area, in the estate of Gvozd.

The main road, M-4.1 Jasenovo Polje - Kruševice - Šavnik – Žabljak, passes through the peripheral part of the planning area on the northwest side. In contrast, the regional road R-11, re-categorized to local road, passes through the central part.
The planned substation SS 33/110 kV Gvozd is located about 650 m east-southeast of the area of Gvozd (the Municipality of Nikšić), on the right side of the main road Nikšić-Šavnik if looked in the direction of Šavnik. The object is located within CM Ćeranića Gora and covers an area of 7663m2.
The existing terrain for building the substation is not used for agricultural purposes, and it is almost flat, except in the southern part, where there is a slight elevation. Therefore, the location is not subject to water collection or retention. The plateau of the substation itself will be aligned in terms of elevation with the existing asphalt road Nikšić-Šavnik and the new planned road infrastructure of Gvozd WPP.

Figure 2.3. The location of the proposed SS 33/110 kV Gvozd, view from the old main road Nikšić-Šavnik

Route TL 110 kV Gvozd - Nikšić

In this section, the route crosses meadows and hilly terrain overgrown with forest, low vegetation and thickets. In this area, the route also crosses the asphalt road Nikšić-Šavnik.

TL 2x110 kV SS Gvozd - SS Krnovo

From SS Gvozd to SS Krnovo, the route crosses arable land, meadows and pastures.
In this section, the route crosses the asphalt road Krnovo-Gvozd-Lukovo-Nikšić, vehicular passage, SN and NN lines.

2.2. Data on the required land area

The area covered by the plan document (Local Study for the Location 'Gvozd', Nikšić) is 2028.07ha, of which 1963.77ha is within the cadastral municipalities of Gradačka Poljana, Ćeranića Gora and Konjsko, where the planned wind turbines and access roads are

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located, while the remaining 64,30ha belongs to the transmission line corridor through the cadastral municipalities of Lukovo, Rubeža and Nikšić.
The land area required for the implementation of the Gvozd Wind Power Plant project is shown in the following table:

Table 2.3. Area needed for project implementation

No.	Municipality	Cadastral municipality	Area	AREA REQUIRED FOR PROJECT IMPLEMENTATION [m^2]							
				(1) Road infrastructure, wind turbine assembly plateaus, wind turbine foundation, underground medium voltage and optical cable	(2) Substation Gvozd	(3) Substation Krnovo - reconstruction	(4) Transmission line 2x110 kV Gvozd-Krnovo	(5) Transmission line 110 kV Gvozd-Nikšić	(6) Transmission lines 35 kV	TOTAL are for construction (1+2+3+4+5+6)	TOTAL area by cadastral municipalities
1	NIKŠIĆ	Gradačka poljana	A	85,099.49	0.00	0.00	0.00	0.00	0.00	85,099.49	111,006.50
2	NIKŠIĆ	Gradačka poljana	B	343.26	0.00	0.00	0.00	0.00	0.00	343.26	
3	NIKŠIĆ	Gradačka poljana	E	4,921.15	0.00	0.00	0.00	0.00	0.00	4,921.15	
4	NIKŠIĆ	Gradačka poljana	I	0.00	0.00	0.00	13,790.00	0.00	0.00	13,790.00	
5	NIKŠIĆ	Gradačka poljana	J	0.00	0.00	0.00	0.00	6,852.60	0.00	6,852.60	
6	NIKŠIĆ	Ćeranića Gora	B	45,525.04	0.00	0.00	0.00	0.00	0.00	45,525.04	325,300.81
7	NIKŠIĆ	Ćeranića Gora	C	0.00	7,671.67	0.00	0.00	0.00	0.00	7,671.67	
8	NIKŠIĆ	Ćeranića Gora	D	205,187.85	0.00	0.00	0.00	0.00	0.00	205,187.85	
9	NIKŠIĆ	Ćeranića Gora	F	0.00	0.00	2,850.25	0.00	0.00	0.00	2,850.25	
10	NIKŠIĆ	Ćeranića Gora	G	0.00	0.00	0.00	0.00	0.00	5,718.60	5,718.60	

No.	Municipality	Cadastral municipality	Area	AREA REQUIRED FOR PROJECT IMPLEMENTATION [m^2]							
				(1) Road infrastructure, wind turbine assembly plateaus, wind turbine foundation, underground medium voltage and optical cable	(2) Substation Gvozd	(3) Substation Krnovo - reconstruction	(4) Transmission line 2x110 kV Gvozd-Krnovo	(5) Transmission line 110 kV Gvozd-Nikšić	(6) Transmission lines 35 kV	TOTAL are for construction (1+2+3+4+5+6)	TOTAL area by cadastral municipalities
11	NIKŠIĆ	Ćeranića Gora	H	0.00	0.00	0.00	0.00	0.00	34,220.00	34,220.00	
12	NIKŠIĆ	Ćeranića Gora	I	0.00	0.00	0.00	15,381.40	0.00	0.00	15,381.40	
13	NIKŠIĆ	Ćeranića Gora	J	0.00	0.00	0.00	0.00	8,746.00	0.00	8,746.00	
14	NIKŠIĆ	Konjsko	D	49,525.85	0.00	0.00	0.00	0.00	0.00	49,525.85	52,482.85
15	NIKŠIĆ	Konjsko	G	0.00	0.00	0.00	0.00	0.00	2,957.00	2,957.00	
16	NIKŠIĆ	Lukovo	J	0.00	0.00	0.00	0.00	64,239.40	0.00	64,239.40	64,239.40
17	NIKŠIĆ	Rubeža	J	0.00	0.00	0.00	0.00	65,227.60	0.00	65,227.60	65,227.60
18	NIKŠIĆ	Nikšić	J	0.00	0.00	0.00	0.00	1,908.60	0.00	1,908.60	1,908.60
TOTAL AREA by objects				**390,602.64**	**7,671.67**	**2,850.25**	**29,171.40**	**146,974.20**	**42,895.60**	**620,165.76**	**620,165.76**

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2.3. Review of pedological characteristics of the terrain

The whole project area contains shallow Rendzina soil, formed from carbonate material, and the forestial, medium-deep, brown acidic soil on flysch.

2.4. Flora, fauna and protected natural goods[1]

2.4.1 Flora

Plant communities on the broader area are formed according to climatic and edaphic conditions.
In this part of the Study, we will pay more attention to those plant species that are of the most significant importance.
Of the herbaceous species - the most important and most attractive is the edelweiss (*Leontopodium nivale subsp. Alpinum Basionym Leontopodium alpinum*), which is protected by law. This species could be found on the slopes of Lojanika, Žuta greda (Bošnjak) and Ranisava (Knap). Edelweiss is a real mountain trophy, meaning its survival is endangered within the already small areas.
Narcissus (*Narcissus poeticus*) is also called daffodil or jonquil. Its pleasantly intoxicating scent dominates the areas of high mountain pastures and meadows in May and June, i.e., after the snow melts.
There are also many species of mushrooms and medicinal plants in the wider area. Blueberry (*Vaccinium myrtillus*) is an indicator of acidic soils. It inhabits glades in beech and fir forests and higher positions in the community with species from the grass family, which make up high-mountain meadows and pastures.
Alpine meadows and pastures are overgrown with plant communities from the Graminea family, where the most common species are chervil, barrenwort, matgrass (*nardus - stricta*). Pastures occur mainly above the forest belt and at the highest altitudes. They are, in principle, degraded forest lands created by clearing natural forest vegetation. Pastures and meadows represent the potential for livestock development (the area of Krnovo).

Habitats[2]

A large part of the Krnovo field is located under the uniform vegetation of mesophilic meadows (*Molino-Arrhennantheretea class*), i.e. semi-natural grasslands, which are mostly mowed and less often used for cattle grazing. The community is dominated by the type of grass called *Agrostis tenuis*. Species like *Achillea millefolium*, *Galium verum*, *Hypericum perforatum*, *Rhinanthus spp. Trifolium repens*, *Hypochoeris illyrica, Cirsum sp.*, *Leucanthemum vulgare*, *Lotus corniculatus*, *Campanula patula*, *Asperula longiflora*, *Anthyllis vulneraria*, *Hieracium bauchinii*, *Trifolium montanum*, *Filipendula hexapetala*,

[1] Strategic Environmental Assessment Report for SUP Šavnik 2011-2020, November 2012, IBI-CAU
[2] Excerpt from the Study on Environmental Impact Assessment of the Krnovo Wind Power Plant, August 2012.

