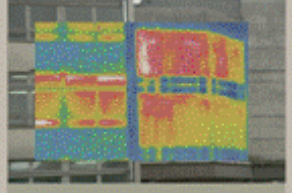
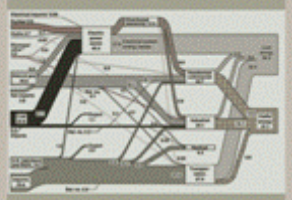







KfW Entwicklungsbank

Preliminary Environmental Impact Assessment for the Wind Farm Mesihovina located on the territory of Municipality Tomislavgrad – owned and operated by EP HZHB

Prepared by:

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ENERGY AND ENVIRONMENT CONSULTANTS

In collaboration with

IHGF

March 2009

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1 NON TECHNICAL SUMMARY

1.1 Project background

Elektroprivreda Hrvatske Zajednice Herceg-Bosne (EP HZHB) is the electricity utility serving the area of Federation of Bosnia and Herzegovina. Currently its generation capacity, based on hydro power, is only sufficient to cover about one third of the electricity demand in the area supplied by EP HZHB. In an effort to expanding and diversifying its generation capacity while adhering to its good environmental records, EP HZHB, with the support of international consultants, is currently exploring a number of sites presenting promising wind potential. Out of the several sites originally examined, 3 were selected for more detailed measurements and construction of wind farms: Borova glava, Midena-Brišnik and Jastrebinka**.**

The present document comprises the Prior Environmental Impact Assessment (prior EIA) concerning the development and operation of a wind farm Mesihovina at Midena-Brišnik site.

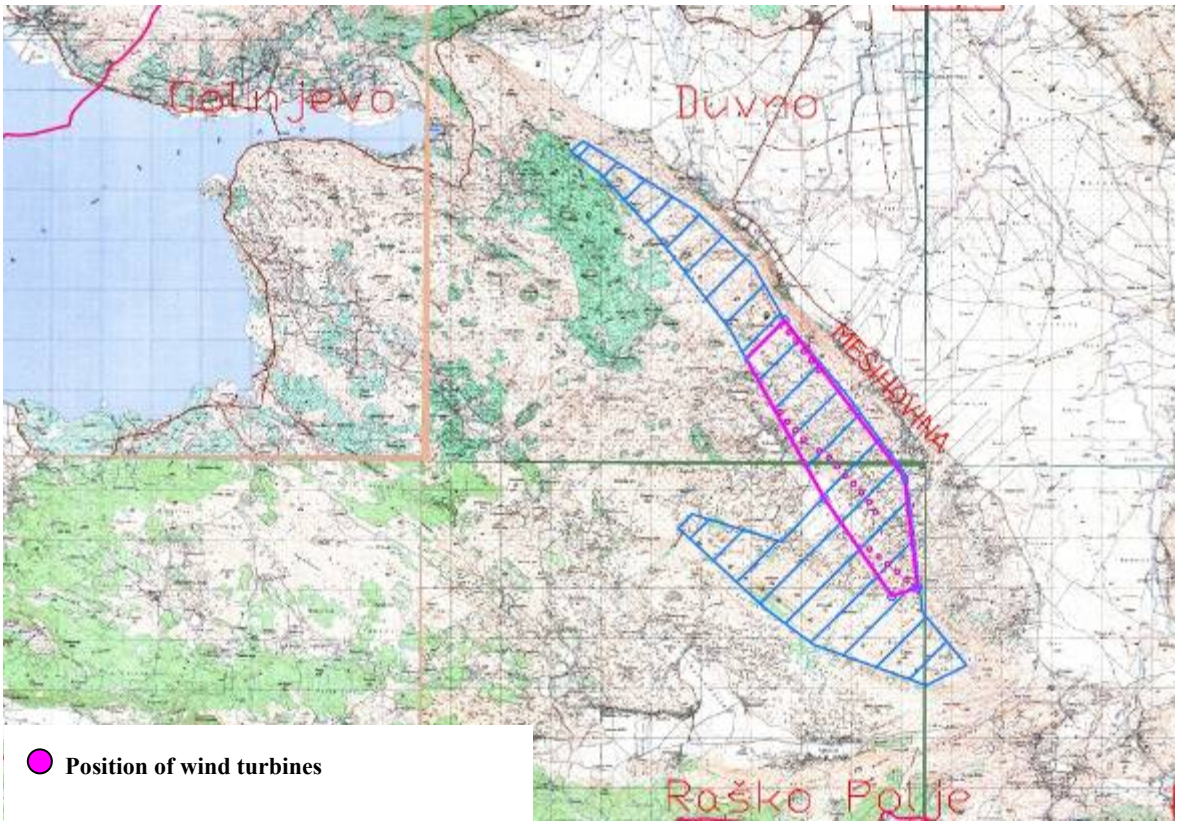
1.2 Legal framework

According to national legislation requirements, the Environmental Impact Assessment and the Public Consultation and Disclosure process form part of the project licensing procedures in BiH. The EIA is undertaken as a part of the urban permitting procedure, as specified in the Law on Environmental Protection (Official Gazette of FBiH no. 33/03), and has two stages: prior EIA and full EIS.

In accordance with the Federal "Rulebook for the industrial plants and installations which require environmental impact assessment and installations which can be built and put in operation only when the environmental license is obtained", the construction and operation of wind farms above 2 MW or with more than 4 turbines is not classified as an activity of high environmental hazard. It rests with the competent authority (the Federal Ministry of Environment and Tourism), upon examination of the prior EIA, to decide whether a full EIS is necessary.

1.3 Project location

The proposed development is planned to be constructed in the area of municipality Tomislavgrad. The wind farm consists of three main rows running from southeast to northwest, following the highest parts of the ridge. In total 22 turbines of 2 MW are proposed, with a total power of 44 MW. The project location is presented in the following picture.



Picture 1.1 Project location

1.4 Technical description

1.4.1 Equipment

The wind farm will comprise the following elements:

- Wind turbines of around 2 MW each. The supplier of the turbines has not been selected yet but typical wind turbine models from well known international suppliers will be used.
- Towers, upon which the wind turbines will be installed, with the appropriate ground construction, wiring, power electronics, etc.
- Transformers (low to medium voltage) which are installed in the interior of the tower base of each turbine with the aim to raise the low voltage produced to medium voltage.
- Underground electricity transmission lines connecting the wind turbines with each other and with the Control Building.
- Control Building which will shelter the electronic system for monitoring and controlling the wind turbines as well as other facilities.
- Electrical connection of the wind farm with the National Grid, through overhead transmission lines departing from the Control Building.

The wind turbines selected have a rotor diameter of 80 to 90 metres and the nacelle located about 80 metres high. That means that the maximum blade tip height is about 125 metres.

1.4.2 Installation

The towers, turbines and related equipment will be transported to the site by special trucks able to carry extreme loads. The tower will be transported in three pieces and will be mounted gradually on site with the use of a crane. In total 8-9 trucks will be required for each wind turbine and roads of minimum width of 5 metres is required for these trucks to manoeuvre their way to the site.

An armed concrete foundation of an area approximately 15x15x2.5 m will be excavated for each wind turbine. This will allow the encapsulation of the foundation base in the ground. At the point of installation of each wind turbine, appropriate plateaus will be formed. The aim of the plateaus will be to facilitate the installation by providing space for the assembly of the tower, the generator and the blades. The area of the plateau will be approximately 50x50 m in the perimeter of each installation point.

The wind turbine parts and related equipment will be transported to the area of installation by special trucks. A dedicated crane, able to handle heavy loads, will be used to handle the parts and assist with mounting the wind turbine in place. Along the wind farm internal road connecting the wind turbines, a channel will be constructed which will host the medium voltage cables and other electricity connections. This channel has a typical width of 80 cm and a depth of 1 m.

The Control Building, hosting electrical instrumentation, the medium voltage switchboard, the remote monitoring and control system, telecommunications and other facilities, will occupy an area of about 120 m^2.

1.4.3 Energy production

Based on the proposed turbine type, the wind farm rating, the wind farm layout and the wind data analysis carried out for wind farm Mesihovina, taking into account all potential losses, the net electricity generation per annum is **128,527 GWh**.

1.5 Description of the environment

1.5.1 Flora and fauna

The wind farm Mesihovina is situated just beneath Duvanjsko polje in the area of Grabovica Mountain. The area belongs to sub-Mediterranean landscapes i.e. it belongs to ecosystems of sub-Mediterranean rocky ground.

Concerning flora, in the dense shrubs floor the Common Hazel (*Corylus avellana*) is frequent while Spindle tree (*Euonymus europea*), Field rose (*Rosa arvensis*) as well as Common Hawthorn (*Crataegus monogyna*) can be spotted occasionally. In the herbaceous floor, Lenten Rose

(*Helleborus multifidus*), horsetails (*Equisteum* sp.), Plantain (*Plantago holosteum*), Common Yarrow (*Achillea millefolium*), Yellow Bedstraw (*Galium verum*), Clustered Bellflower (*Campanula glomerata*), cypress spurge (*Euphorbia cyparissias*) are encountered. Endemic species were not identified at this location.

With regard to animal species quails, grey partridge, wild duck, rabbit, fox, possibly roe deer are spotted on the location, while wild boar and bear appear occasionally. The area is part of the migration route for quails, ducks and other birds. This area is also a habitat of rabbit, fox and wolf.

1.5.2 Geology and morphology

The wind farm Mesihovina belongs to the area of southwestern Bosnia, a mountainous area which gravitates towards karst fields: Glamočko, Livanjsko and Duvanjsko. Mesihovina belongs to Dinara unit inside of which the anticlines, synclinals, groups of flexures and individual flexures can be differentiated. Midena mountain is the southeastern part of Dinara tectonic unit. The area grasps the highlands of Midena mountain, which are built of upper Cretaceous well stratified limestone with chondrodonts. The thickness of layers is 30-50 cm.

Hydrogeologically, karsts are well permeable and those are the rocks of fracture and cavernous permeability. Dolomites are partial hydrogeological barriers and, depending on where they are in the geological pole, they can have a function of underlying stratum barriers.

The terrain represents hard and solid basis for work and an appropriate environment to work in. The hardness of limestone varies from 80 to 110 MPa. The dynamic qualities are well balanced to differ from dolomites where significant variability of these parameters stands in direct link with the degree of rock grussification.

1.5.3 Seismicity and stability

The location can be classified as stabile terrain with stabile precipitations in natural and artificial conditions. These terrains are convenient for excavations, cuttings and side cuttings without special limitations.

With regard to seismicity, the area of interest belongs to areas with possible earthquakes from 3^o to 7^o of MCS scale.

1.5.4 Hydrology

The studied terrain comprises a variety of rocks with terrains of great water permeability, mid and low permeability to terrains being partially or even absolutely impermeable.

No water sources are found in the location of the proposed wind farm.

1.5.5 Climate

The location of wind farm Mesihovina exhibits a moderate continental climate with temperature differences and oscillations along with very strong wind of southern direction (bora and sirocco). There is only occasional snowfall which stays for 5 days a year, in average.

1.5.6 Cultural environment

No cultural heritage monuments are located on the construction site. An archaeological site of old Roman coins ("novac") is located approximately 150 m of wind farm erection while Slavic Fortress ("Slavensko gradiste") from Roman period is approximately 450 m from the closest wind turbine.

1.5.7 Land use – settlements

The proposed site is registered in the municipal land books as forest land. A number of settlements are found in the vicinity of the proposed site – most of them are in the range of a few kilometers away, the closest being over 500 meters away.

1.5.8 Infrastructure

No significant infrastructure is present in the vicinity of the proposed site. The location has access roads which will have to be reconstructed or upgraded to allow the access by large trucks.

1.5.9 Special protection areas

There are no protected areas in the vicinity of the area designated for the wind farm construction.

1.6 Impact assessment and mitigation

The notable environmental or social impacts associated with the construction and operation of wind farms are discussed in the following paragraphs.

1.6.1 Flora and fauna

Generally, impacts on flora and vegetation by the construction and operation of the wind farm can be manifested in reduction of natural habitats and subsequent reduction of the diversity of those habitats, as well as of the diversity of plant associations. However, such impacts are not likely on the basis of the existing information.

With regard to fauna, impacts during construction relate only to temporary displacement, caused by the presence of workers and machines, as well as by the generation of noise, vibrations and detonations, exhaust gases and dust during civil engineering works. Such impacts are temporary in nature and reversible, i.e. fauna species will revisit the area when construction ends.

During operation, impacts will be associated with bird and bat populations. With respect to birds, deaths of bird individuals have been reported internationally due to collision with turbine blades, however they are very limited statistically and by far fewer than the number of deaths caused by other human activities, such as illegal hunting or collision to high voltage overhead lines. Nevertheless, the project owner will undertake a comprehensive monitoring programme to record and assess any collision incidents that may take place during the wind farm

operation. The analysis of the findings will provide the opportunity to identify any specific wind turbine locations that may be of particular concern for birds.

1.6.2 Atmospheric quality

During construction, fugitive dust emissions may be generated due to earthworks, in particular during site clearance and excavations and due to movement of the machinery at the construction site. Similar impacts will be generated during the construction of access roads. Low level atmospheric pollution may also be caused due to exhaust fumes form vehicles moving inside and outside the worksite. In any case those impacts have local character, are of limited duration and have no permanent consequences on the atmospheric quality of the area.

Proposed preventive and mitigation measures comprise the implementation of good working practices in order to reduce dust emissions, i.e. sprinkling the soil especially if earthworks take place during summer period and covering the trucks when transferring excavation or construction materials. As far as exhaust fumes are concerned, these will be reduced by the use of well-maintained vehicles and machinery.

1.6.3 Landscape

Modeling software has been used to assess the visual impacts to close-by settlements by the wind turbines. The Wind farm Mesihovina will be partially visible from local settlements Gornji Brisnik, Donji Brisnik, Cebara, Mrkodol, Bukovica, Borcani, Crvenice. The model run results have shown that the impact to local inhabitants is not significant.

1.6.4 Shadow flickering

In general, the rotating motion of the wind turbine blades can block sun rays and form shadows in the form of flickering. Flickering can be unpleasant to humans and is visible at distances of 500 - 700 m from the wind turbine. Shadow and flickering does not have a negative impact on agriculture and farming.

Computer modelling has been used to assess real flickering and shadow impact that will be avoided in the final design phase. The closest settlement is over 500 m away from the wind farm, so shadow and flickering will not have negative impact on local inhabitants or local transport road M15.

1.6.5 Noise

During operation noise is created as a result of air blowing around the blades and tower (aerodynamic noise) and gear movement (mechanical noise). Modern wind turbines are very quiet by design and, in general, noise from a large modern wind turbine has been found to be entirely neutralized by wind noise at the distance of 200 m. Computer modeling was used to assess the level of noise at the closest settlements to the proposed location.

The noise level at the closest settlement is below 35 dB(A) with the exception of settlement Curcici in Gornji Brisnik where noise can reach the level of 44 dB(A), still being less than the emission limit value of 50 dB(A). It can be concluded that noise will not have negative impact on inhabitants and the environment.

During construction, a relative increase of the current noise levels will take place, due to construction works and vehicles circulation. Noise impacts will generally be temporary in nature and fully reversible once construction ends. Proposed measures to further reduce nuisance from noise would include:

- Heavy vehicle movements will be planned in collaboration with the local traffic police, particularly with regard to passing through local settlements.
- Heavy vehicle movements through schools, hospitals or other sensitive areas will be avoided altogether.
- Noise-generating operations at worksites close to settlements will be avoided during rest hours.

1.6.6 Cultural environment

Despite the fact that the proposed location is not within a designated archaeological area, contacts are made with the Archaeological Authorities to ensure that construction will not have an impact on cultural heritage in the wider area. At a minimum, an archaeologist will be present during the construction works while in case of any findings, these will be rescued by the developer as required.

