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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF PROPOSED KOVACICA WIND PARK, SERBIA

Electrawinds D-Wind D.O.O

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Checked by	Ian Williams	Matt Whalley		
Signature				
Authorised by	Barry Cowell	Barry Cowell		
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Electrawinds D-Wind D.O.O

01/12/2013

Client

Electrawinds D-Wind DOO
Alexander Vulovic
Djordja Stanojevic 14
11070 Belgrade
Serbia

Tel +381 62 471 064
Fax +381 11 71 222 57
a.vulovic@newenergy.rs

Consultant

WSP House
London
WC2A 1AF
UK

Tel: +44 20 7314 5000
Fax: +44 20 7314 5111

www.wspgroup.co.uk

Registered Address

WSP UK Limited
01383511
WSP House, 70 Chancery Lane, London, WC2A 1AF

WSP Contacts

Matt Whalley
Barry Cowell

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1 Introduction

1.1 Project Context

1.1.1 WSP has been commissioned by Electrawinds D-Wind D.O.O to prepare an Environmental and Social Impact Assessment (ESIA) for the development of a wind park and associated infrastructure near the municipality of Kovacica, in Vojvodina Province in northern Serbia.

1.1.2 The Proposed Development is approximately 3711 hectares and would consist of up to 38 wind turbines up to 2.5 MW that would have an overall maximum blade tip height of 190 m and a potential total capacity of 95 MW.

1.1.3 The proposed development is described in greater detail in Chapter 4 of this document.

1.2 Requirement for ESIA

1.2.1 The Equator Principles (EPs) are a framework for identifying, assessing and managing environmental and social risk in project finance transactions. The EPs are adopted voluntarily by financial institutions and are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making.

1.2.2 The EPs are based on the International Finance Corporation (IFC) Performance Standards on social and environmental sustainability and on the World Bank Group Environmental, Health, and Safety Guidelines (EHS Guidelines). These are intended to act as a framework for each institution for their own internal social and environmental policies, procedures and standards related to its project financing activities.

1.2.3 The EPs have become the industry standard for environmental and social risk management and financial institutions, clients/project sponsors, other financial institutions, and even some industry bodies, refer to the EPs as good practice.

1.2.4 Due to the nature of the proposed development Electrawinds D-Wind D.O.O plan to approach a number of international financial institutions including the European Bank of Reconstruction and Development (EBRD) and the International Finance Corporation (IFC) to co-finance the project.

1.2.5 The EBRD and IFC have developed Environmental and Social Policy (ESP) that outlines their commitment to the environmental and social dimensions of sustainable development. Within the ESP a number of Performance Requirements and Performance Standards are detailed.

1.2.6 All EBRD and IFC financed projects are required to meet their core operating principles and financing sustainable development ranks among the highest priorities of both banks activities.

1.2.7 The EBRD and IFC consider it important that all companies receiving financing have a systematic approach to managing the environmental and social issues and impacts associated with their activities. Through their environmental and social appraisal and monitoring processes the EBRD and IFC seek to ensure that the projects they finance:

- are socially and environmentally sustainable;
- respect the rights of affected workers and communities; and
- are designed and operated in compliance with applicable regulatory requirements and good international practice.

1.2.8 The EBRD and IFC expect projects that they finance to meet good international practice related to sustainable development and in order to assist projects achieve this, the EBRD and IFC has defined specific Performance Requirements (PR) and Performance Standards (PSs) respectively for key areas of environmental and social issues and impacts.

1.2.9 PR 1 and PS 1 relate to Environmental and Social Appraisal and Management and outline the client's responsibilities in the process of appraising, managing and monitoring environmental and social issues associated with projects proposed for financing. These include the following:

- identifying and assessing the environmental and social impacts and issues, both adverse and beneficial, associated with the project;
- adopting measures to avoid, or where avoidance is not possible, minimize, mitigate, or offset/compensate for adverse impacts on workers, affected communities, and the environment;
- identifying and, where feasible, adopting opportunities to improve environmental and social performance;
- promoting improved environmental and social performance through a dynamic process of performance monitoring and evaluation.

1.2.10 In preparing this ESIA consideration has been given to the EBRDs Environmental and Social Policy and associated performance requirements as well as IFC Performance Standards and EPs and the ESIA will be cognisant of the requirements of the EC EIA Directive.

1.3 The Approach to Assessment

Introduction

1.3.1 The overall approach to this assessment comprised the following:

- establishment of existing / baseline environmental conditions at the Site;
- identification of the legislative framework for the proposed development and applicable guidance;
- determination of significance criteria to assess the level of any identified potential impacts arising from the proposed development;
- identification, prediction and assessment of the likely significance of the environmental and social effects, both positive and negative, of the proposed development (during construction and operation);
- identification of suitable mitigation, enhancement and monitoring measures to prevent, reduce or remedy any likely significant adverse environmental effects; and
- assessment of the significance of any residual impacts (i.e. those remaining following implementation of mitigation measures).

1.3.2 An overview of the guidance and methodology adopted for each technical study is provided within the respective ESIA chapters (Chapters 5 – 11).

1.3.3 The proposed development has been assessed using site visits and available information and knowledge of the site and surrounding area, to determine the potential for significant environmental effects. Where likely significant environmental effects are identified, mitigation measures to prevent, reduce or remedy these effects are recommended.

Stages of the Assessment

1.3.4 The following stages have been followed during the preparation of this ESIA:

- scoping study;

- baseline assessment of existing environmental conditions within the Site and the surrounding area;
- identification of potential effects arising from the construction and operational phases of project;
- evaluation of the significance of potential effects;
- identification of mitigation measures; and
- assessment of any residual impacts following implementation of the identified mitigation measures.

Scoping Study

1.3.5 A Scoping Report was prepared by WSP in August 2013 for the project. The scoping report identified key issues to enable potentially significant impacts to be identified early on in the process to inform the ESIA.

Baseline Assessment

1.3.6 In order to identify the scale of potential effects as a result of the proposed development, it is necessary to establish the existing baseline environmental conditions and for some technical assessments, it is necessary to establish the future baseline scenario, i.e. the environmental conditions at the Site in the future, without the proposed development.

1.3.7 The baseline scenario was established through the following:

- Site visits and surveys;
- Desk-based studies;
- Review of existing information;
- Modelling; and
- Consultation with the relevant consultees.

Identification of Effects

1.3.8 Various methodologies were applied in order to determine the potential for significant environmental effects as a result of the site preparation / construction works and operation of the proposed development. The topic specific methodologies are provided in each of the technical chapters of this ESIA (Chapters 5 – 11).

Evaluation of Significance

1.3.9 The assessment of the likely significance of potential environmental effects arising from both the construction works and operation of the proposed development required consideration of the following:

- Beneficial and adverse impacts;
- Short, medium and long term impacts;
- Direct and indirect impacts;
- Permanent and temporary impacts; and
- Cumulative impacts.

1.3.10 Several criteria have been used to determine whether or not the likely environmental effects of the proposed development will be deemed ‘significant’. The effects have been assessed quantitatively, where possible.

1.3.11 Generally, the significance of effects has been assessed using one or more of the following criteria:

- International, Serbian or UK national and local standards;

- Sensitivity of receiving environment;
- Extent and magnitude of the impact;
- Reversibility and duration of the impact;
- Inter-relationship between effects; and
- Nature and extent of cumulative effects.

1.3.12 Each impact has been assessed against the change of magnitude and the sensitivity of the receptor as shown in Table 1.1 below.

Table 1.1: Matrix for Determining the Significance of Effects

		Sensitivity of Receptor/Receiving Environment to Change/Effect			
		High	**Medium**	**Low**	**Negligible**
Magnitude of Change/Effect	**High**	Major	Moderate to Major	Minor to Moderate	Negligible
	Medium	Moderate to Major	Moderate	Minor	Negligible
	Low	Minor to Moderate	Minor	Negligible to Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

1.3.13 The likely significance of effects reflect judgements as to the importance or sensitivity of the affected receptor(s) and the nature and magnitude of the predicted changes. For example, a moderate negative effect on a feature or site of low importance will be of lesser significance than the same effect on a feature or site of high importance.

1.3.14 The following terms[1] are used to assess the significance of effects, where they are predicted to occur:

- **Major positive or negative effect** - where the proposed development would cause a significant improvement or deterioration to the existing environment;
- **Moderate positive or negative effect** - where the proposed development would cause a noticeable improvement or deterioration to the existing environment;
- **Minor positive or negative effect** - where the proposed development would cause a barely perceptible improvement or deterioration to the existing environment; and
- **Negligible** - where the proposed development would result in no discernible improvement or deterioration to the existing environment.

1.3.15 Specific criteria have been developed for certain technical studies and these are provided in the respective technical chapters of this ESIA. The inter-relationship between likely significant environmental effects and residual impacts following implementation of mitigation measures has also been discussed.

Mitigation Measures

1.3.16 Following the assessment, where appropriate, mitigation measures have been recommended to prevent, reduce or remedy any potentially significant environmental effects. Such measures are to be implemented during design, construction and/or operation of the proposed development.

1.3.17 Each technical chapter outlines the measures recommended to mitigate any identified significant effects.

[1] These terms have been developed with reference to published UK best practice guidance as well as WSPE's EIA experience.

Residual Impact Assessment

1.3.18 Following the implementation of mitigation measures, an assessment of the significance of any residual impacts was undertaken. The findings are presented in each technical chapter of this ESIA (Chapters 5 – 11).

Decommissioning

1.3.19 Due to the potential longevity of the scheme (approximately 25 years) it is considered that current best practice decommissioning techniques and legislation are likely to continue to develop throughout the operational lifetime of the wind farm site. As such, it is difficult to identify specific mitigation measures that should be adopted during the decommissioning phase. However, it is considered that mitigation measures adopted should be similar to those employed during the construction phase, and are likely to include such measures as the use of specific access roads to minimise potential impacts on local ecological receptors, dust suppression techniques, noise reduction measures, appropriate storage and removal of hazardous substances, pollution incident response planning and adopting of waste minimisation and management techniques.

1.3.20 Notwithstanding the above, decommissioning will be undertaken in line with best practice site management, working practices and legislative requirements that are relevant at that time of decommissioning.

1.4 Assumptions and Limitations

1.4.1 The key assumptions that have been made and any limitations that have been identified, in producing this ESIA are set out below. Assumptions specific to certain topics are identified in the appropriate technical chapters:

- Third party data that has been supplied to WSP (e.g. site investigation data, ecological data, noise monitoring data) is complete and accurate;
- The principal land uses in the surrounding area will remain unchanged;
- The scheme description will be as outlined in Chapter 4 ‘Project Description; and
- The mitigation and enhancement measures stipulated in each technical chapter will be implemented as appropriate.

2 Legislative Framework

2.1 Legislative Framework

International Finance Corporation (IFC)

2.1.1 The IFC have Performance Standards (PS) (IFC, 2012) outlines the IFC strategic commitment to sustainable development. The Performance Standards include:

1. PS 1: Assessment and Management of Environmental and Social Risks and Impacts
2. PS 2: Labour and Working Conditions
3. PS 3: Resource Efficiency and Pollution Prevention
4. PS 4: Community Health, Safety, and Security
5. PS 5: Land Acquisition and Involuntary Resettlement
6. PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
7. PS 7: Indigenous Peoples
8. PS 8: Cultural Heritage

Equator Principles (EPs)

2.1.2 The EPs are based on the IFC performance standards on social and environmental sustainability and on the World Bank Group Environmental, Health, and Safety Guidelines (EHS Guidelines). They aim to serve as a common baseline and framework for international financial institutions to develop their own internal social and environmental policies, procedures and standards related to its project financing activities.

2.1.3 The EPs include:

1. Principle 1: Review and Categorisation
2. Principle 2: Social and Environmental Assessment
3. Principle 3: Applicable Social and Environmental Standards
4. Principle 4: Action Plan and Management System
5. Principle 5: Consultation and Disclosure
6. Principle 6: Grievance Mechanism
7. Principle 7: Independent Review
8. Principle 8: Covenants
9. Principle 9: Independent Monitoring and Reporting
10. Principle 10: EPFI Reporting

EBRD Policy & Guidance

2.1.4 The EBRD's Environmental and Social Policy (EBRD, May 2008) outlines the EBRD's responsibilities and 10 Performance Requirements (PRs) which are supported by a series of guidance documents and good practice notes. The PRs include:

1. PR 1: Environmental and Social Appraisal and Management;
2. PR 2: Labour and Working Conditions;

3. PR 3: Pollution Prevention and Abatement;
4. PR 4: Community Health, Safety and Security;
5. PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement;
6. PR 6: Biodiversity Conservation and Sustainable Natural Resource Management;
7. PR 7: Indigenous Peoples;
8. PR 8: Cultural Heritage;
9. PR 9: Financial Intermediaries; and
10. PR 10: Information Disclosure and Stakeholder Engagement.

2.1.5 The EBRD PR's have been considered as part of this ESIA.

2.1.6 The EBRD's Environmental and Social Policy categorises proposed projects as A/B/C/FI based on environmental and social criteria to:

1. reflect the level of potential environmental and social impacts and issues associated with the proposed project; and
2. determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required for each project, taking into account the nature, location, sensitivity and scale of the project, and the nature and magnitude of its possible environmental and social impacts and issues.

2.1.7 The Proposed Development is for 38 wind turbines of up to 2.5 MW each, with an overall maximum blade tip height of 190 m and a potential total capacity of 95 MW. In addition, the development will also include ancillary infrastructure comprising access tracks, underground electrical cabling, crane hard-standing areas, and a substation complex of approximately 4 hectares and associated overhead power lines (OHL) that connect to the 220kV OHL. The overall area of the site is 3,711 hectares (9,170 acres).

2.1.8 On this basis the proposed development is defined as a Category A project (EBRD, 2008) which is defined as a project which could result in potentially significant and diverse adverse future environmental and/or social impacts and issues which, at the time of categorisation, cannot readily be identified or assessed and which require a formalised and participatory assessment process carried out by independent third party specialists in accordance with the PRs[2].

EC Directives

2.1.9 This ESIA has been carried out to European standards and is cognisant of the requirements of the following key EC Directives:

- Directive 85/337/EEC as amended by Council Directive 97/11/EC – This Directive applies to the assessment of the environmental effects of those public and private projects which are likely to have significant effects on the environment. The Directive of 1997 widened the scope of the EIA Directive by increasing the types of projects covered, and the number of projects requiring mandatory environmental impact assessment (Annex I). It also provided for new screening arrangements, including new screening criteria (at Annex III) for Annex II projects, and established minimum information requirements. The 97/11/EC Directive also brought the Directive in line with the UNECE Espoo Convention on EIA in a Trans-boundary context.
- Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 provides for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC.

[2] EBRD Environmental & Social Policy (May 2008)

Serbian Legislation

2.1.10 The framework law in the Republic of Serbia for ESIA is the Law on Environmental Impact Assessment (OJ RS, No. 135/04, 36/09). Public institutions and those competent for the environment provide their requirements/opinions on the proposed plans and these are taken into consideration in the planning process. Once the plans and programmes have been adopted, the general public is informed about the decision and the decision making procedure. The objective of the environmental impact assessment is to involve the general public and integrate environment related elements in the planning process. This realises the set principles of sustainable development.

2.1.11 In accordance with the Serbian national Law on Environmental Impact Assessment, the development falls within the criteria for a List 2 project (Article 3(3) – Facilities for the generation of electrical energy from wind … of 10MW power or over), therefore an ESIA is at the discretion of the local authority.

2.1.12 In accordance with national legislation, the project was screened and an in-country Scoping Report and EIA were produced and submitted to the Provincial Secretariat for Urbanism, Construction and Nature Protection in support of the development.

2.1.13 Easement right rule will be applied for all the land occupation by the Proposed Development, with exception of the sub-station area which is owned by Electrawinds D-Wind D.O.O.