Scarzonera rosea, *Scorzonera myrtillus*, *Hieracium pillosela*, *Primula elatior*, *Scrophularia bosniaca*, *Geranium macrorhizum*, etc. are also located in the area.
A tiny percentage of the land is cultivated and planted with potatoes or oats. Grassy areas in the plateau's edge are bordered by beech or shrubbery, and only on rare elevations are they interrupted by rocky pastures. The existing anthropogenic impacts are reduced to a small number of households, land cultivation, and livestock breeding and do not significantly impact habitats. The following plant species protected by national legislation have been recorded in the area: *Scrophularia bosniaca* – as a part of the rocky vegetation, a small population (N42° 53' 26,7" E 19° 05" 53, 2"); *Viola orphanidis* subsp. nicolai — part of the vegetation of mesophilic meadows, present in numerous populations (N42° 53' 28" E 19° 05" 54"); *Orchis militaris* - only one flowering specimen was recorded within the vegetation of rocky pastures (N42° 53' 27" E 19° 05" 53").
The loss of land for the construction of wind power plants and access roads will not endanger the survival of the populations of these plant species, nor will it have a significant negative impact on the flora and vegetation of the Krnovo area.

2.4.2. Fauna

The existence of numerous animal species is conditioned by the specifics of their living conditions, formed under the influence of climatic, relief, hydrographic and edaphic conditions.
For the small and large game, it could be said they are of indigenous origin.
Due to the diversity of habitats, many different species of animals of almost all taxonomic groups are present in the project area.
The species of mammals, including carnivores (Carnivora), ruminants (Artiodactyla) and rabbits (Erinaceomorpha) are listed below.
Brown bear (*Ursus arctos*) – the brown bear was registered in Gvozd during the implementation of national monitoring by the Environmental Protection Agency of Montenegro in 2011. The Agency's Report states that the central part of Vojnik, the slope of Vojnik – village of Brezna, the village of Mokro, Krnovska glavica, Surdup canyon, the village of Bijela, Lola and Moračke planine, may be one of the most important habitats of brown bears (source: Environmental Protection Agency, Information on the state of the environment for 2011).
Wolf (*Canis lupus*) – is found everywhere where it finds food and not far from permanent or occasional settlements.
Fox (*Vulpes vulpes*) – inhabits a large area. It is interesting for hunting, both as a pest and in terms of the value of its fur.
Roe deer (*Capreolus capreolus*) – roe deer habitats are mainly beech forests: Bukovička gora, Gora Šušića, Semolj, Biovska gora, Bolj, Dragišnica and Treskovlje.
Wild boar (*Sus scrofa*) - the habitat of this species is much narrower. It refers to lower areas: Vojnik and the forested area around the village of Mokro (Lazi, Tunjemir and Manastirska gora).
Chamois (*Rupicapra rupicapra*) – is the most attractive hunting species and a visual challenge for any nature lover. Its habitats are: Vojnik, Komarnica Canyon, Boljske grede, Lojanik, Sedlene grede, Ranisava.

Rabbit (*Lepus europaeus*) – inhabits a broader area of the Municipality. It can be found over 1,500m above sea level.

2.4.2.1. Bird fauna

The research of birds was performed in the potential Gvozd Power Plant area (to determine the state of ornithofauna, quantitative and qualitative monitoring) between August 2015 and July 2016.
The research aimed to determine the state of orthofauna populations in the project area, which includes the use of thorough methodological field research, namely: migratory species (spring and autumn migratory species), species with nesting status, rare and endangered species and predators. Based on the data obtained from the research, an opinion will be given on the possible impact on ornithofauna i.e. on certain species and their activities (daily raising of predators, species concentration, flight dynamics, nesting, etc.) recorded during field research.
The Report contains graphic and numerical representations, narrative comments of researchers, contributions, and an overview of the results of one-year-long research on ornithofauna between August 2015 and July 2016, which include:

- Favorable point (FP) research during this period, particularly focused on registering the presence of bird species known to be affected by collisions with wind turbine rotors, as well as the use of potential wind power plant area by these species;
- Presence and distribution of nesting birds (May and June 2016);
- Presence and distribution of quail nesting birds (*Coturnix coturnix*) (June 2016);
- Presence and research of predators (all year round);
- The research on owls (October-November 2015 and March-April 2016) to determine their presence in the project area;
- Presence of other bird species during the non-nesting period/migration period (July 2015 - April 2016) in the project area.

The comparison of the findings of the investigated (project) area and the selected control area did not show a significant difference in the number of birds. Therefore, the research results from favorable points for migratory bird species could represent this area.
There is an indication that the spring and autumn migratory species that are considered endangered by impact with wind turbines are low, especially when it comes to predators. The hen harrier (*Circus cyaneus*) appears in low frequency and in smaller numbers, while being the only primary target species with the status of wintering bird in the study area.
Secondary targets with a low-frequency trend and relatively low numbers include the following species: western marsh harrier *(Circus aeruginosus)*, montagu's harrier (*Circus pygargus*), hobby (*Falco subbuteo*) and pern (*Pernis apivorus*). There is no record of parameters that indicate that the risk of collisions is higher during the spring compared to the autumn migration.
The collision risk model indicates a low annual collision risk for all species recorded during the research. However, with regard to migratory species, there are no measures to mitigate the potential impact on them, and future monitoring is considered necessary.

Research on owls

Target owl species that could potentially be present in the project area include the following species: eagle-owl (*Bubo bubo*); little owl (*Athena noctua*); tawny owl (*Strix aluco*); ural owl (*Strix uralensis*) and the long-eared owl (*Asio otus*). Compared to the primary target species, the secondary target species include those with a lower risk of collision with wind turbines such as herons and/or predators and wetland birds, which are less important for protection. During the research done in the project area, the presence of three species of owls was confirmed by qualitative and quantitative monitoring: tawny owl (*Strix aluco*), eagle-owl (*Bubo bubo*) and scops owl (*Otus scops*).

Research on nesting birds

The nesting bird community in the research area is typical for meadow habitats at higher altitudes with smaller forest areas.

Target species and secondary target species of nesting birds registered by research in the area of the Gvozd wind power plant are goshawk (*Accipiter gentilis*), sparrowhawk (*Accipiter nisus*), golden eagle (*Aquila chrysaetos*), buzzard (*Buteo buteo*), long-legged buzzard (Buteo rufinus), marsh harrier (*Circus aeruginosus*), montagu's harrier (*Circus pygargus*), short-toed snake eagle (*Circaetus gallicus*), raven (*Corvus corax*), hobby (*Falco subbuteo*), common kestrel (*Falco tinnunculus*), honey buzzard (*Pernis apivorus*).

The nesting of three species of predators in the area of the wind power plant has been recorded. The most numerous are the common kestrel (*Falco tinnunculus*), the buzzard (*Buteo buteo*) and the sparrowhawk (*Accipiter nisus*).

Bird species important for protection include all species categorized as near endangered (Near Threatened - NT) and endangered (Endangered - E) in the European Red List of Birds (BirdLife International, 2015). The list of all recorded bird species in the wind power plant area is shown in the following table:

Coturnix coturnix	Least concern (LC)	resident/migratory
Alectoris graeca	Near Threatened (NT)	resident
Bonasa bonasia	Least concern (LC)	resident
Pernis apivorus	Least concern (LC)	resident/migratory
Circaetus gallicus	Least concern (LC)	resident/migratory
Aquila chrysaetos	Least concern (LC)	resident
Circus cyaneus	Near Threatened (NT)	migratory
Circus pygargus	Least concern (LC)	migratory
Circus aeruginosus	Least concern (LC)	migratory
Accipiter gentilis	Least concern (LC)	resident
Accipiter nisus	Least concern (LC)	resident
Buteo buteo	Least concern (LC)	resident
Buteo rufinus	Least concern (LC)	migratory
Falco subbuteo	Least concern (LC)	migratory
Falco tinnunculus	Least concern (LC)	resident