1.7 Alternatives

The proposed development has been the result of extensive study of a range of alternatives on the basis of environmental, technical and economic criteria:

- The choice of wind energy exploitation for electricity generation in the area is clearly towards environmental sustainability as it exploits a renewable energy source and avoids the use of fossil fuels.
- With regard to location selection, the proposed site is among the preferred ones from several alternative locations examined at project feasibility level by international consultants. The examination included wind potential measurements using 10 m masts for about a year. Other criteria, besides wind potential, included:
    - Environmental considerations, specifically with regard to implications with protected areas.
    - Landscape issues, with an aim to minimize the necessary interventions and the associated environmental impacts.

  - Access to the site, with the aim to minimize the necessary infrastructure works and the environmental and social impacts associated with them.
  - Proximity and capacity of the receiving electricity transmission network.
- With regard to turbine size, wind turbines of around 2 MW were selected as they are the current trend in wind energy industry. They are sufficiently proven while they achieve economies of scale and result in lower electricity generation cost than smaller machines. From the environmental point of view they are preferred as they require fewer turbines for the same output thus reducing visual impact and environmental impacts for civil works.

1.8 Conclusion

The proposed project comprises a wind farm of installed capacity of 44 MW developed in Mesihovina area. It constitutes one of the three parts of the overall project, comprising a wind park of total installed capacity of 128 MW. The project is of particular importance as it will allow the developer, EP-HZHB, to better meet the electricity demand of the area it serves without relying on extensive power imports.

The selected location is cited within forest land – although vegetation is limited – away from protected areas or areas of specific ecological interest. The impacts to natural environment from construction and operation of the wind farm are therefore limited. Visual impacts, as well as impacts related to shadow flickering and noise emissions have been assessed on the basis of computer models and taking into account the proximity with neighboring communities. In all cases, such impacts were found to be negligible.

On the basis of the above, we kindly request **positive evaluation of our Request for Prior-EIA.**

2 INTRODUCTION

2.1 Project background

Elektroprivreda Hrvatske Zajednice Herceg-Bosne (EP HZHB) is the electricity utility serving the area of Federation of Bosnia and Herzegovina. Currently the electricity generation of EP HZHB is completely based on the exploitation of hydro power resources. The generation capacity of the existing hydro power plants is only sufficient to cover about one third of the electricity demand in the area supplied by EP HZHB. The utility is therefore obliged to import a significant amount of electricity in order to cope with the demand, making it highly vulnerable to market fluctuations.

In an effort to expanding and diversifying its generation capacity, while adhering to its good environmental records, EP HZHB has engaged in various activities in order to explore and eventually develop additional resources of renewable energies. In this framework, Spanish Consultants were employed to prepare a feasibility study for a number of sites presenting promising wind potential. Midena-Brisnik is one of the finally selected sites for more detailed measurements and construction of wind farms.

Prior to development, an environmental impact assessment is necessary to ensure that the project does not cause any adverse impacts to the natural and human environment. The prior EIA is funded by KfW.

2.2 Legal framework

According to national legislation requirements, the Environmental Impact Assessment and the Public Consultation and Disclosure process form part of the project licensing procedures in BiH. The EIA is undertaken as a part of the urban permitting procedure, as specified in the Law on Environmental Protection (Official Gazette of FBiH no. 33/03).

The requirements of the EIA to take public interests into account through a mandatory Public Consultation and Disclosure process are also set out in the Law on Environmental Protection.

The EIA should explain the rationale of the proposed project and assess the environmental effects on the natural, social and built environment. It should also describe possible alternatives, establish the environmental baseline, develop mitigation measures to minimise environmental effects, and ensure the project is compliant with environmental, sanitary and other relevant legislation. According to the Law on Environmental protection, the EIA process has two stages: prior EIA and full EIS.

In accordance with the Federal “Rulebook for the industrial plants and installations which require environmental impact assessment and installations which can be built and put in operation only when the environmental license is obtained”, the construction and operation of wind farms above 2 MW or with more than 4 turbines is not classified as

an activity of high environmental hazard. It rests with the competent authority (the Federal Ministry of Environment and Tourism), upon examination of the prior EIA, to decide whether a full EIS is necessary.

2.3 Scope and objectives

The objective of this Preliminary Environmental Impact Assessment (Prior EIA) Study is three-fold:

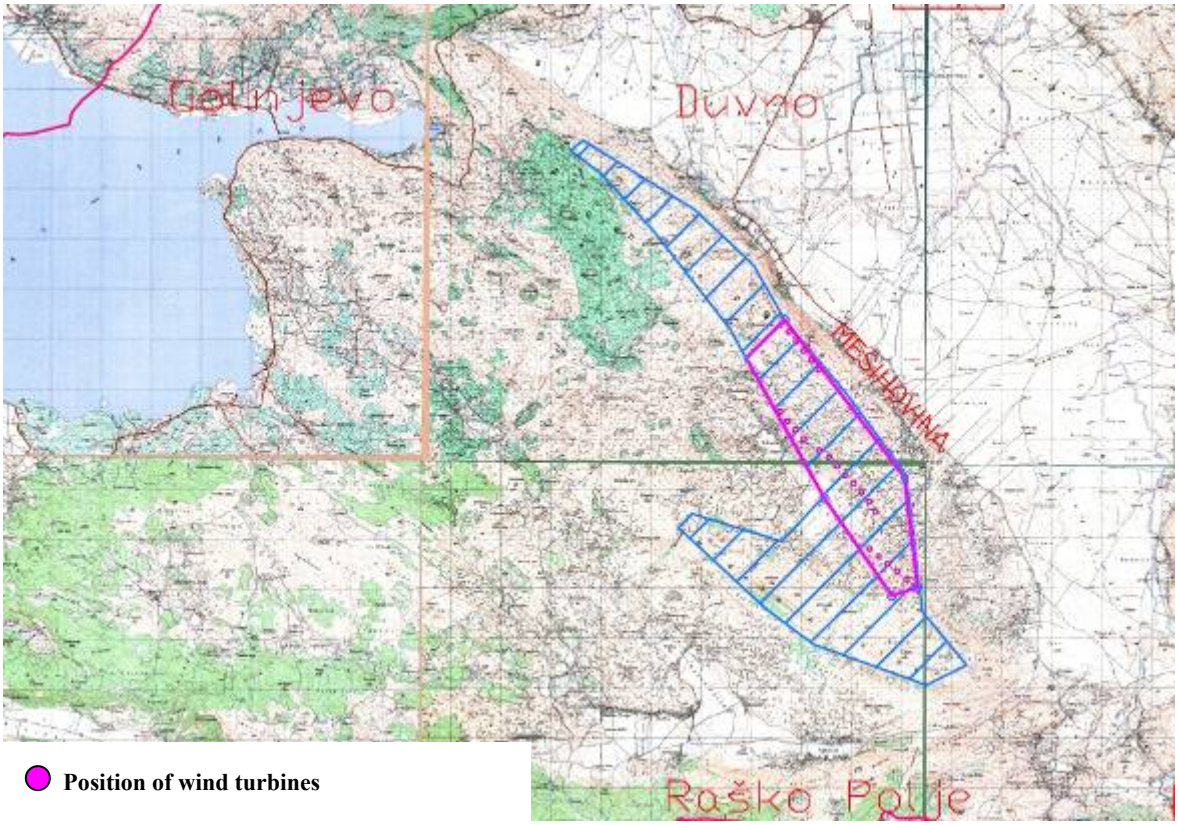
- To provide technical information on the proposed development to the authorities and the concerned public.
- To provide information on the natural and human environment of the wider area of the proposed development in order to substantiate the discussion on potential environmental impacts related to the development.
- To allow the Ministry (FMET) make an informed decision whether a full EIA for the proposed development is required.

The Prior EIA is based on existing material, published through a number of sources, as well as a limited number of site visits. The outline and content of the Prior EIA complies with the requirements of national legislation.

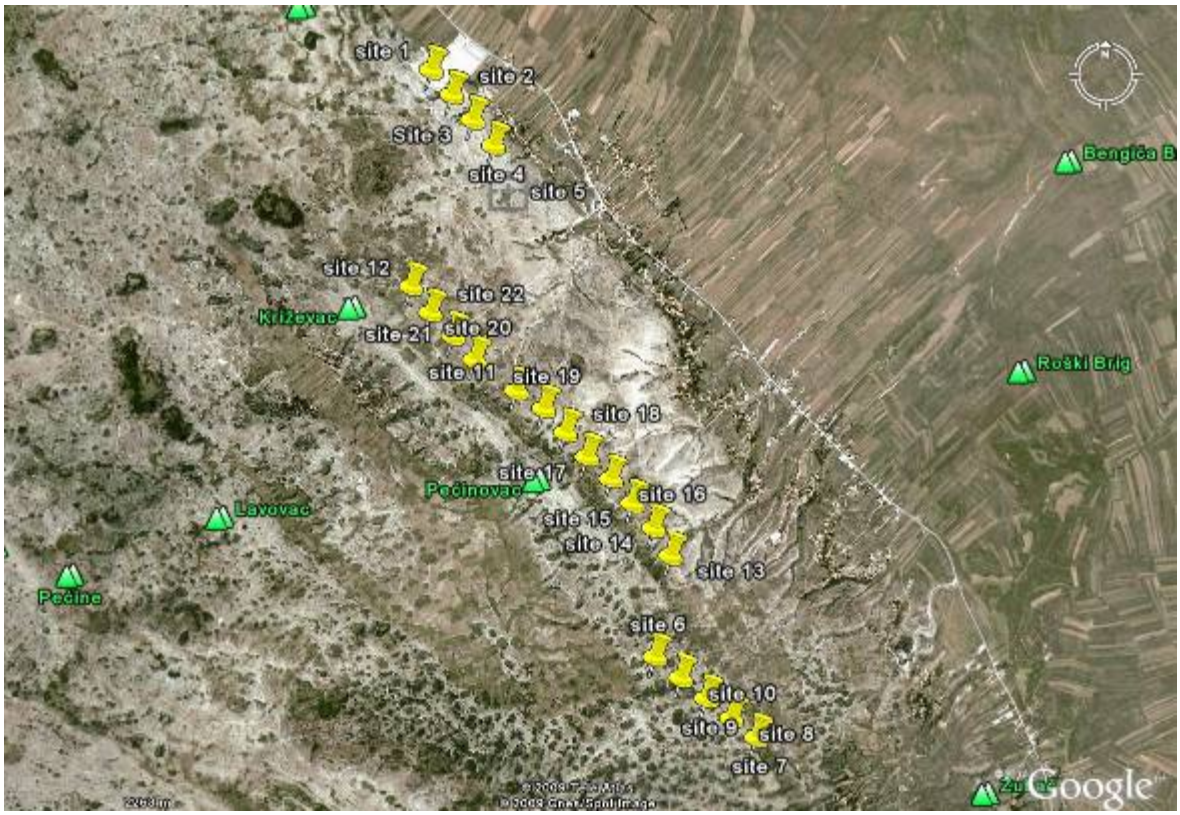
3 PROJECT DESCRIPTION

3.1 Location

The proposed development is planned to be constructed in the area of Tomislavgrad Municipality, Midena-Brisnik site. The project location is presented on topography map 1:25000 (Picture 3.1). The satellite view of the location made using Google Earth application is given in Picture 3.2.



Picture 3.1 Location of the proposed site for the development of the wind farm Mesihovina

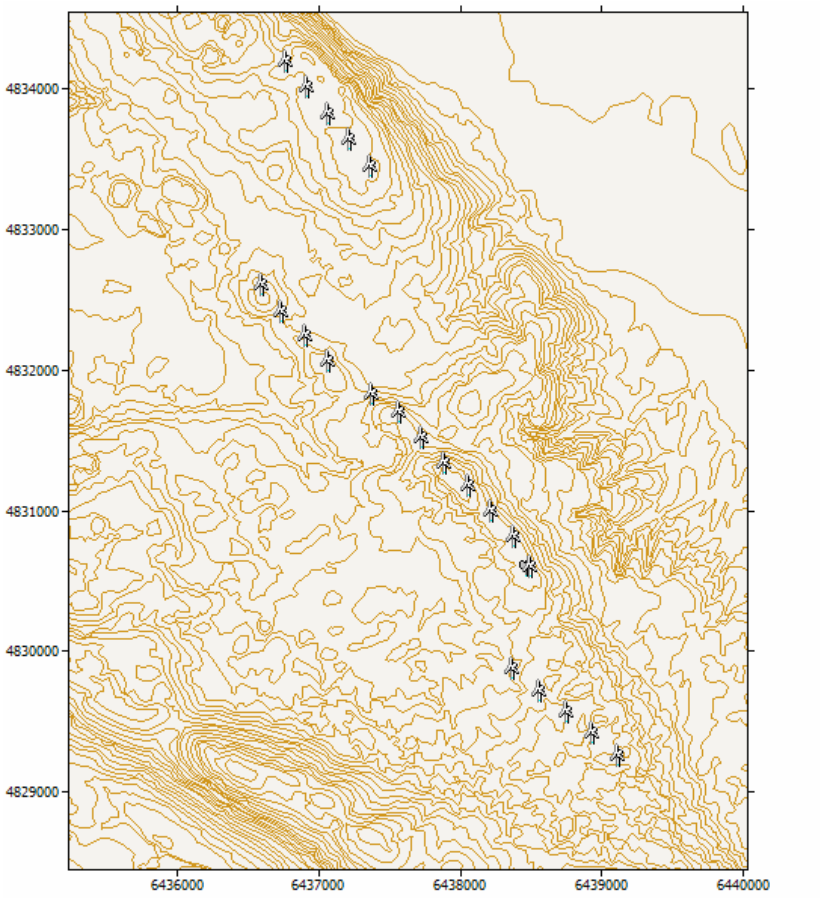


Picture 3.2 Satellite view

3.2 Technical description

3.2.1 Proposed layout

The Prior EIA will address the construction and operation of wind farm Mesihovina. The wind farm consists of three main rows running from southeast to northwest, following the highest parts of the ridge. In total 22 turbines of 2 MW are proposed, with a total power of 44 MW. The following picture shows the topography of the area and the wind turbines distribution in the site.



Picture 3.3 Wind farm Mesihovina layout

It is noted that the wind turbines layout design has been carried out taking into account the following parameters:

- Wind direction and energy distribution.
- Wake interactions due to mutual shadowing between the wind turbines.
- Land availability and construction easiness.

The proposed layout of the wind farm facilitates energy production optimization and minimization of losses.

3.2.2 Wind turbines and related equipment

The wind farm will comprise the following elements:

- Wind turbines of around 2 MW each. The supplier of the turbines has not been selected yet but typical wind turbine models from well known international suppliers will be used.
- Towers, upon which the wind turbines will be installed, with the appropriate ground construction, wiring, power electronics, etc.

- Transformers (low to medium voltage) which are installed in the interior of the tower base of each turbine with the aim to raise the low voltage produced to medium voltage.
- Underground electricity transmission lines connecting the wind turbines with each other and with the Control Building.
- Control Building which will shelter the electronic system for monitoring and controlling the wind turbines as well as other facilities.
- Electrical connection of the wind farm with the National Grid, through overhead transmission lines departing from the Control Building.

The wind turbines selected have a rotor diameter of 80 to 90 metres and the nacelle located about 80 metres high. That means that the maximum blade tip height is about 125 metres. Typical characteristics of a wind turbine likely to be selected for this project are given below.

Typical characteristics of a wind turbine likely to be selected for this project are given below. Picture 3.4 shows typical wind turbine with built in 0.69/x kV transformer.

Power:	2,000 kW
Rotor diameter:	82 m
Pole hight:	78 - 138 m
Wind class (IEC):	IEC/NVN II
Turbine concept:	Variable speed and „pitch“ control
Rotor	
Type:	Upwind rotor with active pitch control
Rotation direction:	Clockwise
Number of blades:	3
Coverage area:	5,281 m2
Blade material:	Fiberglas with integrated protection for thunder
Rotation speed:	Variable, 6 - 19.5 rpm
Pitch control:	ENERCON pitch system with allocated support for emergency
Generator:	Enercon synchronous annular
Pole:	Made of steel or concrete strengthen with steel
Network support:	ENERCON converter
Brakes	
	three independent breaking systems (for safety)
Cut-out wind speed:	25 m/s
	(with Enercon control for thunderbolt)
Remote monitoring:	ENERCON SCADA

Table 3.1 Typical characteristics of ENERCON E-82 wind turbines

Picture 3.4 Typical 2 MW wind turbines Enercon E-82

3.2.3 Access to the sites

The towers, turbines and related equipment will be transported to the site by special trucks able to carry extreme loads. The tower will be transported in three pieces and will be mounted gradually on site with the use of a crane. In total 8-9 trucks will be required for each wind turbine.

