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ELEKTROPRIVREDA BOSNE I HERCEGOVINE
d.d. - Sarajevo

KFW

Interim report 3.3.

Environmental and Social Impact Assessment

Non – technical summary

Feasibility Study

Wind Power Plant Bitovnja

Bosnia and Herzegovina

BMZ No. 2013 67 176

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List of abbreviations

BiH	Bosnia and Herzegovina
CLC	Corine Land Cover
DV	Transmission Line
EPBiH	Elektroprivreda Bosne i Hercegovina
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FBiH	Federation of Bosnia and Herzegovina
kWh	kilowatt-hour
kV	kilovolt
MW	Megawatt
RES	Renewable Energy Sources
BMP	Biodiversity Management Plan
CHA	Critical Habitat Assessment
SEP	Stakeholder Engagement Plan
OG	Official Gazette
TS	Transformer Station
VPP	Wind Power Plant
WT	Wind Turbine

1 INTRODUCTION

The JP Elektroprivreda BiH d.d. - Sarajevo (Employer), plans to establish a wind power plant at Bitovnja, a site located approx. 30 km west of Sarajevo (43°48'16"N 17°56'22"E). The wind power plant Bitovnja (WPP Bitovnja) is scheduled for implementation within the Long-term Development Plan of JP Elektroprivreda BiH d.d. as one of the necessary production energy facilities based on renewable energy sources.

The site stretches for about 6 km on a barren ridge with an elevation of ca. 1530 - 1700 m, thus characterized by complex terrain and harsh weather conditions during winter months.

Figure 1.1-1 Overview of the proposed Bitovnja wind farm area (orange)

After conducting the international bidding process in mid-2019, the Employer signed a contract in mid-2020 for Consulting Services regarding the "Pre-Feasibility and Feasibility Study for Wind Power Plant Bitovnja" with the Consortium of Ivicom Consulting d.o.o., GL Garrad Hassan Deutschland GmbH and Oikon d.o.o. – Institut za primijenjenu ekologiju (Consultant). The WPP Bitovnja project documentation is financed by the Federal Government of Germany through KfW Development Bank (Financier) and managed by the Employer.

The assignment is divided into three components: Component 1 comprises of a Pre-Feasibility Study at the Bitovnja site. Component 2 comprises of a Pre-Feasibility Study at an alternative location, should the Employer determine, based on the outcome of Component 1, that the Bitovnja site is not suitable for a Feasibility Study. Component 3 comprises of a Feasibility Study, carried out at original location of Component 1. Components 2 and 3 are optional.

The comprehensive ESIA aims to identify and assess potentially negative and positive environmental and social impacts, mitigation measures for any potential negative impact, enhance benefits and establish ongoing monitoring activities of all phases of the proposed Project.

For the purpose of development comprehensive ESIA, through Component 1, the preliminary assessment was performed and Scoping report was developed as a part of Pre-feasibility study.

Within the period of scoping phase following activities were performed.

- Step 1: Desk top review of available data and documents
- Step 2: Site verification visit
- Step 3: Engagement with key stakeholders
- Step 4: Preparation and disclosure of a Scoping Report

The Scoping report was accepted in June 2022. Trough this Scoping Report it was found that there is a lack of some important data needed to fully assess the impacts of the project, primarily on bat and bird fauna at location, which was, however, already predicted by TOR. Additionally, in order to correctly assess the impacts on socioeconomic environment such as tourism, recreational activities and informal activities (blueberry and cranberry picking) at location a need to conduct interviews with these stakeholders was identified.

ESIA, together with Birds and bats baseline data survey report, were developed at the same time as wind and energy assessment, feasibility study, technical solution of WPP and transport study.

Monitoring of fauna of birds and bat baseline state was preformed before developing this comprehensive ESIA study. The complete report was given as separate document Birds and Bats Baseline Survey Report, Oikon, April 2024 while short summary is given in this ESIA. Three workshops with local inhabitants and members of various societies were held as a part of this study and main conclusions were integrated in ESIA document.

ESIA analysed proposed options of the layout and characteristics of windturbine generators (WTG), the options of the access road to the location of the project area and the route of the connecting transmission line. The first result of environmental and social impact assessment were then considered in further devlopment of feasibility study and technical solution. Taking, along with other factors, these results into account, the option with 15 WTG was proposed as the most favorable option together with access road that consist of access road to WF Ivan Sedlo and widening of existing macadam road to location.

1.1 Description of the project

Brief project descripton was taken from Conceptual design (IVICOM d.o.o., Interim Report 3.3.) that contains detailed project design.

The visualisation of planned wind farm Bitovnja is given on following Figure.

Figure 1.1-1 Visualisation of the proposed Bitovnja wind farm area

1.1.1 Description of project main components

According to Conceptual design (Interim Report 3.3.) the project includes construction of the Bitovnja wind power plant with associated infrastructure, which includes the following main items:

- installation of a complete wind turbine at 15 positions, with a total installed capacity of up to 90 MW at grid connection incl. foundations with drainage and earthing,
- construction of the new SS 110/35 kV Bitovnja connected with 35 kV cable,
- construction of the OHL 2x110 kV according to the requirements of Elektroprenos BiH on the proposed route,
- construction of access roads to the wind power plant and design of turning areas for vehicles with a gravel surface,
- construction of an underground medium voltage and fiber optic cable network within access roads at the wind power plant site and up to new SS 110/35 kV Bitovnja,
- construction of main and auxiliary crane pads for temporary storage and installation of equipment with a finished layer of stone material, integration of the crane pads into the existing access roads, in terms of position and height,
- construction of pipe culverts, road trenches, retaining walls and other minor works if required

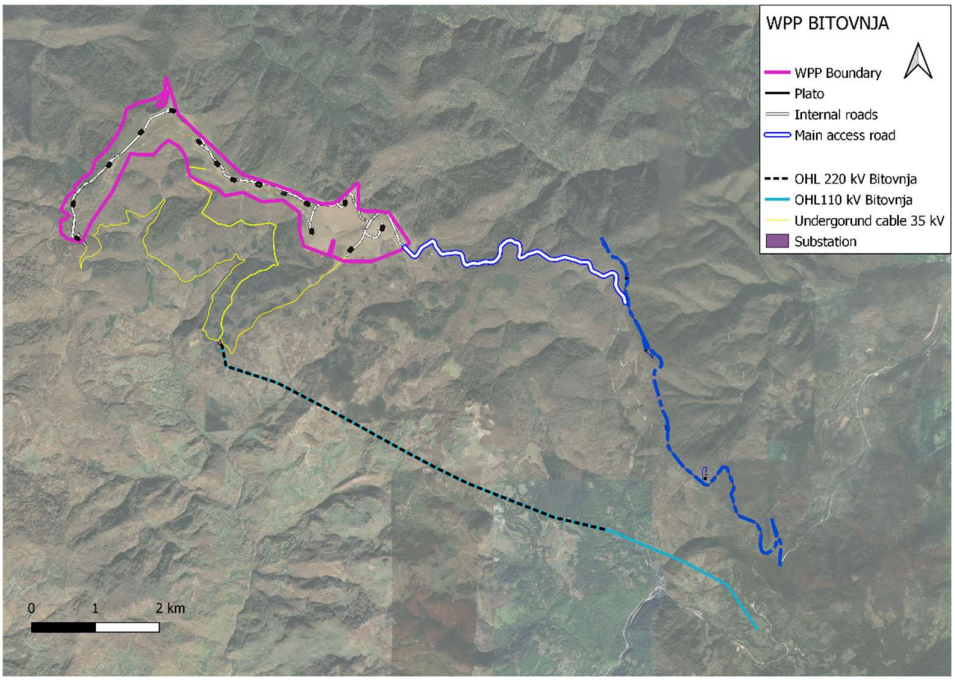

Figure 1.1-2 The WPP Project

1.1.2 Water supply

There is no public water supply network at the site and a connection to the public water supply network is not required. Water supply is only required within the SS 110/35 kV Bitovnja substation and will be solved within the planned facility by constructing a water tank.

1.1.3 Sewage system

There is no public sewerage system on the site and connection to the public sewerage system is not required. Sewage system is provided only for substation control building by using a septic tank with sufficient capacity.

Drainage of rainwater inside the substation is solved by directing it to the surrounding terrain after treatment in an oil separator.

In SS 110/35 kV Bitovnja, in case of oil leakage from the power transformer, a watertight oil pit will be designed as an underground reinforced concrete tank. The transformer foundation/pit and the oil pit are connected by an underground pipeline, between which revision manholes are installed.

The drainage of stormwater on the access roads and crane pads of the wind power plant will be solved by constructing ditches and culverts through the access roads.

1.1.4 WPP Bitovnja

General

Wind turbines will have a nominal capacity of up to 7 MW. The wind turbine will be equipped with a three-blade rotor with a diameter of up to 155 m, and the maximum total height of the wind turbine from the ground level to the tip of the blade will be up to 220 m. The wind turbines are delivered as a prefabricated product with factory documentation and mounted on previously constructed foundations.

Wind turbine tower

The main support structure of the wind turbine is a steel tower with a circular cross-section, consisting of 4-5 sections with different lengths and diameters. It is a cantilever system with column fixed in a circular reinforced concrete foundation and anchor cage.

Nacelle

The nacelle, i.e. the driving part, is part of the wind turbine, which is located at the very top of the column. It consists of a housing to which a slow-running manhole with bearing, generator, transformer and drive motor are attached to make the nacelle rotate, which is located inside the nacelle.

The bearing is located between the nacelle and the mast so that the nacelle can rotate around the axis of the mast, placing the rotor in the most favorable position to the wind. Through this bearing or system, loads are transferred directly from the nacelle to the mast.

The dominant wind rotation signals are located at the top of the nacelle and constantly send data to the control unit, which compares the wind direction with the current position of the rotor.

Rotor

The rotor consists of a rotor hub with three pivot bearings, a blade rotation system and three rotor blades. The rotor blades are made of high-quality glass fiber and carbon fiber reinforced polymer.

The rotor is only locked when a part of the wind turbine is to be serviced or replaced and repaired and when the emergency stop switch is pressed.

Grounding system of wind turbines

The earthing system of wind turbines is an integral part of the earthing system of the entire wind power plant.

Wind turbine foundation

The foundation structure of the wind turbine is monolithic, provided as a single gravity base foundation, circular shape with a plate diameter of up to 24 m on the bottom side at the point of ground level circular shape with a diameter of about 6.0 m. The static calculation of the foundation and the determination of the dimensions is the subject of the main design.

The connection of the tower steel structure to the foundation is made by installing a steel anchor cage consisting of an anchor plate and bolts of the prescribed length and diameter distributed around the circumference of the foundation, which is done simultaneously with the laying of the reinforcement before concreting the foundation.

The anchor cage with complete equipment is supplied by the wind turbine manufacturer as individual elements that must be assembled at a specific location on the foundation according to the specification.

The site layout

The wind farm area will be completely located within the City of Konjic.

After submission of Interim Report 3.3 in November 2023, in a line with Investor comments, a new final layout was agreed in April 2024 that consists of 15 WTG with total installed capacity of 86 MW.

Bitovnja Wind Farm Options	unit	1	2	3
WTG model		Nordex	Vestas V150-6 MW	Siemens Gamesa
Type		N149/5900	V150-6 MW	SG 6.6-155

Number of WTGs	units	15	15	15
Hub height	m	105 - 135	105 - 125	102,5 -122,5
Rotor diameter	m	149	150	155

An illustration of the layouts are shown in the figure below. Fencing of project area is not forseen.

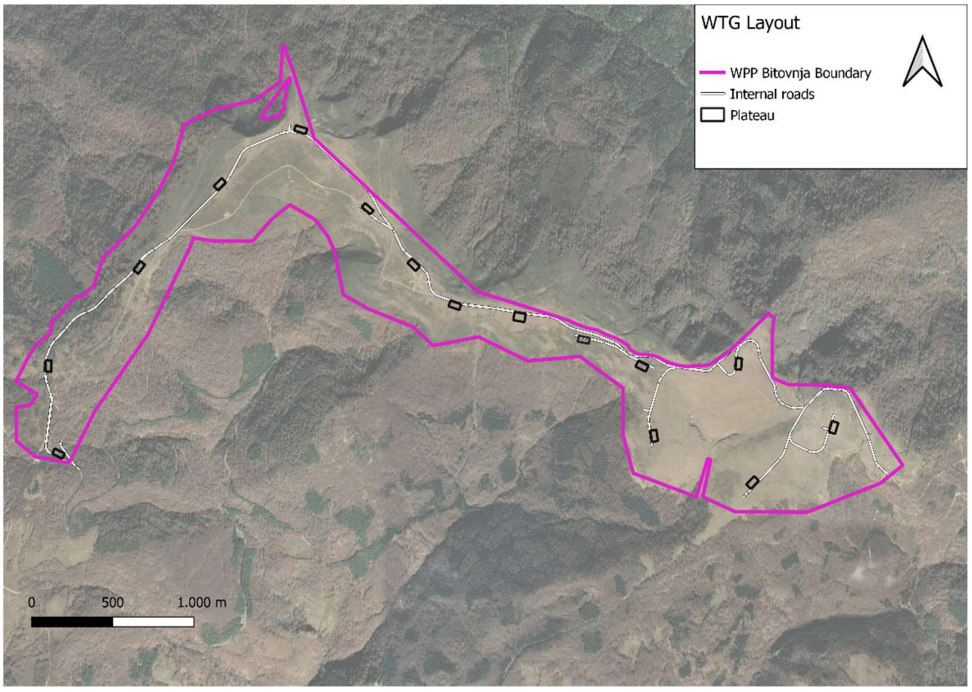

Figure 1.1-3 WTG layout of the Bitovnja wind farm

Internal access roads and cable network at site

The internal access roads connect the wind turbine crane pads and are used for the delivery of the wind turbines and the subsequent maintenance of the Bitovnja wind power plant during operational phase. During road design, existing road routes have been used where possible. The roads area planned as macadam.