Columba palumbus	Least concern (LC)	resident
Streptopelia turtur	Endangered (E)	migratory
Cuculus canorus	Least concern (LC)	resident/migratory
Athene noctua	Least concern (LC)	resident
Otus scops	Least concern (LC)	resident/migratory
Bubo bubo	Least concern (LC)	resident
Strix aluco	Least concern (LC)	resident
Caprimulgus europaeus	Least concern (LC)	resident/migratory
Apus apus	Least concern (LC)	migratory
Merops apiaster	Least concern (LC)	migratory
Upupa epops	Least concern (LC)	resident/migratory
Dendrocopos major	Least concern (LC)	resident
Dendrocopos minor	Least concern (LC)	resident
Dryocopus martius	Least concern (LC)	resident
Jynx torquilla	Least concern (LC)	resident/migratory
Lanius minor	Least concern (LC)	migratory
Lanius collurio	Least concern (LC)	resident/migratory
Lanius excubitor	Endangered (E)	wintering
Pyrrhocorax graculus	Least concern (LC)	resident
Garrulus glandarius	Least concern (LC)	resident
Corvus corone/cornix	Least concern (LC)	resident
Corvus corax	Least concern (LC)	resident
Parus caeruleus	Least concern (LC)	resident
Parus major	Least concern (LC)	resident
Parus palustris	Least concern (LC)	resident
Lullula arborea	Least concern (LC)	resident/migratory
Alauda arvensis	Least concern (LC)	resident/migratory
Riparia riparia	Least concern (LC)	migratory
Ptyonoprogne rupestris	Least concern (LC)	migratory
Hirundo rustica	Least concern (LC)	migratory
Delichon urbicum	Least concern (LC)	migratory
Cecropis daurica	Least concern (LC)	migratory
Aegithalos caudatus	Least concern (LC)	resident
Phylloscopus sibilatrix	Least concern (LC)	migratory
Phylloscopus trochilus	Least concern (LC)	migratory
Phylloscopus collybita	Least concern (LC)	resident/migratory
Sylvia atricapilla	Least concern (LC)	resident/migratory
Sylvia borin	Least concern (LC)	migratory
Sylvia curruca	Least concern (LC)	resident/migratory
Sylvia communis	Least concern (LC)	resident/migratory

Regulus regulus	Least concern (LC)	migratory
Regulus ignicapilla	Least concern (LC)	migratory
Sitta europaea	Least concern (LC)	resident
Certhia familiaris	Least concern (LC)	resident
Troglodytes troglodytes	Least concern (LC)	resident
Sturnus vulgaris	Least concern (LC)	resident/migratory
Turdus viscivorus	Least concern (LC)	resident
Turdus torquatus	Least concern (LC)	wintering
Turdus merula	Least concern (LC)	resident
Turdus pilaris	Least concern (LC)	wintering
Turdus philomelos	Least concern (LC)	resident/migratory
Muscicapa striata	Least concern (LC)	migratory
Ficedula albicollis	Least concern (LC)	migratory
Ficedula hypoleuca	Least concern (LC)	migratory
Monticola saxatilis	Least concern (LC)	resident/migratory
Saxicola rubetra	Least concern (LC)	resident/migratory
Erithacus rubecula	Least concern (LC)	resident
Phoenicurus ochruros	Least concern (LC)	resident
Oenanthe oenanthe	Least concern (LC)	resident/migratory
Oenanthe hispanica	Least concern (LC)	migratory
Prunella modularis	Least concern (LC)	migratory
Anthus campestris	Least concern (LC)	resident/migratory
Anthus trivialis	Least concern (LC)	resident/migratory
Anthus pratensis	Skoro ugrožena (NT)	migratory
Anthus spinoletta	Least concern (LC)	migratory
Motacilla feldegg	Least concern (LC)	migratory
Motacilla alba	Least concern (LC)	resident
Fringilla coelebs	Least concern (LC)	resident
Fringilla montifringilla	Least concern (LC)	wintering
Coccothraustes coccothraustes	Least concern (LC)	migratory
Pyrrhula pyrrhula	Least concern (LC)	migratory
Serinus serinus	Least concern (LC)	migratory
Loxia curvirostra	Least concern (LC)	migratory
Carduelis chloris	Least concern (LC)	migratory
Carduelis carduelis	Least concern (LC)	migratory
Carduelis spinus	Least concern (LC)	wintering
Carduelis cannabina	Least concern (LC)	resident
Carduelis flammea	Least concern (LC)	wintering
Emberiza calandra	Least concern (LC)	migratory
Emberiza citrinella	Least concern (LC)	resident

Emberiza cia	Least concern (LC)	migratory

2.4.2.2. Bats

The research on bats in the project area was performed between 2015 and 2016.
During this research period, not a single bat was visually observed, nor was it recorded with the help of a detector.
No activity of bats in the subject area was recorded.
There are no suitable shelters for bats in the research area. Shelters were not found within the researched area. Therefore, the researched area is not relevant for bat shelters.

2.4.3. Protected natural areas

The area of the Local Study of the Location "Gvozd" is situated within the undeveloped part of the Municipality of Nikšić, in the part that does not belong to the areas protected by regulations on natural heritage.

2.4. Landscape

The Krnovo plateau is a grassy area that stretches on a hilly terrain of some 30 km2 where altitude varies from 1300m to 1600m above sea level. The habitats that predominate on Krnovo are primarily pastures and meadows, followed by rocky areas and smaller beech forest areas.
In Krnovo, there is a relatively extensive agricultural exploitation, which includes livestock and farming in accessible locations. As a result, the Krnovo plateau is rich in resources that affect soil-feeding birds and predators attracted by the presence of passerines and particularly by small rodents.
The wider area includes temporary livestock settlements - katuni. These cabins are mainly made of wood with low stone walls, and complement the landscapes of mountain plateaus and areas, Montenegrin forests and pastures (Krnovo plateau).

2.5. Cultural and historical objects

There are no cultural objects in the project area and its immediate vicinity.

2.6. Population, concentration and demographic characteristics

There are no permanent housing facilities in the planning area of the wind power plant, but there are facilities used for seasonal housing and several shepherd's cabins mostly made of wood, with low stone walls.
According to the Census from 2011, there were 14 apartments without residents in Gvozd, a populated area with permanent housing facilities located in the vicinity of the planned wind power plant.

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2.7. Economic, infrastructural and residential buildings

The area of the plan document meant for the wind power plant includes undeveloped natural areas of the mountain plateau with arable land, meadows, pastures and rocky hills overgrown with small forest areas. The planning area for constructing the transmission line has similar characteristics, except for the area of Nikšić (Rubeža), where the planned corridor passes through the residential area.
The harsh mountain climate with strong snowstorms has conditioned the seasonal use of most of the planning area, without permanent residents, leaving it empty during the winter months.
In the last few years, constant winds have led to the construction of the Krnovo Wind Power Plant, which includes the peripheral parts of the municipalities of Nikšić and Šavnik.
For the needs of building and servicing the Wind Power Plant, the partial reconstruction of the existing and the construction of new service roads was performed, which improved the accessibility of the area.
These changes have not significantly affected the existing way of using the traditionally used area for growing mountain crops and grazing livestock.
The main road M-4.1 Jasenovo Polje - Kruševice - Šavnik - Žabljak passes through the peripheral part of the planning area on the northwest side. In contrast, the regional road R-11, re-categorized to local road, passes through the central part.
The new road Boka Kotorska-Nikšić-Žabljak-Pljevlja-Priboj is the shortest route that connects the Montenegrin coast with the neighboring Republic of Serbia. Also, it is the shortest and fastest road between the northern Montenegro and the coast, as well as the central region (where Nikšić is) and the coast.
There are no larger settlements in the project area and no water supply systems have been built, so the population is supplied with rainwater collected in cisterns or through tank trucks.
The planning area does not have a built-in network of fecal or atmospheric sewage. Instead, wastewater drainage takes place through individual septic tanks, while atmospheric water from the roads flows into the surrounding terrain.
Of the other infrastructure and superstructure facilities in the planning area and its immediate vicinity, the most important ones are the newly built power facilities: wind turbines, transmission lines, underground high voltage lines, and low-voltage optical cables passing through the northwest side of the location.
A similar project was carried out on the edges of the Krnovo field. The land area that the Krnovo WPP project covers is 835239m2.

3. Project description

Phased construction of the following objects is planned in the area covered by the plan document:

1. WPP Gvozd - Phase A
   - wind turbines,
   - wind turbine foundations incl. earthing,
   - wind turbine montage platforms,
   - access and service roads,
   - medium voltage and optical cables,
   - 35 kV TL (T8-T6), L = 1689 m,
   - 35 kV TL (T8-T7), L = 1733 m,
   - 35 kV TL (T15-T14), L = 867m,
2. SS 33/110 kV Gvozd - Phase B
3. SS 33/110 kV Krnovo (reconstruction) - Phase C
4. Transmission line 2x110 kV SS Gvozd - TS Krnovo L = 2 919 m - Phase D.
5. Transmission line 110 kV SS Gvozd - SS Nikšić L = 14730 m, reconstruction of SS 35/110 kV Nikšić, transmission line outlet in front of SS Nikšić (Phase E).