Picture 3.5 Road transportation of a wind turbine tower part

In order for special trucks and cranes to be able to access the sites, roads of minimum width of 5 metres will be required. This means that parts of the existing road network will have to be reconstructed to meet the required specifications.

3.2.4 Installation

In order to secure the installation of the wind turbine, a foundation base will be constructed with the use of armed concrete.

For the installation of the foundation, an area of approximately 15x15x2.5 m will be excavated for each wind turbine. This will allow the encapsulation of the foundation base in the ground (see Picture 3.6). The excavation material will be kept aside and be used for the restoration of the site after the installation of the foundation.

At the point of installation of each wind turbine, appropriate plateaus will be formed. The aim of the plateaus will be to facilitate the installation by providing space for the assembly of the tower, the generator and the blades. This space is also useful for the maneuvering of the trucks and the safe mounting of the cranes. The area of the plateau will be approximately 50x50 m in the perimeter of each installation point.

The wind turbine parts and related equipment will be transported to the area of installation by special trucks. A dedicated crane, able to handle heavy loads, will be used to handle the parts and assist with mounting the wind turbine in place (see **Error! Reference source not found.**7).

Along the wind farm internal road connecting the wind turbines, a channel will be constructed which will host the medium voltage cables and other electricity connections. This channel has a typical width of 80 cm and a depth of 1 m.

Picture 3.6 Typical foundation for a wind turbine

Picture 3.7 Mounting of the wind tower

The Control Building will be installed at an appropriate location of the site. It will host electrical instrumentation, the medium voltage switchboard, the remote monitoring and control system, telecommunications and other facilities. It will occupy an area of about 120 m^2.

It is noted that following the installation of the wind turbines, effort will be made to restore the area to its former state to the extent possible.

3.2.5 Energy production

The aim of the proposed development is the generation of electricity which will be supplied to the national grid. It is calculated that net electricity generation of 128,527 GWh will be achieved per annum.

The energy production was estimated based on the proposed turbine type, the wind farm rating, the wind farm layout and the wind data analysis carried out for the site, taking into account all potential losses, such as:

- Wake effects
- Availability
- Electrical efficiency
- Substations maintenance
- Icing and blade dirtiness
- High wind speed hysteresis

All these losses result in a reduction to the ideal energy production of approximately 7.8 %. The expected annual energy yields are presented in the following table.

Table 3.2 Indicative expected annual energy production

Total gross annual energy production (GWh)	Total net annual energy production (GWh) considering wake losses	Total net annual energy production (GWh) considering other sources of losses	Full load equivalent hours/year	Capacity factor
WIND FARM MESIHOVINA				
145,28	137,904	128,527	2921	33%

3.2.6 Connection to the network

The development of the wind farm on the proposed location has been also examined with respect to its distance from the closest connection points to the high-voltage electricity transmission network in the area.

The 110 kV Tomislavgrad – Posušje transmission line runs over this location, so it is suggested that the electrical energy generated by the Mesihovina wind farm should be discharged to it via an appropriate entrance/exit configuration.

4 DESCRIPTION OF THE ENVIRONMENT

This chapter contains information on aspects of the natural and human environment, with emphasis on those that might be affected by the proposed development. Much of the information found in this chapter are taken from Master Plan Study "Feasibility study: Analysis for the Use of Wind Power for Electricity Generation in Bosnia and Herzegovina" prepared by Ingeniería, Estudios y Proyectos NIP, S.A. in cooperation with a number of subconsultants that was subject of revision and accepted as such by EPHZHB as well as studies on visual impacts, flickering, noise and access roads prepared by EPHZHB. Information on flora and fauna and areas of special protection status were obtained by direct contacts with stakeholders with expertise in this field as well as from site visits and own extensive research. The list of stakeholders and minutes from the meetings are given in Annex II.

4.1 Natural environment

4.1.1 Flora and fauna

The location of wind farm Mesihovina (**Error! Reference source not found.**1) is situated just beneath Duvanjsko polje in the area of Grabovica Mountain. 10 km west is lake Buško jezero which is a natural extension of Livanjsko polje. This area belongs to sub-Mediterranean landscapes i.e. it belongs to ecosystems of sub-Mediterranean rocky ground.

Concerning the flora on site, in the dense shrubs floor the most frequently encountered species is Common Hazel (*Corylus avellana*), while Spindle tree (*Euonymus europea*), Field rose (*Rosa arvensis*) as well as Common Hawthorn (*Crataegus monogyna*) can be spotted occasionally.

In the herbaceous floor there are: Lenten Rose (*Helleborus multifidus*), horsetails (*Equisteum* sp.), Plantain (*Plantago holosteum*), Common Yarrow (*Achillea millefolium*), Yellow Bedstraw (*Galium verum*), Clustered Bellflower (*Campanula glomerata*), cypress spurge (*Euphorbia cyparissias*) etc. Endemic species were not identified at this location.

With regard to animal species quails, grey partridge, wild duck, rabbit, fox, possibly roe deer are spotted on the location, while wild boar and bear appear occasionally. Quails are non-migratory in Duvanjsko polje but they migrate toward the north and flying very low. Migration route goes in the direction of north-south and crosses the proposed site.

During fall, ducks and other birds migrate from lake Buško jezero towards Duvanjsko polje. If the autumn is rainy, ducks and birds stay in Duvanjsko polje and fly over the territory where the wind park will be located. During the day they reside on lake Buško jezero and migrate during the night to field Duvanjsko polje where their breading ground is, in order to fly back to Buško jezero in the morning.

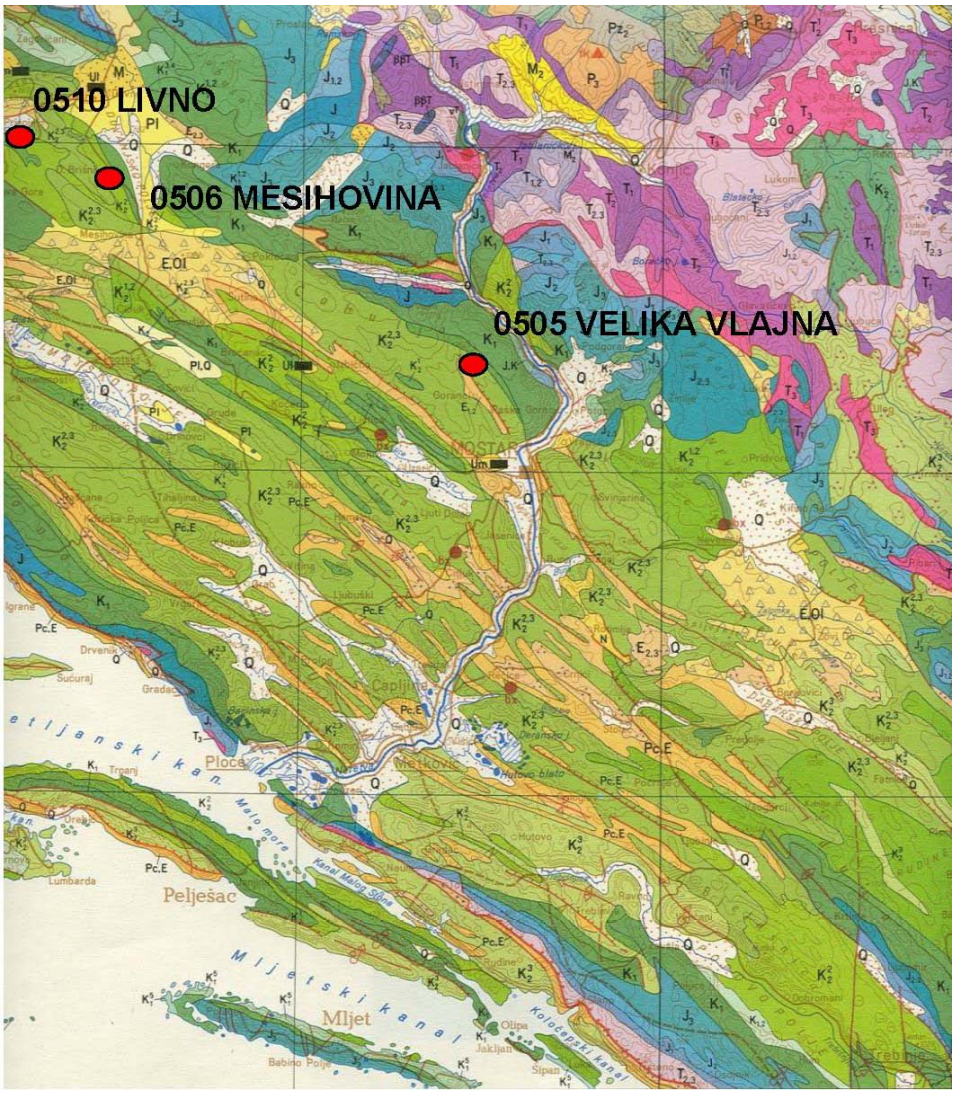
Quail seasonally migrate from Vojvodina and Hungary over these areas towards south, so that the selected location is traversing across the path during the migration periods. This area is also a habitat of rabbit, fox and wolf. North of the proposed zone is Duvanjsko polje which is of great importance during birds migration as their resting place. There is no record keeping system for bat colonies making it difficult to predict any potential negative impact on this population

Picture 4.1 Location of wind farm Mesihovina

4.1.2 Geology and morphology

A section of the geological map of BiH with the proposed locations is provided in the picture overleaf (**Error! Reference source not found.**).

The location belongs to the area of southwestern Bosnia, a mountainous area which gravitates towards karst fields: Glamočko, Livanjsko and Duvanjsko. It spreads from the mountain of Ilica in the west to Posušje in southeast. Its northern boundary goes across Mlinište saddle to Vitorog and Kupres than across Ljubiša and Vrane to location of wind farm Mesihovina, while towards Dalmatia the boundary goes across Dinara and Kamešnica. Location belongs to Dinara unit inside of which the anticlines, synclinals, groups of flexures and individual flexures can be differentiated. Midena mountain is the southeastern part of Dinara tectonic unit.

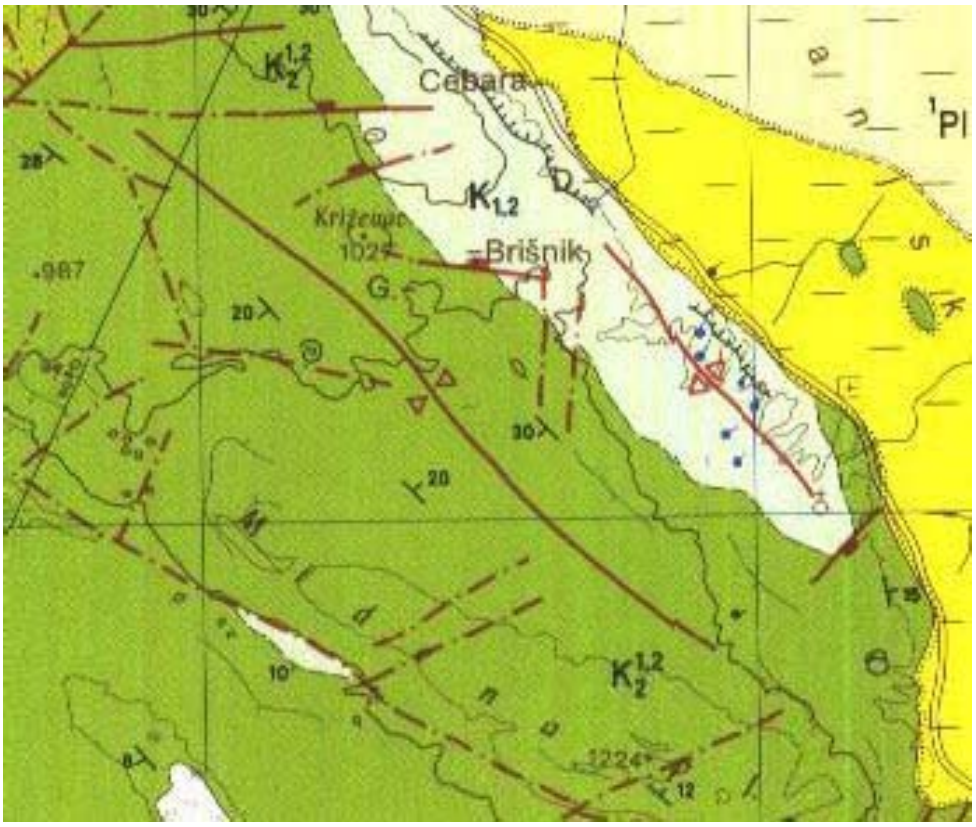


Picture 4.2 Geological map with the proposed locations

The location grasps the highlands of Midena mountain, which are built of upper Cretaceous well stratified limestone with chondrodonts. The thickness of layers is 30-50 cm. Inlays of dolomites inside limestone are rarely encountered. Limestone is presented in the following variations: micrites, intraclastic biomicrites, intrabiomicrites and biointramicrites. The northeast edge of Midena mountain highland is built of lower Cretaceous thin stratified and block limestone and dolomites with inlays of chevron and breccia. The layer thickness is 20-50 cm with dolomite cuts of 20-30 cm. In higher parts the limestone shows inlays of chevron. It is characteristic that thin-layered, clay limestone is secondarily layered in moderate flexures.

The geological terrain construction is given on the Basic geological map in scale of 1:100 000 (

3).



Picture 4.3 Geological map of the location

Legend: K1,2-dolomites, dolomite limestone and dolomite breccia; K2 1,2- limestone with chondrodonts and sub-layers of dolomites and chevron; 2M – marl and marly limestone; Pl- white marl

In the area the greatest representation belongs to coherent solid rocks with crystalloid bonding which, according to the appearance of lithological paragenesis can be grouped in two categories: a) lithologically heterogeneous engineering-geological classes and b) lithologically homogenous engineering-geological classes. Smaller parts of this terrain are built of incoherent rocks but not on the proposed site of wind farm installation.

Exchanging terrains made of karst and dolomites can, lithologically, be separated in heterogeneous engineering-geological classes. For defining engineering-geological qualities of rocks and terrain, the tectonics have great significance. Limestone and dolomites are greatly fissured, sometimes brecciar. Dolomites are sometimes grussified or partly transferred into gruss. Hydrogeologically, karsts are well permeable and those are the rocks of fracture and cavernous permeability. Dolomites are partial hydrogeological barriers and, depending on where they are in the geological pole, they can have a function of underlying stratum barriers. They form stabile terrains but under the influence of exogenetic agents they undergo chemical and mechanical decay: karstification, grussification and block separation along the cracks.

The terrain in the area represents hard and solid basis for work and an appropriate environment to work in. The hardness of limestone varies

from 80 to 110 MPa. The dynamic qualities are well balanced to differ from dolomites where significant variability of these parameters stands in direct link with the degree of rock grussification.

The rocks of stabile and balanced qualitative-quantitative characteristics are separated in engineering-geological classes. The processes of mechanical disintegration are slowed down. Those are parts of the terrain built of plate, layered and banked, massive limestone and stratified and massive dolomites. Plate karst, for its texture, shows evident separation in zone of superficial influence. Mechanical grinding is very characteristic. Planar elements of the complex affect the occurrence of great anisotropy of physical-mechanical characteristics in different directions. This limestone is less karstified. They build stable terrains and have good water permeability. The dynamic characteristics of plate and thinlayered limestone are rather variable and unbalanced.

Banked and massive limestones are tectonically separated into blocks of variable size. Most often they are karstified, and with jagged sharp edges due to chemical decay. They represent appropriate environment for work. Hydrogelogically, they belong to well permeable rocks with fracture and cavernous permeability. They build stable terrains.

Stratified and massive dolomites are poorly or occasionally better grussified. Superficial conditions give characteristic rhombohedric decay. They build mainly stripped and stable terrains. The hardness of dolomites varies from 90 to 100 MPa.