In addition, the investor of the Bitovnja wind power plant is planning to lay an underground medium-voltage and fiber-optic cable network as part of site roads, the route of which will end in the planned SS 110/35 kV Bitovnja.

The project includes the following basic works:

- construction of the roadway with a macadam and partially asphalt surface layer,
- construction of the shoulder with a stone material surface,
- construction of channels and ditches, pipe culverts,
- reconstruction of existing roads, location and height,
- construction of protective fences if required,
- construction of retaining walls if required,
- construction of vertical traffic signalization, fences

The road width will be 4.5 m (driving area) with shoulder width 0.75-1 m that would be used for underground SN and fiber optic cable, trench to substation.

1.1.5 Transmission line

Based on the preliminary assessment of the grid connection, two grid connection proposals for WPP Bitovnja are given from new Substation Bitovnja up to one of the existing overhead line OHL and connected by in/out connection type to existing HV electrical network.

1. Option: Connection to OHTL 220 kV HE Salakovac - RP Kakanj
2. Option: Connection to OHTL 110 kV HE Jablanica - Sarajevo 1

These options were both taken into consideration in ESIA study even Feasibility study propsed only 2 x 110 kV transmission line with connection to OHTL 110 kV HE Jablanica - Sarajevo 1 since the final option and route will be coordinate with Elektroprijenos d.o.o.

1.1.6 Access road

The location of the planned WPP Bitovnja can be accessed by a macadam road about 10.3 km long from the main road Sarajevo - Konjic - Mostar, from which it turns in the settlement of Bradina. One part of the road up to the meteorological station Ivan Sedlo is asphalted, after which the macadam road continues. Other route also starts at Bradina settlement but then continue to the direction of settlement Repovci and then near settlement Stojkovići. This road is a bit longer but paved for around 10 km. Based on the transport analysis of these roads and the selection of the technical solution of the planned WPP (which then affects the size of the individual wind turbine) the route trough settlements Repovci and Stojkovići is rejected.
The first option was analysed with regard to the most convenient start, i.e. getting off the main state road E73/M17 Sarajevo - Konjic - Mostar. The option through the settlement of Bradina proved to be technically demanding in terms of passing through the populated area, and the option of getting off the main road after the Ivan Sedlo tunnel and building a new road to the meteorological station Ivan Sedlo was proposed, in order to enable the transport of large parts of the VA to the project location. However, in the meantime, the construction of the WPP Ivan Sedlo wind farm has started, which includes the construction of an access road to the main road Sarajevo-Konjic-Mostar. The mentioned access road can be used in large part as an access road to the location of WPP Bitovnja, and it represents the most favourable option.

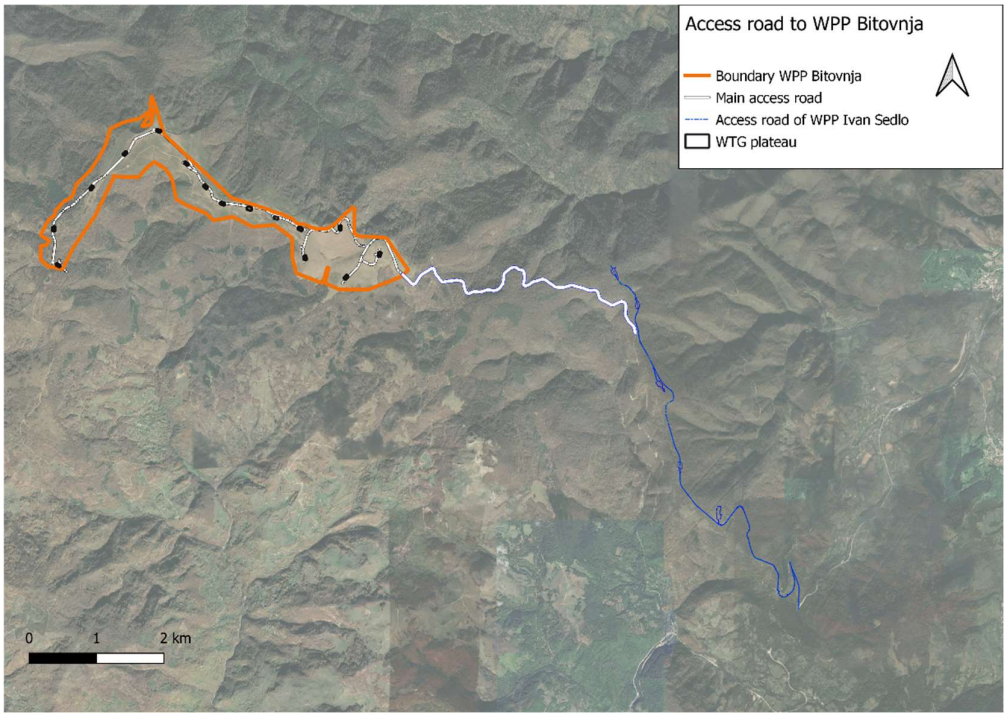

Figure 1.1-4 Main access road – option with access road to WPP Ivan Sedlo

1.1.7 Substation platform

The site on which the construction of the SS 110/35 kV Bitovnja is planned has to be levelled by excavation work and backfilling of stone material. For the long-term successful operation of the plant, it is also necessary to regulate drainage of the surface waters around substation.

Dimensions of platform within fence are 74.61m x 62.03m.

The construction of a prefabricated trapezoidal channel is planned around the platform of substation. The internal roads will be made of asphalt and the areas for the accommodation of the equipment with a crushed stone layer. Internal roads are bordered with curbs of 18/24 cm.

Within the platform is a vertical parking area for five private vehicles and maintenance vehicles, covered with a steel roof. The parking spaces are marked by horizontal, 10 cm wide, white markings.

The entire platform of the substation is surrounded with 2.0 m high metal fence.

Internal roads

From the entrance gate, transport routes are provided for heavy goods traffic. Road between control building and transformer is 6m wide.

Control building and guardhouse

The control building is planned to be built with external dimensions around 25.87 x 9.96 m. The following rooms are predicted to be part of building: the command room, relay room, AC/DC room, 30 kV facility, house transformers, kitchen, sanitary facilities, workshop room, storage room and cable space room.

The diesel generator will be placed outdoors on the platform of the 110 kV plant on a concrete slab that is raised at least 0.5 m from the surrounding ground, covered with a steel roof and fenced to prevent access by unauthorized persons.

All floors on the ground are predicted to be insulated with a layer of waterproofing and thermal insulation.

The inner part of the oil pit is additionally coated with a waterproof coating that is resistant to transformer oil.

Sanitary and sewage installations

For sanitary facilities and kitchen, the water supply will be distributed from external underground water tank. From the tank, the water is pumped to the selected rooms. The water is not intended for drinking. The drinking water is delivered and stored in special containers. The facility's sanitary sewage is routed through a system of sanitary drains into an external watertight sewage pit.

Oil pit

In the event of an emergency oil leak from the power transformer, a watertight oil pit is designed as a buried reinforced concrete tank that retains the collected oil (collection tank). The transformer tank and the oil pit are connected by an underground pipeline with inspection manholes installed between them. The oil pit is dimensioned to collect the intended amount of oil in case of an accident.

Fire water tank and pumping station are designed as underground reinforced concrete structures.

Water supply and drainage

The project includes the following elements:

- Sanitary water supply;
- Fire protection system;
- Sanitary drainage;
- Storm water drainage from the roofs of the building;
- Stormwater drainage from roads and platforms within the substation;
- External storm water outside substation;
- Potential oil drainage from transformers.

Sanitary water

For the sanitary area in the substation, it is necessary to plan water supply with cold sanitary water. Water is supplied from the external water tank and used for toilets, washbasins and sinks.

The water is not intended for drinking. Drinking water is provided and stored in special containers.

Fire-fighting water

According to the Regulation on Technical Standards for the External and Internal Hydrant Network for Fire Fighting, it is necessary to plan a water tank with a capacity of 72.0 m3. The extinguishing water is provided in an underground water tank. Outside the paved areas and at the prescribed distance from the object planned to be protected, above-ground hydrants made of cast iron are installed.

Sewage installations

The following wastewater is discharged in the area within the transformer station: oil wastewater from power transformers, clean rainwater from the control building roof and sanitary wastewater.

Potentially oily water from transformers are discharge into watertight reinforced concrete sumps under the power transformers, which are connected to the oil pit. The foundations of the power transformers are constructed in such a way that the oil cannot spill over the transformer foundation in the event of a leakage. The predicted volume of the oil pit refers to one transformer, as it is assumed that there will not be a simultaneous leakage of both transformers in the future. This drainage forms a closed system. The capacity of the oil pit will be such that it can hold the oil that would leak from a transformer raised by 15 %.

Rainwater from platform and internal transport roads will be discharge into a closed system that will be implemented to drain rainwater from the transport routes. For management of potential oily water along transportation routes, an oil separator is planned.

Clean rainwater will be discharged into the surrounding terrain.

Protection systems

The SS will be equiped with the earthing system lightning protection system, fire alarm system and access control system and video surveillance system.

1.2 Impacts of WPP Bitovnja on environment

1.2.1 Impacts on physical and biological environment

The brief descripton of the state of the physical, biological and socioeconomic environment and the possible impacts are given further in text.

1.2.1.1 The qir quality

According to the multi annual data from the nearest monitoring station for air quality Ivan Sedlo and due to remote location of the planned WPP Bitovnja away from the sources of pollutants, the air quality at location can be regarded as satisfactory.

Negative impact on local air quality can occur during construction mainly due to dust emissions caused by earthworks for the installation of wind turbines and connection cables as well as from construction of access roads and transmission line. Along with these emissions, the emissions of gases from vehicles and machinery that will be used in construction phase will occur as well. Additionally, there are no settlements in nearby area of project site and access road that could be impacted by these emissions. The proposed route of transmission line passes near settlements Stojkovići and Repovci where this impact will be more pronounced. However, these are temporary impacts that will cease upon completion of the works. By applying common measures the impact can be reduce to negligible. During operation, the wind park will not have negative impact on the air quality. On the other hand, wind farms are renewable energy source that can indirectly reduce negative impact on air quality. By using wind farms to produce energy instead of using fossil fuels, reduction of overall emission of air pollutants, including greenhouse gases emissions (GHG) on the territory of B&H is expected.

Emissions and noise levels in the Federation of BiH are regulated by the Law on Noise Protection ("Official Gazette of the Federation of B&H" No. 110/12). The law prescribes the permitted noise level, noise protection measures, method of measuring and recording noise, noise limit values classified according to the environment, purpose of space and time of day (day or night) in order to protect human health, work and living space, and the environment in general.

1.2.1.2 The climate and climate change

Climate of Bosnia and Herzegovina

The climate of Bosnia and Herzegovina is dominantly determined by its geographical position, air masses circulation, relief and geological background. According to Vemić, there is a very intensive exchange of polar and tropical air masses over BiH (Vemić 1953). The basic types of climates represented in Bosnia and Herzegovina are: temperate continental, mountain and Adriatic (Milosavljević 1973). Compared to the moderate continental climate, the mountain climate is harsher. Average annual temperatures range up to 5 °C. The warmest month has an average temperature lower than 18 °C, and the coldest, January, lower than -3 °C. Precipitation falls in the form of rain and snow, which stays much longer than in lower areas. Average January temperatures range from -3.5 °C to -6.5 °C, and July temperatures range from 14.5 °C to 17 °C. The absolute minimum is from -25 °C to -35 °C, and the absolute maximum is from 30 °C to 35 °C (Bjelašnica, Jahorina, Ivan Sedlo). The amount of precipitation is around 1200 mm, snowfalls occur frequently, and the snow cover remains for a relatively long time.

Bosnia and Herzegovina Climate Scenarios

The First National Report (INC), Second National Report (SNC) and Third National Report (TNC) on climate change recognize the fact that climate change affects Bosnia and Herzegovina, as well as the fact that these changes will occur rapidly until the end of the 21st century. According to the analysis of meteorological data for the period 1961-2014, the average annual temperature continues to rise throughout the territory. A positive linear trend was observed in the average annual temperature, which was particularly pronounced in the last 30 years. Annual temperature trends at all analyzed stations are statistically significant, and the changes are more pronounced in the continental part. The annual increase in air temperature ranges from 0.4 to 1.0 °C, while the increase in temperature during the growing season (April - September) goes up to 1.2 °C. At all meteorological stations, the number of cold days has a negative trend. In the central mountain areas, the number of cold days decreased by 4 days per 10 years.