2.1.14 Outlined below is Serbian legislation relating to the environment and also that which is specific to certain technical areas:

General Environmental Legislation and Environmental Impact Assessment

- **Law on Environment Protection** is the framework national environmental law. The law regulates the integral system of environmental protection ensuring the human right to live and develop in a healthy environment as well as developing a balanced economy and protection of the environment in Serbia.
- **Law on strategic environmental impact assessment** determines conditions, form and procedure of performing the environmental impact assessments for individual plans and programs, in order to provide environmental conservation and improvement of sustainable development by integrating main principles of environmental conservation. It is matched with the Directive 2001/42/EC on environmental impact assessment of individual proposed developments.
- **Law on environmental impact assessment** is the framework law in the Republic of Serbia for ESIA. Public institutions and those competent for the environment provide their requirements/opinions on the proposed plans and taken into consideration in the planning process. Once the plans and programmes have been adopted, the general public is informed about the decision and the decision making procedure. The objective of the environmental impact assessment is to involve the general public and integrate environment related elements in the planning process. This realises the set principles of sustainable development.
- **The Law on Environment Protection 2004** is the framework national environmental law. Article 1 states “This Law shall regulate the integral system of environmental protection which shall ensure human right to live and develop in healthy environment as well as balanced economy growth and protection of the environment in the Republic”.

Regulations

- **Regulation on the content of environmental impact assessment** sets out the scope of the environmental impacts assessment studies required for developments. Article 6 requires that a description of the environmental factors that have a potential to be significantly at risk due to proposed construction projects including fauna and flora. Article 7 of the regulation requires a description of the likely significant effects of the project including a qualitative and quantitative review of possible changes in the environment during the construction and regular operation of the project and to assess the temporary and permanent effect of a development upon amongst other things ecosystems.

- **Regulation on the designation of strictly protected and protected wild species of plants, animals and fungi** officially declares all wild plants, animals and fungi that are strictly protected and protected throughout Serbia. The regulation includes two lists; Annex 1 and Annex 2. Annex 1 lists all those plants, animals and fungi that are strictly protected in order to preserve the biological diversity, natural gene pool and species that have special importance to the ecological, ecosystem, bio-geographical, scientific, health, economic and other aspects of the Republic of Serbia. Annex 2 lists all those species of wild plants, animals and fungi that are protected in Serbia and determines conservation measures for protected species and their habitats. Conservation of strictly protected and protected species is achieved through the ban of use, destruction and undertaking any activities that may pose a threat to wild species and their habitats, as well as by implementation of measures and activities for population management.
- **The Rules on the Content of the Environmental Impact Assessment Study ("Official Journal RS", No. 69/05)** prescribes in more detail the content of the Environmental Impact Assessment.
    - Article 3 requires a description of the site designated for the implementation of the project, including an "overview of the main properties of the landscape".
    - Article 6 requires a description of the environmental factors that are likely to incur significant risk due to proposed construction projects including landscape.
    - Article 7 requires a description and assessment of the potential impacts of the project on the different aspects of the environment, including "landscape features of the area and similar."

Protected areas, biodiversity

- **Law on Nature Protection**, among other regulations, determines obligations with regards to nature conservation in relation to renewable energy projects. The law sets out the principle for protection of nature in Serbia with the aim of reducing any negative effects of development.
    - Article 80 sets out the measures for the protection of migratory species. This Article states that in relation to electric systems whose construction would impact upon the usual daily or seasonal migration of wild animals or results in habitat fragmentation or in some other way disturbs the natural lifecycle of migratory species then such developments must be constructed so as to reduce negative impacts through the application of special construction solutions during the construction and operation (exploitation) phase of the development.
    - Article 81 outlines the measures for protection of birds and bats. This Article states that the locations of wind powered generators shall be determined as to avoid important habitats and migration routes of birds and bats. In addition the construction of wind generators in the vicinity of ecologically important areas shall in corporate such technologies as required to avoid adverse effects of wind generators.

Landscape

- **Serbia is a signatory to the European Landscape Convention (ELC),** the fundamental point of which is that all landscapes are important, not just in special places and whether beautiful or degraded. Contracting Parties undertake to: recognise landscapes in law; establish and implement landscape protection, management and planning policies and; establish procedures for public participation.

  The implementation of the ELC is included in the Spatial Plan of the Republic of Serbia 2010-2020 (Official Gazette RS, no. 88/10), which includes a section on the Protection and Development of Landscapes. This states that "*The basic goal of protection and development of landscapes in Serbia is to achieve various high quality and adequately used landscapes and physically developed rural and urban settlements pleasant for living and leisure, with rich identity based on respect and affirmation of natural and cultural values".*

Noise

- **Law on Environmental Noise** (Off. Journal of RS, No. 36/2009, 88/2010);
- Decree on noise indicators, limit values, assessment methods for noise indicators, disturbance and adverse effects of environmental noise (“Official Journal of RS”, no. 75/10); and
- Regulation on methods of noise measuring, the content and scope of the noise measurement report ("Official Journal of RS", no. 72/10)

Cultural Heritage

- **The Serbian Cultural Property Law** regulates the system of the protection and use of cultural property and defines conditions for the implementation of activities relating to the protection of cultural property. Cultural property can be of exceptional or great importance in which case it is subject to the provisions of the Cultural Property Law.

  None of the assets identified in the course of this study are of exceptional or great importance – simply previously or identified cultural property.

  - Article 109 of the Cultural Property Law provides that:
    - If archaeological sites or archaeological artefact are found in the course of execution of construction and other works, the executor of works shall immediately and without delay suspend works and inform the competent institute for the protection of cultural monuments, and take measures so that the finding is not destroyed and damaged, and that it is preserved in the place and position where it was found;
    - In the event of immediate danger of damaging the archaeological site or artefact, the competent institute for the protection of cultural monuments shall temporarily suspend the works until it is established, based on this Law, whether the immovable property or object are cultural property or not; and
    - If the competent institute for the protection of cultural monuments fails to suspend the works, the works will be suspended by the Republic Institute for the Protection of Cultural Monuments.

3 Project Background

3.1 Purpose and the Need for the Project

3.1.1 Serbia has set a target that renewable energy projects will provide 27% of the country's overall generating requirements by 2020. In order to achieve this, major investment will be required in the sector (including wind and solar parks and hydro-electric plants.

3.1.2 The proposed development of the Kovacica Wind Park would have a capacity of 95 MW according with Serbian national policy.

3.2 Scoping and Consultation

3.2.1 In line with IFC/EBRD policy and Serbian legislation a scoping report was prepared in August 2013 to identify the potential environmental and social effects of the proposals. In particular, the Scoping Report describes the existing Site and the proposed development; identifies the key issues to be covered within the ESIA; provides an outline of the assessment methodology to be adopted; and provides an outline of the structure of the ESIA.

3.2.2 As part of the site visits, consultations were undertaken with a number of the local authority / statutory departments / stakeholders to gain an understanding of the potential issues associated with the proposed development, these included meetings with the following:

- Kovačica Municipal Council;
- Landowners and owners of surrounding land plots, in four communities: Kovačica, Padina, Debeljača and Crepaja;
- Residents of Kovačica, Padina, Debeljača, Crepaja;
- Ministry of Energy, Development and Environmental Protection;
- Ministry of Construction and Urban Planning;
- Ministry of Interior; and
- Institute for the Protection of Cultural Monuments in Pančevo.

3.2.3 The key issues identified within the Scoping Report that will be considered further in this ESIA are outlined below:

Ecology and Nature Conservation

- Habitat loss for construction roads and compounds;
- Pollution from construction activities;
- Potential impacts on fauna (birds/bats);
- Habitat loss; and
- Habitat fragmentation

Landscape and Visual Impact

- Impact on landscape character and visual receptors during the construction phase; and
- Impact on landscape character and visual receptors during the operation of the wind farm.

Noise and Vibration

- Impact on noise on local premises and potentially noise sensitive premises, including residential, educational, health care properties and places of worship during the construction phase; and
- Impact of noise on local residents and sensitive receptors during the operation of the wind farm.

Cultural Heritage and Archaeology

- Impact upon multi-phase buried deposits during construction.

Social issues

- Impact on the local economy during construction and operational phases; and
- Impact on local employment during construction and operational phases.

Health and Community

- Potential health and community effects associated with the operation of the wind park.

Shadow Flicker

- Potential effect of shadow flicker on sensitive residential and / or commercial receptors.

Cumulative Impacts

- Potential cumulative impacts of the proposed Kovacica wind park and other proposed developments in the area during both the construction and operational phases.

3.3 Consideration of Alternative Sites and Layouts

3.3.1 As part of Electrawinds scoping for a suitable location, alternative locations were investigated.

3.3.2 Site search included research inside of the Kovacica Municipality, and in selecting the Kovacia Wind Park site, cognisance was taken of the local environmental, cultural and social context. From the earliest phases of site selection, the Applicant has taken measures to design a site that will have the lowest negative influence on the local area and still ensure an economically and technically viable wind development.

3.3.3 The following criteria were taken into consideration in siting of the Proposed Development:

- Wind resource. The Wind Atlas of Serbia (2006) showed that the Province of Vojvodina has some of the best wind speeds across Serbia with mean annual wind speeds over 6 m/s, considered economically viable for wind development. This is also in a region affected by the Kosava winds;
- Local authority support. The municipality of Kovacica has a target to increase the supply of electricity from renewable energy sources and stimulate the development and application of new technologies in the region;
- Proximity to a well-developed electrical distribution network and to large source of electricity demand.
- Outside local settlement zones. A conservative separation distance of 1 km from populated areas has been enforced, with the nearest village of Padina located at least 1km to the north east of the site. This standoff distance will minimise any potential impact of the Proposed Development on the local population from noise, visual amenity and shadow flicker;
- Avoiding areas with protected natural resource. The closest protected area is the Middle Podtamisje, designated as an internationally important bird area, which lies approximately 10km to the north west of the Proposed Development. The site itself is located outside the zones of natural wealth markings and the habitats within the site are considered to be of poor quality to local fauna given the intensively farmed monocultures;

- Presence of good transport links;
- Region with low keraunic levels;
- The land is designated for agricultural production and is surrounded with undeveloped space that is currently also used for agricultural production. As such, this area has limited development constraints for wind energy; and
- Accessible and favourable terrain for the construction of a large wind development.

3.3.4 As a result of the aforementioned factors the capital costs required to construct wind developments in the Vojvodina region are reduced due to lower grid connection fees, transportation and construction costs. These all have significant impact on the increased profitability of developing wind parks in the area.

Design Iteration

3.3.5 Early in the planning process, Electrawinds considered alternative scenarios associated with the wind farm at the proposed site. The turbine layout shown on **Figure 4.1** is the third site layout iteration for the Proposed Development:

Layout 1

3.3.6 Installation of 83 wind turbine generators (WTGs) effectively on a regular grid pattern in order to maximise the potential yield from the site.

Layout 2

3.3.7 Increased spacing between the turbines in order to minimise wake effect, noise and shadow cumulative impact. Three turbines that had previously been sited in the north eastern extent of the site, closest to Padina, were also moved 500m away from the site boundary at the request of the Institute on Nature Conservation of Serbia, due to the close proximity of the Dolina Ecological Network along the Jarkovacki Road.

Layout 3

3.3.8 Reducing the number of WTGs to 38 in order to minimise the property land right issues and risks, implement the conditions received from regional authorities/institutions and align with Electrawinds development plan.

3.3.9 The proposed layout has also taken into account the minimum distance between each turbine in the array to ensure optimal performance of each turbine, reduce maintenance costs and ensure that there are no impacts of 'wind take' on any existing or consented wind development in the area.

3.4 Site Location

3.4.1 The proposed site is located in South West Banat within the Vojvodina Province, in the north east of the Republic of Serbia. The closest settlements are Padina (1km to the northeast), Debeljaca (1.75km to the southwest) and Kovacica (2.5km to the northwest of the development area).

3.4.2 The location of the proposed site is shown in **Figure 3.1** below.

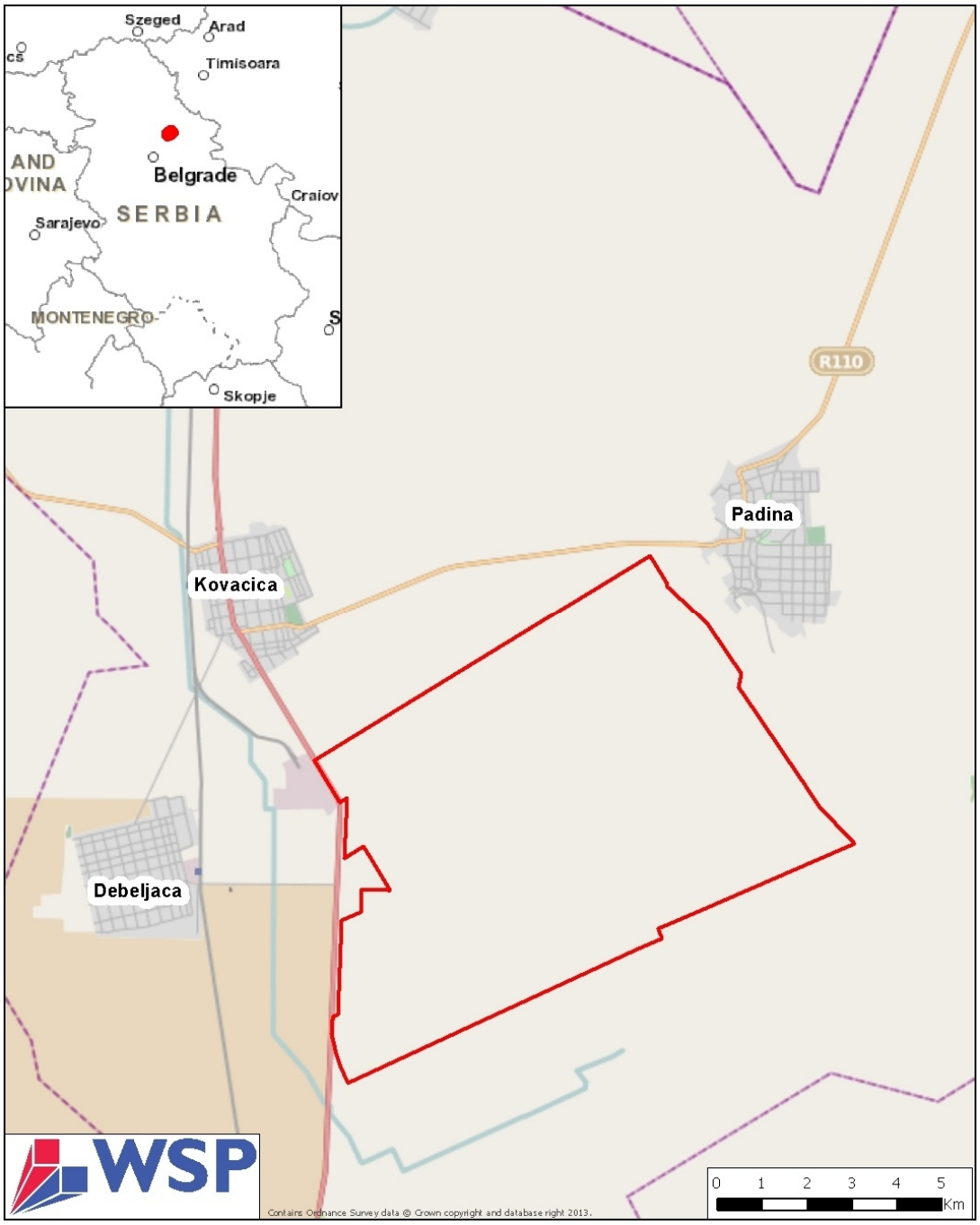

Figure 3.1 – Kovacica Wind Park site location plan

3.5 Site Description

3.5.1 The proposed site covers an area of approximately 3,711 hectares, within the territory the Municipality of Kovacica, CA Kovacica, Debeljaca and Crepaja. The site elevation is approximately 80m above sea level in the west, sloping gently up to approximately 115m above sea level in the east.

3.5.2 State road Category II 111 Ecka - Kovacica – Pancevo or II-111 road runs parallel with the Western boundary of the site and the Jedinstvo sugar plant is located to the west of the road.

Existing Land Use

3.5.3 The majority of the site area comprises intensively farmed strip fields growing agricultural crops mostly in mono culture of little ecological value, with minor areas of low woodland, orchard and vineyard. A small area of research woodland is present on the site (c.14.86 hectares in total area) and there is an area of steppe vegetation at the far eastern end of the site, and a line of acacia trees.