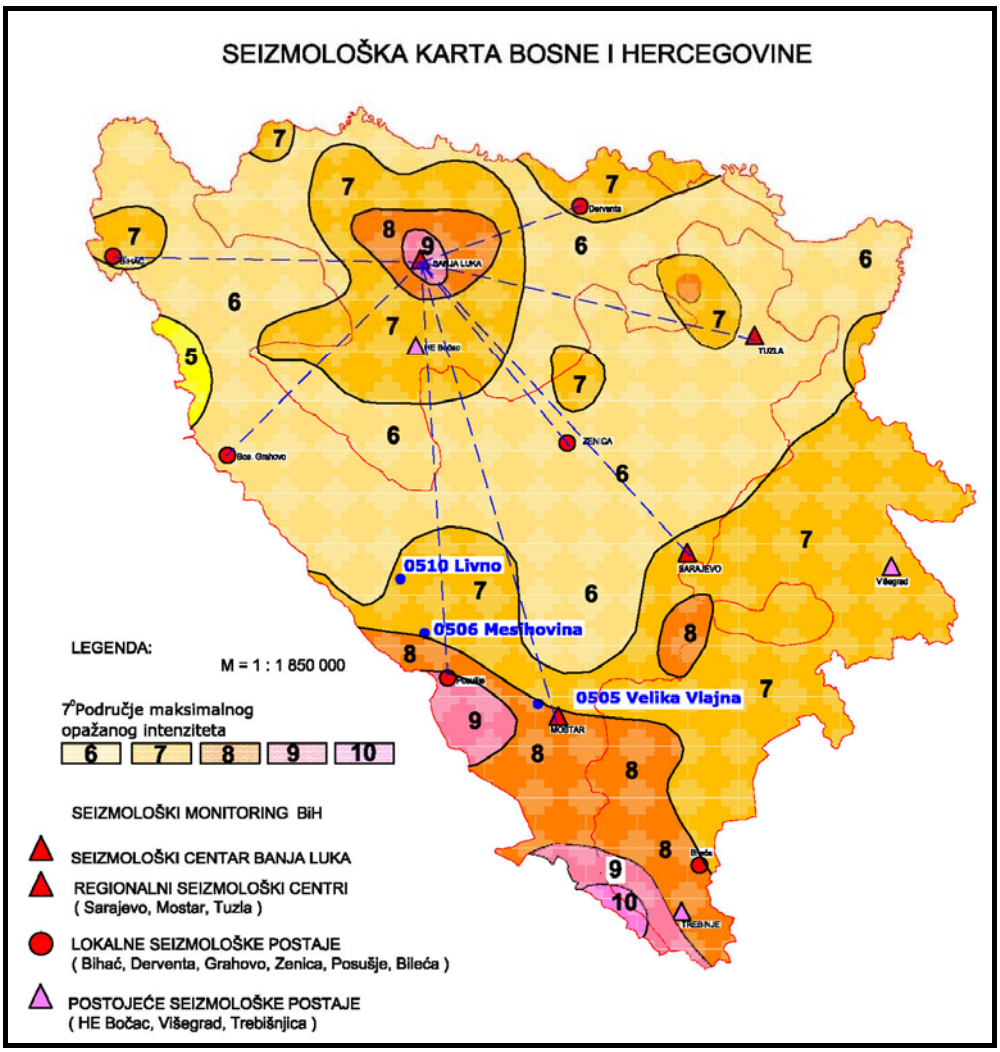
The rocks and terrain of the subject locations have such engineering-geological characteristics that there are no special limitation elements for wind power plants construction. The terrain is mostly built of early Cretaceous and Jurassic carbonate layers with good physical and mechanical characteristics for construction works in them.

4.1.3 Terrain stability and seismicity

The area where wind use is planned can be classified as stabile terrain with stabile precipitations in natural and artificial conditions. These terrains are convenient for excavations, cuttings and side cuttings without special limitations. Decrease in qualitative-quantitative sense is caused by fissure of secondary origin, which, in its intensity and ratio, add up to more expressed anisotropy of massifs in area of superficial destructive agents (water, ice). While founding in these terrains, zones with great fissuring as well as greater throw areas, should be avoided because this area belongs to seismically active terrains.

According to up to date results of earthquake research, the area of interest belongs to areas with possible earthquakes from 3^o to 7^o of MCS scale (Picture 4.4). However, according to data from the area of Livno, Duvno and Kupres, there have been earthquakes of 9^o MCS (1906). It is interesting to say that epicentres of earthquakes were concentrated in locations with determined elevation in Neocene and Holocene (Tušnica, Mesihovina, Šator).

Latest analyses of seismicity point to the fact that the strongest earthquakes were linked to horizontal movement of blocks as well as movement with edge throws and overthrusts.



Picture 4.4 Seismicity map of BiH

4.1.4 Hydrology

The studied terrain is a part of Dinara karst, mid belt, and has all the characteristics of deep karst. Rocks, according to their lithological qualities, tectonic relations, geomorphology and hydrogeological occurrences can be separated to terrains of great water permeability, mid and low permeability to terrains being partially or even absolutely impermeable. Significant part of the area is covered by permeable karsted carbonate layer of upper Cretaceous (mountain of Midena), afterwards follow the terrains mainly built from Jurassic limestone. Dolomites and dolomitic limestone have fracture porosity, rarely cavernous. Those are poorly permeable rocks.

No water sources are found in the location of the proposed wind farm.

4.1.5 Atmospheric quality

There are no measurements of atmospheric quality available for the area concerned. However, its rural character and the lack of organised industrial activity, suggest that the expected level of atmospheric pollution is at minimum.

4.1.6 Soil

According to Master Plan – Technical and Geotechnical Report, examinations of the terrain and findings have shown that the location of interest falls under the bonitet category VIII.

Bonitet category VIII are urban zones, exploitative areas, roads, water accumulations, and very shallow soils which contain up to 90% of skeleton, on the slope of more than 65%, exposed to the worst types of erosion, used as meadows.

4.1.7 Climate

Southwest BiH has typical continental mountainous climate with cold and long winters with vast snowfall that often cause traffic interruptions. Precipitations in this area are rather rich but unevenly distributed due to absolute height and relief. Average annual precipitations are as follows: Livanjsko field 140 mm, Duvanjsko field 1430 mm, Glamočko field 1430 mm and Kupreško field 1250 mm reaching peak at October, November and December.

The wind farm Mesihovina is situated above the settlement of Mrkodol on the road connecting Tomislavgrad and Mostar. Climate is moderate continental with temperature differences and oscillations along with very strong wind of southern direction (bora and sirocco). There is only occasional snowfall which stays for 5 days a year, in average.

Soil quality, climate characteristics and bio-energetic potential of this region creates suitable conditions for development of agriculture, although summer can be quite warm and dry causing longer periods without rain. This gives possibility to use solar energy together with wind energy.

4.2 Human environment

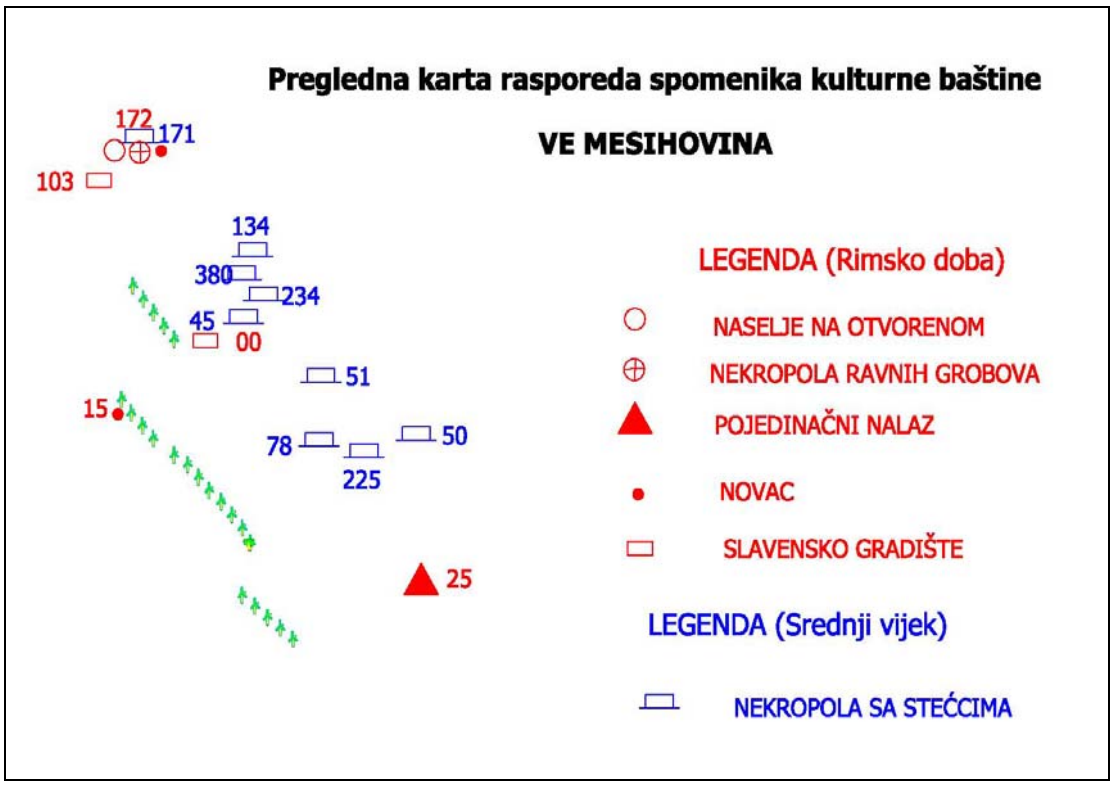
4.2.1 Cultural environment

Information on cultural and historical heritage is obtained from EP HZHB who did extensive research during the process of site selection.

Making an overlay of maps from three historical periods: Prehistoric age, Middle age and Roman period, obtained for the location it can be concluded that in the wider area several archaeological sites from Middle Age and Roman period are found. Of them, an archaeological site of old Roman coins (“novac”) is located approximately 150 m of wind farm erection while Slavic Fortress (“Slavensko gradiste”) from Roman period

is approximately 450 m from the closest wind turbine. **No archaeological remainings are identified on the construction site**.

It should be noted that distances mentioned above are approximate, determined from rough a digitalised terrain map.



Picture 4.5 Relative location of cultural-historical monuments in the wider area of proposed wind farm Mesihovina

4.2.2 Land use – settlements

Based on information obtained from EP-HZHB, land that is planed to be used for construction of wind parks is recorded in municipality land books as forest land and is managed by cantonal Forest Management Utilities.

The city of Tomislavgrad is situated on the north side of the wind farm Mesihovina in front of which the field Duvanjsko polje is found. On the west side is lake Buško jezero, approximately 1.5 km away. On the northwest side is Grabovica Mountain while the field Duvanjsko polje is located on the southwest and south side of the plateau. Settlements found in the vicinity of wind farm, together with altitude and distance from the closest wind turbine, are listed in **Error! Reference source not found.**1.

All settlements listed below are found to be out of the wind park zone of influence.

Table 4.1 Settlements in the vicinity of wind farm Mesihovina

Settlement	Altitude (m a.s.l.)	Distance from the closest wind turbine (km)
Kovači	900	2.0
Omerovići	880-890	1.0
Cebara	890	0.7
Ćerdić	880-890	1.1
D.Brišnik	880-890	1.6
Ćurčić	950	0.4
Bagarić	950	0.9
Jukišići	950	0.4
Anići	930	2.0
Kelave	910-920	2.1
Andrići	910-920	1.6
Pokrajčići	900	1.8
Brižani	900-910	1.6
Naplavci	880-890	1.9

4.2.3 Infrastructure

According to the information obtained and inspection on site no infrastructure objects has been recorded at the location of wind farm construction.

However, the Water Utility of Tomislavgrad just recently started exploiting water from village well near wind farm location for drinking purposes. The water well zone is not proclaimed as protected in accordance with the Water Law. Moreover, the location of the water well and the accompanying facilities are not under the zone of influence of Mesihovina wind farm.

With relation to road access, the road from the settlement of Mrkodol towards the location of Mesihovina wind farm is made of macadam with several alternative approaches which go through the village and among houses. There are two smaller access roads towards the location form the asphalted motorway Tomislavgrad-Mostar:

1. The first access road (**Error! Reference source not found.**6 to **Error! Reference source not found.**9) starts from the crossroads of motorway M15 Tomislavgrad-Mostar and local asphalted road Donji Brisnik – village Cerdici in length of 1.55 km and goes in direction of Donji Brisnik - Gornji Brisnik. Part of the road passing between the houses becomes very narrow and not appropriate for large trucks. There is an acceptable asphalt road in

continuation that connects to the section that needs to be fully reconstructed in order to avoid settlements and provide minimum technical conditions for transport. The remaining sections of this access road need to be widened and asphalted up to the 1.32 km where macadam road starts in length of 0.95 km. This road will require fewer interventions. For access to turbines 1-5, an internal access road needs to be constructed. For access to the remaining 17 turbines, the trucks can use the existing asphalted road from 1.32 km to 2.45 and then 4.70 km road needs to be constructed.

2. The second access road leads from the pass Privala toward the northern part of Mesihovina wind farm (third row). It is necessary to construct a macadam road in length of 9.40 km after which the access to wind park will be the same as described in the first variant.

Picture 4.6 Access road to wind farm Mesihovina

Picture 4.7 Access road to wind farm Mesihovina

Picture 4.8 Macadam road to wind farm Mesihovina

Picture 4.9 Macadam road to wind farm Mesihovina

4.3 Areas of special protection status

There are no protected areas in the vicinity of the area designated for wind farm construction.

However **in the wider region that is not under influence of wind farms,** there are several locations related to areas of special interest that need to be mentioned.

Plateau Krug near Livno is habitat of wild horses and represent tourist attraction unique in Europe. An increasing number of tourists are coming to Livno each year to enjoy horse ride. Due to illegal hunting and a number of deaths caused by collision with cars on road Livno – Kupres – Bugojno, especially near Borova glava, the Tourist Council of Herzegovina-Bosnia Canton requested from the municipal authorities to protect the area of Borova glava and Krug in accordance with the Law on Nature Protection. It is still unknown if these areas will be declared as protected natural park, but they should certainly be protected habitat of wild horses and ecosystem of curative plants, especially yellow gentian,

which is endangered by intensive collection that can lead to its extinction.

Another location of interest is the proposed National Park Prenj – Čvrsnica – Čabulja in northern part of Herzegovina (geographic width 43°21'25 "- 43° 43'12" and geographic length 17°25'00"-17°58'12"). The area covered by this future National Park is 99,500 ha. It is a biodiversity rich area characterized by the presence of a large number of endemic and relict plant communities, high plateaus covering large areas and Neretva River basin which is, at this moment, one of the most endangered karst ecosystems. This is at the same time one of the biggest endemic centres of Bosnia and Herzegovina. At present, unsustainable exploitation of natural resources, unregulated development of tourism as well as uncontrolled waste disposal threatens this rich ecosystem.

A managed nature reservation known as the Masna Luka forest area is found at the foothills of Čvrsnica Mountain. This area, together with lake Blidinjsko jezero is declared Nature Park and enjoys special protection.

A mountainous plateau Dugo Polje is located in the northwestern Herzegovina, between Čvrsnica and Vran Mountain. The plateau is unique by its nature, landscape and ethnography. Dugo polje, Vran and Čvrsnica were declared as a Nature Park in 1995.

Livno polje, located on the west side of the zone foreseen for the construction site is the largest karst field in Bosnia and Herzegovina and the region. This year Livno Polje is declared as a wet habitat of international importance under the auspices of international Ramsar Convention. By this decision, the area of Livanjsko polje becomes the third area in BiH protected under this Convention. Livanjsko polje contains impressive network of surface and groundwater flows and it is the largest wetland area in Bosnia and Herzegovina with significant populations of rare birds.