Expected climate changes

According to global climate models, for the RCP8.5 climate scenario, which represents the most extreme climate scenario, the expected change in mean daily temperature is 4.8 °C, with a range of 4 to 6 °C compared to the reference period 1986-2005. For the middle of this century, the mean change according to this scenario is slightly higher than 2.5 °C, while for the period of the near future (2016-2035) the expected change is about 1 °C compared to the values from the reference period 1986-2005. Unlike temperature changes, precipitation changes show a somewhat more complex structure, with possible positive and negative changes compared to the reference period, especially for periods in the near future, when possible changes range from -5 to + 5 % compared to the values from the reference period. The differences between the scenarios (RCP2.6, RCP4.5, RCP6.0 and RCP8.5) are noticeable only for the periods at the end of the twenty-first century, whereby the RCP8.5 scenario stands out, according to which at the end of the century, the expected value of the change is about -10 % with a range of -4 to 15 %.

For the RCP8.5 scenario, the change in the number of frosty days is significantly reduced for further time horizons and for the period 2036-2065. it amounts to -30 days. The change in the number of ice days is also significantly reduced for further time horizons and for the period 2036-2065. it amounts to -20 days, while for the last period the change is most pronounced in the mountainous parts of the country and amounts up to -30 days.

Climate change preparation

Climate change preparation is made on the basis of the *EU Guidelines Technical Guidelines for the preparation of infrastructure for climate change in the period 2021-2027 (2021/C 373/01)*.

Mitigation of climate change

Wind farms are renewable energy source that can indirectly reduce negative impact on climate change. By using wind farms to produce energy instead of using fossil fuels for its production, reduction of overall emission of greenhouse gases emissions (GHG) on the territory of B&H is expected. According to the data of Agency for statistics of Bosnia and Herzegovina, Energy statistics, the overall share in total energy produced in last available year (2014) from industrial energy power plant including solar and wind power plants was only 4.7 %. Acccording to guidelines *EIB Project Carbon Footprint Methodologies*, renewable energy is regarded as zero or minor absolute emission source of GHG and it is assumed to displace (at least in part) fossil fuels. The expected reduction of emisssion can be also calculated based on the yearly data of emitted CO2 from thermal power plant owned by EPBIH per produced GWh of energy. This reduction is not neligeble.

Adaptation to climate change

Climate change adaptation measures for infrastructure projects aim to ensure an adequate level of resistance to climate change impacts, including acute events such as large floods, cloudbursts, droughts, heat waves, forest fires, storms and landslides and hurricanes, but also chronic events such as which are predicted sea level rise and changes in the average amount of precipitation and soil and air humidity.

Sensitivity analysis identified that there is a certain sensitivity to lightning strikes and hurricane winds. The fact that all generators are grounded and have built-in systems that stop rotation when the wind exceeds 25 m/s and set the arms "on the knife", it has been observed that these systems sometimes fail, leading to damage or complete destruction of the wind generator. Although these events are rare, they should be mentioned as a possibility. The exposure analysis is divided into two basic parts: exposure to existing climate conditions and exposure to future climate conditions. According to the results of the climate model, the increase in maximum wind speed in the affected area will be 1 to 4%, which is almost negligible, but the number of days with wind above 20 m/s will increase significantly, and this exposure is still marked as medium. In the foreseeable future, there will certainly be an increase in air temperature, both average and maximum, but this will not affect the functioning of the wind farm. No increase in the number of thunderstorms is expected. Accumulation of ice and snow is already present due to lower temperatures and due to higher altitude. The vulnerability assessment, which is the basis for deciding whether to carry out the next stage of risk assessment, identified that non of the vulnerability elements a in the "high" category, and detailed analysis was not required.

1.2.1.3 The noise level

According to current legislation in Federation of B&H, the noise level from stationary sources in the open space must be lower than the permitted level determined in Table 2 of the Law on Noise Protection ("Official Gazette of the Federation of B&H" No. 110/12) in accordance with the purpose of the zone, measured at a distance of 5 m from the noise source in the direction of endangered areas.

It is forbidden to perform works or activities that, due to excessive noise, including music reproduction, interfere with night peace and rest in populated areas from 10 pm to 6 am the next day.

For WPP Bitovnja, levels for industrial zone are valid.

Area (zone)	**PURPOSE OF THE AREA**	**Highest allowed levels (dBA)**		
		Equivalent levels Leq		**Peak level**
		Day	**Night**	**L1**
VI	Industrial, storage, service and traffic area without housing	70	70	85

There are no settlements in the immediate project area. The nearest settlements Gobelovina and Stojkovići are located south at a distance of about 3.5 km, while settlements Slavkovići, Dobričevići, Bukovlje and Raotići are located west and southwest of the project area at a distance of more than 5 km.

Due to remote location of the project area, away from the settlements no impact of increased nosie level **during construction** is expected. The accsess road from M17 to location of WPP as well ~~as transmission line~~ is not planned near settlement area so no impact is expected as well. The route of transmission line passes nearby settlements Stojkovići and Repovci where increased leve of noise are possible during construction work. ~~Wind turbines' equipment will be transported mainly by the magistral road M17 and no significant traffic increase that can increase noise level is expected.~~ However, by applying measures prescribed by national Law on noise protection that any legal and natural persons who open a construction site are obliged, in a Plan of the construction site, include and apply preventive measures against the spreading of noise from the construction site above the permitted level no significant impact is expected.

The noise impact calculations **during operation** were performed by GL Garrad Hassan Deutschland GmbH (GH-D) and given in document *10252547-L-6-A Reuslts on noise propagation and shadow flicker calculation for the planned Bitovnja windfaram, June 2024.* ~~The calculations were carried out for two layouts proposed at that time: "W" for 16 wind turbines (WTG of the type Siemens gamesa SG 6.6-155 with a hub height of 102.5 m each and a rotor diameter of 155 m) and layout "X" with 17 wind turbines of the type Siemens gamesa SG 5.0-132 with a hub height 84.0 m each and a rotor diameter of 132 m.~~ The calculations were carried out for layout consisting of fifteen (15) wind turbines (WTG) of the type Siemens gamesa SG 6.6-155 – eleven with a with a hub height of 102.5 m each and a rotor diameter of 155 m and four with a hub height of 122.5 m and a rotor diameter of 155 m. The wind turbines of planned WPF Ivan Sedlo at approximately 3 to 6 km away from Bitovnja plateau to the east were considered as existing state (5 WTGs of the type Siemens SG 4.5-145 with a hub height 102.5 m).

Calculation of noise level at 11 critical impact points was performed. Impact points (IP) represent the nearest object in settlements closest to planned WPP.

For all options the night-time limits at all IPs are undercut by at least 15 dB(A) by the totality of the planned and existing wind turbines and are thus complied with national regulation. ~~A new layout with~~

~~15 wind turbines was propsed that will produced even lower noise level then W(S) and X option analysed within the mentioned document.~~ Therefore, no impact from noise from planned WPP Bitovnja at the nearest setllements is expected.

1.2.1.4 The shadow flickering

Shadow flicker is the occurrence of periodic changes in light intensity due to the shadow cast by the blades and the wind turbine column on an area **during WF operation**. This phenomenon can affect residents living near wind farms. The impact depends on location, latitude and cloud cover. Legal obligations are being introduced on how many hours per year may be allowed to flicker affecting the population. There are programs (within the SCADA system) that can automatically stop individual wind turbines when flickering at a location is too frequent.

Shadow flicker calculation were performed by GL Garrad Hassan Deutschland GmbH and given in separate document *10252547-L-6-A Results of the noise propagation and shadow flicker calculation for the planned Bitovnja windfarm, June 2024.*

The geographical location of the wind turbines, the points of impact (IP) and their position in relation to each other as well as the local conditions have an influence on the shadow impact. The points of impact are described based on the site coordinates, the height above sea level, the size, the placement and the orientation. The maximum possible shadow impact on the IP were calculated for the worst case using assumptions such as: the sun shines continuously during the entire time between sunrise and sunset, so a cloudless sky is always assumed; the wind direction is always assumed so that the rotor surface is perpendicular to the solar radiation, thus causing the maximum possible shadow; the WTGs are always in operation, i.e. they have no technically induced downtimes and the wind is always sufficiently strong; the shadow impact area of a wind turbine is up to 3,000 m. If data on the rotor blade geometry of the WTG are available, the shading area is determined on the basis of the geometry data and the assumed receptors or windows at the IP are not partially or completely obscured by buildings, vegetation or similar.

For the shadow flicker calculation, the same 11 IPs as for noise calculation, were defined. The shadow impact at these points is calculated for a height of 2 m. A shadow effect of the planned WTGs at the IPs under consideration could also not be determined due to their location and distance from the planned WTGs. ~~This statement applies to both layout W and layout X. A new layout with 15 wind turbines was propsed that will produced even lower flickering effect then W(S) and X option analysed within the mentioned document.~~ Therefore, no impact from flickering from planned WPP Bitovnja at the nearest setllements is expected.

1.2.1.5 Geology and topography

Based on a preliminary geological analysis, it was determined that Silurian to Middle Age Triassic deposits are present in the wider subject area. Silurian deposits are non-aquifer rocks (aquitards) without aquifers. Devonian deposits are partly aquifers of crack porosity, while Permian deposits are mostly hydrogeological complexes mostly without aquifers.

The area of the Bitovnja Mountain belongs to the Dinaric mountain system and the tectonic block of the Central Bosnian shale mountains. The analysis of the products of sedimentation and magmatism in the older Paleozoic indicates the presence of Caledonian orogeny in this area.

According to the global distribution of earthquakes depending on their strength, the affected area belongs to the Mediterranean-Asian seismic belt. The project area is located in an area where the intensity of seismicity of the area of the VII Mercalli scale can be expected.

1.2.1.6 Soil

Based on pedological map of Federation of Bosnia and Herzegovina (FBIH) (M 1:50 000), it was determine that in the wider subject area has developed homogeneous, automorphic soil characteristic for central area of FB&H. Present pedological unit „26 – District cambisol on acid silicate rocks“ belongs to a division of cambic soils arising by deepening the humus-accumulative soil. Water stagnation in the soil is rarely excessive primarily due to the inclination of the terrain and good drainage. Water potential is appropriate for cultivating forests with high to medium suitability. Also, erosion tendency, especially if acid brown soils are cultivated, emphasizes the need for sustainable management and preservation of the natural potential of the soil.

The construction of a wind farm and associated infrastructure will negatively impact soil through land occupation, loss of vegetation, and potential pollution from waste and oil spills. Turbine foundations, roads, and transmission lines will occupy significant land areas, affecting soil cover and characteristics. Pollution risks include inadequately stored waste and oil leaks from vehicles and machinery. Adequate waste management and preventive measures can mitigate these impacts. During operation, risks of soil pollution from substation waste and oil spills persist but are minimized by preventive measures.

1.2.1.7 Ground, surface water sources

The observed area is mostly located within the boundaries of the Adriatic Sea basin, the Neretva-Trebišnjica basin, but a smaller part belongs to the Sava River Basin, i.e. the Bosna River Basin. All water bodies are in good ecological status, and thus in equal overall condition. No sanitary protection zones have been identified in the project area, as well as mandatory measures and restrictions that are implemented in them. The project area is not situated in any potential floodplains.

Impact on water is possible in case of accidents and non-compliance with appropriate procedures during the manipulation of various chemicals and materials used during construction (paints, solvents, fuel, lubricants, etc.) and also during wind farm removal, which can result in their infiltration into the soil, nearby watercourses, and consequently underground water. Negative impact during construction or during removal can also come from sanitary water from workers' facility. The preliminary design already anticipated protective measures from spillage of transformer oil. The potentially negative impact on water quality can be further reduced by proper storage of waste material, storage of fuel and lubricants, and by filling fuel and refiling it to work machines on a constructed impermeable plateau that has an oil and grease separator. Contamination is possible in case of unplanned spillage of oil and lubricants on the ground during regular maintenance of wind turbines, which needs to be cleaned up and removed immediately.

These negative impacts can be prevented by proper organization of the construction site in compliance with the rules of the profession and careful execution of works. With the application of protection measures, the possibility of adverse effects on groundwater during construction or wind farm removal will be reduced to a minimum.

1.2.1.8 Land cover/land use

According to the data from Corine Land Cover, The CLC+ Backbone product (2018.), Google satellite images (2022) and field data, it is determined that land cover is made of grasslands, deciduous and mixed forests. Total area of project area fro WPP is 355.70 ha of which 281.37 ha are grasslands, which is in total 79.11 % of surveyed area. Other land use categories belong to forests of which 74.32 ha are broadleaved deciduous (20.53 %) and 1.29 ha are bushes and shrubs (0.36 %).