It is planned to install wind turbines of up to 5 MW nominal power on up to 16 wind turbine positions. Therefore, the total power of the wind power plant on the site of transmission of electricity to the transmission network is up to 50 MW.
For the purpose of transportation and installation of wind turbines, it is necessary to build new macadam and asphalt roads and reconstruct existing roads to be used during construction and exploitation of wind power plant Gvozd. The roads will be available to other existing and future users. The road network (access and service) is dimensioned following the oversized load requirements and serves to deliver equipment, installation and maintenance of wind power plants during exploitation.
The main transportation route runs along the following existing roads:

- Bar-Podgorica-Nikšić
- Main road Nikšić - Plužine, municipal asphalt road through Gradačka poljana, old asphalt road Nikšić - Šavnik, service road C which is used for the needs of wind power plant Krnovo.

No construction works are planned on the main road Nikšić-Plužine, except the temporary removal of traffic signs during the transport of wind turbines, which will be the subject of a special study during the execution of works.
Access and service roads are constructed as macadam roads with a width of (0.75) 1.0+ (4) 5.0+ (0.75) 1.0 m, minimum width of free profile H = 7.5 m, W = 6.0 m. The transverse slope of access and service roads is 2-3%.

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Table 3.1. Estimated road lengths

Municipality	Cadastral municipality	The name of the road	Abbreviated name times	Length (m)	Pavement construction	
					Type	Stationary
Nikšić	Gradačka poljana	Access road 1	AR 1	160.92	macadam	0+000 to 0.160.92
Nikšić	Ćeranića Gora	Access road 2	AR 2	481.00	asphalt	0+000 to 0+481
Nikšić	Ćeranića Gora	Access road 3	AR 3	1,491.28	macadam	0+000 to 1+491.28
Nikšić	Ćeranića Gora/Konjsko	Access road 4	AR 4	3,524.09	macadam	0+000 to 2+974.66
					macadam	2+974.66 to 3+524.09
			Total access roads	**5,657.29**		
Nikšić	Gradačka poljana	Service road 1	SR 1	1,371.65	asphalt	0+000 to 0+109.91
					macadam	0+109.91 to 1+371.65
Nikšić	Gradačka poljana	Service road 2	SR 2	893.75	macadam	0+000 to 0+893.75
Nikšić	Gradačka poljana	Service road 3	SR 3	314.72	macadam	0+000 to 0+314.72
Nikšić	Ćeranića Gora	Service road 4	SR 4	571.21	asphalt	0+000 to 0+571.21
Nikšić	Ćeranića Gora	Service road 5	SR 5	376.97	asphalt	0+000 to 0+376.97
Nikšić	Ćeranića Gora	Service road 6	SR 6	473.29	macadam	0+000 to 473.29
Nikšić	Ćeranića Gora	Service road 7	SR 7	2,937.65	macadam	0+000 to 2+937.65
Nikšić	Ćeranića Gora	Service road 8	SR 8	163.12	macadam	0+000 to 0+163.12
Nikšić	Ćeranića Gora	Service road 9	SR 9	861.84	macadam	0+000 to 0+861.84
Nikšić	Konjsko	Service road 10	SR 10	1,168.58	asphalt	0+000 to 0+683.22

					macadam	0+683.22 to 1+168.58
Nikšić	Ćeranića Gora	Service road 11	SR 11	32.83	asphalt	0+000 to 0+32.83
				Total service roads	**9,165.61**	
				Total	**14,822.90**	

Substation SS 33/110 kV Gvozd

SS 33/110 kV Gvozd is being built to accept the electric energy at the medium voltage level from the future wind power plant Gvozd, and transform it to the 110 kV high voltage level.

The Gvozd substation is planned to cover an area of 7663 m2. The planned location of the substation is next to the old main asphalt road Nikšić-Šavnik, which is northwest of the substation, and the existing macadam road, which is southwest from the substation, where the main entrance to the facility is planned. The plan is to install protective fencing next to the main asphalt road Nikšić-Šavnik and along the area meant for the substation to protect it from motor vehicles.

Access to the location is possible from three directions, and the substation is planned to be positioned centrally as to the planned wind power plant Gvozd.

- Internal medium voltage distribution - cable connection of wind turbines, 35 kV transmission lines

Cable routes depend on the location of each wind turbine, access and service routes and any existing installations.

Through internal cable distribution, wind power plant Gvozd connects wind turbines with 33/110 kV SS Gvozd. Part of the internal MV network of the internal MV distribution will be solved by constructing a 35 kV overhead transmission line.

Technical characteristics of 2x110 kV transmission line SS Gvozd - SS Krnovo

Object name:	2x110 kV transmission line SS Gvozd - SS Krnovo
Isolation:	Glass U120B, 146/255 basic insulation eight cells
Pillars:	Lattice type steel "fir" with a tip for one tension rope
Climate parameters:	Wind pressure: - 90 daN / m2, Additional load - 4 x ODO daN / m
Transmission line	2.92km

Object name:	110 kV transmission line SS Gvozd - SS Nikšić

Conductors:	3 x rope JUS N.C1.351 - 240/40-Al/Č,
Protective rope:	1 x OPGW type T1
Isolation:	Glass U120B, 146/255 basic insulation eight cells, low pollution
Pillars:	Lattice type steel "fir" with a tip for one tension rope
Climate parameters:	Wind pressure: - 90 daN / m2, Additional load - 4 x ODO daN / m
Transmission line	14.73 km

Object connections

2x110 kV transmission line SS Gvozd - SS Krnovo

- Starting point: Portal in SS Gvozd
- Endpoint: Portal in SS Krnovo

The positions that determine the route of the Gvozd - Krnovo transmission line are:

Transmission line 2x110 Gvozd-		
Point mark	**Y(m)**	**X (m)**
	Gauss-Kruger coordinate system	
portal SS Gvozd		
1'	6588779.00	4747027.70
2'	6589093.10	4747280.10
3'	6589258.20	4747823.20
4'	6589169.20	4748367.00
portal SS Krnovo		

110 kV transmission line SS Gvozd - SS Nikšić

- Starting point: Portal in SS Gvozd
- Endpoint: Portal in SS Nikšić

The positions that determine the route of the Gvozd - Nikšić transmission line are:

Transmission line 110 Gvozd - Nikšić		
Point mark	**Y(m)**	**X (m)**

	Gauss-Kruger coordinate system	
portal SS Gvozd		
1	6588673.20	4746982.80
2	6588354.80	4746832.70
3	6587869.50	4745186.20
4	6586657.90	4744524.40
5	6586528.50	4743201.90
6	6585472.60	4741398.00
7	6584617.70	4739873.80
8	6583588.80	4738890.50
9	6583272.90	4738056.20
10	6582347.80	4737843.00
11	6581124.40	4738601.50
12	6580624.40	4738528.80
13	6580391.20	4738369.00
14	6580397.90	4737906.50
portal SS Nikšić		

Poles

Poles of the "fir" type will be used on the subject section, as follows:
Tension poles:
- pole TC-A (0 ° -30 °)
- pole TC-B (0 ° -60 °)

Supporting poles:
- pole SC-B
- pole SC-C

and type "barrel": Tension pole:
- pole D TC-C_s (75 ° -90 °)

4. Description of possible significant effects of the project on the environment

4.1. Air quality

Emissions of dust and vehicle exhaust gases can be expected due to the movement of vehicles and machinery on the location and routes of the road infrastructure during the construction phase of the wind power plant and the accompanying infrastructure (access roads). Exhaust gases consist of nitrogen and carbon oxides and suspended particles. However, the intensity and spatial dispersion of pollutants will be limited in time and space

- to the subject location and the route of the road network and will cease upon completion of works.

Activities during the execution of works, i.e. emissions related to construction machinery, construction vehicles, fugitive emissions from construction sites, and fugitive emissions from construction vehicles, may have an impact only on the following concentrations of these pollutants according to the Regulation:

Carbon monoxide (CO)

- Volatile Organic Compounds (VOCs)
- Nitrogen oxides (NO_x)
- Sulfur oxides (SO_x)
- Suspended particles (PM10)

Activities at the time of construction, according to emission, are divided into three categories:

- Transport of workers to the construction site
- Transport of materials
- Construction machinery

Transportation of workers to the construction site

The maximum number of workers on the construction site is about 50. It is assumed that 100% of workers will have transportation by car (2, 3, 4 passengers in the car), which means there will be a maximum of around 25 cars during the rush hour. This is a very small number of cars, so we will no longer deal with their participation in the emission of pollutants.