3.5.4 A small area of the site is taken up with existing local roads (Level II) (68.3 hectares, or 1.84% of the land area). There are two Level II roads traversing the site; state road Category II 111 Ecka - Kovacica – Pancevo or II-111 and is state road Category I državna granica sa Hrvatskom (granični prelaz Batrovci)-Beograd - Pančevo - Vršac or IA-3

3.5.5 There is a further network of on-site earth roads used for local field access.

Existing Infrastructure

3.5.6 The site is currently crossed by a number of overhead transmission lines as shown on **Figure 3.2**

- 110 kV high voltage overhead electricity transmission line in the direction east-west; and
- 220 kV high voltage overhead electricity transmission line in the direction north-south.

3.5.7 There is one structure within the site boundary, which is a small vineyard located in the east-central part of the site. A disused and dilapidated two-storey house and associated outbuildings, with a small area of planted trees and vineyard (marked as B1 on **Figure 3.2**), is also located outside but within close proximity to the western site boundary, along state road Category II-111.

Climate and Wind Resource

3.5.8 The site is located in the moderate continental climate characterised by long and warm summers and autumns, mild winters and short springs. A strong gusting dry wind, known as Kosava, usually lasting up to three weeks, is observed in early spring and late autumn, with wind speeds reaching up to 100 km/h.

3.5.9 Initial wind analysis at the sites has concluded that the location of the proposed Kovacica Wind Park has a very good wind potential with no anticipated natural turbulence given the local landscape and current land use.

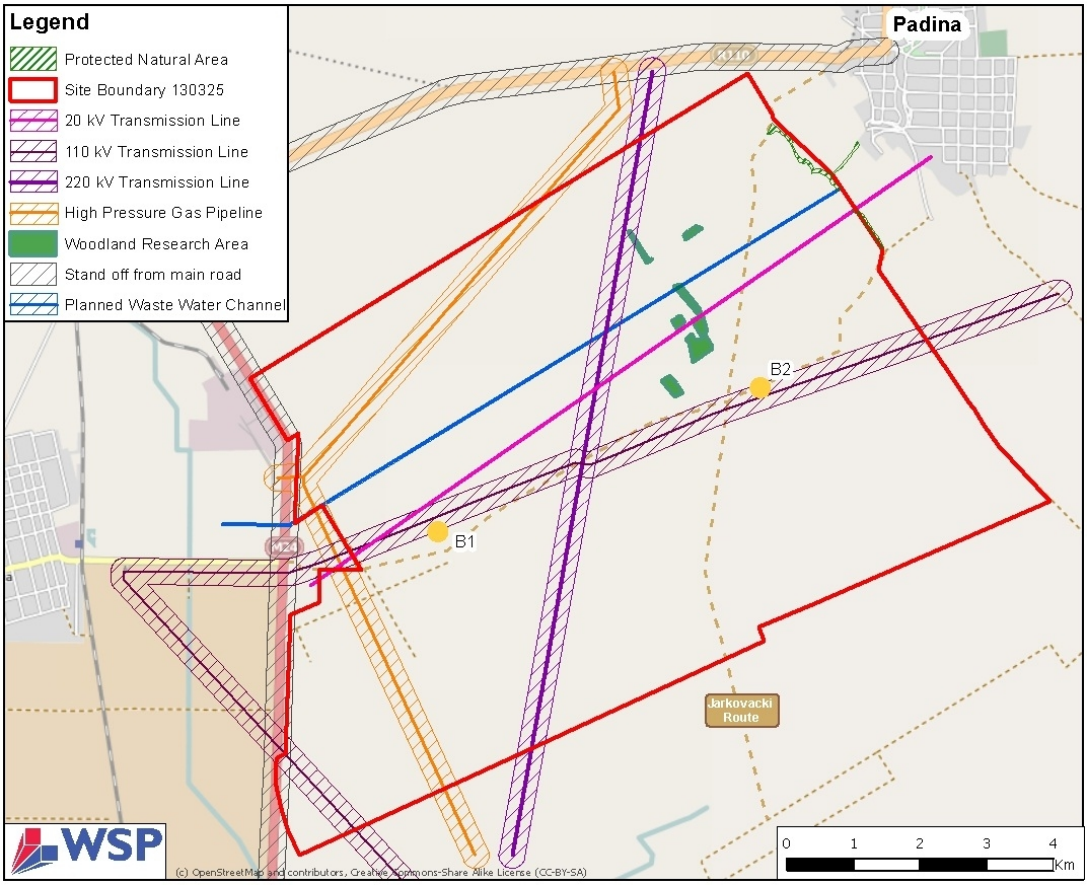

Figure 3.2 – Local Site Constraints and Existing Infrastructure

Landscape

3.5.10 The site forms part of the broader valley of the Danube, in the southern end of what is known geomorphologically as “the great Hungarian plain”, an alluvial plain once steppe lands and now intensively farmed. It is a large scale, generally very flat and open landscape, with the sky often the dominant feature. Two shallow valleys cross the site, one runs southwest – northeast across the middle of the site, the other more or less along the eastern boundary of the site, creating bands of gently undulating land. The streams themselves have been diverted or drained.

3.5.11 As previously noted, the site is strip-farmed, with a rectangular grid of dirt roads dividing the land into parcels in the order of 2 km x 0.4 km, with the land cultivated in varying width strips. There are few trees apart from the research plots, and some scattered scrub, mainly along the former river valley on the eastern edge of the site. The main vertical features in the landscape are the pylons of the overhead electric lines that cross the site.

Habitat

3.5.12 The site comprises mostly intensively cultivated monoculture agricultural fields. Tree lines are missing from field boundaries, which is typical for agricultural production in this area.

3.5.13 Towards the centre of the site, within a natural depression in the landscape, are five small areas (total of 14.86 ha) set aside as woodland research sites (**Figure 3.2),** comprising mostly acacia and black pine (Pinus nigra). Along the eastern border of the future wind park there is a narrow tree line of acacia trees (Acacia sp).

3.5.14 There are no nationally protected areas within the site boundary. There is a small area of locally designated ecological network in the northeast corner of the site, located along the Jarkovacki Road (KOB07a and KOV07b).

Geology

3.5.15 The Municipality of Kovacica is located on the Deliblat loess plane, Banat loess terrace and alluvial plane of the Tamis River, representing favourable conditions for the planning and construction of a wind park.

3.5.16 Proposed site is composed of Quaternary and Pliocene sediments. According to a geotechnical investigation undertaken in November 2012 (GEOPUT D.O.O., 2012), the following lithological cross-section was identified:

- Deluvial loess like deposits - sandy and silty deposits, with partly preserved tubular (or intestinal) porosity, yellowish-grey colour, present at the ground surface, with various thicknesses, from 3 m to 7 m.
- Alluvial silty-sandy-clayey deposits - found from 5 m to 20 m and locally 30 m depth below ground level, with non-uniform properties, saturated, with frequent horizontal and vertical lithological transitions.
- Pliocene marly-clayey deposits with interlayers of sandstones - found at depth below 25 m below ground level, a complex made of marly clays, sands and locally interlayers and lenses of sandstones with cm-dm thickness.

Hydrology

3.5.17 There are no significant surface water bodies on or in the close vicinity of the site. The current groundwater levels are presently unrecorded, however given the presence of loess geology on site it is expected that the soils are highly porous and well drained, with groundwater unlikely to be present at shallow depth (<3.0 m).

3.5.18 The only existing water infrastructure feature present on the site is a small canal called (Canal Crepajacki).

3.5.19 There are no Sanitary Protection Zones within the site.

3.5.20 Drainage of surface and underground waters is regulated through natural drainage through the soil and drainage channels within the wider area.

4 Project Description

4.1 Introduction

4.1.1 This Chapter outlines the proposed development and includes a description of the proposals and the likely activities that can be expected during the construction and operational phases.

Size of the Development

4.1.2 The Proposed Development comprises the construction and operation of up to 38 wind turbines up to 2.5 MW power rating, resulting in a total capacity for the project of up to 95 MW. The turbines would be three-bladed downwind, horizontal axis wind turbines in the order of up to 130 m to the hub and up to 190 m to the blade tip when vertical.

4.1.3 An indicative site layout is shown on **Figure 4.1** below.

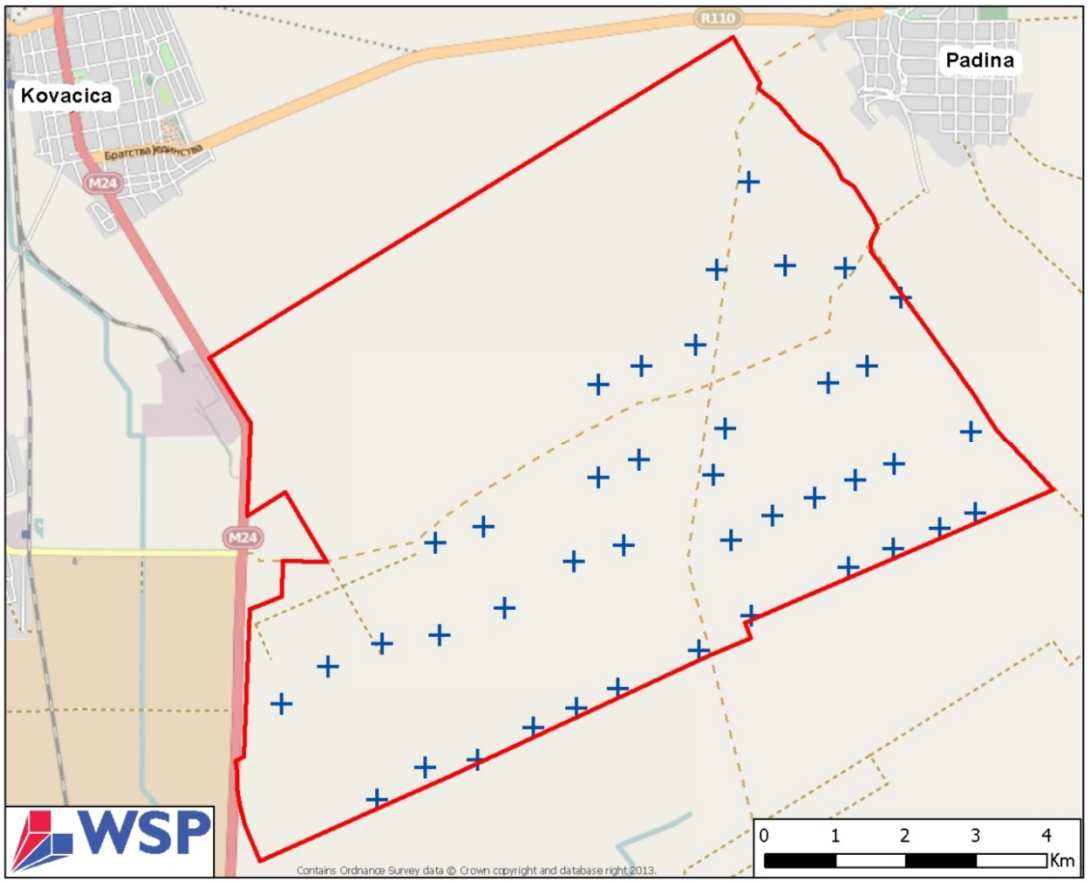

Figure 4.1 – Indicative layout of the proposed Kovavica Wind Park.

4.1.4 The Proposed Development will comprise the following infrastructure during construction and operation:

- Wind turbines and associated infrastructure;
- Crane hardstandings;

- Site entrance and access tracks;
- On-site access tracks between turbines including passing bays and corners;
- Underground cabling, both electrical and fibber optic, between the turbines;
- An on-site substation and maintenance building with welfare facility (approximately 4 ha);
- Overhead power lines from the on-site substation to the existing 220kV overhead power lines;
- Temporary construction compound;
- Potential excavations/borrow workings, to provide materials for access roads and turbine foundations; and
- Permanent meteorological mast(s).

4.1.5 The expected operational life of the turbines is 25 years from the date of commissioning. Before the end of this period, a decision would be made as to whether the wind farm should be decommissioned and removed, refurbished or replaced.

Land Use

4.1.6 The site is currently used for agriculture, with a small area of woodland and a small vineyard. Most of the land area will continue in its current use, with a small proportion being lost to the turbine bases (0.65% or 24.12 hectares of the total land area), infrastructure and transformer complex (Table 2.1 below). The woodland and vineyard will be avoided wherever possible in the wind park design and layout.

Table 4.1 – Changes in land use type at the proposed site.

Land Use Type	Existing Use		Proposed Use	
	Ha	%	Ha	%
Agricultural	3,632.4	97.98	3,608.2	97.23
Water	10.3	0.28	10.3	0.28
Local Roads	68.3	1.84	88	2.37
Construction	N/A	N/A	4.5	0.12
Total	3,711.0	100	3,711.0	100

Use of Natural Resources and Energy

4.1.7 The construction phase of the project will use the following resources:

- Concrete and metal reinforcement and bolts for turbine foundations;
- Water for concrete mixing;
- Aggregate/crushed stone, cement, sand and geotextile for access tracks and crane hardstandings;
- Metals and other components of the wind turbines themselves (steel towers, blades, nacelles) and of the substation;
- Electrical cabling and aggregate/crushed stone for backfilling cable trenches; and
- Fuel for construction vehicles.

4.1.8 The total volumes and weights of the above resources will be determined at the detailed design stage for the Proposed Development.

4.1.9 The operational phase of the project will use minimal electricity to operate the turbines (substantially out-weighed by the electricity to be generated by the turbines), and minimal fuel for maintenance vehicles.

Generation of Waste

4.1.10 It is expected that there will be very little waste generated by the project. Any waste materials generated by the maintenance activities will be removed from site by the maintenance teams and disposed of in an appropriate manner at a suitably licensed facility.

Water Pollution

4.1.11 It is not expected that any substantial quantity of fuels or chemicals would be stored or used on site during construction. Only the fuels needed to operate construction machinery and vehicles will be used on-site; there will be no bulk fuel storage or re-fuelling facility.

4.1.12 There will no chemical or fuel storage or use on-site during operation.

4.1.13 Utility infrastructure planned for the wind farm management and substation complex will include wells for process water, foul drainage via watertight septic pits, and internal sewerage to the pits.

Pollution of Air and Soil

4.1.14 The Proposed Development will not during the operational phase emit any airborne substances into the atmosphere and will reduce the amount of carbon dioxide emissions released into the atmosphere by replacing conventional methods of electricity generation, such as coal firing.

4.1.15 Wind turbine foundations will be installed, crane pads (manipulation planes) and access roads will be constructed, and a transformer complex will be built. This will result in a loss of only c.0.7% of the site area which is currently in agricultural use, to construct the wind turbines, crane pads, access roads and the transformer complex.

4.1.16 Drainage channels will be constructed around the crane pads and alongside the access roads, however runoff from the drainage channels will be discharged back into the greenfield areas of the site, through a series of infiltration trenches, in order to maintain the natural flow regime on site.

5 Ecology and Nature Conservation

5.1 Introduction

5.1.1 This chapter assesses the effects of the proposed development on the ecological receptors with particular reference to bird and bat species. It describes and analyses the existing ecological baseline of the area, and it considered its sensitivity to the changes that might arise from the construction of the proposed wind farm. Potential ecological impacts of the proposed development are outlined and an assessment is made based on the value of the receptor and the magnitude of the impact giving the significance of the effect. Where appropriate, mitigation measures to enhance, prevent, minimise or control the identified ecological effects are presented and residual ecological effects following the adoption of those measures are assessed.

5.1.2 Potential ecological effects associated with the development of a wind farm include: direct habitat loss and indirect effects on habitat quality and disturbance and displacement of wildlife. These effects may be associated with the three stages of the development; construction, operation and decommissioning.

5.1.3 This chapter and its associated figures are not intended to be read as a stand-alone assessment but should be read in conjunction with the Front End of this ES (Chapters 1 – 4).

5.2 Legislation, Policy and Guidance

Serbian Legislative Framework

National Legislation

5.2.1 **Law on Environment Protection** is the framework national environmental law. The law regulates the integral system of environmental protection ensuring the human right to live and develop in a healthy environment as well as developing a balanced economy and protection of the environment in Serbia.

5.2.2 **Law on strategic environmental impact assessment** determines conditions, form and procedure of performing the environmental impact assessments for individual plans and programs, in order to provide environmental conservation and improvement of sustainable development by integrating main principles of environmental conservation. It is matched with the Directive 2001/42/EC on environmental impact assessment of individual proposed developments.