5 DATA REQUIRED TO IDENTIFY AND ASSESS THE MAIN IMPACTS WHICH THE PROJECT IS LIKELY TO HAVE ON THE ENVIRONMENT

Some of the biggest concerns related to the construction of wind farms in respect to their impact on the environment are visual impact on the landscape, shadow flickering and noise generation. In order to assess these impacts on the environment, computer modelling was carried out using three relevant software packages

- WAsP 8.3;
- GH WindFarmer 3.6.1; and
- AutoCAD 2005.

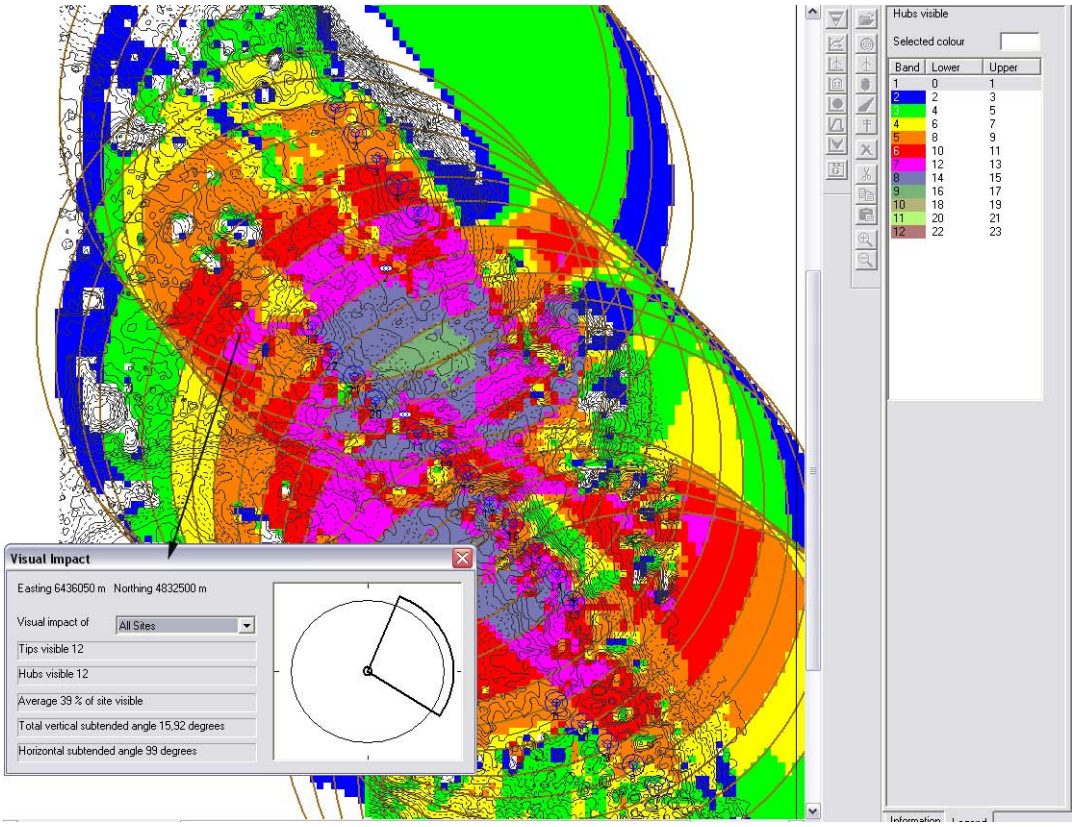
The information presented in this chapter is taken from the study "Environmental Impact Assessment Study for wind farms Mesihovina, Borova glava and Velika Vlajna – Preliminary design VISUAL IMPACT, SHADOW FLICKERING AND NOISE ASPECTS OF WIND FARMS" prepared by PE ELEKTROPRIVREDA HZ HB D.D. Mostar.

5.1 Visual impacts on landscape

The impression one could have looking at a wind farm is very subjective. The visual acceptance of a wind farm depends on the observers' eye and its familiarity with the view (like in the case of long distance transmission lines) but also on the attitude an observer has regarding wind technology in general; meaning that recognizing its other environmental benefits creates a positive attitude toward visual look of the wind farm.

However, there are a number of elements that influence visual impression that need to be taken into account in the planning phase. Landscape can be more or less susceptible to changes, and its visual perception, besides natural characteristics, strongly depends on cultural tradition, even on the economic situation of the observer. The visual impact the wind farm Mesihovina might have is described and assessed below.

The wind farm Mesihovina and its 22 wind turbines will be partially visible from local settlements Gornji Brisnik, Donji Brisnik, Cebara, Mrkodol, Bukovica and local transport road M15 Posusje-Tomislavgrad, but also from the wider area of settlements Borcani, Crvenice, etc. The position of wind turbines is the result of detailed calculation based on wind data analysis, measurements on the mast installed on site, topography and information on land ownership. GH WindFarmer software was used to calculate Zones of Visual Impact in previously defined perimeter and given visibility locations on the map. Picture 5.1 gives visibility map for wind turbine type E-82/78 (hub height 78m+blade 41m= 119m above the ground).



Picture 5.1 Map of zones of visual impact for the wind farm Mesihovina – height 119 m above ground

An estimated 39% of the wind farm Mesihovina, including parts of 12 wind turbines and hubs of 12 wind turbines will be visible at the reference point located 493 m west from wind turbine no. 12 (red dot on Picture 5.1). Taking into account visibility of wind turbines it can be assessed that visual impact is acceptable and that no negative impact on local inhabitants will occur.

5.2 Shadow flickering

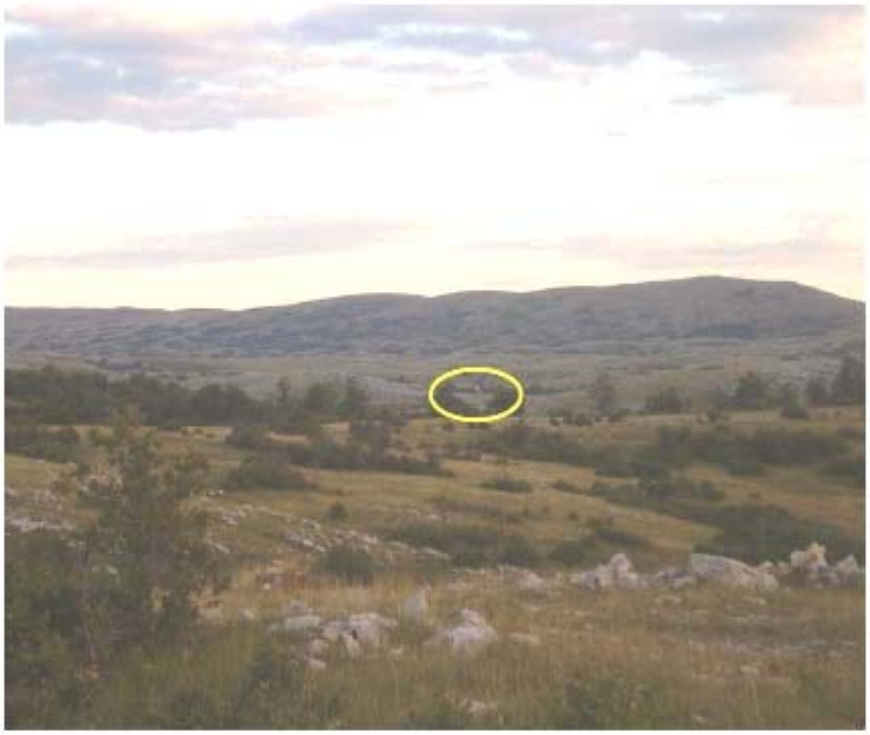
Wind farms are tall objects of relatively small volume but still can block sun rays and form shadow. In working mode they can cause unpleasant flickering visible from distances calculated as 10 times the diameter of rotor. Shadow falls over the ground at a distance calculated as 7-10 times of the rotor blade diameter, being the longest at the time of sunrise and sunset. Intensity of shadow and flickering depends on the time of the year, time of the day, geometry of wind turbine and position of wind turbine to surrounding houses. Shadow is decreasing, in general, with the increase of tower height. Flickering can be very unpleasant to humans and is visible at distances of 500 - 700 m from the wind turbine. Shadow and flickering does not have a negative impact on agriculture and farming.

Having in mind that shadow of rotating turbine blades can be seen as a negative visual impact inside buildings (through windows) that are

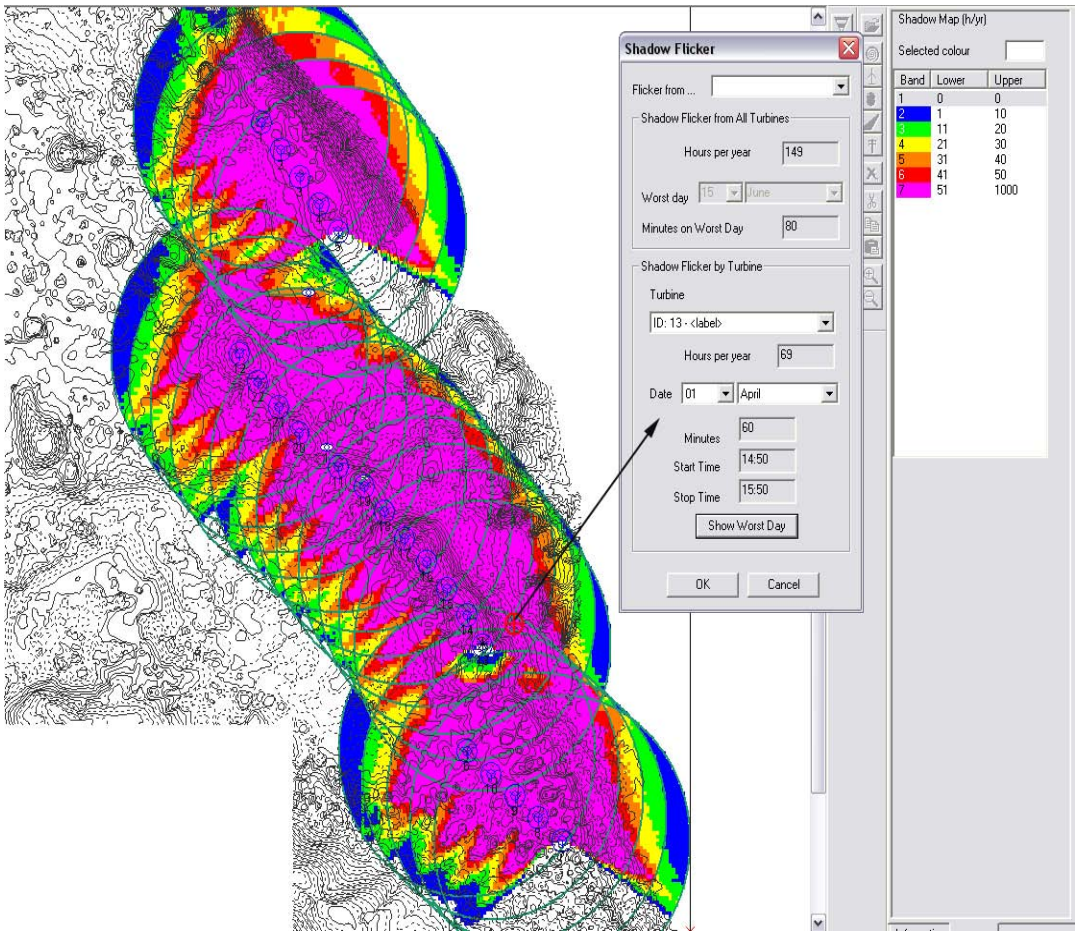
located in shadow zone, computer modeling is done to assess real flickering and shadow impact that will be avoided in the final design phase. For that purpose Shadow Flicker module of GH WindFarmer software is used. This module can foresee flickering and shadow intensity in foreseen diameter and gives shadow position on the map. It also identifies wind turbine(s) that cause flickering and flickering intervals in any time of the hour, day or year.

Since the wind farm Mesihovina is located in the middle and southwest section of Duvanjsko field, and taking into consideration that closest settlement is over 500 m away from the wind farm, shadow and flickering will not have negative impact on local inhabitants (Picture 5.2).

Picture 5.2
Location of wind farm Mesihovina



Shadow flickering will not have significant impact on transport road M15 due to terrain configuration and sufficient distance. Picture 5.3 gives graphic presentation of Mesihovina wind farm shadow modeling with reference point located 300 m southeast from 50 m measurement mast.



Picture 5.3 Shadow modeling for Mesihovina wind farm

As it can be seen from the Picture 5.3 that represents modeling of shadow in the 1 km diameter from each wind turbine, most of the wind turbines are visible 1-50 hr/year in the 500 m zone of influence. At reference point located 300 m from the measurement mast (red dot on the Picture) the day with highest intensity of shadow and flickering would be April 1, with shadow duration of 60 minutes between 14:50-15:50. Reference point will be in shadow 149 hours during the whole year which is 0,017% of time in the year. Even for this extreme case the impact of shadow flickering is negligible.

5.3 Noise

During the wind turbine operation noise is created as a result of air blowing around the blades and tower (aerodynamic noise) and gear movement (mechanical noise). Noise intensity depends on:

- design and dimensions of the turbine,
- wind speed,
- distance from turbine,

- noise in the environment (background noise).

Modern wind turbines are very quiet and noise produced is almost negligible comparing to the noise coming from similar machines. In general, the rule of thumb is that noise from one large modern wind turbine is completely neutralized by wind noise at the distance of 200 m. Mechanical noise resulting from wind turbine operation mainly has low frequencies, from 20 Hz (noise from gear and other slowly rotating equipment) up to 100 Hz (noise of electrical generator). The noise level is decreasing with increasing distance. Additional nuisance can be produced if noise has tonal character, i.e. if noise emission is intensive at discrete frequencies (Table 5.1).

Typical noise generated by wind farm at distance of 350 m is 35 – 45 dB(A), and in most cases even below 35 dB(A).

Table 5.1 Noise decrease with increasing distance from the source

Distance [m]	Change in noise level dB(A)	Distance [m]	Change in noise level dB(A)	Distance [m]	Change in noise level dB(A)
9	-30	100	-52	317	-62
16	-35	112	-53	355	-63
28	-40	126	-54	398	-64
40	-43	141	-55	447	-65
50	-45	159	-56	502	-66
56	-46	178	-57	563	-67
63	-47	200	-58	632	-68
71	-49	224	-59	709	-69
80	-50	251	-60	795	-70
89	-51	282	-61	892	-71

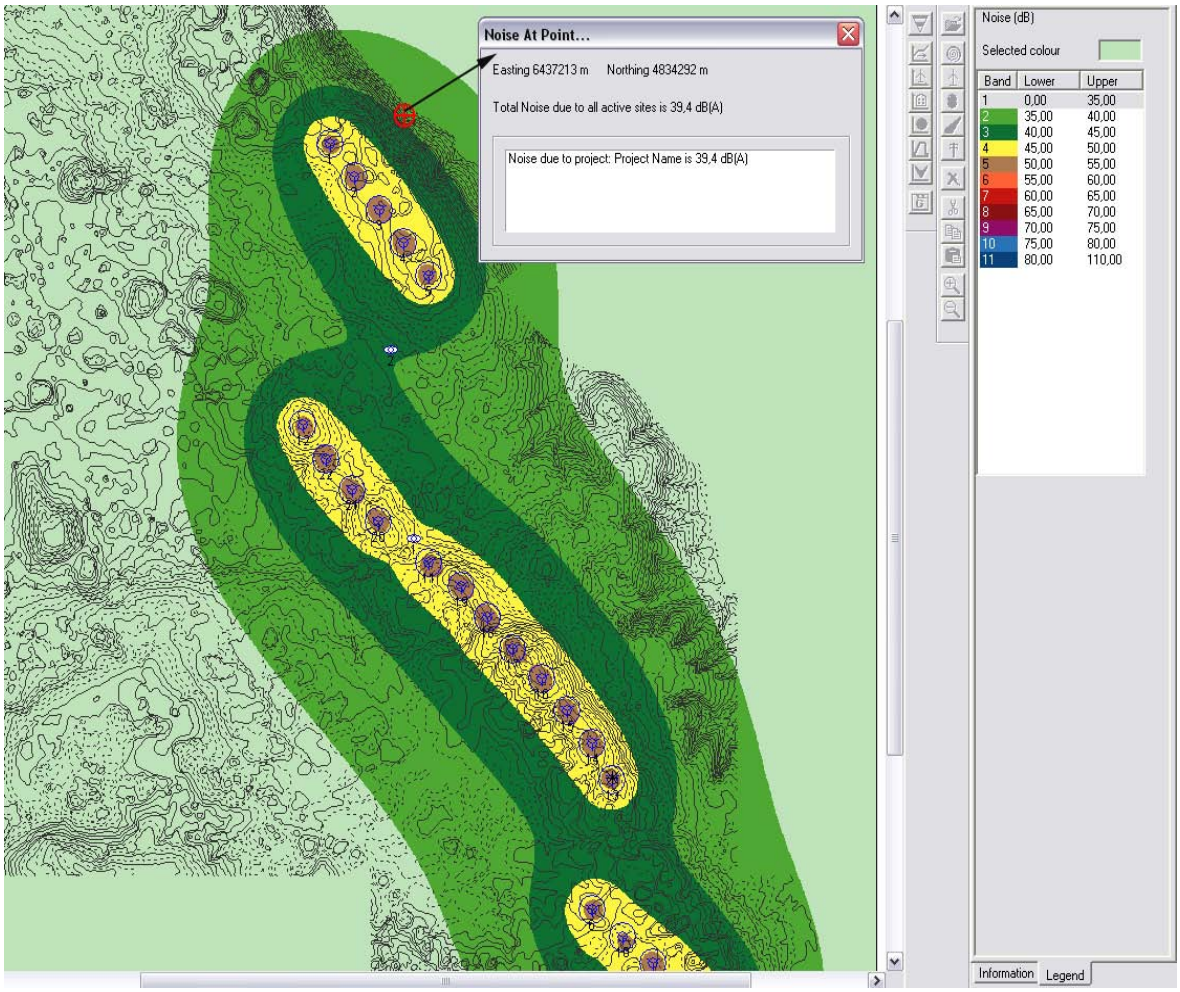
If there are more than one noise sources, that is, if there are more wind farms located at the same distance from the observer, the noise level will increase according to the values given in Table 5.2.