Transportation of materials

Trucks will bring loose material (concrete building components), parts of metal structures, reinforcing steel, and other materials to the construction site. In addition, construction waste that cannot be used on-site will be removed. The trucks will move on the main road Nikšić - Šavnik and local roads. It is estimated that there will be a maximum of around 80 rounds of trucks a day in the busiest period of material delivery (start of construction: digging and pouring of foundations), whose distance is estimated at 20 km (individual tour). To estimate the emission of pollutants, we took the emission factors of the Copert software for the calculation of emissions resulting from truck traffic. The average emission factors of pollutants were determined from the relevant emission factors. The estimation of the emission of construction machinery was determined for the period of the highest activities on the construction site.

Emission factors are taken from the South Coast Air Quality Management District (AQMD) website (http://www.aqmd.gov/ceqa/hdbk.html) where emission factors are given

(expressed in units of lb/hr) for certain types of construction machines and their different powers (expressed in horsepower). In accordance with the determination of emissions during the construction of other projects, the average daily operating time of construction machinery is 8 or 10 hours.
The presented results show that the impact of NOx emissions on air quality is possible. However, we believe that this deviation can be ignored according to the deviation shown, the type of project, and the length of construction works. Therefore, we can state that due to construction activities, there will be no significant emissions that could impact air quality.
In addition to the mentioned emissions, there will also be dust emissions from handling bulk materials and vehicles' movement on unpaved surfaces. However, this emission is extremely local with rapid deposition and can be minimized by appropriate measures such as spraying surfaces with water, covering the truck's cargo space, etc.
The state borders are significantly away from the project location, so there can be no transboundary air pollution.
The use of wind energy in the production of electricity does not lead to the emission of pollutants into the air.
During the project's operation, a positive global impact on air quality is evident, because the wind power plant will, after commissioning, contribute to lower electricity production from fossil fuels and thus lower CO2 emissions.

4.2. Water quality

No negative impacts on water quality are expected during the construction and regular activities on the construction of the wind power plant and its operation.
The project's location is in the wider zone of sanitary protection of Vidrovanska vrela. Therefore, the project's construction has no conflict with this water facility.
There is no impact on water quality during construction because the works are not performed near springs and watercourses. Also, the impact on groundwater is not possible (assuming that the mechanization is adequately maintained).
In regular maintenance, the oil in the wind turbine assemblies is changed periodically, and in case of failure, parts may be replaced. Waste generated in this way is immediately evacuated from the site and handed over to an authorized collector-operator.
Groundwater can be endangered only in the project implementation phase, in case of accidents (spillage and leakage of petroleum products).
Potential soil pollution, which could lead to groundwater pollution due to the operation of the wind power plant, is a case of uncontrolled leakage of oil from wind turbines or leakage of oil and other hazardous and harmful substances from the substation.
Therefore, it can be stated that after installation, with proper construction and maintenance, wind power plants should not have any impact on groundwater.

In the substation area, a closed system of drainage of atmospheric water from internal roads inside the substation is planned, using inspection manholes and drains.
Atmospheric water from roads is treated in an oil separator (made according to standard EN858-2) with a capacity of 3l/s before entering the surrounding terrain. After treatment on the separator, the water must meet the requirements of the Regulation on quality and sanitary-technical conditions for wastewater discharge, manner and procedure of testing wastewater quality and content of the Report on the determined wastewater quality, "Official Gazette of Montenegro", No. 56 /19).

4.3. Land

Due to the realization of the project, there will be a conversion of surfaces in the area of the wind power plant, substation, and transmission line. Therefore, the area where the realization of the Gvozd wind power plant is planned is for the most part classified as a meadow and pasture in the spatial plan.
There will be no restrictions on access to the area with the implementation of the project. Furthermore, the subject space won't be fenced off, so there will be no major changes in the way we use this space. Therefore, it can be concluded that there will be no change of purpose for the part of the meadow and pastures, i.e. that the area will still be able to be used for grazing.
As for the influence of the transmission line, the rule of a corridor 1.5 times the width of the pole on each side applies to its route. In general, the practice has shown that installing the transmission line route requires a certain permanent usurpation and conversion of agricultural land to install poles. Agricultural land below the transmission line route (i.e. below the transmission line conductor) can only be used through certain types of agricultural production, such as grazing, haymaking, mechanized tillage, and the establishment of annual or perennial crops. In contrast, they can't be used to raise orchards, prepare fruit species with high-growing native trees, or build temporary or permanent infrastructure facilities in agriculture.
Given the structure of the terrain, construction, and nature of the project, there is no possibility of creating and subsequent occurrence of landslides. Also, there are no recorded paleontological sites, so there is no danger of their damage.
Soil contamination can occur in the disposal of construction materials and excess excavated material on land that is not designated and prepared as a landfill, and due to uncontrolled leakage of fuel and lubricants from construction machinery and vehicles. However, this impact is time-limited, i.e. until the moment of project construction.
During the works, the waste will be managed as follows:

- a separate method of collection (communal, construction, etc.),
- it is necessary to respect the Rulebook on construction waste treatment, method and procedure of construction waste processing, conditions and manner of

disposing of cement asbestos construction waste ("Official Gazette of Montenegro", No. 50/12). Following Article 4 of the Rulebook, construction waste on the construction site is stored separately by type of construction waste by the waste catalog and separately from other waste, in a way that does not pollute the environment,

— proper management of hazardous waste. Under Article 4 of the Rulebook on Waste Oil Treatment ("Official Gazette of Montenegro", No. 21/10), the owner of waste oil may hand over waste oil to distributors and collectors of waste oils. However, the owner of the waste oil must, before handing it over to the distributor or collector of waste oils, keep the waste oil separate from other waste and cannot hand it over as mixed municipal waste.

As for possible soil pollution during the operation of the wind power plant, they can occur in the event of a leak of oil from the wind turbine or a leak of oil and other hazardous and harmful substances from the substation.
However, with the standard construction of the catch elements, the free discharge of hazardous substances is reduced to a minimum. Namely, the standard construction of the wind turbine prevents oil from penetrating the ground in the event of oil leaks from the housing, but it collects in the wind turbine itself.
Hazardous waste management must comply with the Law on Waste Management. Following Article 4 of the Rulebook on Waste Oil Treatment ("Official Gazette of Montenegro", No. 21/10), the owner of waste oil may hand over waste oil to distributors and collectors of waste oils. However, the owner of the waste oil must, before handing it over to the distributor or collector of waste oils, keep the waste oil separate from other waste and cannot hand it over as mixed municipal waste.
Also, during the wind power plant operation, the following waste is generated: packaging from spare parts, old oil after replacement, oil packaging, etc.
All waste will be collected separately and handed over to authorized collectors.

4.4. Local population

The proposed solutions will not harm environmental segments that may affect the population's health.

4.5. Noise

Noise will be emitted from time to time during the works.
During the construction phase of the wind power plant, increased noise levels can be expected due to the operation of construction equipment and heavy machinery. The intensity and spatial dispersion of noise will be limited to the subject location of the network of road corridors, but it is also limited in time. Noise in distant locations is affected by

several external factors, such as wind speed and direction, temperature, and above all, wind strength and air absorption noise (depending on pressure, temperature, relative humidity, noise frequency), soil relief, and quantity and type of vegetation.
In the calculations of the noise caused by the works on the construction of the wind power plant, we did not perform the calculations of the noise caused by the transport, considering that the dynamics of the traffic noise due to the transport cannot significantly endanger the population.
Noise in the construction phase will be analyzed by the RCNM model (Roadway Construction Noise Model). RCNM is the Federal Highway Administration's (FHWA) model for noise calculation in construction work based on noise calculations and extensive collected data on noise from construction machinery work.
According to the calculations of noise levels during the works for distances of 50, 250 and 500 meters from the construction site's location, it is concluded that the assumed limit values are not exceeded.
The nearest wind power plant is a facility 266m away from wind turbine no. 6, and a noise level of 55dB can be expected during the most intensive construction works. Therefore, from the performed noise calculations, it is noticeable that there can be no significant impact on the population in terms of noise during the execution of works.
During the execution of works, the Contractor is obliged to perform all works by the prescribed working hours, i.e. not to perform works at night.
In further consideration, we analyzed the noise levels generated during the operation of the wind power plant and the noise levels that can be expected at the nearest facilities.