5.2.3 **Law on environmental impact assessment** is the framework law in the Republic of Serbia for ESIA. Public institutions and those competent for the environment provide their requirements/opinions on the proposed plans and taken into consideration in the planning process. Once the plans and programmes have been adopted, the general public is informed about the decision and the decision making procedure. The objective of the environmental impact assessment is to involve the general public and integrate environment related elements in the planning process. This realises the set principles of sustainable development.

5.2.4 **Law on Nature Protection**, among other regulations, determines obligations with regards to nature conservation in relation to renewable energy projects. The law sets out the principle for protection of nature in Serbia with the aim of reducing any negative effects of development.

5.2.5 Article 80 of the Law on Nature Protection sets out the measures for the protection of migratory species. This Article states that in relation to electric systems whose construction would impact upon the usual daily or seasonal migration of wild animals or results in habitat fragmentation or in some other way disturbs the natural lifecycle of migratory species then such developments must be constructed so as to reduce negative impacts through the application of special construction solutions during the construction and operation (exploitation) phase of the development.

5.2.6 Article 81 outlines the measures for protection of birds and bats. This Article states that the locations of wind powered generators shall be determined as to avoid important habitats and migration routes of birds and bats. In addition the construction of wind generators in the vicinity of ecologically important areas shall in corporate such technologies as required to avoid adverse effects of wind generators.

Regulations

5.2.7 **Regulation on the content of environmental impact assessment** sets out the scope of the environmental impacts assessment studies required for developments. Article 6 requires that a description of the environmental factors that have a potential to be significantly at risk due to proposed construction projects including fauna and flora. Article 7 of the regulation requires a description of the likely significant effects of the project including a qualitative and quantitative review of possible changes in the environment during the construction and regular operation of the project and to assess the temporary and permanent effect of a development upon amongst other things ecosystems.

5.2.8 **Regulation on the designation of strictly protected and protected wild species of plants, animals** and fungi officially declares all wild plants, animals and fungi that are strictly protected and protected throughout Serbia. The regulation includes two lists; Annex 1 and Annex 2. Annex 1 lists all those plants, animals and fungi that are strictly protected in order to preserve the biological diversity, natural gene pool and species that have special importance to the ecological, ecosystem, bio-geographical, scientific, health, economic and other aspects of the Republic of Serbia. Annex 2 lists all those species of wild plants, animals and fungi that are protected in Serbia and determines conservation measures for protected species and their habitats. Conservation of strictly protected and protected species is achieved through the ban of use, destruction and undertaking any activities that may pose a threat to wild species and their habitats, as well as by implementation of measures and activities for population management.

Policy

EBRD / IFC

5.2.9 The EBRD publication 'Environmental and Social Policy' (2008) and IFC publication 'Performance Standards on Environmental and Social Sustainability' (2012) has been a key consideration in the production of this chapter. EBRD Performance Requirement 1 (Environmental and Social Appraisal and Management) and Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts) are considered relevant. The specific objectives of PR / PS 1 are summarised below:

- To identify and assess environmental and social impacts and issues, both adverse and beneficial, associated with the project;
- To adopt measures to avoid, or where avoidance is not possible, minimize, mitigate, or offset/compensate for adverse impacts on workers, affected communities, and the environment;
- To identify and, where feasible, adopt opportunities to improve environmental and social performance; and
- To promote improved environmental and social performance through a dynamic process of performance monitoring and evaluation.

5.2.10 In addition to PR / PS1, PR / PS6 Biodiversity Conservation and Sustainable Management of Living Natural Resources is also relevant. The key objectives of PR6 that are relevant to the proposed development are outlined below:

- To protect and conserve biodiversity; and
- To avoid, minimise and mitigate impacts on biodiversity and offset significant residual impacts, where appropriate, with the aim of achieving no net loss or a net gain of biodiversity.

5.2.11 Further to this PR / PS6 outlines that the client should identify and characterise the potential impacts on biodiversity likely to be caused by the project as part of the environmental and appraisal process.

Guidance

International conventions and agreements

5.2.12 **Ramsar Convention:** The Convention on Wetlands of International Importance was adopted in Iran in February 1971 and came into force in December 1975. The Convention considers the subject area of wetland conservation and comprises three elements of activity. The three elements are; the designation of wetlands of international importance as Ramsar sites, the promotion of sustainable use of all wetlands on the territory of each country, and international co-operation with other countries to further the sustainable use of wetland and their resource.

5.2.13 **The Convention on Biological Diversity:** The Convention on Biological Diversity (CBD) was adopted in Rio de Janeiro in June 1992, and came into force in December 1993. It was the first global treaty to provide a legal framework for biodiversity conservation. The treaty has three primary goals; the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources. Signatories to the Convention are required to create and enforce national strategies and action plans to conserve, protect and enhance biological diversity. The Republic of Serbia ratified the convention in 2002.

5.2.14 **The Bern Convention:** The requirements of the Convention on the Conservation of European Wildlife and Natural Habitat came in into force in 1982. The Convention requires signatories to ensure the conservation and protection of wild plant and animal species that are listed within the Convention which number over 500 wild plants and more that 1000 wild animal species. The Republic of Serbia ratified the Convention in 2007.

5.2.15 **The Bonn Convention on Conservation of Migratory Species of Wild Animals:** The aim of the convention in respect to migratory species is to achieve their effective management across national or jurisdictional boundaries. Threatened migratory species are listed in Appendix 1 of the Convention. The signing states are obliged to protect them. The migratory species in need of international cooperation for their conservation are listed in Appendix II. The convention allows for development of special international agreements. These agreements include those protecting populations of European bats (Eurobats), African-Eurasian migratory water birds (AEWA) and birds of grassland habitats (Grassland Birds). Serbia ratified the Bonn Convention in 2007.

International directives and resolutions

5.2.16 **The Habitats Directive (92/43/EEC):** The EU Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive, 1992) is the mechanism by which the requirements of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) are met. The Directive requires Member States of the EU to implement a range of measures for the protection and monitoring of habitats and species. The focus of the Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species at a favourable conservation status, introducing a requirement for robust protection of habitats and species of European importance.

5.2.17 Annex I of the Directive lists 189 habitats; Annex II lists 788 species which together with habitats are afforded protection through a network of designated sites (Special Areas of Conservation (SAC)) which along with Special Protected Areas (SPAs) (designated under the Birds Directive – see below) form a network of protected areas known as Natura 2000.

5.2.18 Serbia is not obliged to implement the requirements of the Habitats Directive however the national legislation of Serbia does include the requirements of the Directive in the national statute. All bat species in Serbia are included in Annex IV which prescribes strict protection, while 13 species are included in the list in Annex II pertaining to the threatened species whose conservation requires designation as an SAC.

5.2.19 **The Birds Directive (79/409/EEC):** The European Union (EU) Directive on the Conservation of Wild Birds (79/409/EEC) was adopted in 1979 and is the primary mechanism for delivering the EU's

obligations under the CBD, the Ramsar and Bonn Conventions. Collectively, the Birds and Habitats Directives require Member States to take action in order to protect all bird species and their habitats which includes the designation of Special Protection Areas (SPAs) in respect to species listed on Annex I of the Directive.

5.2.20 Serbia is not obliged to implement the requirements of the Birds Directive however the national statute does implement it.

5.2.21 **The Agreement on the Conservation of Populations of European Bats (Eurobats**): The agreement on the conservation of populations of European bats was concluded in 1991 and came into force in 1994 through the Convention on Migratory Species of Wild Animals. The agreement aims to protect all 45 species of bats identified in Europe through legislation, education, conservation measures and international co-operation as it is acknowledged that endangered migratory-species can only be adequately protected only if measures are carried out over the entire range of the species.

5.2.22 **Wind energy and Natura 2012:** EU guidance on wind energy developments in accordance with the EU nature legislation analyses the possible risk and offers recommendations for their removal or mitigation.

5.3 Assessment Methodology and Significance Criteria

Scope of the Assessment

5.3.1 This assessment has been prepared with reference to guidance provided in the Serbian Law on Environmental Impact Assessment and the guidance in the Regulations on the content of environmental impact assessment with specific reference to nature conservation. In addition the guidance produced by Scottish Natural Heritage (SNH), the Chartered Institute of Ecology and Environmental Management (CIEEM) and the Institute of Environmental Management and Assessment (IEMA) with respect to ecological impact assessment have been followed as international best practice.

5.3.2 This section identifies the 'key ecology and nature conservation issues' to be considered as part of the Ecological Impact Assessment (EcIA) and with an understanding of these issues, describes the methods used to establish the baseline conditions and assess the magnitude and significance of ecological effects of the proposed wind farm on ecological receptors.

Extent of the Study Area

5.3.3 As outlined, field surveys applicable to the pertinent ecological receptor were undertaken within all suitable areas of the site and a wider study area outside the Proposed Development, which varied in radius dependent on the considered ecological receptor. The following study areas where undertaken:

- Diurnal raptor vantage points surveys – site plus 200m
- Breeding raptor surveys – site plus 2,000m; and
- Bats – site plus 200m

Consultation

5.3.4 Following consultation with the Institute for Nature Conservation of Vojvodina Province the following pertinent conditions regarding the proposed wind farm were issued:

- In Phase One of construction, the construction of a maximum 38 wind turbines (generators) is allowed in the subject location, where the maximum overall height, including the blade, does not exceed 190m, and the maximum blade length does not exceed 60m;
- Wind turbines numbered 2, 3, 4, 5, 6, 7, 9, 11, 13, 14, 16, 18, 30, 31, 32, 33, 36, 37, 39, 40, 46, 47, 63, 64, 65, 66 and 70 shall be marked as obstacles to flying, to be made visible by day, alternate bands of red and white color, so the band at the top of the blade is red and the total number of red bands equals two. The height the band shall be one-seventh of the total length of the rotor blade (Regulation of Airports "Official Gazette of the Republic of Serbia", No. 23/12).

- The base of each wind tower must be constructed and secured in a manner to prevent burrowing of mammals with a subterranean way of life, which are potential prey for birds of prey;
- In order to protect migratory species, wind power plants exceeding 50 MW of installed capacity should be equipped in a manner which ensures the continuous monitoring of birds and bats crossing over the territory occupied by the wind power plant;
- The Investor shall, during the preparation of the environmental impact assessment study of the wind farm (Law on Environmental Impact Assessment, "Official Gazette of the Republic of Serbia", no. 135/2004 and 36/2009), especially develop the impact assessment study of wind turbines located within the subject wind park on birds and bats. Collection of data for this study shall last for at least one year. The study shall include detailed information on:
    - all types of birds and bats that appear in the subject and surrounding area within the monitoring period of at least one year;
    - international and national conservation and protection status for each species;
    - population abundance of each species;
    - seasonal changes in the abundance during the monitoring period;
    - day-night and seasonal migration routes;
    - reproduction sites;
    - stop location during migration;
    - wintering sites;
    - possible significant impacts of wind turbines on birds and bats; and
    - description of proposed measures to eliminate or reduce any significant adverse impacts of wind turbines on birds and bats.
- The drafter of the study shall foresee and specify the protective measures for all strictly protected species (Regulation on Proclamation and Protection of Strictly Protected and Protected Wild Species of Plants, Animals and Fungi, "Official Gazette of the Republic of Serbia", no. 5/2010) registered during the period of subject monitoring, and particularly the strictly protected species Saker Falcon (Falco cherrug), should the same be registered within the subject area;
- The Investor (main contractor) shall apply the prescribed protective measures related to all strictly protected species and especially the protective measures related to the strictly protected species Saker Falcon (Falco cherrug), should the same be registered within the subject area; and
- The formation of concrete foundations for wind turbine towers shall not be permitted in aquatic habitats: ponds, depressions, agricultural land depressions (waterlogged), ponds or other water bodies.

Method of Baseline Data Collation

5.3.5 Following consultation with the Institute for Nature Conservation it was apparent that the key ecological receptors for the proposed wind farm will be birds and bats. Therefore, this Ecological Impact Assessment (EcIA) will focus upon these two species groups. The methods employed to inform this assessment are summarised below. All surveys were undertaken by suitably qualified Serbian ecologists.

5.3.6 In addition to the above the wind park was reduced in size from 78 turbines to 38 turbines as a result of emerging ecological data with particular reference to use of the site bird and bat species. The reduction in wind park size served to protect the ecological resources at the site as well as to help mitigate any potential impacts.

5.3.7 It should also be noted that the original wind park layout of 78 turbines was used as the layout to design the scope and extent of the ecological surveys. However due to emerging data from the surveys the wind park layout was modified to the reduced size of 38 turbines after the commencement of field

studies. For example six vantage points were established to cover the original wind park design despite a reduced wind park site could have been covered by a reduced number of vantage points. However in order to maintain consistency in data collection and to collect valuable data from the areas surrounding the site the original vantage point layout was maintained through the survey season. Likewise in order to maintain consistency in the data collection for bats the original survey design for this species group was continued throughout the field studies.

Site Visit

Birds

5.3.8 Consultation with Institute for Nature Conservation of Vojvodina Province identified that Vantage Point (VP) surveys would be required for diurnal raptors.

5.3.9 Six VPs were established using maps allowing View Shed coverage of approximately 100 % of the Site and 200m Study Area.

5.3.10 Information on bird flight activity was collected during timed watches from VPs using the methods outlined in SNH (2005). For diurnal raptors, watches were stratified across three daylight periods (termed 'dawn', 'day' and 'dusk') to allow for diurnal variation in activity rates. All surveys were undertaken by a single observer in a wide range of weather conditions, but mainly in conditions of good ground visibility (> 2 km).

5.3.11 The timing of watches within each survey season was adjusted to account for changes in sunrise and sunset times.

5.3.12 In total, a minimum of 36 hours of observation were undertaken during the breeding period (Late March 2012 to August 2012; approximately six hours per month), and during the non-breeding period (September 2011 to February 2012; approximately six hours per month) for diurnal raptors.

5.3.13 During each VP watch, two methods of recording were used; focal sampling of target species and activity summaries of secondary species. Observations were recorded against four height bands (HB) which were determined against a 3.3 MW generic turbine specification comprising a turbine hub height of 134.45m and 63.5m long blades, these included:

- HB1; <34m;
- HB2; 35-69m;
- HB3; 70-199m; and
- HB4; 200+m.

5.3.14 With the current specification of turbine HB3 is considered to be potential collision height (PCH) as it occupies the same height window as the potential rotor sweep.

Migratory Movements

5.3.15 Due to the concerns raised through consultation with the Institute for Nature Conservation of Vojvodina Province, additional VP surveys were undertaken for migratory waterfowl and comprised at least 36 hours of survey at each VP over the following periods:

- September - November 2012(autumn migration);
- October 2012 – March 2013 (wintering birds); and
- March-mid-May 2013 (spring migration).

5.3.16 VPs are located to allow visual coverage of the entire site plus an area extending 200m from the site boundary. This is in accordance with the request made by Institute for Nature Conservation of Vojvodina Province (Personal Communication, Nikola Stojnic, 10th March 2012). Each VP assumes an optimum viewing distance of 2km and a viewing arc of 180o. The same VP locations established for the diurnal raptor surveys can be used for the migratory waterfowl surveys.

5.3.17 Watches are undertaken over two periods, these being: dawn (from one hour before sunrise) and dusk (one hour after sunset). All surveys are undertaken by a single observer in a wide range of weather conditions, but mainly in conditions of good ground visibility (> 2km). All VP surveys are undertaken for a period of 3 consecutive hours. There must be a minimum 'break' period of 1 hour between any two vantage point surveys.

5.3.18 An alteration of the start and finish times of the diurnal raptor surveys has been undertaken during these periods to allow these surveys to also fulfil some of the survey hour requirement of the migratory waterfowl surveys.

5.3.19 It should be noted that observations undertaken as part of the diurnal raptor surveys also record waterfowl movements over the Proposed Development Site during the diurnal period and therefore no additional diurnal surveys were proposed.

Owl Survey Methods

5.3.20 It is acknowledged that due to their nocturnal activities VP surveys are ineffective when surveying for owl. Consequently, a two stage approach was proposed:

- Stage 1: An initial focussed day time site walkover of the Site and wider study area extending 1km from the Site boundary to check for features with the potential for supporting owls and to identify additional features of interest that may be of value to owls such as roosting locations. This survey looked for evidence such as feathers, droppings, pellets and evidence of nesting. This survey was undertaken in June 2012.
- Stage 2: This further assessment includes a series of VP surveys of features known to support owls. It was proposed to undertake dusk VP surveys for 48 hours per VP over a period of 12 consecutive months from June 2012, if necessary, to watch for owls emerging and re-entering any buildings, mature trees or other features, or hunting and foraging across the site. Dusk surveys have been undertaken for a period of 2 hours around sunset.