Table 5.2 Increase in noise level depending on number of noise sources

Number of noise sources sited together	Increase in the noise level comparing to only one noise source dB(A)
2	3.0
3	4.8
4	6.0
5	7.0
10	10.0

If the wind farm is not located at a sufficient distance from a settlement then the noise can have negative impact on local inhabitants and animals. Parameters that negatively influence noise propagation are source height (i.e. tower height), topography, soil and vegetation, meteorological characteristics, and intensity and spectral content of noise source. Thus it is necessary to calculate noise level for each location taking into account distance from settlements and animals. This is done using GH WindFarmer software.

The graphical output of noise level created in WindFarmer is given on Picture 5.4. It is calculated that noise level at the reference point located 495 m southeast from wind turbine no. 1 is below 39.4 dB(A) which is approximately the noise level in the office and can be considered negligible. The noise level at the closest settlement is below 35 dB(A) with exception of settlement Curcici in Gornji Brisnik where noise can reach the level of 44 dB(A), still being less than the emission limit value of 50 dB(A). It can be concluded that noise will not have negative impact on inhabitants and environment.



Picture 5.4 Map of noise level at location of Mesihovina wind farm

6 IMPACT ASSESSMENT AND MITIGATION

As any project of such scale, the proposed development has an impact to the receiving environment. In this section the impact to the environment is identified, assessed and prevented or mitigated, as appropriate, by incorporating specific measures to project design. Environmental impacts are identified at construction, operation and de-commissioning phase of the proposed development.

Special attention is paid to visual impact assessment, flickering and noise impact assessments.

6.1 Impacts during construction

6.1.1 Flora and fauna

Flora

As mentioned in previous paragraphs, no areas of special protection status have been identified in the vicinity of the proposed development.

Generally, impacts on flora and vegetation by the construction of the wind farm can be manifested in reduction of natural habitats and subsequent reduction of the diversity of those habitats, as well as of the diversity of plant associations. However, impacts on flora are not likely on the basis of existing information. The proposed project locations are mainly rocky areas with limited vegetation where no endemic species were found.

Impacts on forests are mainly manifested in permanent loss of forest land due to the construction of wind turbines and the associated works. Although the proposed site is indeed cited in forest areas and pasture, actual vegetation is very limited. Flora in the selected sites is generally confined to low shrubs. The removal of vegetation will take place locally, during excavations for the construction of wind turbine's bases and other installations. However, the removal of vegetation will be limited and soil surfaces will be reinstated after the completion of works. Any surface receiving vegetation will be replanted with endemic species of the area.

Fauna

With regard to large mammals, the area's fauna will not be affected during construction as well. Impacts on terrestrial animals relate only to temporary displacement, caused by the presence of workers and machines, as well as by the generation of noise, vibrations and detonations, exhaust gases and dust during civil engineering works. Such impacts are temporary in nature and reversible, i.e. mammals will revisit the area when construction ends.

The impacts to ornithofauna are related to direct loss of bird habitats, which may occur during construction of foundations for wind turbines, access roads and service areas. It is also possible that bird disturbance

during these construction works may cause temporary abandonment of the area. Disturbing of bats or destruction of their habitats may also occur during the construction phase. Such impacts will be reduced by minimising vegetation clearance to the absolutely necessary and reinstating the environment after the end of the construction activities.

As for large mammals, potential impacts on the area's ornithofauna will be limited spatially and temporarily.

6.1.2 Geomorphology

Limited impacts to the geomorphology of the area are expected during civil engineering works, associated mostly with the construction of the wind turbine foundations, as well with the implementation of improvements of road and electricity network infrastructure.

These impacts are limited, as the size of the interventions does not cause alteration of the area's general geomorphology. The required earthworks will be limited, as current morphology is relatively smooth, and will be concentrated on the necessary interventions to install the turbines in place. The same applies to infrastructure works.

6.1.3 Atmospheric quality

Fugitive dust emissions may be generated due to earthworks, in particular during site clearance and excavations and due to movement of the machinery at the construction site. Similar impacts will be generated during the construction of access roads. During the transportation and installation of the wind turbines, dust emissions will be generated by heavy machinery movement and increased traffic on surrounding roads.

Low level atmospheric pollution may also be caused due to exhaust fumes form vehicles moving inside and outside the worksite. In any case those impacts have local character, are of limited duration and have no permanent consequences on the atmospheric quality of the area.

Provisions will be made to implement good working practices in order to reduce dust emissions, i.e. sprinkling the soil especially if earthworks take place during summer period and covering the trucks when transferring excavation or construction materials. As far as exhaust fumes are concerned, these will be reduced by the use of well-maintained vehicles and machinery.

Additionally the effective planning of construction works will allow control of the vehicles circulation, resulting in reduction of exhaust fumes. In any case, the impact to atmospheric quality due to the construction works will be temporary and fully reversible once construction ends.

6.1.4 Groundwater – surface waters

During the wind farm construction, adverse impacts on water bodies may be caused by inadequate management of liquid wastes produced by the personnel working onsite. As surface waters are not present in the area of interest, adverse effects may be caused to groundwater due to uncontrolled discharge of untreated waste water from sanitary facilities

or construction processes. More significant issues are related to potential spills of oil, hydraulic fluids, oil derivatives and fuel. The issue requires particular attention due to high permeability of the soils.

Such impacts will be minimised by applying good practice measures to the worksite. Especially vehicle maintenance (change of oils, etc.) on the construction site will not be permitted while any oily waste will be collected and managed according to the applicable legislation. Measures will also be taken to ensure that adequate sanitary facilities are provided to the personnel working on site.

6.1.5 Cultural environment

As it is explained in previous paragraphs, no archaeological remainings were found on the construction site. An archaeological site of old Roman coins is located in the wider area of wind farm Mesihovina. Contacts are made with the Archaeological Authorities to establish an agreed way of proceeding with construction while preserving cultural heritage. At a minimum, an archaeologist will be present during the construction works while in case of any findings, these will be rescued by the developer as required.

6.1.6 Landscape – aesthetics

Some visual impacts are expected on the landscape during construction phase, due to the development of the worksite. Such impacts will be limited and mostly related to the presence of the machinery and their operation on site.

Aesthetic impacts during the construction of the wind farm will be temporary, lasting for as long as the construction works, and restricted to communities in short distance from settlements.

Any change to the landscape due to the construction works, such as excavations, we will be reinstated to the greatest possible extend after construction works are completed. This will include removal of any remaining debris or excavation material and replanting of vegetation.

6.1.7 Noise

During construction, a relative increase of the current noise levels will take place, due to construction works and vehicles circulation. More specifically, noise will be emitted by the operation of the machinery for earth moving works and for the installation of the wind turbines. Noise will also result during the transportation of the turbine parts on site by trucks.

Noise impacts will generally be temporary in nature and fully reversible once construction ends. In addition, as the closest settlements in the worst case are at least a few hundred metres away, noise at the worksite will not be particularly noticeable. However, measures will be taken to further reduce nuisance from noise:

- Heavy vehicle movements will be planned in collaboration with the local traffic police, particularly with regard to passing through local settlements.

- Heavy vehicle movements through schools, hospitals or other sensitive areas will be avoided altogether.
- Noise-generating operations at the worksite will be avoided during rest hours.

6.1.8 Climate

No impacts to climate are anticipated to be caused by the construction of the wind farm.

6.1.9 Infrastructure – networks

Positive impacts are expected on the area's networks. In particular, road and electricity infrastructure will have to be improved to accommodate for the project needs. As described above, parts of the existing road network will be reconstructed to accommodate heavy vehicles. In the same direction, electricity infrastructure in the area will be improved to accommodate the electricity produced from the wind farms.

6.1.10 Socio-economic impacts

Limited impacts are anticipated during construction due to the change of the land use in the proposed site from forest land to wind energy exploitation. However, since no noticeable use of the land at the proposed site is currently taking place, such impacts are insignificant.

It is worth noting that wind farms in general may require significant land size, depending on their installed power, but wind turbines are located at distance form each other, resulting in a coverage of less than 1% of the total site's area. The rest of the area at the site is not affected and maintains its use as before the construction of the wind farm.

From an economic point of view, positive impacts are expected, as new job opportunities will be created during construction. It is likely that local working personnel will be employed to carry out part of the construction works, in particular those that do not require specialisation. This will result in reducing unemployment rates and support the local economy.

In case specialised personnel from other parts of the country (or abroad) needs to be involved, there will be need for accommodation, catering and related services, which are likely to be met by neighbouring communities.

6.2 Impacts during operation

6.2.1 Flora and fauna

The operation of the wind turbines has negligible impact to flora and fauna in general, with the exception of bird and bat populations. Once installed, the wind turbines will cause negligible nuisance to vertebrates and large mammals residing in the area, using it as hunting ground or crossing it for migration purposes.

With respect to birds, deaths of bird individuals have been reported internationally due to collision with turbine blades, however they are very limited statistically and by far fewer than the number of deaths

caused by other human activities, such as illegal hunting or collision to high voltage overhead lines. Indicatively, studies carried out in Germany, the Netherlands, Denmark and the UK have revealed that for the total number of bird deaths per year only 20 are due to wind turbines (for an installed capacity of 1000MW), while 1,500 deaths are due to hunting and 2,000 due to collisions to vehicles and overhead lines (which are almost invisible to birds). Apart from fatal collisions, other impacts on ornithofauna from the operation of wind farms are generally related to loss of habitats, loss of nesting or breeding areas and interference on migration routes.

In the scope of this project, the operation of the proposed wind farm is of concern for the populations of quails and ducks whose migration route crosses the area of Mesihovina wind farm location. In general, the risk of collision to wind turbines depends on a number of parameters such as the bird species, the age and the stage of their biological cycle, their number in the area, their flight patterns, the availability of food, meteorological conditions, the topography of the area and the characteristics of the wind farm. The specific mechanism on how these parameters affect risk is not known and thus the quantitative assessment of the collision risk is not feasible.

- The species present in the area are relatively common and the wider area is not under any nature protection status
- The bird species of concern (i.e. quails, ducks and similar) are relatively small in size and thus less prone to collision risks compared to larger species
- The area exhibits a relatively smooth terrain which will make wind turbines more visible to bird population during migration flights.

Given the above, the project owner will undertake a comprehensive monitoring programme to record and assess any collision incidents that may take place during the wind farm operation. The analysis of the findings will provide the opportunity to identify any specific wind turbine locations that may be of particular concern for birds.

The presence of bats is also an issue of concern. The impact of wind turbines to bats is lately considered more of an issue than the impact to birds. Bats are at risk from wind turbines, researchers have found, because the rotating blades produce a change in air pressure that can be fatal for bats while it has no effect on birds or other animals.

However, very few data exists on the presence of bats in the area of interest and thus the potential risk to bats population is difficult to be assessed. During detailed project design, the project owner will investigate the use of newly proposed methods to keep bats away from the wind farm – such as the use of radar emissions as proposed by researchers at the University of Aberdeen.

6.2.2 Geomorphology

No impacts are anticipated on the land's geomorphology, during the operation of the wind farm.

6.2.3 Atmospheric quality

No impacts are anticipated on atmospheric quality, as no air emissions will be generated during the operation of the wind farm.

6.2.4 Groundwater – surface waters

No impacts are anticipated on ground or surface waters, as the operation of the wind farm does not result in the production of liquid waste. In case that maintenance of the wind turbines requires the use of lubricants or oils, any oil or oil derivatives waste generated on site, will be appropriately managed and disposed of.

6.2.5 Cultural environment

Other than the view of the wind turbines from known archaeological sites in the vicinity of the wind farm location, there are no other impacts to archaeological or cultural heritage during wind farm operation.

6.2.6 Landscape – aesthetics

Generally, wind turbines are dominant structures that are visible from a distance due to their size. Wind farms create a "technological" landscape that may not appeal to many people, although this is a highly subjective issue.

In chapter 5, a detailed analysis of the impacts of the wind farm operation has been provided with respect to visual intrusion and shadow flickering and the way these may affect neighbouring communities. The computer models that have been developed showed that the impacts are negligible.

6.2.7 Noise

Similarly, noise impacts to the neighbouring communities by the operation of the wind farm were presented in chapter 5. Computer modelling has demonstrated that noise emissions are maintained within the limits set by legislation, while noise actually reaching neighbouring population is at particularly low level, i.e. everyday noise in an office environment.

As a result, no particular mitigation measures for noise control are foreseen, other than the selection of modern wind turbine equipment that incorporates the latest technological developments on noise emissions control.

6.2.8 Climate

No impacts to climate are anticipated during the operation of the wind farm.

6.2.9 Infrastructure – networks

During their operation, wind turbines can cause disturbance in transmitting and receiving electromagnetic waves used for the

transmission of telecommunication, navigation radio, or TV signals. Disturbances are caused due to the location of the wind turbines in relation with existing stations or to electromagnetic emissions from themselves. The main problem relates to the reflection and scattering of electromagnetic waves by blade surfaces that cause fluctuation to the transmitted signal when the wind turbine comes between transmitter and receiver. However, these issues were more of a concern for previous generations of wind turbines having metal blades. The contemporary wind turbines' blades are made totally from synthetic materials that have minimum impacts on electromagnetic radiation transmission. In addition, electromagnetic wave emissions during operation of wind turbines are particularly weak, confined in small distance around the nacelle and not affecting the surrounding area at all.

6.2.10 Socio-economic impacts

Social impacts form the change of land use in the selected site, are expected to be low and related to the permanent loss of land occupied by the wind farm. As mentioned above, the actual land uptake is localised in the area around each wind turbine, leaving the rest of the site unaffected. Moreover, currently the selected site is characterised as forest land and are mostly mountainous and rocky, covered only by low vegetation. Therefore it is of limited use for other purposes.

On the other hand, significant positive impacts are anticipated from the operation of the proposed wind farm from an economic point of view. These are related to the generation of electricity, the stabilisation of the electricity network and the provision of electricity to more people. Currently electricity generation is completely based on hydro power plants, covering only a part of the electricity demand in the area. The proposed project will increase electricity production, resulting in better response to increasing demand, in reinforcement of economic and technological advance and in general improvement in the quality of life in the area.