During construction of the wind farm and its infrastructure, the primary negative impacts on land cover involve the loss of existing land cover, particularly natural grasslands and woody vegetation. Deforestation poses risks to soil stability, especially on slopes. Turbine foundations and roads will occupy significant land areas, affecting soil cover and characteristics. Transmission lines will also impact land cover, with larger effects from 110 kV lines.

However, no agricultural activity is recorded in the area, so there won't be an impact on agriculture. Informal activities like wild berry picking may be affected during construction but will resume during operation. Pollution risks from waste deposition and oil spills exist but can be mitigated with proper measures. Throughout operation, berry pickers will continue their activities except in areas occupied by infrastructure.

1.2.1.9 Forests

According to the CORINE Land Cover (CLC 2018) database, the project area is covered mainly with the natural grasslands (77 %), while the rest refers to forest areas (23 %), mostly broad-leaved forests.

According to the map of ecological-vegetation regions of Bosnia and Herzegovina (Beus et al., 1980), the project area is located on the junction of the sub-Mediterranean-mountainous area of the Mediterranean-Dinaric region and the mid-Bosnian area of the inner Dinarides. According to the map of real forest vegetation of Bosnia and Herzegovina (Stefanović and Beus, 1980), the wider project area is dominated by subalpine beech forest (*Fagetum subalpinum*) with phytocenoses of rocks and cliffs, and is surrounded by beech forests (*Fagetum montanum*) in the south and beech-fir forests (*Abieti-Fagetum*) in the north.

Among all the analysed variants of the Bitovnja wind power plant, the current one has the least impact on forest ecosystems.

Negative impacts on forests during construction works primarily manifest through the permanent or temporary loss of habitat and wood stock, or the repurposing of forests and forest land due to direct occupation of forest land.

Since official data containing descriptions and spatial distribution of forest stands are unavailable, spatial analysis of existing land classes for the catchment area was conducted based on "Corine Land Cover + Backbone" (CLC+ Backbone) raster data, with a spatial resolution of 10 x 10 meters.

The total area of permanent occupancy by the wind turbine construction plateaus and substation is 4.39 hectares. Of this area, 0.37 hectares, or less than 10% of the total, is located on land cover classes belonging to forests.

The network of service within the wind power plant area, extends to approximately 11 km. It is planned with a total width of 5 meters and occupies a permanent area of a total of 4.94 hectares. Of that area, 0.21 hectares is located within forests and forest ecosystems. The service road network within the wind power

plant area is primarily planned to utilize existing roads, with some sections requiring widening or partial construction.

To access the wind power plant area, a 4.9 km main access road is required, traversing through the forest along its planned route, utilizing the existing forest road. This road needs widening to accommodate specialized vehicles for transporting turbine components during construction. It differs from the forest road with gentler turns and wider serpentines to meet transportation needs. The planned width is 18 meters, requiring a total area of 8.72 hectares. Expanding the road occupies forest land permanently and fragments ecosystems.

Three underground cable routes connect the wind power plant to the substation, all following existing roads with a 2-meter width. Forest ecosystems are predominant along all three routes. The most favorable option for the forest ecosystems is the shortest route at 2.76 km, while the longer routes of 4.83 km and 7.37 km have a greater impact due to their length.

Project proposes two transmission line variants (110 kV and 220 kV), both cutting through forests for about half of the route. They share a planned width of 50 meters but differ in length: 110 kV spans 9.8 km, while 220 kV connects to an existing line for a 6.8 km route. Construction will permanently convert forests, create new edges, and alter nearby ecosystem conditions. 220 kV transmission line route has a comparatively smaller negative impact on forest ecosystems, attributed to its lesser occupation of surface area by the land classes associated with forest vegetation.

During construction, heavy machinery poses risks like damaging vegetation and soil, causing erosion, and introducing invasive species. It may also damage trees, cause pest infestations, and disrupt forest infrastructure. Nearby wind energy projects, like WPP Ivan Sedlo, could worsen the cumulative impact on biodiversity. However, sharing access roads with existing projects, like WPP Bitovnja with WPP Ivan Sedlo, could lessen this impact.

During operation, the loss of forest vegetation impacts climate change mitigation efforts by disrupting carbon absorption and soil erosion prevention. It increases flood risks and pollution of water bodies. Infrastructure construction fragments forests, alters habitat conditions, and raises the risk of fires. During wind power plant operation, unforeseen events like malfunctions or natural disasters can lead to fires or soil pollution.

The construction of the planned wind power plant, given its proximity to existing and planned wind energy projects like the Ivan Sedlo wind power plant, is expected to have a cumulative impact on forest ecosystems. This impact includes the loss of forest habitats, permanent conversion to other land uses, reduction in forest functions, habitat fragmentation, changes in microclimatic conditions, increased surface runoff, and consequent erosion. Therefore mitigation measures are prescribed.

1.2.1.10 Gaming

In the project area, located in the teritiry of the City of Konjic, near the border with the Municipality of Kreševo, there are two hunting organizations. The primary game species found in this area are roe deer, wild boar, and brown bear. Other relevant game species in the hunting management include European hare, hazel grouse, forest snipe, partridge, white marten, red fox, European wildcat, grey wolf, and common wood pigeon. Additionally, one endangered and protected species of game that can be found in the area is the western capercaillie.

During the construction phase, there will be temporary negative impacts due to increased human and machine movement and noise, which can disturb the game.

Upon completion of the wind farm construction, a small to moderate negative impact on wildlife is possible due to the noise generated by wind turbines. Most game species will eventually acclimate to the turbine noise and continue to use the area. The negative impact on wildlife and hunting is also evident through the loss of forest land resulting from the expansion of the access road to the wind farm tehrefore mitigation measures are prescribed through tis study.

1.2.1.11 Biodiversity

The environmental impact of constructing and operating a wind farm in a biodiverse region such as Bosnia and Herzegovina were analysed. Surveys and former research have identified various habitat and species as present or potentially present in and around the area of the Project.

Construction activities are expected to result in habitat loss, with approximately 4 hectares of permanent habitat to be occupied by wind turbine foundations and substations (mostly grasslands). Additionally, widening access roads on the plateau will lead to a further 6 hectares of habitat loss (grasslands and heaths). Mitigation measures have been proposed in the sense of “re-naturalizing” access roads post-construction.

Forest removal for a transmission line will result in around 34.30 or 48.94 hectares of permanent habitat loss depending on final option of transmission line of 220 kV or 110 kV, respectively. This area without trees under and around the transmission line is important for the transmission line maintenance. After its installation it will not be possible to completely return the vegetation to its original state, which represents a permanent loss of the forest cover. Nevertheless, this area under and around transmission line will be restored with grass and woody vegetation. This will ensure favourable habitat conditions for some plant and animal species of such habitats.

Furthermore, temporary habitat loss will occur due to the installation of underground cables for energy transmission. The cables will be placed under existing macadam roads. For the installation of the cables, it will be necessary to remove 2 m of forest from each side of the existing macadam road. The cables will be placed under existing macadam roads. Approximately 0.55 hectares of forest will be removed in case of variant v0, 1.47 hectares in case of variant v1 or 0.97 hectares if variant v2 is opted out. The overall impact is considered temporary because the forest will naturally regrow on the affected area.

The overall loss of habitat depends on the variant of the project that will be realised; in the variant of the transmission line 220kV, the total loss of habitat will be approximately 55 hectares. In the variant of the transmission line 110kV the total loss will amount to approximately 69 hectares. Both options are considered to be moderate do to the fact that habitats under transmission line will be restored with grass and woody vegetation and prescribed mitigation measures of restoring natural habitats wherever this is technically feasible after construction. This will ensure favourable habitat conditions for some plant and animal species of such habitats.

Other types of potential impacts (impairment of the quality of the habitat (e.g. the appearance of noise, dust, and vibrations in the environment due to the increased presence of people and mechanization, Fragmentation of habitats, Accidents)) have been determined as of low and/or moderate significance. Strategies to minimize these include restricting vehicle movement off existing roads and careful disposal of invasive plant species. Despite ongoing risks during operation and maintenance, such as hazardous

waste generation, proactive management and timely interventions can mitigate these impacts.

During construction, temporary impacts such as habitat disturbance and dust emissions are anticipated. Strategies to minimize these include restricting vehicle movement off existing roads and careful disposal of invasive plant species. Despite ongoing risks during operation and maintenance, such as hazardous waste generation, proactive management and timely interventions can mitigate these impacts.

There is no literature data about reptile fauna in the WF Bitovnja project area, but based on habitat, vegetation cover and climate of the site, it is to be expected that there are favourable conditions for some reptile species. If the construction work (vegetation removal) starts in the fall (after the reproduction and before the hibernation), and then continues unhindered, significant negative impacts will be avoided as it will allow the reptiles to escape from the wider project area. The negative impact of individuals loss will be reduced, as well as the negative impact of vibrations and noise on reproduction. There is a possibility that a significant number of endangered *Vipera ursinii* individuals are present in the project area. It is assessed that in the project area there are possibly critical habitats for the species. It cannot be ruled out that the occupation of the project area will mean a significant interruption of communication within the population, which will be cut off and even more threatened as a result. It is also possible that the construction of the planned intervention will occupy a significant area of habitat for this species. However, this is only a question of probability based on literary sources, which are not recent for the Bitovnja area. Therefore, focused survey by reptile exoert to identified if the *Vipera ursinii* is presnt at the loaction and at the wider area of the planned intervention. ~~Based on the results, further activities and/or measures will be proposed.~~ The results obtained should be used to determine the importance of the planned intervention as a habitat for *Vipera ursinii* and the extent of the impact in the event of the construction of a wind farm and a power line and be part of the Biodiversity Management Plan (BMP) that should be developed in line with ESS6 Standard (Environmental and Social Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources). The BMP should define mitigation and management measures, identify the parties responsible for their implementation (investor, contractor, experts) and specify the required monitoring and monitoring schedule

Bosnia and Herzegovina is one of few countries in Europe that offers favourable habitats for three species of large carnivores: *Canis lupus*, *Ursus arctos* and *Lynx lynx*. There will be temporary fragmentation of their habitat during construction, after which individuals are expected to adapt to new habitat conditions and return to the wind farm area. In the case that large carnivores use planned windfarm surroundings for denning, it is probably possible for them to remove the den, as the size of their territories far exceeds the area of the planned wind farm and additional infrastructure. The wind farm construction period should be as short as possible, and it is advisable to carry out construction activities outside sensitive periods in the life cycle of large carnivores.

Data on bat fauna was collected during bats baseline survey which was carried out from September 2022 until September 2023. There were at least 13 bat species recorded. Overall bat activity recorded during the baseline survey was low to medium (in optimal microclimatic conditions), while habitat and environmental conditions are not favorable for bat activity most of the time. It is presumed that bats prefer forest habitats over open grasslands. There will be a small loss or change of habitat for bats due to construction of the wind farm, but it won't be significant. Disturbance and pollution during works can be minimised by avoiding work at night whenever possible, by performing work in stages instead of in the entire WPP area at once, and by using acceptable lighting to illuminate the construction site that

does not disperse light and does not attract insects. Bats' commuting routes might be slightly displaced, but not significantly. WPP Bitovnja could have a potentially unacceptable impact on local populations of *Pipistrellus pipistrellus* and *Pipistrellus kuhlii* and potentially *Vespertilio murinus* due to collision with turbine blades, medium impact on *Eptesicus serotinus*, *Hypsugo savii*, *Nyctalus leisleri*, *Nyctalus noctula*, and potentially on *Miniopterus schreibersii* and *Nyctalus lasiopterus*, which are not confirmed in the Project area but cannot be excluded. Negative impact of WPP on bats due to collision with wind turbines can be avoided by implementing blade feathering and increase of cut-in wind speed during peak activity of bats, when most of the fatalities are expected. Post-construction monitoring program is proposed to monitor bat fatalities and mitigation measures efficiency.