Breeding Walkover Survey

5.3.21 It is best practice to undertake breeding bird work within a single breeding season, in this case 2013. The breeding walkover survey was undertaken in the open ground areas within the proposed development site and a 500m study area extending from the Site boundary. The surveys were carried out in line with methodologies detailed in 'Bird Monitoring Methods - a manual of techniques for key UK species' (Gilbert et al., 1998) and focussed on identifying approximate numbers of breeding pairs for each target species including Birds Directive Annex 1 and species identified in national Serbian legislation. Visits were made in the early morning and were timed to coincide with peak times of song / breeding activity.

5.3.22 When individuals or pairs of birds were encountered, the surveyor determined whether the bird(s) were different from any previously encountered. This involved careful attention to the whereabouts and movements of birds, together with birds' sex and plumage characteristics. To minimise the risk of double counting, behaviour and location of birds were carefully observed so that previously encountered birds were not recorded twice. Surveys were not conducted in winds greater than Beaufort Force 5, in persistent rain or when visibility was poor.

5.3.23 The following behaviour or signs were considered to represent evidence of breeding:

- displaying or singing;
- territorial dispute;
- repeated alarm calling or distraction displays;
- occupied nests;
- adult(s) carrying food;
- adult(s) carrying nest material; and
- newly fledged young with parent(s).

5.3.24 Other records were considered to be of non-breeding birds, failed breeders or birds loafing, feeding or on passage to other areas.

5.3.25 The location and activities of all bird species were recorded on a map. A species list and breeding population estimates were derived from the four survey visit maps. Where birds were recorded on more than one survey visit and considered to represent the same bird(s), the location recorded was taken as equidistant from each mapped observation.

Breeding Raptor Surveys

5.3.26 A focussed breeding raptor survey was undertaken within the Site boundary and wider Study Area up to 2km from the Site between late March and August 2013. The methods follow those recommended by SNH (2005) and Hardey et al., (2006).

Winter Walkover Survey

5.3.27 Winter walkover surveys were carried out between November 2012 and March 2013 to identify winter roosting and foraging bird populations within the Site and a 500m of Study Area. The surveys were carried out in line with methods detailed in Gilbert et al., (1998) and consisted of three visits during this period. As with the breeding walkover bird surveys, the winter walkover survey focused on identifying the presence and/or absence for each target species including species listed within the Birds Directive Annex 1.

Bats

5.3.28 Following a site visit and consultation meeting with the Institute for Nature Conservation undertaken 10th March 2012 the following scope of bat surveys was determined:

- Surveys at height;
- Emergence and re-entry surveys of structures;
- Activity transects; and
- Surveys from static detectors.

Surveys at Height

5.3.29 A static detector was attached to the meteorological mast and has recorded over five consecutive nights per month over the active bat season (October 2012 to November 2012; and April 2013 to July 2013). The detector recorded at 1m above ground level (AGL) and 95 m AGL.

Emergence/Re-entry Surveys

5.3.30 During a Site walkover one group of structures (vineyard buildings) was identified as having the potential to support roosting bats. It was therefore recommended that a series of emergence and re-entry surveys were undertaken.

5.3.31 Surveys have taken cognisance of the Bat Conservation Trust guidance publication (BCT, 2012). Three emergence surveys and one re-entry surveys have been undertaken throughout the active bat season comprising:

- One emergence survey in June 2012;
- One emergence and re-entry survey early-July 2012; and
- One emergence survey in early-August 2012.

5.3.32 Surveys undertaken late June and in early July were timed to provide the best data for the identification of maternity roosts.

5.3.33 Emergence surveys began 30 minutes prior to sunset and concluded 2 hours after sunset. Re-entry surveys began 2 hours prior to sunrise and concluded 15 minutes after sunrise or 10 minutes after the last bat recorded whichever is latest.

5.3.34 The emergence and re-entry surveys in mid-July occurred within the same 24 hour period.

Activity Transect Surveys

5.3.35 The study area for the activity transects includes the site plus an area of 200m extending from the site boundary. This survey area is in accordance with the survey methods outlined in the UK Bat Conservation Trust guidance document (Hundt, 2012) and takes cognisance of the Eurobats publication; Guidelines for consideration of bats in wind farm projects (Rodrigues et al, 2008).

5.3.36 From discussion held on site with local bat experts (Branko Karapandza), in the absence of prominent linear features, bats have been recorded using permanent man made tracks to commute. Therefore five activity transects were proposed on site.

5.3.37 Activity transects have been subject to a dusk and whole night surveys throughout the active bat season comprising:

- August 2012: Dusk or dawn survey;
- September 2012: Whole of night survey;
- October 2012: Whole of night survey;
- November 2012: Dusk or dawn survey;
- April 2013: Dusk or dawn survey;
- May 2013: Dusk or dawn survey;
- June 2013: whole night survey; and
- July 2013: Whole night survey.

5.3.38 Each dusk transect begins 15 minutes prior to sunset and lasts no longer than 3 hours after sunset; dawn surveys begin no later than 3 hours before sunrise and end 15 minutes after sunrise. Whole of night surveys begin 15 minutes prior to sunset and are completed 15 minutes after sunrise. Along each transect the surveyor undertakes 5 minutes 'stops'; these are evenly distributed along the length of the transect. The direction each transect is completed in is alternated between months.

Survey from Static Detectors

5.3.39 Fourteen static detector locations (20% of the total number of proposed turbines) have been selected to be evenly distributed throughout the site. These locations also correspond to turbine locations where these are known.

5.3.40 Each location is surveyed over 3 consecutive nights per month within the active bat season (March to November). Surveys began in August 2012 the survey covered August 2012 to November 2012 and March 2013 to August 2013

5.3.41 A small number of static detectors (7 detectors) are used on a weekly rotation until all 14 locations have been surveyed within the calendar month.

Identification and Assessment of Valued Ecological Receptors (VERs)

5.3.42 Current CIEEM guidelines (2006) support the focus of an ecological assessment on VERS, that is, those ecological receptors assessed as being of greatest value/sensitivity present within a proposed development. In order to identify the VERs for the proposed wind farm at Kovacica an examination of the various parameters and categories of global, continental or national degree of treats and trends in the population sizes of each identified VER was undertaken. A number of national, European and international information sources listing the conservation status and population trends of the different birds species recorded were examined allowing for the evaluation of the ecological sensitivity of each ecological receptor.

5.3.43 The sensitivity of species was categorised into **High, Medium, Low** or **Negligible** as described in Table 5.1 below.

Table 5.1: Sensitivity of receptor

Scale of Ecological Value	Examples
High	An internationally designated area meeting the criteria for an Special Protection Area (SPA) or provisional SPA, a Special Area of Conservation (SAC) or candidate SAC, or Ramsar site. Considerable extents of a priority habitat type listed in Annex 1 of the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora or smaller areas of such habitat that are essential to maintain the viability of a larger whole. Any regularly occurring population of an internationally important species, which is threatened or rare in Serbia i.e. a Serbian Red Data book species or of uncertain conservation status or of global concern in the Serbian Biodiversity Acton Plan. A regularly occurring, nationally important population of any internationally important species such as a Species of European Conservation Concern category 1 or 2. A population of more than 1 % of the Serbian population of a European or nationally protected species (e.g. otter or badger), or an otherwise important population (e.g. a population on the edge of its natural range).
Medium	A nationally protected area for nature conservation including locally designated sites. Semi-natural woodland (not of plantation origin) greater than 0.25 ha in size. Regular occurrence of a European or nationally protected species. Any regularly occurring population of a nationally important species which is threatened or rare in the Serbia.
Low	A viable area of semi-natural ancient woodland smaller than 0.25 ha. sites that are protected through inclusion within local authority plans, for example, sites of Importance for Nature Conservation (SINC) or equivalent sites selected on local authority criteria e.g. Local Nature Reserves (LNR). A river and/or other freshwater receptor classified as fair and/or poor and unlikely to support a coarse fish population. Areas of habitat or species considered to appreciably enrich the ecological resource within the local context e.g. species rich flushes.
Negligible	Habitats and species that are of low to no ecological value and enrich the habitat resource at a site level due to their size, extent, species composition and other factors. A river and/or other freshwater receptor classified as impoverished and unlikely to support a fish population.

Assessment of Impact Magnitude and Potential Ecological Effect Significance

5.3.44 The magnitude of any impact on VERs was categorised according to the criteria outlined in Table 5.3, which is based on a table presented in the IEMM (2006) guidelines. The concept of integrity refers to coherence of ecological structure and function and includes both temporal and special considerations.

5.3.45 The significance of the ecological effect was determined as a function of the sensitivity of the VER (value level) and the magnitude of the impact. The matrix presented in Table 5.2 outlines how these criteria are combined to determine ecological significance. This table is adapted from the matrix

provided in CIEEM (2006). As outlined above, a degree of professional judgement was exercised to attribute ecological significance within the ranges in the matrix.

Table 5.2: Assessment of Impact Magnitude and Significance Matrix

Magnitude of Change / Impact	Change / Impact Characterisation	Level of Ecological Value			
		High	Medium	Low	Negligible
High	A permanent or long-term effect on the distribution and/or abundance of a habitat, species assemblage/community or population. If negative this would have implications for the integrity of the receptor and its conservation status, and if positive would result in an improvement to the conservation status of the receptor.	Major	Major - Moderate	Moderate - Minor	Negligible
Medium	A permanent or long-term effect on the distribution and/or abundance of a habitat, species assemblage/community or population. If negative this would have negligible implications for the integrity of the receptor and its conservation status, and if positive would result in an improvement to the conservation status of the receptor.	Major	Moderate	Minor	Negligible
Low	A short-term reversible effect on the distribution and/or abundance of a habitat, species assemblage/community or population and within normal fluctuations observed within the ecology of the receptor.	Moderate - Minor	Minor	Minor - Negligible	Negligible
Negligible	A short-term reversible effect on the distribution and/or abundance of a habitat, species assemblage/community or population unlikely to be detectable by monitoring.	Negligible	Negligible	Negligible	Negligible

5.3.46 For the purposes of this assessment, adverse effects which are assessed to be from major to moderate (as highlighted in red in Table 5.2) will be considered significant ecological effects. Minor to negligible

effects are not assessed to be significant such that bespoke detailed mitigation would be typically required.

Confidence in Predictions

5.3.47 As part of the assessment of ecological impact magnitude and significance, the degree of confidence in the assessment was qualitatively described as outlined below, in addition to the consequences for the confidence in the prediction:

- certain/near-certain: probability estimated at 95% chance or higher;
- probable: probability estimated above 50% but below 95%;
- unlikely: probability estimated above 5% but less than 50%; and
- extremely unlikely: probability estimated at less than 5%.

Requirement for Mitigation

5.3.48 Following the determination of ecological value and assessment of potential ecological effects, professional judgement was used, coupled with an understanding of the legal requirements of the statutes, to assess and determine the requirements for appropriate mitigation. Mitigation is proposed (where practicable) at the relevant scale of significance to avoid, reduce or offset identified potential effects.

Residual Effects

5.3.49 Residual effects have been assessed using the same methodology as the potential effects but taking into consideration the proposed mitigation.

5.4 Baseline Conditions

Baseline Conditions and Designated Sites

5.4.1 The proposed site is located in South West Banat within Vojvodina Province, in the north east of the Republic of Serbia. The closest settlements are Padina (1km to the northeast), Debeljaca (1.75km to the southwest) and Kovacica (2.5km to the northwest of the development area). The proposed site covers an area of approximately 3,711 hectares, within the territory the Municipality of Kovacica, CA Kovacica, Debeljaca and Crepaja. The site elevation is approximately 80m above sea level in the west, sloping gently up to approximately 115m above sea level in the east.

5.4.2 To the west of the Proposed Development, along the II-111 roadway, lies the Jedinstvo sugar plant.

5.4.3 The site comprises mostly intensively cultivated monoculture agricultural fields. Tree lines are missing from field boundaries, which is typical for agricultural production in this area.

5.4.4 Towards the centre of the site, within a natural depression in the landscape, there are small areas of woodland comprising mostly acacia and black pine (Pinus nigra). Along the eastern border of the future wind park there is a narrow tree line of acacia trees (Acacia sp).

5.4.5 There are no nationally protected areas within the site boundary. There is a small area of locally designated ecological network in the northeast corner of the site, located along the Jarkovacki road (KOB07a and KOV07b).

Field survey results

5.4.6 In total over the course of the vantage point surveys 110 different bird species have been recorded. The abundance, distribution and season of appearance of each bird species is listed in Appendix 5.1.

Raptors

5.4.7 Sixteen species of raptor have been recorded at the proposed wind farm over the course of 12 months of study. The occurrence of each species is discussed below.

Northern goshawk Accipiter gentilis

5.4.8 Northern goshawk was recorded on the 20/10/12; 27/03/13 and the 21/04/13. On all occasions single female birds were observed. The flight in October included 15 seconds of flight at Potential Collision Risk Height (PCH). The flight in March represented a bird flying through the southern portion of the site in the risk window however this flight was below PCH. The flight in April related to a single bird hunting in the southern portion of the site in the risk window. This flight was below PCH. No evidence of a mass migration route or corridor over the proposed development site has been identified from the studies.

Eurasian sparrow hawk Accipiter nisus

5.4.9 With regards to the proposed development 31 flights of sparrow hawk have been recorded in the breeding and non-breeding seasons. In total 19 flights were recorded in October 2012; seven flights were recorded in November 2012 and five flights were recorded in March 2013. The flights in October were centred around the north east corner of the site with flights traversing the site from a south easterly direction to the north westerly direction. In addition a number of flights were recorded off site to the north east as well as flight sin the southern portion and central portions of the site. The flights during November were centred on the central and north eastern corners of the site. The flights in March indicated that all parts of the site were being used by sparrow hawk.

5.4.10 With regards to flight height, all flights recorded were below PCH. With observed behaviour indicating that birds either flew over the site without stopping or rested within the site to feed. No observed breeding behaviour was recorded throughout the surveys.

Common buzzard Buteo buteo

5.4.11 Common buzzard was frequently observed within the site and the wider study area. Common buzzard has been recorded in every month of the surveys with the exception of August 2012. In total 193 observations of this species have been made from the vantage point surveys with records form all six vantage points. The majority of the flights recorded have been below PCH with only 810 seconds out of a total 35,370 seconds of flight time at PCH.

5.4.12 It is reasonable to assume that the birds observed are resident in the area of the proposed wind farm and will use the site for hunting and breeding. The breeding raptor surveys confirmed a single nest located in the central eastern part of the wind farm site. In addition birds were observed hunting and flying within the same area as the nest location indicating that this is an occupied territory with five birds being observed flying around the nest in late August 2013. The wind farm area is therefore of value to this species. No further nests were recorded within the site or the wider study area however activity by this species to the north, east and west of the site was also recorded.

Rough-legged buzzard Buteo lagopus

5.4.13 Only two observations of rough-legged buzzard have been recorded over the course of the vantage point surveys. These observations were in the October and November 2012 and involved single birds on both occasions flying below PCH. No evidence of breeding by this specie was recorded during the breeding raptor surveys. Indicating the bird observed during the vantage point survey must nest elsewhere away from the site and immediate surround countryside.

Long-legged buzzard Buteo rufinus

5.4.14 Only two observations of long-legged buzzard have been recorded over the course of the vantage point surveys. These observations were in the September and October 2012 and involved single birds on both occasions. The flight in September involved flight time at PCH albeit only 75 seconds. No evidence of any nest or other breeding behaviour such as displaying or singing by adult was recorded during the breeding raptor surveys. Indicating the bird observed during the vantage point survey must nest elsewhere away from the site and immediate surrounding countryside.

Marsh harrier Circus aeruginosus

5.4.15 Marsh harriers have been regularly observed during the vantage point surveys with a total of 50 flights recorded. Marsh harriers have been recorded in every month from July 2012 onwards indicating that there is likely to be resident birds in the area which will regularly use the site and the wider area.

5.4.16 The breeding raptor surveys indicate that no nesting locations were recorded within the site with activity generally centred on the artificial wetland to the west of the site near the sugar factory. The only activity recorded within the site was by a single male hen harrier hunting in the north eastern corner of the site during the 2013 breeding season. It is therefore considered that if marsh harrier is breeding then the likely location of a nest is to the west in the vicinity of the wetland although there is no direct evidence to support this other than levels of activity and frequency of observations at this location. Nevertheless the wind farm area could provide a suitable hunting habitat for this species.