The following table shows the basic parameters of a wind turbine.
Table 4.1. Wind generator parameters

Ord. no.	Wind generator	Turbine type	Pillar height	Rotor diameter	Capacity (kW)
1	T1	Vestas V136-4.2	112.0	136.0	4200
2	T2	Vestas V136-4.2	112.0	136.0	4200
3	T3	Vestas V136-4.2	112.0	136.0	4200
4	T4	Vestas V136-4.2	112.0	136.0	4200
5	T5	Vestas V136-4.2	112.0	136.0	4200
6	T6	Vestas V136-4.2	112.0	136.0	4200
7	T7	Vestas V136-4.2	112.0	136.0	4200
8	T8	Vestas V136-4.2	112.0	136.0	4200
9	T9	Vestas V136-4.2	112.0	136.0	4200
10	T10	Vestas V136-4.2	112.0	136.0	4200
11	T11	Vestas V136-4.2	112.0	136.0	4200
12	T12	Vestas V136-4.2	112.0	136.0	4200
13	T13	Vestas V136-4.2	112.0	136.0	4200
14	T14	Vestas V136-4.2	112.0	136.0	4200
15	T15	Vestas V136-4.2	112.0	136.0	4200
16	T16	Vestas V136-4.2	112.0	136.0	4200

Table 4.2. Calculated noise value

Ordinal number	Calculated valu	Assumed limit value
1	44.66	50.00
2	44.23	50.00
3	41.60	50.00
4	41.35	50.00
5	44.50	50.00
6	45.97	50.00
7	46.59	50.00
8	44.76	50.00
9	36.09	50.00
10	42.74	50.00
11	42.83	50.00
12	40.79	50.00

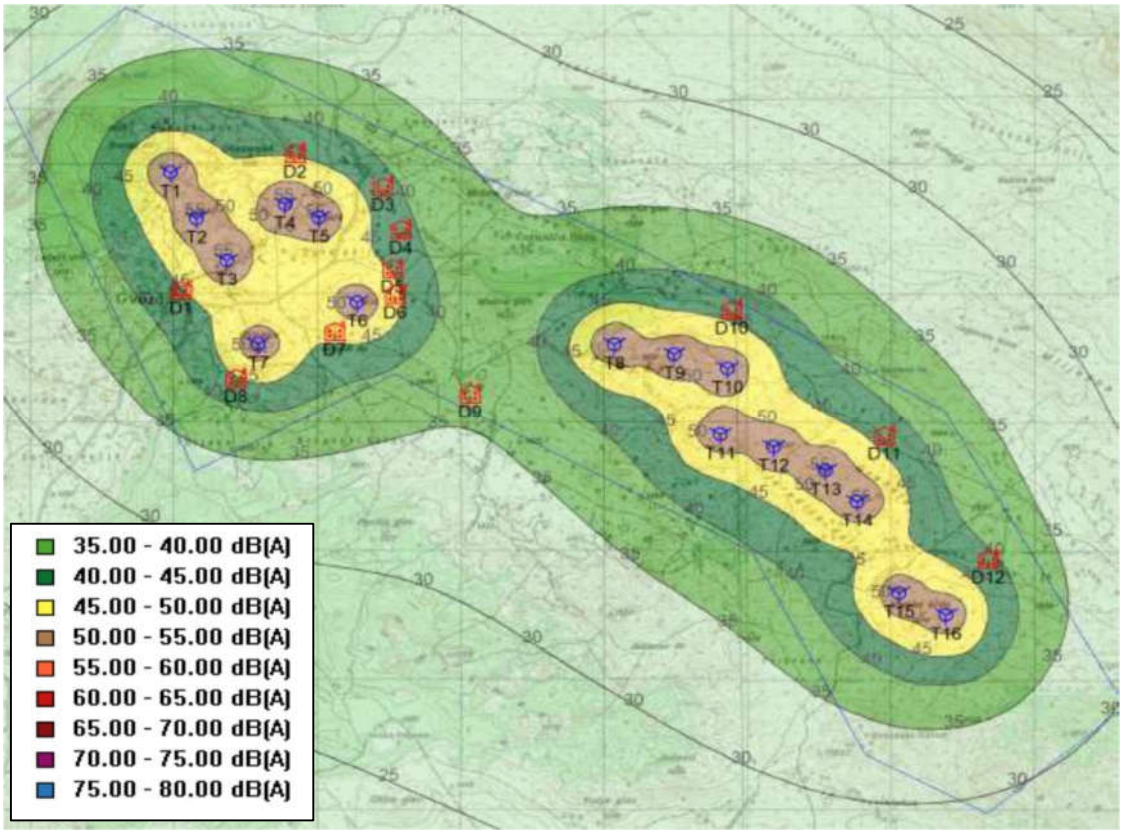

Image 4.1. Calculated noise values

The noise caused by the operation of the wind turbine decreases with increasing distance from the wind turbine.
The highest noise level expected on the façade of the nearest buildings is 46.59dBA, which is a low noise value.

4.7 Electrical and magnetic radiation

The criteria of the World Health Organization (WHO), the International Commission on Non-Ionizing Radiation Protection (INIRC, ICNIRP), the requirements of the International Radiation Protection Association (IRPA), and the Ordinance on Electromagnetic Field Exposure Limits may be used to determine the limit values of electric and magnetic fields ("Official Gazette of Montenegro", no. 6/2015).
The calculation was performed with the PLS-CADD software package, which was also used to design the transmission line. The parameters of the transmission line (height, shape, and position of the poles, height of the conductors above the ground, equipment, etc.) are chosen so that the values of electric and magnetic fields are less than the limit values prescribed by the World Health Organization.
For the most part, the transmission lines' routes do not pass through populated areas, and do not intersect any building or residential building, passing at a great distance from the settlement.
The exception is the end of the route, in a stretch of about 400m, where in order to connect to the existing 110 kV substation Nikšić, the routes of the transmission lines in question pass through the inhabited periphery of Nikšić near Željezara (Ironworks). Even there, the distance from the houses is enough for the influence of the 110 kV transmission line to be significantly below the limit values.
The following are the distances of transmission lines from houses closer than 50 m:

- a lonely house near the village of Gvozd at a distance of 12m,
- house in the hamlet of Seneca at a distance of 46m,
- Seven buildings, houses, and auxiliary buildings in the vicinity of Nikšić at a distance of 27m to 38m, and
- Eight buildings, houses, and auxiliary buildings near the Nikšić Ironworks from 17m to 43m.

According to the calculations of the electric and magnetic field made in the Study, it is concluded that the influence of the electromagnetic field of the transmission lines in question is fully in line with the recommendations of relevant organizations (WHO, INIRC, ICNIRP, and IRPA) and current Regulations.
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question is fully in line with the recommendations of relevant organizations (WHO, INIRC, ICNIRP, and IRPA) and current Regulation.

4.8 Shadow flicker effect

In addition to the impact caused by noise emissions, the wind power plant can impact the surrounding population by casting shadows on residential buildings when the sun is low in the sky. This effect is known as shadow flicker (shadow effect) and is created when the propeller casts a shadow on the windows of houses, i.e. the space where people live, and the propeller's rotation leads to alternating formation and disappearance of the shadow. The shadow effect depends on the size of the rotor. However, the correct choice of micro-location has influenced the nearest facility to be 266 m away from the nearest wind turbine, and therefore this type of interference is not considered a matter of importance for the project in question.

4.9 Socio-economic impact

Socio-economic impacts that will arise as a result of construction and operation and the eventual removal of wind power plants are reflected through impacts on land use, increasing employment opportunities, infrastructure, and tourism.
Wind power plants physically occupy only a few estimated areas (areas intended for the foundation of objects) where they are built, while the rest of the area between turbine bases and around internal roads can be used for other purposes, i.e. it can be used for its original purpose. In this case, it can still be used for pastures and agricultural production, so there are no significant impacts in the context of changing the purpose of land use. Therefore, the total average value of the magnitude of the project's expected impacts on the purpose of land use is within the low efficiency.
The need to employ local people during the construction phase can be expected. Local subcontractors can be hired to provide road materials such as crushed stone, etc., and all the equipment needed during the construction phase (mechanization, parts, etc.).
As a result of the construction of the wind power plant, the road infrastructure will be improved, because of the improvement and widening of access roads. However, a negative impact on infrastructure could occur in case of damage to road surfaces during heavy traffic trucks. In addition, an increase in traffic frequency (due to delivery of materials and equipment to location and travel of employees) could lead to a temporary reduction in quality of life.
During the operation of the wind power plant, the area of available arable land will be reduced due to the occupation of the plots. The operation of the wind power plant will create an opportunity for direct employment. In addition to direct employment, the operation of the wind power plant will also indirectly affect employment due to the need

for procurement of materials and consumption of employees in wind power plants within the local community.
The operation of the wind power plant will enable an increase in the power plant of the Municipality of Nikšić due to its participation in realized profit. The Gvozd wind power plant can contribute to the development of tourism. As a result, the construction of the wind power plant will improve the road infrastructure, primarily due to the maintenance of access roads required for access to wind turbines for maintenance.
Quality roads can affect better accessibility to the wider area and thus lead to the development of tourism in Krnovo.
Upon the dismantling of the equipment and removal of the wind power plant, the arable land will become available for agricultural activities. Wind power plant removal and disposal of work materials and the return of land to its original function will affect the emergence of new direct and indirect employment opportunities. These employment opportunities will be in part also available to the local workforce.