In order to obtain qualitative and quantitative data on the populations inhabiting the project site and the wider project area as well as to determine whether any of the sensitive bird species live there, the necessary research was conducted from September 2022 to September 2023. Same methodology and research effort was conducted on the reference site Mejnik (similar habitat types to the project area). During monitoring there were in total 10 bird species that have a higher chance of collision with the wind turbines. The observed species are the Norther Goshawk (*Accipiter gentilis*), Eurasian Sparrowhawk (*Accipiter nisus*), Golden Eagle (*Aquila chrysaetos*), Common Buzzard (*Buteo buteo*), Short-toed Eagle (*Circaetus gallicus*), Marsh Harrier (*Circus aeruginosus*), Montagu's harrier (*Circus pygargus*), Hobby (*Falco subbuteo*), Common Kestrel (*Falco tinnunculus*) and Honey Buzzard (*Pernis apivorus*). Most recorded overflights were Common Buzzard, while the least recorded species were the Norther Goshawk, Short-toed Eagle, Montagu's Harrier and Marsh Harrier. According to CLF BiH Golden Eagle has a status of endangered (EN), Short-toed Eagle, Marsh Harrier and Montagu's harrier have a status of vulnerable (VU). While, according to FBiH Nature Protection Act only Golden Eagle has a status of protected species. Species that are in the Annex I EU Birds Directive are: Golden eagle, Marsh harrier, Montagu's harrier, Short-toed eagle and Honney Buzzard. Annex II Bern and Bonn conventions are: Norther Goshawk, Eurasian Sparrowhawk, Golden Eagle, Common Buzzard, Short-toed Eagle, Marsh Harrier, Montagu's harrier, Hobby, Common Kestrel and Honey Buzzard. In order to assess said impact, The Collision risk model was used. The model showed that annual fatality with 98 % of avoidance rate is possible. For the Golden eagle, the collision risk model estimated that one individual would collide each year, meaning that a collision with the wind turbine rotor blades would result in the loss of a breeding pair in the wider vicinity of the project. As this is an endangered species protected under the FBiH Nature Protection Act, this would constitute a significant adverse impact from the perspective of protecting the national population, as there would be a loss of 1 and/or more than 1 individual. But it is assumed that the individuals recorded are locally resident individuals that rarely use the Bitovnja plateau for hunting. Recorded nocturnal species were Tawny Owl (*Strix aluco*) and Ural Owl (*Strix uralensis*). The breeding population of the Tawny Owl in the study area includes at least 11 pairs, while Ural Owl is rare (given that only one individual was recorded). From wood grouse species (Capercaillie and Hazel grouse), only Hazel grouse was recorded. The observations suggest that the breeding population of the Hazel grouse in the study area includes at least 1 pair which is in the west part of wider area, while Capericaillie is not present in the project area. The density of the nesting population of songbirds in the forest habitat in the wider area of Bitovnja plateau consists of 23 species. The most abundant species are Robin, Chaffinch, Willow tit and Goldcrest. While in open habitat it consists of 12 species. The most abundant species are Skylark, Chaffinch and Song thrush. During the autumn (September 24th to October 9th 2022) and spring (April 29th to May 14th) migration period, the radar survey was conducted on 15 calendar days. It was conducted by visual observation with help of radar (the species were

identified) and only radar detection (without species identification, only detection by size -small, medium and large birds). As a result of visual observations with radar monitoring during daylight hours, 41 bird species were detected, along with 15 unidentified but mostly classified to the genus or family. A total of 1 237 observations were made and 3 869 individuals were recorded. Analysis of the altitude characteristics of migration revealed that Large Birds migrated more intensively in the higher altitude ranges, Medium Birds used the airspace most evenly, but preferred altitudes from about 300 to about 400 m. Small Birds migrated mainly at low and medium altitudes, with a clear preference for altitudes in the 100-300 m range. Spatial distribution of bird flight tracks showed that migrating birds of prey mostly flew over the mountain ridge, crossing it perpendicularly. A large part of the flights took place in the central part of the Bitovnja mountain, especially for birds of the Accipiter and Circus genera and European Honey-buzzard. In the autumn, most flights were in the S or SW direction. In the spring, the main migration directions were N and NE. Possible negative impacts of wind farm on ornithofauna include collision, habitat loss or change, displacement and barrier effect.

Proposed mitigation measures are: 1. Removal of existing vegetation and excavation for the purpose of access roads to WTG and WTG plateau should be planned to start in the second half of August and to continue in the same autumn season until all vegetation is removed to avoid direct individual loss; 2. Carry out two-year monitoring after the construction of the wind farm, and if the fatality of birds of prey is determined, it will be necessary to implement additional mitigation measures, such as use of a system that selectively shuts down wind turbines in the case of detection the flights of birds of prey, especially the endangered one (Golden eagle, Harriers, Short-toed eagle, Herons and Egrets); 3. After the first year and determining the need for additional measures, conduct another year of monitoring; 4. To reduce the impact of collision of species actively flying over the wind farm area at night on their regular flight paths, it is necessary to illuminate each wind turbine with a red light that is switched on after sunset. Possible negative impact of transmission line are: loss of habitats, edge effect, collision, electrocution. In order to reduce the mentioned impact, it is necessary to mark the grounding wire at the locations of first and the largest mountain cut (on the part of the transmission line route between 300 m and 1.5 km from the substation under the Bitovnja plateau) with line markings that are recommended by the Avian Power Line Interaction committee (APLIC, 2012). Also, it is recommended that parts in the forest area (from 5 km till the end of the transmission line) would be marked with line markings.

1.2.1.12 Landscape

The wind farm is planned in a flat part of the Bitovnja ridge, on an altitude between 1500 and 1700 meters above sea level. The dominant land cover on the site is natural grasslands. The planned site for the wind farm is in a mountainous area, which causes terrain morphology change during the construction of access roads, wind plateau, and power lines. The construction of this wind farm will potentially result in extending the existing forest path and the loss of developed vegetation Only maintenance of the forest corridors will cause more significant changes in the visual experience of the space. According to the created map of theoretical visibility, the wind park will not be visible from the settlement of Kreševo and the surrounding roads, but it will be visible from the settlement's northwest of it (Jasenik, Požetva, Bare) and from the southeast and the settlements Trešnjevica, Tuhobići and Repovci. They have become an interesting accent in space and a symbol of care for the environment for using renewable energy sources. That is compatible with the protection of the natural heritage of the site.

1.2.1.13 The waste management

At the area of the City of Konjic, collection and disposal of municipal waste is in competence of JKP Standard Ltd. Konjic. Waste is currently deposited at the temporary city landfill in Konjic at the "Repovački potok" site. In addition to regular collection of municipal waste, the company also collects bulky waste on request and as needed in accordance with the Law on public cleanliness and hygiene. Due to the distance, inaccessibility, and lack of appropriate equipment, JKP standard does not collect waste in the area of MZ Bulatovići (Repovci, Stojkovići) and MZ Bradina (Šunji) settlement nearest to the project area WPP Bitovnja. Other type of waste is collected, treated or disposed by special companies, authorised by Federal Ministry of environment and tourism. Currently, in FB&H, most of the produced hazardous waste is exported for further treatment to other countries. Five companies are authorised for their export. Small percentage is treated within territory of B&H.

During the construction of WPP Bitovnja, several types o hazardous and non-hazardous waste will be produced. The largest waste quantities mainly refer to construction waste and earth material from site of wind turbines. Prior to start, the Contractor should develop Waste Management Plan for the construction site in accordance with national legislation. For temporary disposal of construction waste, the Contractor should provide temporary depositing locations at the site, within the construction zone. Negative impact from produced waste can be expected in a case of improper waste storage and management at site. Therefore, it is important to plan in advance location for waste storage. Generated waste should be collected selectively in accordance with the waste type. Waste incineration on site or in the open is prohibited. Separately collected waste should be stored on previously designated locations in adequate waste bins/containers that should be resistant to this type of waste, thus shall not allow leakages. Each container must be appropriately labelled. Hazardous liquid waste shall be collected in barrels or other suitable containers that should be stored on impermeable surface with secondary tank for preventing its leakage to soil and in fenced area with limited access. It is forbidden to discharge waste oil on surface and drains or soil.

The waste should be delivered only to companies that have been authorised from Federal Ministry for environment and tourism to collect that type of the waste which should be regulated through a contract.

Temporary landfill sites are required for deposition of humus, excavated materials, as well as for smaller amounts of buffer material and stone fractions that would be use after for terrain recultivation.

Due to remote location of the project area without municipal waste collection system, such waste must be collected and temporarily stored in closed buckets or containers until it can be collected by JKP Standard Konjic. It is important to agree with the company the appropriate dynamics of its collection which will best correspond to the dynamics of its creation at the location of the construction site. Upon establishment of organized separate waste collection systems by municipal structures, recyclable waste (plastics, paper, glass and iron) will be separated and disposed of in special containers intended for the recycling purpose. If waste would be collected and stored separately by their properties and on previously determined impermeable area that will prevent its spillage or dispersion on soil and then delivered to an authorised operator in accordance with national legislation and Waste Management Plan, no negative impacts on the environment are expected.

Wind farms as such are not significant waste generators during operation. However, waste should be never the less safely stored to prevent its spillage and leakage to the environment and then delivered only authorised companies at a time. In accordance with Waste Management plan.

1.2.2 Impacts on socioeconomic environment

1.2.2.1 Traffic flows

Negative impact on traffic flow during construction is expected from transport of wind turbine elements to the location and from transport of people and machinery. Transport study, ~~defined the most favourable access route by road from the Port of Ploče in the Republic of Croatia, along state roads D45, D8 and D9 to enter in BiH and then continue along~~ developed as part of the project documentation, defined the most favourable access route by road from the E73/M17 to the exit for main access road to project site near Ivan Sedlo where it turns left to new constructed access route to WF Ivan Sedlo that is currently under construction. Further main access route will be reconstructed due to small road radius and steep gradients, low quality of the final layer and insufficient width in certain places acc. to requirements of WTG supplier. The route E73/M17 is ~~already~~ traffic loaded and the exit/entrance of traffic from construction works of WF Bitovnja will have to be regulated ~~will not have any significant additional impact~~. ~~Moreover, the transport study proposed night transport in order to avoid the most congested time period that should reduce any possible negative impact on traffic flow.~~ Due to construction work of widening of local access road to Bitovnja the plan of traffic regulation should be developed that would enable access to site Bitovnja for other users (berry pickers, hikers…) during its' construction.

Traffic regulation plan during construction work of transmission line should also be developed since planned transmission line crosses existing local road from Bradina to settlements Repovci, Gobelovina and Stojkovići. The plan should enable the traffic during the construction work that will be held near this road.

1.2.2.2 Occupational Health and Safety

Hazards to health and safety at work that may occur during the construction, and decommissioning of wind farm, building of the access road and connecting transmission line include physical hazards, such as falling from heights, fall of persons or objects in excavations and work in enclosed spaces, injuries caused by working with rotating machines, injuries caused by welding works, working with electrical equipment, working with heavy machinery, lifting operations or fire and explosion hazards that may arise from handling flammable and combustible liquids or gases.

These aspects are mandatory part of the Main project design i.e. Occupational safety project and Fire protection project and include at least the following: worker accommodation on site, installation of warning signs and safety fencing at all critical work areas (e.g. open trenches, excavations, materials and equipment areas, etc.), vehicle movement and traffic on site, safety procedures for working at height, working with hazardous materials, working with heavy machinery, usage of personal protective equipment, spark protection, prevention measures from electricity hazards, prevention of accidental ground movement and cave-ins as well as developing an Emergency response plan. The construction site should have at least one occupational health and safety coordinator.

During operation, potential hazard are lower then during construction phase and are related to the workers who will be responsible for the maintenance and includes falling from heights, injuries caused by working with rotating machines or sharp objects, from welding work, lifting operations or fire and explosion hazards

that may arise from handling with flammable and combustible liquids or gases, electricity hazards. These aspects should be covered in health and safety plans during maintenance.

1.2.2.3 *The Social Activities*

Since the site of the Wind Power Plant Bitovnja is placed on the mountain ridge, at the altitude between 1530m and 1800m above the sea level, in an uninhabited and isolated land, the social impacts are hence quite limited. The most important impacts pertain to the informal users of the area, such as, berry pickers, and the hampered ~~reduced~~ access to the area for berry picking during the construction and decommissioning phase. Since only small area at plateau, currently covered with blueberries and cranberries, will be lost due to construction (only two of fifteen WTG are planned at this habitat), and considering that the main harvesting area is located on the slopes, the scope of foreseen mitigation measures is low, as the mitigation measures are limited to the informational activities and traffic regulation that will enable free access to the area that won't be under construction work at time. The access to the project area will also be hampered ~~reduced~~ for other users, including recreational users and tourist visitors (cycling, trekking, hiking). However, for these groups, too, the access will be hampered ~~reduced~~ only temporary, during the construction and decommissioning phase. The lost of visual quality of the area and natural environment especially concerns hikers while it can be concluded that does not affect significantly general local population in the vicinity of the project. Even some opposite experience from other windfarm in the area where recorded (the location of Windpark Podveležje gain on its attractiveness after the WF was built) so this impact can be assumed as moderate to high. Additionally, the theoretical assessment of visibility shows that impact would be moderate to low.

1.2.2.4 *Archaeology and Cultural heritage*

The municipality of Konjic in Bosnia and Herzegovina possesses a significant cultural-historical heritage spanning from prehistory to modern times, characterized by a rich archaeological legacy, particularly notable for its medieval stećak necropolises. Bosnia and Herzegovina has initiated a project for the protection of stećak monuments, underscoring the importance of preserving cultural heritage. The municipality boasts forty-eight national monuments and six cultural properties listed on the preliminary list of national monuments. However, potential impacts on cultural heritage arise from planned construction projects, such as the Bitovnja Wind Power Plant, which necessitate adherence to protective measures outlined in the Chance Finds Procedure. During construction, if archaeological findings are uncovered, operations must halt immediately, and the relevant cultural preservation authorities notified. Similarly, the cultural significance of Martin's Grave, a site of folklore and religious tradition, requires careful preservation during both construction and operational phases, with considerations given to local beliefs and practices. Through diligent adherence to established protocols and collaboration with cultural heritage authorities, the municipality aims to safeguard its rich historical legacy amidst ongoing development projects. Additionally, depending on the work dynamics, but if necessary, the construction work should be ceased on the 29 June, during pilgrimage to Martin's grave.