Hen harrier Circus cyaneus

5.4.17 Hen harriers have been regularly observed during the vantage point surveys with a total of 20 flights recorded. Hen harriers were recorded regularly November 2012 to April 2013 with observations in every month. No flights at PCH have been recorded. No evidence of hen harrier breeding either within the site or the wider study area has been recorded. It is therefore considered that the site does not offer suitable breeding areas for this species with birds migrating elsewhere within the region to nest.

Montagu's harrier Circus pygargus

5.4.18 Montagu's harrier has been infrequently recorded during the vantage point surveys. Only five flights in total have been recorded over the course of the vantage point surveys. This species was recorded in October 2012 with no further observation until April 2013.

Saker falcon Falco cherrug

5.4.19 Saker falcons have been regularly observed during the course of the vantage point surveys. Between June 2012 and May 2013 this species was observed in every month except July 2012, October 2012 and January 2013. In total 35 separate observations (including flights and occurrences of birds perching) were recorded. With regards to frequency of occurrence at the site, this species represents 1.3% of all observations recorded during the vantage point surveys.

5.4.20 This species was recorded form VP1, VP2, VP4 and VP6. VP1 was located in the north east corner of the site, VP2 was located in the south east corner, VP4 was located in the south west corner and VP6 was recorded in the north western portion of the site (Please see Appendix 5.1 for location grid references). The majority of observations were recorded from VP6 in the north western part of the site.

5.4.21 Flights at potential collision risk height (PCH) (Height band 3 as described above in section 5.3) represented less than 20% of the total flight activity by this species; with only 2580 seconds out of a total flying time of 13110 seconds were recorded at PCH. Therefore the limited time spent at PCH indicating that at the proposed wind farm site this species did not commonly fly at heights that would result in a collision risk.

5.4.22 Saker falcon, as indicated previously, has been recorded regularly at the site, with observations in both the breeding and non-breeding seasons. As a consequence it is recognised that the proposed wind farm site does form part of a territory for saker falcon although no evidence of actual breeding has been recorded. In addition no chicks were recoded as being fledged form the site. Nevertheless the site does appear to be of value to his species with suitable hunting habitat and suitable features (pylons) for nesting.

Merlin Falco columbarius

5.4.23 Merlin has been infrequently observed during the vantage point surveys. Only two flights of this species were recorded, both of which were in November. No flights at PCH were recorded. The lack of observations may indicate the unsuitable nature of the site for this species. No evidence of breeding by merlin within the site has been recorded. This species tends to breed on the ground in concealed

nests in dense vegetation. The disturbed agricultural nature of the site may therefore preclude this species from nesting within the wind farm area.

Peregrine falcon Falco peregrinus

5.4.24 Peregrine falcons have been infrequently recorded during the vantage point surveys. A total of three flights were recorded and these were in December 2012, February 2013 and April 2013. The infrequent use of the site by this species may indicate that the birds observed have territories outside the proposed development area in the wider region with birds utilising the site for infrequent foraging only. In addition the habitats within the site are considered to be of little to no value for this species for nesting with no evidence of any breeding behaviour being observed. Peregrine falcon tend to nest on high rocky cliffs and the absence of such features from the generally flat landscape of the site limits the wind farms suitably to support breeding pairs.

Eurasian hobby Falco subbuteo

5.4.25 Hobby have been regularly observed utilising the site during the vantage point surveys with a total of 33 flights recorded, none of which at PCH. Birds were recorded regularly in the 2012 breeding season between July and August and then into autumn 2012 until October. No birds were recorded over the winter months with the next observation of this species in May 2013. It is therefore likely that the birds observed are resident in the summer into early autumn then migrate to other areas over the winter returning the following summer.

5.4.26 The breeding raptor surveys did not record any breeding activity of this species within the site or the immediate surrounding countryside. Nevertheless it is possible that given the good hunting and foraging habitat for this species that the site may still form part of an active territory given the regular occurrence of this species during the 2012 breeding season.

Common kestrel Falco tinnunculus

5.4.27 Common kestrels have been frequently and regularly observed utilising the site over the course of the vantage point surveys with flights recoded in every month of the surveys. In total 203 flights have been recorded. Only five flights have involved time at PCH with a total flying time of 405 seconds at PCH out of a total flying time of 40,345 seconds. It is likely that the site is of value to this species with resident birds using the site for hunting and breeding.

5.4.28 The breeding raptor surveys recorded three nest located within the central part of the site. The nests were recorded in old magpie nest and hooded crow nests. In addition a further four nests were recorded to the north of the site again with birds utilising old magpie nests. It is there concluded that there is a resident population of this this species both within the site and the wider study area representing at least seven pairs of birds. Further to this the level of activity recorded during the breeding season and over the course of the vantage point surveys strengthens the argument that the site and the wider area are of value to this species with frequent observation of birds hunting and flying over the western and central parts of the site.

Red footed falcon Falco vespertinus

5.4.29 Red-footed falcons have been irregularly recorded using the site with only eight flights recorded. This species was recorded in April and May 2013 only. No flights were at PCH. The occurrence of this species in the breeding season only may indicate that birds observed are migrants either returning to the region after over wintering or birds on route to breeding grounds. No observation of this species breeding within the site have been recorded and as such the site may be of limited value for nesting but rather offer hunting habitat for this species.

White-tailed eagle Haliaeetus albicilla

5.4.30 White-tailed eagles have been rarely observed with only two flights recorded in August and November 2012. The lack of observation possibly indicated that the site is of limited value to this species.

European honey-buzzard Pernis apivorus

5.4.31 European honey-buzzards have been rarely observed with only two flights recorded in September 2012. The lack of observation possibly indicated that the site is of limited value to this species.

Owls

5.4.32 Two species of owl were considered to be target species for the vantage point surveys. These species were long-ear owl and little owl. The occurrence of both of these species is discussed below.

Long-eared owl Asio otus

5.4.33 Long-eared owl has been recorded on seven occasions during the field studies. Flights of this species were recorded in November 2012 then March and April 2013. All flights related to single birds flying low over the site.

5.4.34 With regards to breeding, long-eared owl were observed to be breeding both within the wind farm site and the wider study area. Five occupied nests were recorded within the site located in the central part, the northern part and western part of the site. In addition roosting birds were recorded in trees along the western edge of the site. Three further nests were located to the north west of the wind farm in the vicinity of the Kovacica along with a number (at least four) of communal roosting sites in the urban areas to the north west and north east of the proposed wind farm. It is therefore concluded that the wind farm area and the immediate surrounding environments are of value to this species.

Little owl Athene noctua

5.4.35 Little owl was recorded on two occasions, once in November 2012 and once in February 2013. Only the flight in November 2012 involved flight time with the observation in February representing a single bird calling from the vine yard area of the site. In addition the breeding raptor surveys indicate that at least one occupied territory is located within the site towards the eastern central area of the site in an old building. In addition pellets of little owl were recorded in another old building located to the west of the site. The presence of pellets within the buildings indicates that little owl are indeed utilising these structures for roosting and potentially nesting. It is therefore considered that the site is of value to this species providing good nesting locations and hunting opportunities.

Cranes and Storks

White stork Ciconia ciconia

5.4.36 Only three observations of white stork were recorded during the vantage point surveys. All three observations were made in March 2013. In total four birds were recorded with only one observation of a pair of birds made. All flights were below PCH.

Black stork Ciconia nigra

5.4.37 Black storks have been infrequently observed during the vantage point surveys. Only two flights, one in September 2012 and one in March 2013 were recorded. On both occasions the observations involved pairs of birds with no flight time at PCH. It is therefore reasonable to conclude that the proposed development site is not of high value to this species.

Common crane Grus grus

5.4.38 Common cranes have been rarely observed with only two flights recorded in March and April 2013. The lack of observation possibly indicated that the site is of limited value to this species.

Geese and Swans

Greater White-fronted goose Anser albifrons

5.4.39 Greater white fronted goose was primarily recorded during the wintering period in October, November and December 2012 and January and March 2013. In total eight flights of this species have been recorded with peak flock size of 280 birds recorded in November 2012. In addition 38 birds were recorded in February 2013 during the winter surveys. The infrequent observation of this species across

the survey period indicates that the birds observed are those on migration across the region rather than resident birds.

Greylag goose Anser anser

5.4.40 Greylag geese were recorded in December 2012 and March and April 2013. In total six flights have been recorded with birds generally flying across the site without stopping within the areas to be developed. Only two flights in November included time at PCH, albeit only 180 seconds out of total 720 totally flying time recorded for this species. The largest flock size recorded was 53 birds in November. In addition nine birds were recorded in February 2013 during the winter walkover surveys.

5.4.41 No evidence of greylag goose breeding within the site or wider study are has been recorded. The infrequent observation of this species across the survey period indicates that the birds observed are those on migration across the region rather than resident birds.

Bean goose Anser fabalis

5.4.42 Bean goose has been recorded once in November 2012. The recorded flight represented a flock of 54 birds crossing the site from the north west to the south east. No further observations of this species were recorded during the ornithological surveys. Given the infrequency of observation of this species it is likely that this observation in November related to birds passing through the area potential on route to a roosting area elsewhere in the region.

Mute swan Cygnus olor

5.4.43 Mute swans have been rarely observed utilising the proposed wind farm site. Only two flights of this species have been recorded during the course of the vantage point surveys with a total of nine birds being observed. This indicates that the site and wider area is of limited value to this species.

Waders

5.4.44 Wader species recorded at the site include common sandpiper, dotterel, snipe, curlew, wood sandpiper and lapwing. During the course of the vantage point survey dotterel were recorded on one occasion in April 2013 with 2 birds observed from VP2. Snipe were also recorded only once during the vantage point surveys with a single bird recorded in July 2012 from VP5. Curlew was recorded on two occasions in September 2012 and November 2012 with 4 birds recorded from VP2 in September and 3 birds from VP4 in November. Wood sandpiper was recorded during the vantage point surveys with a single observation of this species in July 2012. Lapwing was recorded on four occasions; twice in October 2012 and twice in March 2013. In October this species was recorded on two separate dates with 8 birds recorded in total from VP 3 and Vp4. In March lapwing were recorded from VP2 and VP4 with 36 birds recorded in total.

5.4.45 In addition lapwing was also recorded during the breeding walkover surveys with 21 birds recorded; 19 in March 2013 and 2 in May 2013.

Farmland and Woodland Birds

5.4.46 The farmland and woodland bird assemblage recorded at the site included 69 different species comprising 56 species of passerines, one species of swift, five species of doves, one species of cuckoo, one species of quail, one species of rail, one species of pheasant, two species of woodpecker and one species of hoopoe. This species assemblage is considered to be typical of open agriculture habitats with a mosaic of woodland.

5.4.47 With regards to breeding, 35 species of passerine were recorded between March 2013 and May 2013. Skylark (Alauda arvensis) was the most commonly occurring passerine during the breeding season with 231 individual birds recorded followed by hooded crow (Corvus cornix) with 163 birds recorded then fieldfare (Turdus pilaris) with 130 birds recorded and chaffinch (Fringilla coelebs) with 97 birds recorded. All other species of passerines were recorded in lower numbers. In relation to other breeding farmland and woodland species the following were recorded during the breeding surveys;

wood pigeon (Columba palumbus), quail (Coturnix coturnix), cuckoo (Cuculus canorus), great spotted woodpecker (Dendrocopos major), collared dove (Streptopelia decaocto), and turtle dove (Streptopelia turtur). Only wood pigeon were recorded in any numbers with 144 birds observed. This breeding assemblage is considered to be typical of the habitats present at the site.

5.4.48 With regards to overwintering farmland and woodland species 38 species of passerine were recorded along with three species of dove, one species of woodpecker, one species of quail and one species of pheasant. Starling (Sturnus vulgaris) was the most numerous species recorded with 4801 birds recorded the majority of which (4685) in October 2012. Skylark were second most numerous species with 751 birds recorded over the course of the winter surveys. Hooded crow were the third most common species with 442 birds followed by pheasant (Phasianus colchicus) with 230 and magpie (Pica pica) and chaffinch with 179 each. All other species were recorded in lower number. As with the breeding assemblage the wintering assemblage is considered to be typical of agricultural systems.

Migration paths and local flyovers of birds

5.4.49 The proposed development area currently comprises intensively cultivated monoculture of agricultural fields. The site is generally flat with little diversity in landform, the only exception to this being a natural depression in the centre of the site. Within this depression there are a number of small woodland areas. The site does not include any large and obvious landscape features such as mountain ridges, large forests, rivers or other natural linear objects, which could be used by migrating birds as navigational aids. It is therefore considered that the observed flights over the site relate to birds moving around the local region only.

Bats

5.4.50 The following section outlines the baseline with regards to bats and presents a summary of the results of the bat surveys. A full description of the bat activity at the site is provided in Appendix 5.2.

Habitat Assessment

5.4.51 The site was evaluated as being of medium value to bats as outlined in Hundt (2012) and Eurobats (2008). This value was attributed given the known use of the site for foraging and commuting by bats and the lack of suitable areas for roosting.

5.4.52 It was considered that there were few features within the site boundary which would be of value to roosting bats. The site is largely comprised of open, flat agricultural fields of limited structural complexity. There are only five small blocks of broadleaved plantation woodland within the site that are considered to be of limited value to roosting bats. In addition along the eastern border of the wind farm site there is a narrow line of acacia trees again considered to be of limited value to roosting bats.

5.4.53 There is one structure within the site boundary, which is a small vineyard located in the east-central part of the site. A disused and dilapidated two-storey house and associated outbuildings, with a small area of planted trees and vineyard, is also located in close proximity to the western site boundary, along state road Category II-111. The second of these buildings was deemed as having potential to support roosting bats and as such a series of emergence and re-entry surveys were undertaken.

Transect and Listening Points

5.4.54 Five walked transects and one driven transect were completed with integrated listening points within the Proposed Development site and survey area (an area extending to 200m from the site boundary). Each transect was walked once in August 2012 and twice a month from September 2012 to July 2013. Each transect was designed to incorporate a range of habitat types whilst also paying attention to features which may be important to bats. Walked transects were carried out at a steady pace. Transects were designed to start at least 15 minutes prior to sunset to allow commuting and foraging bats to emerge and reach the area, surveys were generally concluded 2-3 hours after sunset in accordance with good practice guidelines. Dawn transects commenced approximately 3 hours before sunrise and concluded 15 minutes after sunrise. Each transect was walked an alternative direction

(clockwise/anti-clockwise) on each visit to allow for different emergence times of species and to provide a comprehensive representation of habitat use throughout the survey period.

5.4.55 A series of pre-determined, five minute point counts were incorporated into all transects to allow for a sample of bat activity to be taken in a range of habitat types, including habitats which are considered to be of minimum value to bats. Listening points were sampled at the same locations continuously throughout the active season.

5.4.56 A total of 80 transects were undertaken between the months of August 2012 and July 2013, comprising 58 dusk and 22 pre-dawn surveys resulting in a total 13,660 overall survey minutes (227.67 hours) completed, recording a total of 2,674 bat registrations[1]. Throughout the survey season at least 12 bat species were confirmed by an analysis of their echolocation. These species were: Greater Horseshoe bat (Rhinolophus ferrumequinum), Geoffrey's bat (Myotis emarginatus), Bechstein's bat (Myotis bechsteinii), Soprano pipistrelle (Pipistrellus pygmaeus), Common pipistrelle (Pipistrellus pipistrellus), Kuhle's pipistrelle (Pipistrellus kuhlii), Nathusius pipistrelle (Pipistrellus nathusii), Savi's pipistrelle (Hypsugo savii), Leisler's bat (Nyctalus leisleri), Noctule bat (Nyctalus noctule), Parti-coloured bat (Vespertilio marinus) and Serotine bat (Eptesicus serotinus). In addition three groups of bats were also recorded including Greater mouse-eared bat (Myotis myotis)/Lesser mouse-eared bat (Myotis blythii); Brandt's bat (Myotis brandtii)/Whiskered bat (Myotis mystacinus)/Alcathoe whiskered bat (Myotis alcathoe) and Plecotus species. It is considered that at least one species from each group is present on the site, which makes the number of species at least 15. However, it is very likely that the actual number of species is higher than that, potentially up to 18 species, because the occasional and/or sporadic presence of at least 6 species from these groups (Whiskered bat, Alcathoe whiskered bat, greater mouse-eared bat, lesser mouse-eared bat, brown long-eared bat (Plecotus auritus) and grey long-eared bat (Plecotus austriacus)) is almost certain, based on their distribution and the presence of adequate ecological conditions on the site and its immediate surroundings

5.4.57 The majority of bat registrations recorded during the transect surveys were attributable to five species and two species groups. These species were Kuhle's pipistrelle, Nathusius pipistrelle, Noctule bat, Leisler's bat and Serotine bat along with Kuhle's/Nathusius pipistrelle and Noctule/Leisler's bat groups. Within this group (and all species recorded) Kuhle's pipistrelle was by far the most recorded species with 846 separate registrations representing 31.64% of all contacts. Nathusius was the second most commonly recorded bat with 495 registrations or 18.51% closely followed by the Kuhle's pipistrelle/Nathusius pipistrelle group (442 or 16.53%), then Noctule bat (180 or 6.73), Serotine bat (154 or 5.76%), Leisler's bat (148 or 5.53%) and the Noctule/Leisler's group (106 or 3.96%).