4.10 Ecosystems and geological environment

During the project's construction, increased noise levels will be emitted due to the operations of construction machinery. The maximum expected noise levels due to simultaneous operations of a greater number of construction machines at one location are from 85-100dB. This noise level will certainly affect the living world, i.e., a temporary depart/bypass of some species (primarily birds) of this area. Certainly, after the completion of the works, all these species will return to this area, so the impact of noise shall be reversible and limited only to the construction period. Noise that will be generated during the production of electricity due to the operation of the wind power plant will have a strictly local negative impact on the immediate vicinity and will not have negative impacts on the wider area.
The realization of the planned project will affect the biodiversity, flora and fauna at the construction site, i.e. at the micro-location. The area where the direct impact will occur is limited to the locations of the wind turbines where no rare or endangered species have been detected. In the zone of the direct impact of the planned intervention, there will happen temporary devastation due to the operations of large construction machines and the installation of temporary structures. This negative impact will be short-termed and will be restored after the completion of the works.
It will be necessary to conduct partial deforestation in a certain part of the transmission line route. It should be noted that during the process of choosing the route, it was taken into care, as much as possible, to reduce the length of the route that passes through the forest. As a result, the route goes mainly along the edge of the forest area (which is not of major importance).

Potential impacts of wind plant on birds

When adjusted for the avoidance rate, the collision risk model shows a relatively low annual bird mortality rate. The highest collision rates were obtained for the two most commonly recorded species: *buteo* (Buteo buteo) and *kestrel* (Falco tinnunculus), assuming a collision-avoidance rate of 98% for buteo and 95% for kestrel (SNH, 2010). The collision rate for these two species is 2 and 3 individuals per year, respectively.

Table 4.2. The estimated annual risk of bird collisions with wind turbines

Species	Avoidance rate				
	Without	**90%**	**95%**	**98%**	**99%**
Accipiter gentilis **Northern goshawk**	4.39	0.43	0.22	0.08	0.04
Accipiter nisus **Sparrowhawk**	2.15	0.21	0.11	0.04	0.02
Buteo buteo **Buteo**	85.17	8.51	4.25	1.7	0.85
Circus aeruginosus **Western marsh harrier**	4.31	0.43	0.21	0.08	0.04
Circus cyaneus **Hen harrier**	2.09	0.21	0.22	0.04	0.02
Circus pygargus **Montagu's harrier**	5.84	0.58	0.29	0.12	0.06
Corvus corax **Raven**	18.11	1.81	0.91	0.36	0.18
Falco Subbuteo **Hobby**	2.22	0.22	0.11	0.04	0.02
Falco tinnunculus **Kestrel**	58.34	5.83	2.91	1.16	0.58
Pernis apivorus **Pern**	1.99	0.2	0.1	0.04	0.02

In the risk area (50 - 180 m) of collision with the wind turbines, the following species have not been recorded:
- Golden eagle (Aquila chrysaetos)
- Long-legged buzzard (Buteo rufinus)
- Short-toed snake eagle (Circaetus gallicus)

The cumulative impact on birds

No wind power plant ("Krnovo" and "Gvozd") is located on "bird migration routes" or within the area of "vulnerability of tall birds". It is considered that none of the wind plants is

located on a regular flight line between nesting and feeding areas. It is unlikely that the development of the proposed Gvozd wind plant near the Krnovo wind plant will create a significant barrier, as both wind power plants are within a 4km radius, which is considered short and it is not expected to lead to any flight diversions or to affect the flight energy. The distance between the Krnovo site and the Gvozd site (1.5km to the south) is such that it is unlikely that any combined effects will occur as a result of the construction of both wind plants for species that potentially migrate through the region.
Habitat loss or fragmentation will be temporary during the construction and decommissioning phases, and permanent during the operational phase of wind power plants.
Habitat loss is estimated only at "Krnovo" - about 0.25% of the total wind power plant (estimated to be about 1.125 hectares) will be permanently lost, and an additional 0.13% will be temporarily lost during construction. This information can be used to extrapolate habitat loss to other wind power plants - estimating that no more than 1-1.5% of the habitat at each wind power plant will be lost. The total habitat loss in the studied area will be small compared to the remaining suitable habitats. Given that the habitat in the project area is a mixture of arable land and pastures, the effects of habitat loss for birds in the wind power plant area are not considered significant, as birds will be able to use alternative habitats in the wider area.

The extent of disturbances caused by wind plants varies greatly. The variation depends, among other things, on the seasonal use of the area by birds, the presence of important habitats and the availability of alternative habitats. Temporary disruption and relocation during wind power plant construction are likely to result from increased noise, vibration and human presence. Disruptions during the operational phase are considered similar to those of existing disruption levels due to ongoing agricultural works.
The construction of the Gvozd wind plant is likely to have a low impact on the disturbance of Alectoris graeca, Bubo bubo and other small songbirds during the nesting season. However, due to the availability of alternative habitats, no significant impact is expected.

The results of the collision risk model for both wind plants are given in the following tables.

Table 4.3. The estimated annual risk of collision (northern series of turbines at the wind plant "Krnovo")

	Collision avoidance rate				
Species	None	90%	95%	98%	99%
Buteo buteo	90.70	9.07	4.53	1.81	0.91
Falco tinnunculus	39.70	3.97	1.98	0.79	0.40
Circus aeruginosus	4.40	0.44	0.22	0.09	0.04
Circus pygargus	2.14	0.21	0.11	0.04	0.02
Aquila chrysaetos	7.48	0.75	0.37	0.15	0.07

Corvus corax	27.17	2.72	1.36	0.54	0.27
Pernis apivorus	0.62	0.06	0.03	0.01	0.01
Falco vespertinus	2.35	0.24	0.12	0.05	0.02
Circaetus gallicus	0.31	0.03	0.02	0.01	0.00

Table 4.4. The estimated annual risk of collision (southern series of turbines at the wind plant "Krnovo")

	Collision avoidance rate				
Species	None	90%	95%	98%	99%
Buteo buteo	63.21	6.32	3.16	1.26	0.63
Falco tinnunculus	13.63	1.36	0.68	0.27	0.14
Falco subbuteo	0.36	0.04	0.02	0.01	0.00
Circus pygargus	0.40	0.04	0.02	0.01	0.00
Circus aeruginosus	0.10	0.01	0.00	0.00	0.00

The following species were not recorded in the collision risk window at altitudes of 50-150m in WPP "Krnovo":

1. Accipiter gentilis
2. Accipiter nisus
3. Buteo rufinus
4. Circus cyaneus
5. Circus macrourus
6. Grus grus

Table 4.5 Estimated annual risk of collision (WPP "Gvozd")

	Collision avoidance rate				
Species	None	90%	95%	98%	99%
Accipiter gentilis	4.39	0.43	0.22	0.08	0.04
Accipiter nisus	2.15	0.21	0.11	0.04	0.02
Buteo buteo	85.17	8.51	4.25	1.7	0.85
Circus aeruginosus	4.31	0.43	0.21	0.08	0.04
Circus cyaneus	2.09	0.21	0.22	0.04	0.02
Circus pygargus	5.84	0.58	0.29	0.12	0.06
Corvus corax	18.11	1.81	0.91	0.36	0.18
Falco Subbuteo	2.22	0.22	0.11	0.04	0.02
Falco tinnunculus	58.34	5.83	2.91	1.16	0.58
Pernis apivorus	1.99	0.2	0.1	0.04	0.02

The following species were not recorded in the collision risk window at altitudes of 50-150m in WPP "Gvozd":

1. Aquila chrysaetos
2. Buteorufinus
3. Circaetusgallicus

In total, the cumulative values for both wind power plants are given in Table 4.17.