2 PROTECTION AND MITIGATION MEASURES

2.1 Measures during preparation/planning

General

1. Develop and implement appropriate environmental and social management system (ESMS) for the Project
2. ESMS will incorporate environmental and social policies, procedures, plans with mitigations measures. The ESMS will apply during the construction and operation phase of the Project. The ESMS will be communicated to Contractors which have to ensure that ESMS requirements extend to their contractors and subcontractors. Provide resources for implementation and monitoring of the ESMS

Soil

3. Determine the location of the soil material disposal site.

Water

4. Anticipate and design locations for the manipulation of oil, oil derivatives, oils and lubricants and the servicing of construction machines and mechanization with the implementation of appropriate water and soil protection measures. Refiling should be carried out using leak-proof containers under the machinery and in a covered area to prevent grease and oil from being washed away by rainwater.
5. When designing the locations of the poles of the connecting transmission line, avoid the troughs of water bodies, that is, prevent damage to the ecological, chemical and overall state of the fluids.

Biodiversity

6. Whenever possible, plan to divide the area of construction into construction phases and perform work in each phase at a different time in order to avoid carrying out work on the entire area of the wind power plant construction site at the same time.
7. Provide an area in the nearby urban environment where cleaning of construction vehicle tires will be carried out as a protection against the introduction of invasive species into the project area.
8. Plan the area for waste and excavated material temporary disposal in order to prevent its spreading on nearby habitats

9. Removing of existing vegetation and excavation for the ~~purpose of access~~ service roads to WTGs and WTG plateau should be planned to start in the second half of August and to continue in the same autumn season until all vegetation is removed to avoid direct ~~individual~~ loss of reptile individuals and disturbance of large carnivores.
10. Removing of existing forest and construction work for the purpose of main access road and transmission line should be planned to carry out from the second half of August to mid-March, i.e. outside the birds' reproductive activity (in autumn and winter).
11. Do not plan construction works at dusk, dawn and at night whenever it is technically feasible, as not to disturb nocturnal animals.
12. In the further optimization of the project design, in case of a decision to reduce the number of wind turbine generators, prioritize removing WTG1 from the design first, then WTG2, then WTG3 due to possible higher risk of bat collision.
13. Plan to use lighting with a beam of light directed towards the ground, with wavelengths above 540 nm and a colour temperature of less than 2700 K, which reduces light pollution and does not attract insects.
14. Installed wind turbines should have ability to rotate turbine blades approximately perpendicular to the wind direction in order to stop their free rotation below cut-in wind speed.
15. A survey of the population of *Vipera ursinii* on Bitovnja Mountain and surrounding mountain areas to assess the current local population size and the state of its habitat should be carried out by an expert herpetologist prior to wind farm construction. Based on the survey results, implement mitigation or compensation measures (to achieve net gains for the species) and monitoring program as proposed by the expert. Mitigation measures and monitoring program must be described in a Biodiversity Management Plan that should be prepared following good international practice.

Forest ecosystems

16. Determine in advance areas for temporary storage of construction materials, excavation materials, waste, and areas for parking vehicles on areas without forest vegetation.
17. During the planning and preparation for carrying out the works, establish active collaboration with the relevant organizational units responsible for forest management.

Game and hunting

18. During the preparatory works, it is necessary to establish cooperation with the hunting ground user.
19. In collaboration with the hunting ground user, determine the possible need for the relocation of hunting and game management objects.
20. Inform the hunting ground user about the start time of the works.

Landscape

21. Develop a project for the rehabilitation of landscape after the completion of construction works which should include:
    - After the completion of the construction works, the excavations made during the works should be levelled with the preserved soil to a shape that corresponds to the primarily found relief and left for natural reclamation
    - The project documentation should predict the color of the columns and rotors of the wind turbine that will stand out the least in the landscape, and also avoid colors and shades that give a dazzling effect in the sun. Use light, matte colors that best fit the background of the sky (matte white, light grey, etc.)

- The plan is to plant only autochthonous species from the wider catchment area.

22. During the further elaboration of the project of access and service roads and the plateau of wind turbines, design them so that they adapt as well as possible to the existing terrain while avoiding deep cuts and embankments. Unavoidable slopes should be designed with as little slope as possible.

Archaeology and cultural heritage

23. As a part of the project documentation, develop a "chance find" procedure for dealing with random archaeological finds of cultural heritage, defined as a physical cultural heritage that is unexpectedly found during the implementation of the project.
24. The "chance find" procedures should cover:
    - Warning of project staff on the possibility of detecting archaeological finds of cultural heritage,
    - Steps of temporary work stoppages in the event of potential discovery
    - Fencing the area to prevent further disruption or destruction,
    - Procedure of notifying competent authorities of findings / locations
    - Further cooperation with cultural heritage experts from competent authorities

Waste

25. Developed Waste Management Plan
26. Define the area for temporary waste storage that should prevent pollution of soil and its spreading to environment

Socioeconomic environment

27. Inform the local population which uses the project site for informal economic activities (such as, picking of blueberries and cranberries) in advance of the exact period in which they will have hampered access due to the construction works.

28. Inform the associations of recreational users (hiking clubs, hunting clubs, cycling clubs) in advance of the exact period in which the recreational users will ~~not~~ have limited access to the ground of the project site due to the construction works.

29. Inform the Catholic community from the nearby towns and pilgrims to the Martin's grave—where they gather annually on 29 June to hold a religious practice in honour of St. Petar or Petrovo — on the start of the construction works and if necessary (depending on the work dynamic) foresee the cessation of work during the pilgrimage.

Occupational health and safety

30. As a part of the project's Main design develop Health and Safety Plan for construction site that should at least cover following issues: working at heights, working in confined spaces, welding works, working with heavy machinery, installation of safety fences and signs warnings on all critical work, vehicle movement at site, spaces for placing hazardous materials and work with hazardous materials, dangers, prevention of unintentional soil displacement and collapse, health supervision, electric management, the obligation of wearing personal protective equipment and other risks in line with Health and Safety work hazard checklist for wind power plant (European OSHA https://osha.europa.eu/en/publications/e-fact-80-hazard-identification-checklist-occupational-safety-and-health-osh-risks-wind).

Traffic flow

31. Develop the Traffic Management Plan for construction site that should cover the traffic regulation during construction of access road in order to ensure free access to the site for other users (forestry management company, berry pickers, hikers,…) by temporary limiting the traffic or enabling the alternative route; the safety measures at entrance/exit of mechanisation and vehicles on magistral road (warning signs, speed limit, etc.). The Traffic Management Plan should be developed in accordance with forestry management company.
32. Plan the rehabilitation of existing roads that would be ruined during construction works.

Health and Safety of the Community

33. Traffic Management Plan for traffic regulation during the construction works should also ensure the safety and protection of other participants who use these roads.
34. Develop Fire protection plan at construction sites.

Local employment

35. Create and implement a Work and Employment Plan that will include:
    1. Details on: (i) employment opportunities for the local population; (ii) how employment opportunities will be advertised; (iii) recruitment procedure that will be transparent and fair, non-discriminatory and provide equal opportunities for both men and women; (iv) training opportunities to be provided to graduates and employees in technical, health and safety and manual work, where appropriate;
    - Requirement that all workers (including subcontractors) have employment contracts and that these contracts comply with domestic legislation, and applicable international labour standards (ILO);
    - Requirement that all workers have access to human resources policies and procedures;
    - Requirement that all workers (including subcontractors) must comply with the Code of Conduct for Construction Workers (this will be included in employment contracts);
    - Details of the appeal mechanism for all workers (including sub-contractors) as required by lenders.

2.2 Measures during construction

Water

1. Manipulation of oil, oil derivatives, oils and lubricants and replacement of batteries on construction machines and vehicles should be carried out exclusively in predetermined locations with appropriate water and soil protection measures.
2. On the construction site, provide a sufficient number of chemical toilets for workers and construction site staff with a tank for sanitary wastewater according to sanitary regulations, which will be regularly emptied by an authorized person.
3. Prevent the leakage of oil and fuel into the surrounding soil with movable impermeable containers under parked machines and vehicles.
4. Along with the implementation of appropriate water and soil protection measures, plan an appropriate impervious and/or covered surface on which the waste generated during construction will be temporarily collected, and timely organize the removal of waste through an authorized collector, depending on the construction dynamics. Ensure regular emptying of sanitary wastewater according to sanitary regulations by an authorized person.
5. Ensure sufficient quantities of drinking water for workers by installing a water tank.

Air quality

6. Before the transport of powdered material, spray the material with water and cover the vehicles with a protective tarpaulin in order to reduce air pollution
7. If the work is carried out in extremely dry weather, manipulative surfaces and access roads should be sprayed with water to reduce the rise of dust particles and their spread to the surrounding surfaces
8. Control the speed of machinery and vehicles when moving on unpaved surfaces depending on weather and surface condition especially near settlement Stojkovići and Repovci, located near planned transmission line route
9. Regularly maintain equipment and vehicles.
10. Regularly check the vehicles in accordance with the regulations on the emission of pollutants from vehicle's exhaust.

Soil, land use

11. Ensure protection of slopes due to possible landslides and material drift
12. After construction restore the original land cover wherever possible and green the area with native plant species that are ecologically appropriate for the region

Biodiversity

13. The protection measure defined in Biodiversity Management Plan for the protected species *Vipera ursinii* should be applied during construction work
14. Before each arrival in construction area, machines and vehicles should be carefully cleaned in the nearby urban area to remove all potential invasive species from vehicles.
15. During the construction works, use existing or new planned access roads, i.e. avoid driving and parking machinery and vehicles on the natural habitats that are not planned to be converted into a tower foundation or access road.
16. Vegetation removal for the construction of access roads and transmission line should begin in the fall, that is, secure the construction area and clear the vegetation in the fall, after the reproductive activity of all animal species, and before the hibernation of reptiles and bats.
17. Upon completion of the construction of all surfaces that vehicles and machinery will not use any more, should be grassed with native vegetation.
18. Limit the speed of vehicle movement on the access road leading to the planned wind power plant
19. In case of encountering invasive plant species, remove them carefully and dispose of them in such a way that plant parts do not remain in the natural habitat.
20. Mark the grounding wire at the locations of first and the largest mountain cut (on the part of the transmission line route between 300 m and 1.5 km from the substation under the Bitovnja plateau) with line markings that are recommended by the Avian Power Line Interaction committee (APLIC, 2012). Also, it is recommended that parts in the forest area (from 5 km till the end of the transmission line) would the marked with line markings.
21. Avoid carrying out construction works at dusk, dawn and at night whenever it is technically feasible.
22. Whenever possible, divide the area of construction into construction phases and perform work in each phase at a different time in order to avoid carrying out work on the entire area of the wind power plant construction site at the same time.
23. During construction use lighting with a beam of light directed towards the ground, with wavelengths above 540 nm and a colour temperature of less than 2700 K, which reduces light pollution and does not attract insects.

24. When felling trees, leave the tree at the felling site for at least 24 hours before removing it to allow animals to get out.

Landscape

25. Landscape rehabilitation after the completion of construction works

Noise

26. Use machines and vehicles that emit lower noise levels and less affect the surrounding fauna.
27. Plan to transport the equipment at a time when there are no large daily traffic jams.
28. Regularly maintain machines and vehicles.
29. It is forbidden to perform construction from 10 pm to 6 am the next day in line with Law on noise protection.

Forest ecosystems

30. When planning the works, by properly organizing and arranging the edge parts of the construction site by protecting edge trees, careful handling of construction machines, etc., prevent damage and felling of trees on the newly created edges.
31. When planning and preparing construction works, define access roads to the construction site, using planned or built forest infrastructure in order to avoid further damage on forest trees and compaction of the forest soil, and in case of need for the construction of new (temporary) access roads. It is needed to strictly adhere to the defined dimensions of construction plateaus and work zones to avoid unplanned damage to single trees or forest ecosystems. To ensure the functionality of existing forest roads during the construction of the wind power plant and associated infrastructure it is necessary to establish active collaboration with the relevant organizational units responsible for forest management while carrying out these works.
32. In order to protect the land from erosion, build access roads in such a way that rainwater does not cause increased erosion in the surrounding terrain.
33. Handle highly flammable substances and machines and tools in line with the provisions outlined in the legislation on fire protection on federal and cantonal level such as regular maintenance and control of the functionality of devices and installations whose malfunctions can affect the occurrence and spread of fire; properly storage of highly flammable substances, banning the use of open fire and other sources of ignition in forest area; training of all employees in the practical use of fire extinguishers…), .
34. Maintain the functionality of the existing forest fire protection infrastructure during the execution of works.
35. Adjust the time of tree felling to the dynamics of construction and the method and time of proper disposal of the felled wood stock. During the execution of the works, establish and maintain forest order and apply integrated forest protection measures against diseases and pests. During times of the year when there is an increased risk of a rise in the population of forest pests (such as insects, fungal diseases, and other types of afflictions), it is crucial to promptly remove and manage damaged and felled trees. This will minimize the likelihood of pest populations escalating. Establish active collaboration with the relevant organizational units responsible for forest management while carrying out these works.
36. On areas that are not directly affected by construction works, preserve the existing vegetation, and promptly repair all potential damage to the forest land, forest vegetation and forest infrastructure upon completion of the works.
37. All waste (construction, communal, plant) generated during the execution of works must be removed from the forest and properly disposed, i.e. handed over to legal entities authorized to deal with this type of waste.