6.3 Impacts from decommissioning

No significant environmental impacts are anticipated following the project's operation seizure, due to its nature and the construction materials used. Decommissioning will require removing the wind turbines from place and processing the waste materials. Waste management will be performed as per applicable legislation.

In addition, it should be noted that wind turbines are expected to have a useful life of 25 years, which may be prolonged if they are properly maintained.

6.4 Cumulative or secondary impacts

No cumulative or secondary impacts are anticipated during the construction and the operation of the wind farm.

7 ALTERNATIVES

In the following paragraphs, a number of alternatives to the proposed development are presented, which were rejected for environmental, technical feasibility or practical reasons. The alternative proposed here has been the result of extensive study, on the basis of environmental, technical and economic criteria.

7.1 Energy form

As already mentioned earlier in this study, the electricity generation of EP HZHB is currently completely based on the exploitation of hydro power resources, with the generation capacity only sufficient to cover about one third of the electricity demand in the area supplied by EP HZHB.

The choice of wind energy exploitation for a further contribution to electricity generation in the area is clearly towards environmental sustainability as it exploits a renewable energy source and avoids the use of fossil fuels. Such an option is also in line with the EU environmental policy, which strives for the increase of the exploitation of RES in Europe and the reduction of GHG emissions.

7.2 Location

As part of the feasibility study carried out for this particular project, several sites were initially selected and examined for the feasibility of the project development. The examination included wind potential measurements using 10 m masts for about a year. Other criteria, besides wind potential, included:

- Environmental considerations, specifically with regard to implications with protected areas.
- Landscape issues, with an aim to minimize the necessary interventions and the associated environmental impacts.
- Access to the site, with the aim to minimize the necessary infrastructure works and the environmental and social impacts associated with them.
- Proximity and capacity of the receiving electricity transmission network.

The site Midena-Brisnik was selected on the basis of the above criteria, and was further examined for their appropriateness by measurements with 50 m masts.

7.3 Project size

Wind energy exploitation is a capital intensive form of energy generation and as such needs careful consideration of the economic feasibility of the associated projects. In line of this, the project size selection has been

defined by carefully balancing the need to have a critical project mass to ensure the project economics while still maintaining environmental impacts at acceptable levels.

7.4 Technological options

Wind turbines are nowadays available from a range of international suppliers using state-of-the art technology.

In this respect, the main question with regard to technology for wind turbines is basically the size of the turbines. Two sizes were considered for the proposed development, 850 kW and 2 MW.

- **Smaller wind turbines** are in general well proved designs with many references and with a lot of experience in the operation and maintenance tasks. These kinds of turbines are better if local electrical grid is weak. They result in less fluctuation in the electricity output and may have an advantage during construction as the infrastructure and machinery needs are smaller.
- **Large wind turbines,** over 1 MW, are the current trend in wind energy industry. They are also sufficiently proven while they achieve economies of scale (the cost of foundations, new infrastructure, connection to the grid, maintenance, etc. are independent of size) and result in lower electricity generation cost than smaller machines. From the environmental point of view they are preferred as they require fewer turbines for the same output thus reducing visual impact and environmental impacts for civil works.

The wind turbines of around 2 MW were selected for this project.

7.5 No-project scenario

In case the proposed development is not realized, EP-HZHB will fail to generate a calculated total of 367,500 GHz per annum, out of which 128,527 MW are estimated to be produced by Mesihovina wind farm. The options in this case would be:

- To import this amount of electricity, with the associated cost implications as well as the reliance of EP-HZHB on external sources, the exposure to price fluctuations and in general the lack of security of energy supply.
- To generate electricity by other means, notably the use of coal, that is the native fuel in BiH.

In the later case, even if we disregard the environmental impacts during construction of a thermal power plant, the electricity generation would result in a constant emission of pollutants, including particles, NOx and SO_2, as well as CO_2 emissions.

For the above reasons, the proposed development is clearly the preferred option over the no-project scenario.

8 CONCLUSION

The present Prior Environmental Impact Assessment study provides a comprehensive presentation of the proposed development, the human and natural environment relevant to the development, the anticipated impacts to it and the proposed mitigation measures.

The proposed project comprises the development and operation of a wind farm Mesihovina of installed capacity of 44 MW in the area of Tomislavgrad Municipality. The overall project is of particular importance as it will allow the developer, EP-HZHB, to better meet the electricity demand of the area it serves without relying on extensive power imports.

The proposed location for the installation of the wind farm has been identified and assessed during an extensive feasibility study, carried out on behalf of EP-HZHB by international consultants and supported by wind measurements for over a year. The location satisfies a range of selection criteria, including environmental, technical and economic ones.

The selected location is cited within forest land – although vegetation is limited – away from protected areas or areas of specific ecological interest. The impacts to natural environment from construction and operation of the wind farm are therefore limited.

The existing impacts are mainly associated with the effect that the wind farm operation will have on birds and bats population residing in the area or using the area as part of their migration routes. With respect to birds, international experience and scientific references lead to the fact that any potential impacts will be limited. The project owner will undertake to verify that through an impact monitoring and assessment programme which will record, assess and report to the Authorities bird collision incidents. With respect to bats, the lack of baseline information prevents the assessment of the risk. However, the project owner is committed to examine the use of methods to scare bats away from the turbines, as suggested by international literature.

Visual impacts, as well as impacts related to shadow flickering and noise emissions have been assessed on the basis of computer models and taking into account the proximity with neighboring communities and were found to be negligible.

On the basis of the above, we kindly request **positive evaluation of our Request for Prior-EIA.**

9 REFERENCES

1. Feasibility study: Analysis for the Use of Wind Power for Electricity Generation in Bosnia and Herzegovina, "NIP, SA", Madrid, 2006.
2. Technical and Geological Report - Possibilities of Wind Energy Use in Production of Electric Energy, Dvokut pro and NIP. S.A., April 2006.
3. Environmental Impact Assessment Study for windfarms Mesihovina, Borova Glava and Velika Vlajna - Preliminary Design of Access Roads, PE ELEKTROPRIVREDA HZ HB D.D. Mostar, Electrical energy production-Sector for Development, November 2008
4. Environmental Impact Assessment Study for windfarms Mesihovina, Borova glava and Velika Vlajna, preliminary design " VISUAL IMPACT, SHADOW FLICKERING AND NOISE ASPECTS OF WINDFARMS", PE ELEKTROPRIVREDA HZ HB D.D. Mostar, Electrical energy production-Sector for Development, December 2008
5. E-mail from EPHZHB dated 12.12.2007 with letter in response to the issue of cultural-historical heritage on the sites
6. COUNCIL DIRECTIVE of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, (85/337/EEC), http://ec.europa.eu/environment/eia/eia-legalcontext.htm
7. Environmental and Social Policy, EBRD, 2008

Annex I

Approval from municipality

BOSNA I HERCEGOVINA
FEDERACIJA BOSNE I HERCEGOVINE
HERCEGBOSANSKA ŽUPANIJA
OPĆINA TOMISLAVGRAD
Služba za graditeljstvo, prostorno uređenje i
stambeno-komunalne poslove
Broj:07-23-1103/08
Tomislavgrad, 08.10.2008..godine

Na temelju članka 6. Odluke o uvjetima i lokacijama za izgradnju farmi vjetroelektrana br: 01-02-3516/07 od 18.12.2007. godine i članka 169. Zakona o upravnom postupku («Službene novine FBiH», broj 2/98), Služba za graditeljstvo, prostorno uređenje,stambeno-komunalne poslove, općine Tomislavgrad, rješavajući po zahtjevu JP EP HZ HB d.d. Mostar , donosi:

POTVRDA

1.Kojom se potvrđuje od strane ove Službe da se zemljište omeđeno točkama iz tabele 1. i tabele 2 nalazi u okvirima zemljišta koje je Odlukom o uvjetima i lokacijama za izgradnju farmi vjetroelektrana br: 01-02-3516/07 od 18.12.2007. predviđeno za izgradnju farmi vjetroelektrana.

TABELA 1.Koordinate rubnih točki zemljišta su:

Oznaka	Y	X
1	6434206,04	4848375,40
2	6435011,32	4848363,45
3	6435366,12	4847247,48
4	6434249,89	4846171,36
5	6432362,66	4847211,11
6	6432418,18	4847911,63

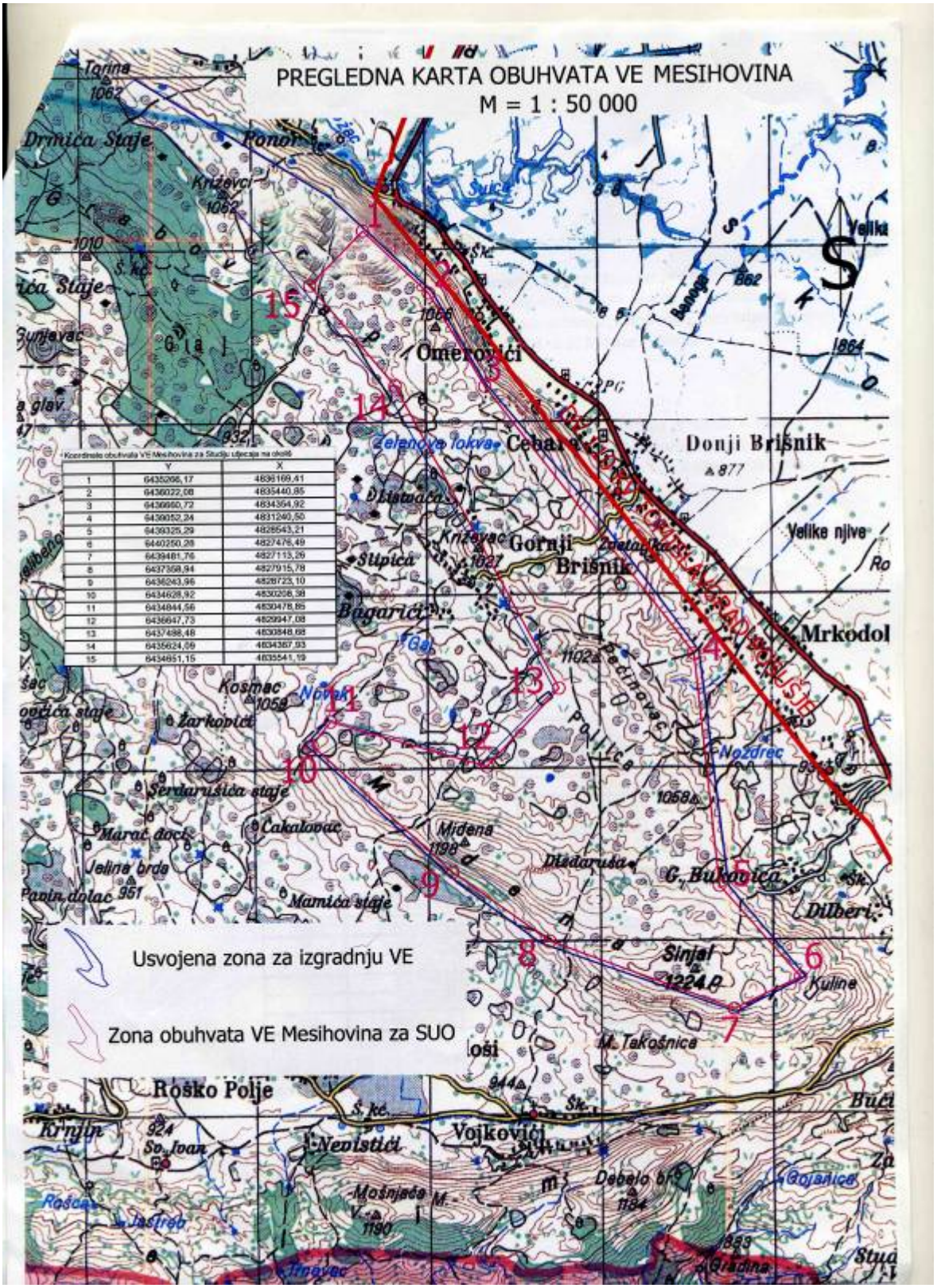
TABELA 2.Koordinate rubnih točki zemljišta su:

	Y	X
1	6436266,17	4836169,41
2	6436022,08	4835440,85
3	6436660,72	4834354,92
4	6439052,24	4831240,50
5	6439325,29	4828543,21
6	6440250,28	4827476,49
7	6439481,76	4827113,26
8	6437358,94	4827915,78
9	6436243,96	48287236,10
10	6434628,92	4830208,38
11	6434844,56	4830478,85
12	6436647,73	4829947,08
13	6437488,48	4830848,68
14	6435624,09	4834367,93
15	6434651,15	4835541,19

Ova Potvrda se izdaje u svrhu izrade studije utjecaja na okoliš.

POMOĆNIK NAČELNIK
za graditeljstvo,prostorno uređenje i
stambeno-komunalne
Zdravko Krišto, dipl. ing. grad.

Dostavljeno:
-Službi za geodetske i imovinsko
pravne poslove
-Poduzeću JP EP HZ HB d.d. Mostar
-Pismohrani



	Y	X
1	6435266,17	4836169,41
2	6436022,08	4835440,85
3	6436660,72	4834364,92
4	6436052,24	4831240,50
5	6436325,29	4828543,21
6	6440250,28	4827476,49
7	6439481,76	4827113,26
8	6437358,94	4827915,78
9	6436243,96	4828723,10
10	6434628,92	4830208,38
11	6434844,56	4830478,85
12	6436647,73	4829947,08
13	6437498,48	4830848,68
14	6435624,09	4834367,93
15	6434851,15	4835541,19

Annex II

List of stakeholders and minutes of meetings conducted

LIST OF MEETINGS HELD:

Msc. Dražen Kotrošan, curator.
Mr. Dejan Kulijer, entomologist
Ornithologist in the National Museum of Bosnia and Herzegovina
Zmaja od Bosne 3, Sarajevo
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e-mail: kotrosanih@bih.net.ba

Branko Vučijak, Neretva freshwater projects coordinator
WWF Mediterranean Programme
Stjepana Tomića 1
71 000 Sarajevo, BiH
Tel: 033/212-466
e-mail: bvucijak@wwfmedpo.org

Mijo Matešković
Hunting association Vran Tomislavgrad
Tel: 036/343-514

Mr. Omer Zubanović, Mr. Salko Kolukčija
Hunting association„Jarebica kamenjarka“ Mostar
Braće Brkić 10
Tel: 036/550-448

Mr. Jozić Ivan, Mr. Dubravko Suša
Hunting association Cincar Livno
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Cell: 063/371-383

Zdravko Krišto
Municipality Tomislavgrad
Department for Urbanism
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Mr. Tomislav Džaković
Water Utility Tomislavgrad
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Gorana Marinčić
Municipality Livno
Department for Urbanism
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EP HZHB
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Ulice Mile Budaka 106, Mostar
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fax. +387 36 335 777

LIST OF EMAIL CONTACTS:

Mato Gotovac, Sharing Waters - Cetina basin project coordinator
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Cell: +387 63 475 738
e-mail: gotovac@wwfmedpo.org

REPORT FROM THE MEETING

Project:	Environmental Impact Assessment for a Wind Park Project		
Date:	29.09.2008.	**Venue:**	Premises of Hydro-Engineering Institute
Minutes prepared by:	Vildana Đonko		
Present:	Mr. Branko Vučijak	Neretva freshwater projects coordinator	
	Ms. Vildana Đonko	Biodiversity expert HEIS	

REPORT FROM THE MEETING

The purpose of the meeting: The purpose of the meeting is to collect information about activities of WWF in Livanjsko polje and any other information relevant to the area proposed for the wind turbines construction.

Ms. Đonko explained to Mr. Vučijak the reason of her visit i.e. that development of PEIA for the wind turbines construction at three sites is currently under way. After that she asked him whether he knows of some projects that are currently being implemented at these sites.

Mr. Vučijak said he knows that some projects are being implemented at these sites, however, he is not involved in any of them. He mentioned the WWF Mediterranean Freshwater Programme which, in addition to other objectives, aims at safeguarding wetlands. He said that it would be good to contact Mr Mato Gotovac, Sharing Waters Livanjsko Polje (Livanjsko Field) Coordinator who knows quite well that area and can give more detailed information.