Table 4.6 Cumulative values for wind plants "Krnovo" and "Gvozd". Species colored in red letters were observed in the area of both wind power plants in the collision risk window.

	Collision avoidance rate				
Species	None	90%	95%	98%	99%
Buteo buteo	239.08	23.9	11.94	4.77	2.39
Falco tinnunculus	111.67	11.16	5.57	2.22	1.12
Corvus corax	45.28	4.53	2.27	0.9	0.45
Circus aeruginosus	8.81	0.88	0.43	0.17	0.08
Circus pygargus	8.38	0.83	0.42	0.17	0.08
Aquila chrysaetos	7.48	0.75	0.37	0.15	0.07
Accipiter gentilis	4.39	0.43	0.22	0.08	0.04
Pernis apivorus	2.61	0.26	0.13	0.05	0.03
Falco subbuteo	2.58	0.26	0.13	0.05	0.02
Falco vespertinus	2.35	0.24	0.12	0.05	0.02
Accipiter nisus	2.15	0.21	0.11	0.04	0.02
Circus cyaneus	2.09	0.21	0.22	0.04	0.02
Circaetus gallicus	0.31	0.03	0.02	0.01	0

The highest cumulative value of turbine collision risk is for two widespread and numerous species of predator birds buteo (Buteo buteo) and kestrel (Falco tinnunculus), species with no significant conservation value. The rest of the species is estimated to have very low turbine collision risk values . This cumulative estimate is still not substantial regarding the number of possible collisions within both wind plants. Since these wind plants are very close to each other (within a radius of 4 km), the estimated number of pairs and owls with large territories is given below.

Table 4.7 Estimated number of pairs of predator birds

Accipiter gentilis	**Least concern (LC)**	**100-200 [1-2]**	**1**
Accipiter nisus	Least concern (LC)	200-300 [2-3]	1-2
Aquila chrysaetos	Least concern (LC)	30-50 [1]	1 in a wider area
Buteo buteo	Least concern (LC)	400-600 [4-6]	4-6
Circaetus gallicus	Least concern (LC)	40-60 [1]	1 in a wider are
Falco tinnunculus	Least concern (LC)	400-600 [4-6]	6-8
Pernis apivorus	Least concern (LC)	150-200 [2]	1-2

*BirdLife International 2015

Given the presence of five pairs of barn owls (Strik aluco), two pairs of scops owl (Otus scops) and at least one pair of eagle-owl (Bubo bubo) in both wind power plants and the fact that nocturnal activity can pose a greater danger to birds (SNH, 2015), special

attention should be paid to the monitoring of nocturnal birds. However, the cumulative impact is considered small on nocturnal birds, as well as because the number of nesting pairs in the area of both wind power plants is small compared to the number of pairs in the whole of Montenegro. Nevertheless, continuous monitoring will identify the need for operational measures to mitigate adverse effects if necessary.

Potential impacts of wind power plants on bats

In the area of research, the presence of bats was not recorded. Bat shelters do not exist at the wind plant site. Overall, the area can be characterized as insignificant for bats.
It can be concluded that the "Gvozd" wind plant will not be a barrier for bats and, therefore, will not cause habitat fragmentation.

4.14. Landscape characteristics

The impacts of the construction of the Gvozd wind plant on the landscape are reflected in two approaches: structural and visual.
The realization of the project, structurally speaking, will physically change the existing space in the central area of the project.
This primarily refers to constructing the necessary infrastructure and wind turbines. Due to their size, number, and position on top of the hills, wind turbines are always very noticeable elements in space.

Structural influence
The intervention area, mostly in its natural state, with spatial impacts regarding the construction of the Krnovo wind plan and anthropogenic impacts in the form of access dirt roads and smaller agricultural areas, will be further changed. The impact of the intervention will be direct; it will expand the existing impact caused by the Krnovo WPP, with the conversion of land use and the installation of permanent facilities in the area. Indeed, the significant impact on the structure of the landscape will have the construction of the road, which will connect the wind turbines and access road to the plant.
Removing the surface cover in the wind plant area does not represent a loss of greater importance for the landscape in a broader sense, given that these are different forms of meadows and pastures.

Visual impact - wider impact area
The visual impact that the project will make is firstly reflected in the perception of the entire area, which will, by the construction of the wind plant, continue to have the expression of the industrial area, i.e. it will expand the existing impact created by the construction of

WPP Krnovo. Thus, this area, previously traditionally rural and natural, will continue the landscape of the technological area created by the construction of the Krnovo WPP.

Impact of the transmission lines

The impact of the planned transmission line, reflected in the disturbance of the existing balance of landscape structures in the wider and narrower project area, is reflected through the inevitable changes in the physical structure and, thus, the visual perception of the landscape. During the use of the transmission line, there will be long-term impacts on the physical structure of the landscape by maintaining a zone of the permanent clean belt. Removing plants and trees along the route that passes through the forest will lead to forming the notch, which causes degradation of visual values of the area. Within the specified band, no activities will be possible. These changes will be most evident in areas of high vegetation with the emergence of forest notches, which cause permanent changes in the landscape. It is expected to impact the entire length of the route in terms of change of visual qualities and land conversion. This anthropogenic line element is highly noticeable in the organic lines of the natural landscape and represents a permanent degradation of the visible values of the landscape.

4.15 Unexpected situations

Potential unexpected situations with wind turbines that can be foreseen are: ice formation on the propellers, tearing or breaking of the blade, falling wind turbine or lightning strike and fire.

5. Description of measures to prevent, reduce or eliminate harmful effects

Prevention, reduction and elimination of harmful effects are considered in the Study through:

- protection measures provided for in the technical documentation,
- protection measures envisaged during the construction of the facility,
- protection measure during the operation of the facility and
- accident protection measure.

6. Environmental Impact Monitoring Program

Monitoring the state of the essential segments of the environment is an obligation arising from legal regulations. The Environmental Protection Agency of Montenegro implements the State Monitoring Program through authorized institutions.

The parameters to be monitored are as follows:

Noise:

- Make a one-time 24-hour measurement of existing noise levels (LAeq in dBA) for the day, evening and night according to the Rulebook on limit values of noise levels in the environment (Official Gazette of Montenegro no. 27/14) by an authorized company/institution in the vicinity of the listed facilities D6, D7 and D8 (these metering points can be considered as a reference for the entire area of the wind plant) which are located closest to the location of the wind turbine. Measurements should be made before the construction works, in the usual conditions prevailing at the site, and performed by an authorized organization.
- After the measurement and before the commissioning of the project, the Report must be submitted to the Environmental Protection Agency.
- After putting the wind plant into operation, it is necessary to perform noise level measurements at the same measuring points near facilities D6, D7 and D8 (these measuring points are closest to wind generators).
- Test methods for existing noise levels are defined by ISO 1996-1: 2016, Part 1.
- Methods for testing noise levels during a wind power plant operation are defined by IEC 61672-1: 2003.
- All equipment used for measurement and testing must have a calibration certificate

EM field:

The first measurement of the electric field and magnetic induction (substation and transmission line) should be performed during the test run to see the EM field's real values. After that, the plant is put into operation, i.e. it receives a use permit only if the results of the first measurement are below the reference limit values for professional exposure in the zone inside the fence or below the reference limit values for public safety outside the fence in the environment. Therefore, the first measurement of the EM field must be performed after the commissioning of the substation and transmission line. For measurements, it is necessary to provide the maximum current load to measure the maximum values of the EM field. After that, periodic measurements should be made following the legal regulations.

Ornithofauna:

Given the presence of four pairs of forest owls, two pairs of scops owls (Otus scops) and at least one pair of eagle owl (Bubo bubo), as well as the fact that nocturnal activity can

pose a greater danger to birds (SNH, 2015), monitoring owls is recommended as part of operational monitoring during the construction phase and in the 1st and 2nd year of operation. In addition, monitoring will identify the need to take specific operational mitigation measures if such a need arises.

Monitoring in qualitative and quantitative terms, as well as measurements of bird mortality rates and possible changes in the trend for each recorded species presented in the Study, it is necessary to:

- Organize monitoring by hiring experts in the field of ornithology;
- Monitor of nesting birds, migratory species in autumn and spring aspects;
- Perform targeted monitoring of predators;
- Monitor mortality;
- Monitor below and around the wind turbine (interaction: predator (bird) / prey).

It is mandatory to conduct post-construction monitoring for at least two years after the construction and commissioning of wind plants to test the expert opinion regarding bats in practice, which was given in the Study. If the two-year post-construction monitoring results are not clear, it is recommended that the post-construction monitoring be extended for another year.