38. Undertaking preventive and protective measures to safeguard forest ecosystems from the introduction of invasive organisms, it is necessary to: educate staff and contractors about the risks of invasive species and the importance of following prevention protocols, and implement strict hygiene protocols for vehicles, equipment, and personnel entering the wind power plant site. This includes cleaning vehicles and tools to remove seeds, soil, and plant material.

Game and hunting

39. Restrict the movement of machinery and equipment within the construction site work zone.
40. Limit construction work to daylight hours and perform work at night only in exceptional circumstances.

Archaeology and Cultural Heritage

41. Even if it is not officially protected, the area with "stećci" in the vicinity of the access road to Repovci settlement, should be protected from damages during road reconstruction in a case that EPBIH decide to support its renovation in accordance with its policy as socially responsible Company..
42. Martin's grave, even if it is not officially protected, should be protected prior to construction work to prevent damages during construction.
43. Implement the "Chance find" Procedure during the construction work, and ensure that the appropriate staff and the Contractor are trained on the requirements of the Procedure.
44. In case of discovery of archaeological finds or cultural-historical goods, stop work, cordon off the area of the finds, protect the finds and inform the relevant authorities immediately so that appropriate measures can be taken to protect the finds and the site.

Socioeconomic environment

45. The access to the project site for all groups of stakeholders who use the grounds (berry pickers, recreational users, pilgrims to the Martin's grave, tourist entrepreneurs) should be organized in accordance with the phased construction of the wind power plant, which will enable ~~that limited~~ access to the location expect of the current works, after which access should be possible again as soon as health and safety conditions allows it. Depending on the work dynamics, but if necessary, the construction work should be ceased on the 29 June, during pilgrimage to Martin's grave.
46. Allow the access to other particular parts of the project site for all groups of stakeholders in periods in which these parts are not directly used for construction works.
47. Draft a project of temporary traffic regulation during construction in order to mitigate the overburdening of the existing road structure.
48. In case of possible damage to the pavement due to the passage of heavy machinery, the road damage should be repaired in the shortest possible period..
49. Qualified local firms and people shall be ~~given preference~~ taken into account as one of the criteria in hiring for construction works in line with developed Work and Employment Plan.

Traffic flow

50. Organise the traffic at location where transportation vehicle exit/enter the magistral road and at access road in line with Traffic Management Plan.

Health and Safety of Community

51. Prevent unauthorised access to the construction site by forming safety zone at the location of current construction work.

52. Regularly performed control of vehicles and mechanisation in order to prevent possible accidents at access roads
53. Prevent the possibility of fire in line with developed Fire protection plan for construction work by applying measures such as careful handling of flammable materials and avoiding open flames, ensure fire protection equipment at the storage area etc.
54. The manipulation with flammable materials is forbidden in forest area.

Occupational Health and Safety

55. All measures prescribed by Health and Safety Plan at construction site should be applied
    - Appoint at least one person responsible for safety and health at construction site
    - All workers should have valid contracts in line with national legislation
    - All workers should be educated and validated for their knowledge of safety procedures
    - Develop Emergency Rescue Plan that should contain all identified risks for workers and eventually local community
    - Regularly check the implementation of the health and safety measures at site
    - Ensure personal protective equipment at site
    - Ensure that construction workers are trained to identification of potential UXO during construction works. In the event of suspecting and encountering the presence of unexploded ordnance, immediately stop all work in the immediate vicinity, cordon off the area and contact the competent BHMAC authority. Only after the arrival, inspection and given approval of the competent BHMAC, it is possible to continue with the works.

Waste

56. Waste management at construction site should be in accordance with prepared Plan
57. Educate the workers on proper prevention and handling of generated waste.
58. Prevent the generation of waste. Separately collect the waste.
59. Hazardous waste should be stored in closed containers/barrels at covered, fenced area on an impermeable surface to prevent soil contamination
60. Containers with hazardous liquid waste should have secondary containment to prevent leakage of waste.
61. Maintain the necessary documentation on the generation and delivery of waste (such are the data on: the evidence of generated waste quantity, the date of delivery to authorised company, the data on where it was deposited or treated in line with national legislation)
62. The waste should be delivered only to company authorised (licenced) for that type of waste

2.3 Measures during operation

Water

1. Regularly maintain and control the watertight protective structures of the substation (collection and oil pits).
2. Intervening servicing of machinery should be carried out in such a way as to prevent leakage of oil and lubricants into the environment by using movable impermeable containers under machines and vehicles, provide appropriate containers for waste oils and lubricants and properly dispose of them.
3. Ensure regular emptying of sanitary wastewater according to sanitary regulations by an authorized person.
4. Ensure sufficient quantities of drinking water by installing a water tank and regular maintenance.

Biodiversity

5. Limit the speed of vehicle movement on the main access road leading to the planned wind power plant
6. In case of encountering invasive plant species, carefully remove them and dispose in such a way that parts of the plant do not remain in the natural habitat i.e. by harvesting them with their roots and disposing them in accordance with local waste management company that is responsible for bio waste
7. At wind turbine generators locations WTG3, WTG4, WTG5, WTG6, WTG7, WTG8, WTG9, WTG10, WTG11, WTG12, WTG13, WTG14, and WTG15, increase cut-in wind speed from July 1st until August 31st to 6 m/s from sunset to sunrise, with the conditions that the air temperature is at least 10 ^{o}C and there is no precipitation (relative humidity less than 95 %).
8. At wind turbine generators locations WTG1 and WTG2, increase cut-in wind speed from May 1st until October 31st to 6.5 m/s from sunset until sunrise, with the conditions that the air temperature is at least 10 ºC and there is no precipitation (relative humidity less than 95 %)
9. Implement blade feathering (rotation of blades approximately perpendicular to wind direction to stop their free rotation below cut-in wind speed) at all wind turbine generators from May 1st until October 31st from sunset to sunrise.
10. Avoid carrying out maintenance at dusk, dawn and at night whenever it is technically feasible.
11. During maintenance use lighting with a beam of light directed towards the ground, with wavelengths above 540 nm and a colour temperature of less than 2700 K, which reduces light pollution and does not attract insects.
12. During operation implement two-year monitoring of bat fauna (according to the Monitoring plan). If negative impacts of the wind power plant are determined by ~~post-construction bat fauna~~ the monitoring, apply expertly based mitigation measures (e.g. increase of cut-in wind speed).
13. It is necessary to carry out a two-year monitoring of birds after the construction of the wind farm Bitovnja and refrent site Mejnik, and if the mortality of birds of prey is determined after first year, it is necessary to implement additional mitigation measures, such as the use of a system that selectively turns off wind turbines in case of detection of the flight of birds of prey, and especially when detecting endangered species (golden eagle, harrier, kite eagle, cranes and herons).
14. After the first year and determining the need for additional measures based on the results, it is necessary to conduct another year of bird monitoring.
15. In agreement with Elektroprenos d.o.o. it is recommended to carry out two-year monitoring after construction under the parts of transmission line where the marks will be installed as suggested by new guidelines (TransMit; BIOM, 2024).

Forest ecosystems

16. Actively implement environmental protection measures of ensuring minimal disturbance to surrounding forests by proper handling and storage of generated waste avoiding its spread to the environment, especially forest area and regular maintenance of vehicles in order to prevent oil spill and regular implementation of fire safety measures.

Game and hunting

17. Report any wildlife casualties or the discovery of deceased wildlife in the area of wind park to the hunting ground user.

Socioeconomic environment

18. Stopping the wind turbines in the near vicinity of the Martin's grave on 29 June each year so as to prevent being a nuisance for the pilgrims.
19. Qualified local population shall be given preference of employment.

Health and safety of community

20. Place warning signs on WTG against falling ice in the immediate vicinity of the wind turbine
21. Forbid the access of unauthorised persons into the WTG

Occupational health and safety

22. Develop Health and Safety Plan for maintenance activities at site.
23. All workers should be educated on safety procedures
24. Develop Emergency Rescue Plan for identified risks at site location
25. Regularly check the implementation of the health and safety measures at site

2.4 Protection measures in case of uncontrolled events

1. In the event of an uncontrolled spill of dangerous substances, immediately take measures to prevent further spillage, completely clean the contaminated surface, i.e. remove the contaminated soil, and entrust its disposal to an authorized person.

2.5 Measures after the end of life

Most of the measures prescribed during construction phase are also applicable to the decommissioning phase.

Soil

1. Determine the location of the soil material disposal site.

Water

2. Manipulation of oil, oil derivatives, oils and lubricants and replacement of batteries on construction machines and vehicles should be carried out exclusively in predetermined locations with appropriate water and soil protection measures.
3. On the construction site, provide a sufficient number of chemical toilets for workers and construction site staff with a tank for sanitary wastewater according to sanitary regulations, which will be regularly emptied by an authorized person.
4. Prevent the leakage of oil and fuel into the surrounding soil with movable impermeable containers under parked machines and vehicles.
5. Along with the implementation of appropriate water and soil protection measures, plan an appropriate impervious and/or covered surface on which the waste generated during demolition will be temporarily collected, and timely organize the removal of waste through an authorized collector, depending on the construction dynamics.
6. Ensure sufficient quantities of drinking water by installing a water tank.

Air quality

7. Before the transport of powdered material, spray the material with water and cover the vehicles with a protective tarpaulin in order to reduce air pollution
8. If the work is carried out in extremely dry weather, manipulative surfaces and access roads should be sprayed with water to reduce the rise of dust particles and their spread to the surrounding surfaces
9. Reduce the speed of movement of machinery and vehicles when moving on unpaved surfaces depending on weather and surface conditions
10. Regularly maintain equipment and vehicles.
11. Regularly check the vehicles in accordance with the regulations on the emission of pollutants from vehicle's exhaust.

Noise

12. Use machines and vehicles that emit lower noise levels and less affect the surrounding fauna.
13. Plan to transport the equipment at a time when there are no large daily traffic jams.
14. Regularly maintain machines and vehicles.

Biodiversity

15. Before each arrival in construction area, machines and vehicles should be carefully cleaned in the nearby urban area to remove all potential invasive species from vehicles.
16. During the dismantling works, use existing roads, i.e. avoid driving and parking machinery and vehicles on the natural habitats.
17. Upon completion of the decommissioning, all surfaces should be grassed with native vegetation.
18. Limit the speed of vehicle movement on the access road leading to the planned wind power plant
19. In case of encountering invasive plant species, remove them carefully and dispose of them in such a way that plant parts do not remain in the natural habitat.
20. Avoid carrying out demolition works at dusk, dawn and at night whenever it is technically feasible.
21. Avoid carrying out work on the entire area of the wind power plant construction site at the same time.
22. During decommissioning use lighting with a beam of light directed towards the ground, with wavelengths above 540 nm and a colour temperature of less than 2700 K, which reduces light pollution and does not attract insects.

Landscape

23. Landscape rehabilitation after the completion of demolition
24. Develop a project for the rehabilitation of landscape which should include:
    - After the completion of the demolition works, the excavations from removed WTG should be levelled with the preserved soil to a shape that corresponds to the primarily found relief and left for natural reclamation
    - The plan is to plant only autochthonous species from the wider catchment area.

Game

25. Restrict the movement of machinery and equipment within work zone of the construction site.
26. Limit construction work to daylight hours and perform work at night only in exceptional circumstances.

Waste

27. The operator have to prepare Waste Management Plan
28. Waste management at construction site should be in accordance with prepared Plan
29. Educated workers on proper prevention and handling of generated waste.

30. Prevent the generation of waste. Separately collect the waste.
31. Hazardous waste should be stored in closed containers/barrels at covered, fenced area on an impermeable surface to prevent soil contamination
32. Containers with hazardous liquid waste should have secondary containment to prevent leakage of waste.
33. The waste should be delivered only to authorised (licenced) company

Socioeconomic environment

34. Inform the local population which uses the project site for informal economic activities (such as, picking of blueberries and cranberries) in advance of the exact period in which they will have hampered access to it due to the dismantling works.
35. Inform the associations of recreational users (hiking clubs, hunting clubs, cycling clubs) in advance of the exact period in which the recreational users will ~~not~~ have hampered access to the ground of the project site due to the dismantling works.
36. Inform the Catholic community from the nearby towns of Kreševo, Fojnica, Kiseljak and Brestovski in advance of the exact period ~~in which~~ of the dismantling works. The work should be ceased on the 29 June enabling free and undisturbed access to the ~~On the~~ pilgrims to the Martin's grave ~~where they gather annually on 29 June~~ to hold a religious practice in honour of St. Petar or Petrovo.~~ will not have access to it due to the dismantling works~~.