Mr. Vučijak also mentioned that International Development Agencies GEF and UNDP, together with the relevant ministry in the Canton, are implementing a project to protect biodiversity in Livanjsko polje. The primary objective of this project is the protection of ecosystems.

The third project he mentioned was Euronatur project. In fact, Youth Center Livno and EURONATUR launched the initiative for Livanjsko polje to be inserted onto the Ramsar List of Protected Areas. Livanjsko polje will become third wetland site in Bosnia and Herzegovina to receive official Ramsar recognition.

At the end, Mr. Vučijak gave to Ms. Đonko contact e-mail of Mr. Gotovac

The meeting was over.

FOLLOW UP ACTIVITIES

Contact Mr. Gotovac and ask him more about the WWF Mediterranean Freshwater Programme and activities implemented within the project in the area of Livanjsko polje, and whether they cover the area planned for wind turbines.

REPORT FROM THE MEETING

Project:	Environmental Impact Assessment for a Wind Park Project		
Date:	29.09.2008.	**Venue:**	Premises of National Museum of BiH
Minutes prepared by:	Vildana Đonko		
Present:	Mr. Dražen Kotrošan	Curator for vertebrates, ornithologist	
	Mr. Dejan Kulijer	Entomologist	
	Ms. Vildana Đonko	Biodiversity expert HEIS	

REPORT FROM THE MEETING

The purpose of the meeting: The purpose of the meeting was to find out if there is any information on migration paths of birds at selected locations for the wind turbines construction, what will the impacts of wind turbines have on them, and investigate whether there are data on important habitats and endangered or endemic species on these sites.

Ms. Đonko explained to Mr. Kotrošan the reason for her visit i.e. that there is an ongoing elaboration of PEIA for the wind turbines construction at the three sites. She said that she was already acquainted with the implementation of some projects in the area Livanjsko polje which is entered in the Ramsar list of protected areas. After that she showed to Mr. Kotrošan selected sites on maps and asked him to say whether they once performed some researches of these sites when it comes to the birds.

Mr. Kotrošan said that the area of Livanjsko polje is very important corridor for birds migration because it is a wetland area. After he saw the position of the wind turbine on the map**,** which is placed in Mesihovina, in the area of municipality Tomislavgrad, he explained, that it was precisely between the two migration corridor passing from Livanjsko polje field to Buško jezero lake.He also said that next year the procedure will be to start procedure for proclamation of Livanjsko polje as a protected area. He did not know, however, which degree of protection it will be. There will be held the meeting Ramsar on 12.12.2008 for Livanjsko polje as significant area for birds and Mr. Kotrošan expressed his wish to invite interpreters of PEIA to attend the this event. Some birds that would be directly threatened by the wind turbines construction are cranes (they fly in flocks of 500 birds), than corncrakes being globally endangered species and having their most important habitat is in Livanjsko polje in BiH. He also mentioned bird species dotterel that comes from the Northern Europe.

Ms. Đonko than asked whether there is such a detailed data for the third site, Velika Vlajna. Mr. Kotrošan said that this site should not have such great impact on birds as previous two sites. He said that this site is very important for flyover of birds of prey, such as large vulture, that fly over mountain routes Čvrsnica and Vran. However there is no birds watching system that can determine exactly migration paths of these birds.At the end, Mr. Kotrošan proposed to Ms. Đonko to use data that are related to birds' population in these sites from a number of separates from the National Museum of BiH library.

Ms. Đonko thanked to Mr. Kotrošan and meeting was over.

FOLLOW UP ACTIVITIES

To visit The National Museum library and buy separates related to birds' population which were registered at the sites proposed for the wind turbine construction.

REPORT FROM THE MEETING

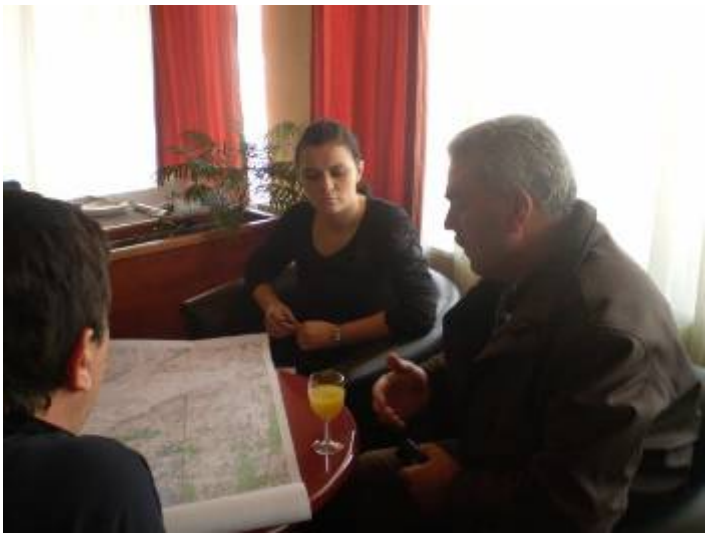
Project:	Environmental Impact Assessment for a Wind Park Project		
Date:	14.10.2008.	**Venue:**	Premises of Hunting Association Vran Tomislavgrad
Minutes prepared by:	Vildana Đonko		
Present:	Mr. Mijo Matešković	President of the Hunting Association „Vran" Tomislavgrad	
	Mr. Emir Imamović	HEIS	
	Mr. Almin Džafić	HEIS	
	Ms. Vildana Đonko	HEIS	

REPORT FROM THE MEETING

The purpose of the meeting: The purpose of the meeting is to collect data and documents about fauna presence, boundaries of hunting grounds and corridors of animal movement.

Ms. Đonko briefly explained the reason for this visit and asked Mr. Matešković whether the selected location is within the boundaries of their hunting grounds, which animal species are presented at the site and whether the corridors of animal movement coincident with the location.
Mr. Matešković said that whole proposed location is within the boundaries of hunting grounds of Hunting Association "Vran".
In his opinion, the most important is to mention that quails, grey partridge, wild duck, rabbit, fox, possibly of Roe deer are spotted on the location, while wild boar and bear appear occasionally.
Mr. Matešković said that wind turbines could most affect the migration of quail. Quails are non-migratory in Duvanjsko polje but they migrate toward the north and flying very low.
Migration route goes in the direction of north-south and crosses proposed site.
He explained that during fall, ducks and other birds migrate from lake Buško jezero toward filed Duvanjsko polje. If the autumn is rainy ducks and birds stay in Duvanjsko polje and fly over territory where wind park will be located. During the day they reside on lake Buško jezero and migrate during the night to field Duvanjsko polje to their breading ground in order to fly back to Buško jezero in the morning.
Quail seasonally migrate from Vojvodina and Hungary over these areas toward south, so that the selected location is traversing across the path during the migration periods. In his opinion wind turbines will have some impact on them, but he does not know exactly what kind of impact.
This area is also a habitat of rabbit, fox and wolf.
Ms. Đonko thanked to Mr. Matešković and meeting was over.

REPORT FROM THE MEETING



REPORT FROM THE MEETING

Project:	Environmental Impact Assessment for a Wind Park Project		
Date:	13.10.2008	**Venue:**	Premises of Hunting Association „Jerebica“ Mostar
Minutes prepared by:	Vildana Đonko		
Present:	Mr. Salko Kolukčija	President of the Hunting Club „Jerebica“ Mostar	
	Mr. Omer Zubanović	Member of the Hunting Club „Jerebica“ Mostar	
	Ms. Vildana Đonko	Biodiversity expert, HEIS	

REPORT FROM THE MEETING

The purpose of the meeting: The purpose of the meeting is to collect data and documents about fauna presence, boundaries of hunting grounds and corridors of animal movement.
Ms. Đonko briefly explained the reason for this visit and asked Mr. Kolukčija whether the selected location is within the boundaries of their hunting grounds, which animal species are presented at the site and whether the corridors of animal movement coincident with the location.

First of all, Mr. Kolukčija said that this location is not within the boundaries of their hunting grounds, but that it belongs to hunting society of Herceg Bosna. Although the slopes of Velika Vlajna toward Drežnica belong to their hunting ground he could give some information about present wildlife but not the exact corridors of their movement. The most represented species is Grey partridge that migrate during winter from top of Velika Vlajna in direction of Bogodol, while appearance of bear, rabbit, foxes and doe is not so frequent. From other bird species, here can be often noticed jay, hawks etc. Čabulja Mountain is also known as hunting ground for leaps which are now very scarce.

In their opinion, for wind turbines construction it would probably be necessary to construct roads, since this area is inaccessible, and by doing that, access for poachers would be easier as well. That would significantly endanger all wildlife at this location. It is necessary to restrict the use of those roads only for the purposes of wind park, and to place signs on the road that are notifying that wild animals could be crossing it.

Ms. Đonko thanked to Mr. Kolukčija and Mr. Zubanović and meeting was over.

REPORT FROM THE MEETING

Project:	Environmental Impact Assessment for a Wind Park Project		
Date:	13.10.2008	**Venue:**	Premises of Hunting Association „Cincar“ Livno
Minutes prepared by:	Vildana Đonko		
Present:	Mr. Dubravko Suša	President of the Hunting Club „Cincar” Livno	
	Ms. Vildana Đonko	Biodiversity expert, HEIS	
	Mr. Almin Džafić	HEIS	
	Mr. Emir Imamović	HEIS	

REPORT FROM THE MEETING

The purpose of the meeting: Team in charge of feasibility study development is collecting data and documentation about fauna presence, boundaries of hunting grounds and corridors of animal movement.

Ms. Đonko briefly explained the reason for this visit and asked Mr. Suša whether the selected location is within the boundaries of their hunting grounds, which animal species are presented at the site and whether the corridors of animal movement coincident with the location.
Mr. Suša said that areal of wild horses is in the area of Krug Mountain and that they migrate (daily migrations) to the proposed site, location of Bunari, where they are fed by hunters. It is necessary to dislocate these feeders in their areal, and not to be located next to roads. Area between Jelovača and Tušnica Mountain represents a unique wildlife site being home to wild boar, Roe deer, rabbit, bear, foxes and wild cats.
There is natural passing for the cattle from the village that is moving to Bunar, right on the area proposed for wind turbines construction. Considering season migrations, members of this hunting association are one step from starting of attracting Roe deer from area of Jelovača Mountain in natural way, meaning by feeding and not disturbing, and this location that is foreseen for wind turbines is the only direction that leads to big forest of Krug Maintain, since there is natural barrier in its foothills, known as Greda.
Mr. Suša said that from hunting point of view, he does not know exactly what will be the impact on wildlife, but he believes that won't affect it in the best way, since construction of wind turbines may cut the hunting ground by middle.
Ms. Đonko asked Mr.Suša whether he is familiar with the present bird species, and whether they have their own corridors at the site.
Mr. Suša said that the Krug Mountain is a habitat of Golden eagle, while Grey partridge habit on the slopes of Borova glava., so knowing that water source for birds is not available on their way from field Livanjsko polje to the Šuica River in the east, it is assumed that birds use water from Bunari. This area is also home to ravens and hawks.
Ms. Đonko thanked to Mr. Suša and meeting was over.

	REPORT FROM THE MEETING
	

REPORT FROM THE MEETING

Project:	Environmental Impact Assessment for a Wind Park Project		
Date:	14.10.2008	**Venue:**	Premises of Municipality Tomislavgrad, Department for Construction, Physical Planning and Housing-Municipal Affairs
Minutes prepared by:	Almin Džafić		
Present:	Mr. Zdravko Krišto	Chief of Department	
	Mr. Almin Džafić	HEIS	
	Mr. Emir Imamović	HEIS	
	Vildana Đonko	HEIS	

REPORT FROM THE MEETING

The purpose of the meeting: The purpose of the meeting was to collect data and documentation about settlements, land use, physical plan of the area and infrastructure on the site.

Mr. Imamovic presented the team members and project and asked from Mr. Kristo for information about settlements, land use, physical plan of the area and infrastructure on the site and other relevant information for the location of wind farm construction.
Mr. Kristo informed Mr Imamovic that he does not poses information about number of inhabitants in surrounding settlement and that the team can look in Yearly Statistic of Institute for Statistic of FBiH. He said that people living in surrounding settlement work in different construction companies, do trade and work in quarry opened nearby.
He said that several water well is located in the area nearby but is not in area under influence of wind park.
He said that the wind park will be situated in karstic area and that several cave are located in surrounding of wind park.
He handed over a map of energy potential in municipality Tomislavgrad.
He said that Municipality gave official Agreement for construction of wind farm on Mesihovina site and that municipal Physical Plan is updated with future wind farm zone of construction and zone of influence.

REPORT FROM THE MEETING

Project:	Environmental Impact Assessment for a Wind Park Project		
Date:	14.10.2008	**Venue:**	Water Utility Tomislavgrad
Minutes prepared by:	Almin Džafić		
Present:	Mr. Tomislav Đaković	Engineer in Water Utility	
	Mr. Almin Džafić	HEIS	
	Mr. Emir Imamović	HEIS	
	Vildana Đonko	HEIS	

REPORT FROM THE MEETING

The purpose of the meeting: The purpose of the meeting was to collect data and documentation water infrastructure on the site.

Mr. Imamovic presented the team members and project and asked from Mr. Dakovic for information about water wells and infrastructure as well as other relevant information for the location of wind farm construction.

Mr Dakovic showed the map of existing and future water supply system for municipality Tomislavgrad with information about water well, reservoirs, pumping station. Water protection zones are defined only for main water supply Ostrozac near settlement Vucipolje. The water protection zone project can be found in the library of HEIS. He also mentioned that one of the village water wells is located in surrounding of future windfarm location however that the well is not under windpark zone of influence.

REPORT FROM THE MEETING

Project:	Environmental Impact Assessment for a Wind Park Project		
Date:	14.10.2008	**Venue:**	Premises of Municipality Livno, Department for Construction, Physical Planning and Housing-Municipal Affairs
Minutes prepared by:	Almin Džafić		
Present:	Mr. Gorana Marinčić	Assistant to Major for Urbanism	
	Mr. Almin Džafić	HEIS	
	Mr. Emir Imamović	HEIS	
	Vildana Đonko	HEIS	

REPORT FROM THE MEETING

The purpose of the meeting: The purpose of the meeting was to collect data and documentation about settlements, land use, physical plan of the area and infrastructure on the site.

Mr. Imamovic presented team members and project and asked from Mrs. Marincic for information about settlements, land use, physical plan of the area and infrastructure on the site and other relevant information for the location of wind farm construction.

Mr. Marincic tokk the notes and said that she is not in position to reveal information she possess without official request to Major. She promised that she will give her best to provide the team with information as soon as she receive Major's approval.

REPORT FROM THE MEETING

Project:	Environmental Impact Assessment for a Wind Park Project		
Date:	13.10.2008	**Venue:**	Premises of EPHZHB
Minutes prepared by:	Almin Džafić		
Present:	Mr. Dalibor Marinčić, Mr. Josip Marincic, Mrs. Ivana Matijevic, Mr. Miroslav Nikolic	EP HZHB	
	Mr. Almin Džafić	HEIS	
	Mr. Emir Imamović	HEIS	
	Vildana Đonko	HEIS	

REPORT FROM THE MEETING

The purpose of the meeting: The purpose of the meeting was to collect data and documentation about the windpark project and to visit the site with EPHZHB team.

Mr. Imamovic explained the purpose of the meeting and asked EPHZHB team for more information about windpark sites.
Mr. Marincic said that they did extensive research on archaeological sites during site selection and he handed over the maps of archaeological sites to Mr. Imamovic for all three locations. He also handed over the topographic map with wind farm locations 1:25 000.
Mr. Marincic also informed the team that land planned for construction of wind park Mesihovina and Velika Vlajna is designated as forest land and is managed by Cantonal Forest Management Utility. For Velika Vlajna, Mostar and Siroki Brijeg list of landowners can be found in the municipality. He said that they have to change use of land from forest to meadow or construction land through regular municipal procedure.
He mentioned that wind farm Velika Vlajna is located in the zone of Radobolja spring watershed but that thespring will not be under wind farm zone of influence.
After meeting was over both teams went to visit future locations of wind farms.