5.4.58 Activity levels were greatest in September 2012 and July 2013 with a total of 731 registrations and 913 registrations respectively. Activity in August 2012 was next highest with 315 registrations followed by June 2013 (271), April 2013 (207) then May 2013 (170). Activity in October and November 2012 by contrast was low with only 44 and 23 registrations respectively.

5.4.59 An examination of the spatial levels of activity across the site, the highest number of total registrations were recorded along transect 5. In total 1056 separate registration were recorded along this transect. Activity levels were highest in July 2013 with 448 registrations or 16.8% of all registrations recorded during the transect surveys. This transect was located on the eastern boundary of the site and did not cover areas within the site itself; however it does provide a useful comparison of activity on the site and activity in the wider environment.

5.4.60 With regards to transects within the site and therefore covering potential areas to be developed (i.e. transects 1 to 4) the highest levels of activity were recorded along transect 1. In total 603 registrations were recorded followed by transect 4 with 362 registrations, then transect 3 with 356 registrations and finally transect 2 with 297 registrations. Locations of transect are provided in Appendix 5.2.

[1] A bat registration refers to the number of recordings of individual echolocation events i.e. 1 registration represents 1 echolocation occurrence being picked up by the bat detector. The number of registrations does not directly correlate to the number of individual bats i.e. 15 registrations does not necessarily mean 15 bats were recorded rather it could be 15 registrations by the same bat for example.

Automated Surveys

5.4.61 A total of 14 locations were chosen as locations for static detectors. Locations for static detectors are provided in Appendix 5.2. Locations were chosen to represent all habitats and features with the site considered to be of value to bats. Where possible the locations also coincided with proposed locations of turbines. Seven SM2 detectors were rotated around the 14 locations over the course of the surveys. During each surveying event the detectors were placed each location for a minimum of three consecutive nights. Detectors were programmed to start recording 30 minutes prior to sunset and continued to recording until sunrise.

5.4.62 Throughout the surveys a total of six species groups were recorded as follows:

- Myotis/Plecotus species
- Pipistrellus/Hypsugo species
- Eptesicus species
- Nyctalus/Vespertilio species
- Nyctalus/Vespertilio/Eptesicus species
- Vespertilionidae species

5.4.63 No Rhinolophus species were recorded throughout the survey season.

5.4.64 In total 4994 registrations were recorded by the static detectors over the course of the surveys. Bat activity was greatest at detector WT47 with 1301 registrations, followed by WT09 with 671, WT31 with 452 and WT82, WT05 and WT01 with 303, 302 and 303 registrations respectively.

5.4.65 Detector WT47 was located in the centre of the site in close to the woodland blocks in the valley system. Detectors WT01, WT05 and WT09 were located along the southern boundary of site in open agricultural fields to the north of the small dirt road. Detector WT31 was located in open fields the south west of the site to the south of a small dirt track. Detector WT82 was located in open fields in the north west of the site again adjacent to an existing small dirt road.

5.4.66 As mentioned previously the highest levels of activity were recorded by detector WT47. This activity is largely attributable to Pipistrellus/Hypsugo species and is represented by a peak in activity in June 2013. In contrast the species group recorded the most at other detectors as a whole was Nyctalus/Vespertilio species group.

5.4.67 When the data are examined per month as with the activity transects there was a clear peak in activity in September with 2068 registrations recorded, 1486 or 71.85% of which are attributable to the Nyctalus/Vespertilio group. However, in contrast to the activity surveys the results of the static detector second peak in activity recorded by the static detectors was in June 2013 rather than July 2013.

5.4.68 Activity in June is largely attributable to the Pipistrellus/Hypsugo species group with 787 or 93.9% of all activity recorded in that month. Activity levels in August 2012 were also considered to be high with a total of 988 registrations largely comprising 496 registrations or 50.2% by Nyctalus/Vespertilio species group and 381 registrations or 38.6% by Pipistrellus/Hypsugo species.

5.4.69 Activity levels in April 2013, May 2013 and July 2013 are considered to be of medium levels with 429, 248 and 214 total registration recorded respectively. Activity levels in October 2012, November 2012 and March 2013 are considered to be low with 143, 3 and 63 registrations respectively.

At height surveys

5.4.70 In addition to activity transects and static detectors at ground level survey were also undertaken at height utilising the met mast which was located in the centre of the site (45°04'44.72"N; 20°41'04.65"E). The surveys were undertaken in October and November 2012 followed by March to July 2013. A

detector and two microphones were attached to the met mast with one at 1m above ground level (agl) and one at 95m agl.

5.4.71 In total 167 registrations were recorded during the at height surveys. Of these 120 were at 1m agl and only 47 and 95m agl. Over the course of the survey season a total of five species groups were recorded. These were as follows:

- Myotis/Plecotus species
- Pipistrellus/Hypsugo species
- Nyctalus/Vespertilio species
- Nyctalus/Vespertilio/Eptesicus species
- Vespertilionidae indet.

5.4.72 Activity at 1m agl in October was comprised of Pipistrellus/Hypsugo species, Nyctalus/Vespertilio species and Vespertilionidae indet. In comparison at 95m agl in October Myotis/Plecotus, Pipistrellus/Hypsugo species and Nyctalus/Vespertilio/Eptesicus species were recorded. At both 1m and 95m agl no activity in November was recorded. The highest levels of activity were recorded in April with four species/species groups recorded at 1m agl compared with two at 95m agl. At both 1m and 95m agl activity from April onwards was by Pipistrellus/Hypsugo species and Nyctalus/Vespertilio species groups.

5.4.73 In general activity at height is considered to be low with only 47 registrations. Of these the majority of these were by Pipistrellus/Hypsugo species and Nyctalus/Vespertilio groups representing 42.55% or 20 registrations and 53.19% or 25 registrations respectively. Activity levels by other species groups were very low at 95m agl with only a single registration of both Myotis/Plecotus species and Nyctalus/Vespertilio/Eptesicus species groups. No activity by Vespertilionidae indet. was recorded at 95m agl.

Bat Roost Surveys

5.4.74 As outlined above a series of dusk emergence and dawn re-entry surveys were undertaken at the Old Winery in June, July and August 2012. These surveys indicated there were no roosts of any bat species within the complex of buildings at the Old Winery.

5.4.75 However bats were observed flying in-between the buildings and around the buildings during the surveys. In June two confirmed species and one species group were recorded hunting and commuting in the vicinity of the buildings. Species recorded included Kuhle's pipistrelle and the Parti-coloured bat along with Kuhle's/Nathusius pipistrelle group. All observations were of single bats.

5.4.76 In July 12 separate sightings of bats were recorded. Again Kuhle's pipistrelles were noted, with eight passes by 8 individual bats observed along with two passes by Kuhle's/Nathusius species also recorded. In addition to this Leisler's bat were noted flying south to north in the yard at the buildings along with a single observation of Myotis species (probably greater mouse-eared bat or lesser mouse-eared bat).

5.4.77 In August 12 sightings of individual bats were again observed during this month. Activity was recorded in the corn fields, the dirt roads, the vineyard, the orchard and flying between the buildings. Species recorded include Kuhle's pipistrelle, Serotine bat, part-coloured bat along with vespertilio species and Kuhle's/Nathusius species group.

5.4.78 In terms of temporal spread of observations in June Kuhle's/Nathusius pipistrelles were the first to be observed with Kuhle's pipistrelle the last species observed also. In July again Kuhle's pipistrelle were sighted first and last during the dusk emergence survey. Leisler's bat was observed later on in the night during the July dusk survey. During the July emergence survey Myotis species were observed along with Kuhle's/Nathusius pipistrelle. The Myotis species were observed first closely followed by the pipistrelle species. During the August emergence Kuhle's/Nathusius pipistrelles were the first species

to be observed early on the night with Kuhle's pipistrelle the last species to be recorded too. Serotine bat along with Vesper bats and parti-coloured bat were recorded mid to late survey.

Evaluation of Valued Ecological Receptors

5.4.79 This section provides the evaluation of the ornithological baseline (comprising bird species and populations) with the site and the study area and has been undertaken in accordance with the methods described in Tables 5.1 and 5.2. A total of 25 bird species were identified as VERs along with 2 species groups/assemblages. In addition all species of bats recorded were identified as VERs along with four main habitat areas. Table 5.3 presents the justification for the ecological valuation with specific reference to the criteria set out in Tables 5.1 and 5.2.

Table 5.3: Evaluation of ornithological receptors

Species	Feature of interest	Evaluation
Northern goshawk	Northern goshawk is listed on Annex 1 of the Wild Birds Directive, Appendix III of the Bern Convention and Annex II of the Bonn Convention. This species is not a species of European conservation concern as is listed as Least Concern by the IUCN. The Serbian population of goshawk are considered to be in a stable state. No evidence of breeding by this species within the wind farm area or wider study area has been recorded. In addition the habitats within the site and wider study area for this typically woodland nesting bird are of lower value and as such this species in the context of the site is considered to be of low ecological value.	Low
Eurasian sparrow hawk	Eurasian sparrow hawk is strictly protected in Serbia despite a stable population. This species is listed on Annex 1 of the Wild Birds Directive, Appendix III of the Bern Convention and Annex II of the Bonn Convention. This species is not a species of European conservation concern as is listed as Least Concern by the IUCN. Given the frequency of occurrence and wide spread distribution of flights across the site coupled with its status as a strictly protected species in Serbia sparrow hawk are considered to be of medium ecological value.	Medium
Common buzzard	Common buzzard is strictly protected in Serbia despite a stable population. This species is listed on Appendix III of the Bern Convention and Annex II of the Bonn Convention. This species is not a species of European conservation concern as is listed as Least Concern by the IUCN. Although strictly protected in Serbia common buzzard is considered to be a widespread and common species. However the regular and numerous observation of this species increase the ecological value from low to medium.	Medium
Rough-legged buzzard	Rough-legged buzzard is strictly protected in Serbia. This species is not known to breed in Southern Europe with the breeding population in Europe as a whole small in comparison to the core areas in northern Europe and Russia. Rough-legged buzzard is not a species of conservation concern and are listed as of Least Concern by the IUCN. The birds observed in October and November most likely represent over-wintering birds however the infrequency of observations of this species indicates that the proposed site is not along the route of a migration flyway.	Low
Long-legged buzzard	Long-legged buzzard is strictly protected in Serbia. Although being native and known to breed in Serbia no assessment of the population has been made to date. This species is listed on Annex I of the Wild Birds Directive but is not a species of European conservation concern or global conservation concern being listed as Least Concern by the IUCN. With regards to the proposed development only two observations of this species have been recorded in autumn 2012 with no evidence of any breeding or no nest locations recorded. This is species is therefore considered to be of low ecological value in the context of the development given the infrequency of observation.	Low
Marsh harrier	Marsh harrier is strictly protected in Serbia. The population in Serbia is thought to be stable. Although native to Serbia and Europe this species is not known to breed in Serbia. Marsh harrier is listed on Appendix III of the Bern Convention and Annex II of the Bonn Convention reflecting its strictly protected status and that conservation of this species would benefit from international cooperation. Nevertheless marsh harriers are not a species of European conservation concern and are listed as	High

Species	Feature of interest	Evaluation
	least concern globally. However given the frequency of observations (50 in total) indicates that the site if of value to this species and as such in the context of the development this species is considered to be of high ecological value.	
Hen Harrier	Hen harrier is strictly protected in Serbia. This species is native to Serbia although not known to breed in the country and as such Serbian population is considered to be fluctuating. This species is of European conservation concern being listed as SPEC 3 indicting the unfavourable conservation status in Europe. It is also listed on Annex 1 of the Wild Birds Directive, Appendix III of the Bern Convention and Annex II of the Bonn Convention. Globally it is of least concern with regards to conservation status. In the context of the proposed development this species has been regularly observed utilising the site and the wider study area although the habitats present are of limited value to this species with regards to breeding due to the anthropogenic nature of them. Nevertheless the conservation status of this species in Serbia and the apparent importance of the site especially in the winter months results in a high ecological value.	High
Montagu's harrier	Montagu's harrier is strictly protected in Serbia with the native population considered to be stable. This specie is listed on Annex I of the Wild Birds Directive, Appendix III of the Bern Convention and Annex II of the Bonn Convention. However it is not a species of European or global conservation concern. With regards to the proposed development this species has only been observed twice, once in October 2012 and once in April 2013. Therefore despite is legal protection nationally and internationally in the context of the proposed development this species is not considered to be of high ecological value and has been evaluated as low.	Low
Saker falcon	Saker falcon is strictly protected in Serbia despite a stable population. This species is also listed on Annex I of the Wild Birds Directive. Saker falcons are of European and international conservation concern being listed as a SPEC 1 species and endangered by the IUCN. In the context of the development site this species has been frequently observed over 12 months. Although no direct evidence of breeding has been observed from within the site or the wider study area the site does provide nesting opportunities for this species. Given the legal protection afforded both nationally and internationally and its European and global conservation status coupled to the frequency of occurrence this species if considered to be of high ecological value in the context of the proposed development.	High
Merlin	Merlin is strictly protected in Serbia. Although considered to be native to Serbia merlin are not known to breed in the country and are likely to be winter visitors. Nevertheless merlin is listed on Annex I of the Wild Birds Directive, Appendix III of the Bern Convention and Annex II of the Bonn Convention. However this species is not considered to be of conservation concern both in a European context or internationally. In the context of the proposed development this species has been infrequently observed with only two flights both of which were in November 2012 being recorded. In addition this species is not considered to have bred within the site or the wider study area with the highly disturbed nature of the habitats present providing unsuitable nesting conditions. Therefore this species is considered to be of low ecological value.	Low
Peregrine falcon	Peregrine falcon is strictly protected in Serbia despite the stable national population. This species is also listed on Annex I of the Wild Birds Directive, Appendix III of the Bern Convention and Annex II of the Bonn Convention. This species is however	Low