Health and Safety of Community

37. Prevent unauthorised access to the construction site by forming safety zone at the location of current construction.
38. Regularly performed control of vehicles and mechanisation in order to prevent possible accidents at access roads
39. Prevent the possibility of fire by applying measures in line with Fire Protection Plan such as careful handling of flammable materials and open flames.
40. Traffic Management Plan for traffic regulation during the construction works should also ensure the safety and protection of other participants who use the same roads.

Occupational Health and Safety

41. Develop Health and Safety Plan for all activities at site.
42. All workers should be educated on safety procedures
43. Develop Emergency Rescue Plan for identified risks at site location
44. Regularly check the implementation of the health and safety measures at site
45. At least one person should be appointed as EHS manager
46. Develop Fire protection plan at construction sites.

Traffic flow

47. Develop the Traffic Management Plan for construction site that should cover the traffic regulation during decommissioning in order to ensure free access to the site for other users (forestry management company, berry pickers, hikers,…); the safety measures at entrance/exit of mechanisation and vehicles on magistral road (warning signs, speed limit, etc.). The Traffic Management Plan should be developed in accordance with forestry management company.

Local employment

48. Create and implement a Work and Employment Plan that will include:
    - Details on: (i) employment opportunities for the local population; (ii) how employment opportunities will be advertised; (iii) recruitment procedure that will be transparent and fair, non-discriminatory and provide equal opportunities for both men and women; (iv) training opportunities to be provided to graduates and employees in technical, health and safety and manual work, where appropriate;
    - Requirement that all workers (including subcontractors) have employment contracts and that these contracts comply with domestic legislation, and applicable international labour standards (ILO);
    - Requirement that all workers have access to human resources policies and procedures;
    - Requirement that all workers (including subcontractors) must comply with the Code of Conduct for Construction Workers (this will be included in employment contracts);
    - Details of the appeal mechanism for all workers (including sub-contractors) as required by lenders.

2.6 Proposed Monitoring plan

2.6.1 Implementation of mitigation measures

In order to ensure the implementation of the environmental and social management plan (ESMP) for the Project i.e., that incorporate environmental and social policies, procedures, plans with mitigations measures, appropriate monitoring of ESMP should be conducted during construction and operation phase. The ESMP will be communicated to contractors which have to ensure that ESMP requirements extend to their subcontractors. Implementation and monitoring of the ESMP should be monitored by EHS manager. The Environmental and Social Report on the environmental and social performance and implementation of ESMP should be developed at least quarterly during construction work.

2.6.2 Survey of *Vipera ursinii*

A survey of the population of *Vipera ursinii* on Bitovnja Mountain and surrounding mountain areas to assess the current local population size and the state of its habitat should be carried out by an expert herpetologist prior to wind farm construction.

Based on the survey results, implement mitigation or compensation measures (to achieve net gains for the species) and monitoring program during construction as proposed by the expert. Mitigation measures and monitoring program must be described in a Biodiversity Management Plan.

2.6.3 Monitoring of ornithofauna

Monitor the condition during operation of the wind turbine using the same methodology as for previous research. Monitor the status of bird populations in the area of the Bitovnja wind farm for at least two years. Experts (ornithologists) should carry out a monitoring program that includes the following activities:

1. Monitoring of bird activity - identification of changes in species composition, behaviour, abundance and activity of bird populations in the area of the Bitovnja wind farm in relation to the newly created infrastructure in the area (wind turbines, substation and access roads). The method of counting from vantage points must be carried out at the locations of the vantage points carried out in the past, and the method of counting points must be carried out along the lines of the transects carried

out during the previous research. For more details on the methods and location coordinates of the points conducted in the basic research, can be found in the final report of the ornithofauna research.

2. Search for nests of birds of prey in the wider area of the project (primarily Golden Eagles) during the first three years after construction of the wind farm. After completion of the three years, carry out the search every 5 years.

3. Monitoring bird fatality - Determine bird fatality by searching a circular area around each wind turbine to find injured/killed birds, for a duration of at least 15 minutes/person/wind turbine (while taking into account the visibility of the site and the search performance of the researcher). The radius of searching will depend on the final height of the wind turbine (EBRD, KfW, IFC (2023): Post-construction bird and bat fatality monitoring for onshore wind energy facilities in emerging market). The search must be conducted at an interval of 14 to 28 days between two searches at each wind turbine. For each injured/dead individual found, it is necessary to record the condition of the corpse (fresh, old, etc.) and the type of injury, type, sex and age, position (GPS coordinates, location of the find in relation to the visibility of the terrain, marking of the nearest wind turbine and distance to the wind turbine must be.

If, at the end of the first-year monitoring of bird fauna, a high intensity of bird fatalities is detected, it is necessary to apply additional protection and mitigation measures prescribed by the competent nature conservation authority as well as WB ESS and international good practices. The effectiveness of the additional measures should be tested during further monitoring over a critical period of at least one year. The results and analyses of all monitoring activities should be properly recorded and submitted to the central state administrative body responsible for nature conservation at the end of each monitoring year. If monitoring reveals a significant impact on birds, the competent authority must be notified immediately.

In addition to monitoring at the Bitovnja site, it is necessary to carry out monitoring at the reference location Mejnik in the same period according to the same methodology. After two years of research at the Mejnik, it is necessary to compare the data from the research before construction and after construction on the Bitovnja site with the data at the reference location in order to determine whether there are changes in the composition of the ornithofauna and other parameters that could be affected by the construction of the wind farm.

Transmission line

In agreement with Elektroprenos d.o.o. carry out two-year monitoring after construction under the parts of transmission line where the marks will be installed (first and the largest mountain cut - on the part of the transmission line route between 300 m and 1.5 km from the substation under the Bitovnja plateau) as well as parts in the forest area (from 5 km till the end of the transmission line). It will be necessary to search the area of 10+10 m from the transmission line axis. The search will need to be conducted every month. Besides searching it will be necessary to conduct searcher efficiency test and carcass persistence test as suggested by new guidelines (TransMit; BIOM, 2024).

2.6.4 Post-construction bat fauna monitoring

Carry out bat fatality monitoring for a period of two years from the commissioning of the wind power plant, including trial operation. Carry out monitoring in accordance with relevant guidelines (e.g. Rodrigues L.,

Bach L., Dobourg-Savage M.-J., Karapandža B., Kovač D., Kervyn T., Dekker J., Kepel A., Bach P., Collins J., Harbusch C., Park K., Micevski B., Minderman J. (2014): Guidelines for consideration of bats in wind farm projects – Revision 2014. EUROBATS Publication Series No. 6 (English version). UNEP/ EUROBATS Secretariat, Bonn, Germany; EBRD, KfW, IFC (2023): Post-construction bird and bat fatality monitoring for onshore wind energy facilities in emerging market countries). Monitoring should be carried out between May 1st and October 31st, and should include:

1) Monitoring of bat activity

Monitor possible changes in the level of activity and behaviour of bats. Monitor activity using the following methods:

a. bat sound recording along linear transects

b. all-night bat sound recording at stationary points.

The number and routes of linear transects and the number and locations of stationary points should be adapted to the project in such a way that activity monitoring takes place as close as possible to the wind turbines. If it is technically feasible, one device for stationary recording should be installed to record bat sounds within rotor-swept zone.

2) Monitoring of bat fatalities

Monitor bat mortality by searching the area around wind turbines approximately every two weeks or more often. Determine the search area, i.e. the search distance from the centre of the tower, according to the relevant methodology (e.g. EBRD, KfW, IFC (2023): Post-construction bird and bat fatality monitoring for onshore wind energy facilities in emerging market countries).

Based on the search results, estimate fatality rate for each year of monitoring. For the purposes of fatality rate estimation, carry out searcher efficiency and carcass persistence trials. In addition to search and trial results, take into account search dynamics and density weight proportion. Fatality rate should be analysed with regard to the activity of bats in the WPP area.

Based on the results after each year of monitoring, as well as published monitoring results from WPP Ivan Sedlo, analyse the effectiveness of mitigation measures and, if necessary, propose their modification. Also, after each year, if necessary, propose a modification of the monitoring methodology or dynamics. After two years of monitoring, if necessary, propose the continuation of monitoring, mandatory in the case of the implementation of modified or additional mitigation measures, so that their effectiveness can be monitored.

3 Conclusion

Environmental and Social Impact Assessment included an analysis of the legislative framework, available documentation, collection and analysis of data on the current state and possible impacts on the environment and society due to the implementation of planned activities for the construction of a wind farm at the Bitovnja site.

Based on the results of the gap analysis, it was concluded that the large part of the European legislation are translated into national legislation of Federation of Bosna and Herzegovina. International standards such as of KfW and World Bank, in relation to national legislation on environmental and nature protection cover more issues, especially socioeconomic environment where they also impose stricter requirements than national regulations. Therefore, even the Ministry of Environment and Tourism had issued the environmental permit for the WF Bitovnja project (Environmental Permit No. UPI 5/2-23-11-124-16, 2017) and that JP Elektroprivreda was not required to develop EIA study and conduct an EIA procedure, according to international standards, a complete ESIA should be developed for this type of project together with SEP and ESMP.

In order to obtain necessary data to assess all of the potential impacts and risks on bird and bat species, which may rise as a result of WPP Bitovnja construction and operation a yearly monitoring of birds and bat baseline state was conducted as a part of this ESIA study. The main goals were to obtain the data on:

- State of local biological diversity with focus on bird and bat species richness;
- Number of endangered bird and bat species in the wider Project area and the status of their habitats in the Project area;
- Abundance of migratory and resident/breeding birds and bats using the Area of Influence;
- Bird and bat populations abundance and habitat use in the Project area and the importance of the Project Area to those populations;
- Flight paths and flight patterns of priority species above the Project area.

Additionally, in order to correctly assess the impacts on socioeconomic environment such as local population, tourism, recreational activities and identified informal activities (blueberry and cranberry picking) at location three workshops with local population and members of hiking and hunting society at settlements Bradina, Deževice and Dusina were held during May and July 2023.

Environmental and Social Impact Assessment assessed possible impacts of planned Wind Power plant Bitovnja on physical and biological environment as well as on socioeconomic environment during all phases: construction, operation and dismantling phase. ESIA analysed and evaluated several layout options and characteristics of WTG together with associated service roads, access road and transmission line. The possible impact of WTG layout consisting of 15 wind turbines but from different producer, were analysed through all environmental components. The widening of the existing access road to the project site to the access road to WF Ivan Sedlo, that is currently in construction and then to the main road was analyzed. This option that partially use the planned access road of WPP Ivan Sedlo is the most favorable due to smaller cumulative negative impact of loss of habitat and forest area. The study also assessed two options of transmission lines that coincide with the route, but the route of the 110 kV transmission line is slightly longer. Separate Critical Habitat Assessment was conducted in order to identify areas of high biodiversity value where development would be particularly sensitive and require special attention. It's based on five criteria that address habitat of significant importance to threatened, endemic, congregatory and migratory species, threatened or unique ecosystems, and key evolutionary processes. It is assessed that there is a possibility that the project area is critical habitat for one fauna species, *Vipera ursini*. Although the current distribution (species range) and population size of this species in Balkan is unknown, distribution area of this species in general is very limited, narrow and discontinuous and Vipera ursinii is one of the most threatened reptiles in the whole Europe. Therefore, a specific survey of the population of Vipera ursinii on Bitovnja Mountain and other surrounding mountain areas is prescribed in order to assess the current local population size and the state of its habitat. Based on the survey results, it should implement mitigation or compensation measures (to achieve net gains for the species) and monitoring program, as proposed by the expert. Mitigation measures and monitoring program must be described in a Biodiversity Management Plan.

Generally, during construction phase the possible negative impacts on soil, ground water bodies, land use, biodiversity and forests were identified. The impact on air quality could be expected only in settlement Stojkovići and Repovci that are situated near proposed route of transmission line. Due to its temporary character and by applying mitigation measures, it could be reduced to acceptable level. Negative impacts on forestry exploitation and management activities, informal human activities such as picking of blueberries and cranberries, hiking and religious customs and traffic flow can be expected as well. However, the estimated loss of area under blueberries and cranberries will be negligible while free access should be enabled to the harvesting area (slopes) that are not directly impacted by current construction work). A positive impact on the local population through employment, payment of compensation and improvement of transport infrastructure was also identified. During operation of WPP Bitovnja, due to its remote location, away from settlements, WPP will not have impact on noise level at nearest settlements. WPP Bitovnja will have indirect positive impact on air quality and climate change through the reduction of emissions of pollutants into the air since electricity will be produced from RES instead of fossil fuels. Possible negative impacts on birds and bats population during operation phase is identified as well. These impacts can be reduced by applying prescribed protection measures with regular monitoring of their performance.

Based on identified possible negative impacts on soil, forests, landscape, biodiversity especially birds and bats, social and economic activities that were identified, mitigation measures were proposed in order to prevent or reduce those negative impacts. The prescribed monitoring of their implementation as well as the monitoring of the state of the environment (state of the birds and bats population) should ensure their

effectiveness or need for other mitigation measures. Through applying those measures and monitoring of their implementation the project won't have significant negative impact on the environment.