Species	Feature of interest	Evaluation
	not of European or global conservation concern reflecting the increases in populations throughout its range. With regards to the proposed development peregrines have been infrequently observed with little or no suitable nesting habitats within the site or wider study area. Therefore in the context of the proposed development peregrine are considered to be of low ecological value despite their legal protection.	
Eurasian hobby	Eurasian hobby are strictly protected in Serbia. The population is considered to be stable with this species known to breed in Serbia. This species is listed on Appendix III of the Bern Convention and Annex II of the Bonn Convention. Hobby is not considered to be of European or global conservation concern. Within the site and wider study area hobby have been regularly observed over the summer and early autumn periods with birds absent during winter months. Although not strictly protected internationally this species is of national importance within Serbia and therefore this fact coupled to the regular occurrence of this species within the proposed wind farm it is considered that hobby are of medium ecological importance.	Medium
Common kestrel	Common kestrel is strictly protected in Serbia. The national population is considered to be stable and is known to be a resident breeding population. This species is listed on Appendix III of the Bern Convention and Annex II of the Bonn Convention. In a European context this species is of conservation concern due to overall declining populations. In the context of the proposed development this species has been frequently recorded with over 200 flights observed during the vantage point surveys. In addition it is known that this species does breed within the wind farm area itself and the wider study area. Therefore given the frequent occurrence of this species and the international concern in a European context this species is considered to be of high ecological value.	High
Red-footed falcon	Red-footed falcon is strictly protected in Serbia and is also listed on Annex I of the Wild Birds. The national population is considered to be fluctuating. In a European context this species is considered to be vulnerable and is listed as a species of European conservation concern. Globally this species is also of conservation concern being listed as near threatened by IUCN. With regards to the proposed development red-footed falcons have been irregularly recorded using the site with only eight flights recorded. The occurrence of this species in the breeding season only may indicate that birds observed are migrants either returning to the region after over wintering or birds on route to breeding grounds. Nevertheless given the fluctuating national population coupled with its legally protected status both nationally and internationally and its conservation status this species is considered to be of medium ecological value.	Medium
White-tailed eagle	White-tailed eagle is strictly protected in Serbia and is also listed on Annex I of the Wild Birds. The national population is considered to be increasing. This species is also listed on Appendix III on Bern Convention and Annexes I and II of the Bonn Convention. In Europe this specie sis considered to be of conservation concern. Likewise globally this species is listed as of near threatened conservation status. In the context of the proposed development this species has been rarely recorded with only two flights recorded. It is therefore considered that this species in the context of the proposed development is of low ecological value only rather than medium or high.	Low
European honey-	European honey-buzzard is strictly protected in Serbia and is also listed on Annex I of the Wild Birds. The national population	Low

Species	Feature of interest	Evaluation
buzzard	is considered to be increasing. This species is also listed on Appendix III on Bern Convention and Annexes I and II of the Bonn Convention. With regards to conservation status this species is not of European or global conservation concern. European honey-buzzards have been rarely observed with only two flights recorded in September 2012. Therefore, in the context of the proposed development, this species is considered to be of low ecological value.	
Long-eared owl	Long-eared owl is strictly protected in Serbia. It is a native resident breeder with an increasing population. It is listed on Appendix III of the Bern Convention. With regards to conservation status it is not of European or global conservation concern. In the context of the proposed development this species was irregularly observe during the vantage point surveys however the breeding raptor surveys indicated that long-eared owl were nesting both within the site and the wider study area. In addition the wider areas may be of value for overwintering birds. Therefore in the context of the proposed development this species is considered to be of medium ecological value.	Medium
Little owl	Little owl is strictly protected in Serbia and is listed on Appendix III of the Bern Convention. The population in Serbia is considered to be stable despite European wide declines in this species reflected in the SPEC 3 listing for this species. In the context of the proposed development this species has been rarely recorded with only two flights observed over the winter month. With regard to breeding, at least one territory was identified in the eastern part of the site with further evidence of occupation of buildings both within the site and to the west of the site recorded. Therefore, it is considered that given the conservation status of this species and the likely value of the site for breeding individuals that this specie sis of medium ecological value.	Medium
Greater white-fronted goose	Greater white-fronted goose is protected in Serbia and in addition is listed on Annex I of the Wild Birds Directive and Appendix III of the Bern Convention. This species is also listed on Annexes I and II of the Bonn Convention. This species is considered to be a migrant species with an increasing population in Serbia. This species is not of European or global conservation concern. With regards to the proposed development this species was primarily recorded during the wintering period in October, November and December 2012 and January and March 2013 indicating that the birds observed are those on migration. The birds were not observed stopping over within the site or the wider study area with birds just passing over the site. In addition it is considered that although agricultural land is of value to geese for over wintering feeding the site is currently not used as such a resource. Therefore in the context of the development this species is considered to be of low ecological value.	Low
Greylag goose	Greylag goose is strictly protected in Serbia and in addition is listed on Annex II and III of the Wild Birds Directive along with Appendix III of the Bern Convention. In addition this species is listed on Annex II of the Bonn Convention. In terms of conservation status this species is not of European of global concern with a secure and stable population. In terms of Serbia this population is increasing. In the context of the site this species has been infrequently observed with those flights recorded probably relating to bird on migration. It is likely that the site if along the route of local or regional migration only and not a continental migration flyway given the limited observations and number of birds observed.	Low
Bean goose	Bean goose is protected in Serbia and in addition is listed on Annex II of the Wild Birds Directive and Appendix III of the Bern	Negligible

Species	Feature of interest	Evaluation
	Convention. The population of non-breeding birds in Serbia is increasing. The conservation status of this species is of no concern both at the European level and globally. With regards to the proposed development site this species has been recorded only once in November 2012. No further observations of this species were made over 12 month. It is considered that the birds observed were probably on migration across the region however the lack of further sightings indicates that the site is not along the route of a habitually used flyway. It is therefore considered that in the context of the proposed development that this species if of negligible ecological value.	
Mute swan	Mute swan is not protected in Serbia. The population in the country is increasing. This species is not of European or global conservation concern. In the context of proposed development mute swans have been rarely observed utilising the proposed wind farm site. It is therefore considered that this species is of negligible ecological value.	Negligible
White stork	White stork is strictly protected in Serbia and is listed on Annex I of the Wild Birds Directive. The population in Serbia is considered to be stable and is known to breed in and migrate through Serbia. With regards to conservation status this species is of European conservation concern listed as SPEC 2. In the context of the proposed development only three observations of white stork were recorded during the vantage point surveys. The site is considered to be limited value to this species and as such white storks are of negligible ecological value given the infrequent observations.	Negligible
Black stork	Black stork is strictly protected in Serbia and is listed on Annex I of the Wild Birds Directive. The population in Serbia is considered to be stable and is known to breed in and migrate through Serbia. With regards to conservation status this species is of European conservation concern listed as SPEC 2. Black storks have been infrequently observed during the vantage point surveys. Only two flights, one in September 2012 and one in March 2013 were recorded. The site is considered to be limited value to this species and as such white storks are of negligible ecological value given the infrequent observations.	Negligible
Common crane	Common crane is strictly protected in Serbia and is listed on Annex I of the Wild Birds Directive along with Appendix III of the Bern Convention and Annex II of the Bonn Convention. The population in Serbia is considered to be fluctuating and known to be comprised of migrant birds. With regards to conservation status common cranes are a species of European conservation concern being listed as SPEC 2. In the context of the proposed development common cranes have been rarely observed with only two flights recorded in March and April 2013. In addition the lack of observation of this species indicates that the site does not fall along the route of a habitually used migration flyway. Therefore it is considered that this species in the context of the development area is of negligible ecological value.	Negligible
Waders	Wader species recorded at the site include common sandpiper, dotterel, snipe, curlew, wood sandpiper and lapwing. All of these species are strictly protected in Serbia with wood sandpiper additionally listed on Annex I of the Wild Birds Directive. With the exception of dotterel all of these species are also listed on Annex III of the Bern Convention and are also species of European conservation concern with curlew listed as near threatened globally. With regards to occurrence within the proposed development site all species were irregularly observed with common sandpiper, dotterel and snipe only being recorded once over the course of 12 months. Curlew wood sandpiper and lapwing were each recorded twice. It is therefore considered that	Negligible

Species	Feature of interest	Evaluation
	the site is of limited value to waders and as such this assemblage is considered to be of negligible ecological value in the context of the development.	
Farmland and woodland bird assemblage	The farmland and woodland bird assemblage recorded at the site included 69 different species comprising 56 species of passerines, one species of swift, five species of doves, one species of cuckoo, one species of quail, one species of rail, one species of pheasant, two species of woodpecker and one species of hoopoe. In total 55 species are listed as strictly protected in Serbia. Around half (25 species) of the species recorded are considered to be stable in terms of population trend with 20 species considered to be in decline. Of the species recorded 19 are considered to be of European conservation concern. This species assemblage is therefore considered to be of medium ecological value.	Medium

Table 5.4: Evaluation of ecological receptors (bats)

Area/Habitat/Species	Feature of Interest	Evaluation
Bats:	All 18 species of bat recorded at the proposed wind farm site are considered to be Strictly Protected in Serbia as set out in the Law on Nature Protection (2009) and the Regulation on declaring and conservation of strictly protected and protected wild species of plants, animals and fungi (2010). In addition all bat species recorded at the site are afforded protection at a European level through inclusion within the EC Habitats Directive (92/43/EEC) 1992 (as amended). In addition, all of the species recorded are included in the Eurobats agreement (Rodrigues et al. 2008).	High
Open agricultural fields/steep habitat	The majority of bat activity at the site was recorded in areas associated with the open agricultural fields. It is considered likely that the crop fields are the main foraging area for all of bat species recorded. These areas will coincide with the areas with highest prey abundance. In the context of the site these areas are considered to be of medium ecological value.	Medium
Old winery	No roosts were found within the old winery buildings surveyed as part of the ecological studies although bats were recorded foraging in the grounds of this building. It is likely that if bats are utilising this building for roosting it will be in small numbers and by single sex rather than acting as a maternity roost or hibernation roost. It is therefore considered that given the use of the grounds around the buildings for foraging that this structure is of no more than low ecological value in the context of the proposed development site.	Low
Linear features (existing access roads, forest edge, valley, linear tree lines and scrub, power lines)	As with crop fields the highest level of activity by bats was associated with linear features such as the existing dirt roads and woodland and scrub edge. It is likely that these features do not only provide a good foraging habitat but also navigational aids for bats commuting through the landscape providing connectivity to the wider environment. In the context of the site these areas are considered to be of high ecological value.	High

Area/Habitat/Species	Feature of Interest	Evaluation
Woodland	Woodland as a standalone habitat is not common within the site. The woodland is limited small broadleaved plantations and tree lines. These wooded habitats are of limited or no value for roosting bats but of higher value as foraging areas.	Medium

Future Baseline

5.4.80 If the Proposed Development was not permitted and an assessment was made on a 'do nothing' scenario, then the identified receptors could be expected to continue to occupy the site. It is likely however that the continuation of agriculture may lead to longer term declines in prey abundance as a result of agricultural activities leading to fluctuations in the populations of both bird and bat species.

5.5 Assessment of Impacts, Mitigation and Residual Effects

Introduction

5.5.1 The development of wind farms results in a range of researched and well documented ecological effects associated with their construction, operation and decommissioning. This section assesses the effects of the proposed development to ornithology and ecology VERs identified in Table 5.3 and Tables 5.4 respectively. As outlined, effects are considered for the construction, operation and decommissioning phase of the proposed development.

5.5.2 In total 38 identical wind turbines, with a maximum height of 190m and total blade length up to 60m will be constructed within the boundary of the proposed development. The estimated on site construction period of the development will be 24 months, which includes time to reinstate working areas following conclusion of construction activities. The construction programme is likely to consist of the following stages:

- Upgrade of existing and construction of new on-site access tracks;
- Construction of wind turbine foundations and temporary crane hard standing;
- Excavation of cable trench and cable laying;
- Construction of a substation;
- Erection of wind turbines and turbine foundations;
- Connection of on-site electrical and signal cables;
- Commissioning of the development; and
- Site reinstatement and restoration.

Generic Effects

5.5.3 Potential ecological effects during construction include the risk of injury or direct mortality as a result of collision with site traffic or protected wildlife becoming trapped in site excavations. There would also be a risk of disturbance to VER species, including impacts of noise and lighting.

5.5.4 The construction of turbines and access tracks may result in habitat fragmentation impacts which in turn could create a barrier effect to the movement of species across the site. The development of the site may also lead to a reduction in foraging resources through habitat loss or due to pollution effects. There may also be a loss of sheltering opportunities for protected species such as the loss of suitable nesting and roosting opportunities for birds and bats.

Specific Effects

5.5.5 As outlined previously (Approach and Methods), all potential effects described below would be considered significant in accordance with CIEEM Guidelines; however, as noted adverse impacts which are assessed to be from major to moderate will be considered significant ecological effects. Mitigation is therefore proposed (where practicable) at the relevant scale of significance to avoid, reduce or offset identified potential effects.

5.5.6 It is important to recognise that potential ecological impacts may interact; e.g. habitat loss during construction could potentially result in disturbance and habitat fragmentation, and the resulting combination of effects may, through synergistic effects, increase the overall adverse effect of the Proposed Development (Luell et al., 2003).

5.5.7 The assessment of effects considered for construction, operation and decommissioning of the proposed development and the influence these effects could potentially have on VERs is outlined below. The potential effects described below are all considered to be adverse unless otherwise stated.

Construction

Raptors

Northern Goshawk

Displacement and Disturbance

5.5.8 During the construction phase of the project disturbance as a result of noise and vibration caused by construction activities is considered likely to occur. Disturbance will result in temporary effects for the duration of the construction and decommissioning periods.

5.5.9 Effects during construction and decommissioning are considered to be of low magnitude and **minor-negligible** significance.

Habitat Loss and Habitat Fragmentation

5.5.10 The suite of ornithology surveys identified that the site is infrequently used by goshawk. The site occupies an area of sub optimal habitat for goshawk comprising of flat monoculture agricultural fields. Goshawk is a typically forest and woodland dwelling bird and as such is more likely to use such habitats in the wider area away from the site. It is therefore considered that the proposed development is unlikely to form a core area of a goshawk territory. Nevertheless this species has been observed hunting across the site, albeit infrequently and as such the construction of the wind farm may lead to loss of hunting habitat for this species. In addition during the construction phase habitat fragmentation will occur as suitable areas for hunting will become fragmented due to construction activities.

5.5.11 Effects of habitat loss and fragmentation are considered to be of low magnitude and **minor-negligible** significance given the infrequent use of the site by this species.

Eurasian Sparrowhawk

Displacement and Disturbance

5.5.12 Eurasian sparrow hawk were regularly observed utilising the whole wind farm area during the ornithological surveys. In addition this species is known to be breeding both within the site and the wider study area. The construction of the proposed wind farm is therefore likely to result in disturbance and displacement of individual birds due to increased noise and vibration resulting from construction activities. Any disturbance will result in temporary effects for the duration of the construction period.

5.5.13 Effects of disturbance and displacement during construction are considered to be of low magnitude and **minor** significance.

Habitat loss

5.5.14 Habitat loss for this species is likely to occur during the construction phase. It is likely that the construction activities will result in the permanent loss of suitable hunting and nesting habitat for this species along with additional temporary habitat loss due to the areas required to construct the wind turbines.

5.5.15 Effects of habitat loss are considered to be of medium magnitude and **moderate** significance.

Common buzzard

Displacement and Disturbance

5.5.16 Common buzzards have been regularly recorded within the proposed development site throughout the ornithological surveys. In addition common buzzard are known to have bred within the site and the wider study area and as such it is considered that the site if of value to this species. Therefore given occupation of the site by this species it is certain that this species will be disturbed leading to displacement from the wind farm area during the construction of the wind farm. The increased noise

levels, vibration and human presence during the construction and decommissioning of the wind farm will give rise to temporary disturbance and displacement.

5.5.17 The effect of this temporary disturbance and displacement during the construction and decommissioning phases of the project are considered to be of low magnitude and **minor** significance.

Habitat loss and fragmentation

5.5.18 Habitat loss and fragmentation is likely to occur during construction due to the loss of hunting and commuting habitats as a result of construction of wind turbines. Common buzzards were observed throughout the site and the construction of 39 turbines will lead to loss of habitat for this species. This habitat loss will be both temporary during the construction and decommissioning phases and permanent during the operational phase albeit total habitat loss will be small in comparison to remaining suitable habitat.

5.5.19 The effect of habitat loss is therefore considered to be of medium magnitude and **moderate** significance.

Rough-legged and Long-legged buzzard

Displacement and Disturbance

5.5.20 Both these species have been rarely recorded during the ornithological studies. There is no evidence to indicate that the site forms part a key part of any breeding territory for either species. Both species were observed in late autumn and over winter indicating that both species are infrequent winter visitors to the area. It is therefore unlikely that the construction of the wind farm is going to have any significant impact upon either species. Nevertheless temporary disturbance of both species may occur during the construction phase of the wind farm with any effect being of negligible magnitude and **negligible** significance.

5.5.21 No further potential impacts upon either species are considered likely during the construction, operation or decommissioning phases of the proposed wind farm.

Marsh harrier

Displacement and Disturbance

5.5.22 Marsh harriers have been regularly observed during the course of the ornithological studies. It is therefore considered that the site is of value to this species. During the construction and decommissioning phases of the project it is likely that construction activities will result in increased noise and vibration coupled with increased human presence. These effects are likely to lead to disturbance of this species potentially leading to abandonment of any territory. The effect of disturbance will be temporary lasting throughout the duration of construction and decommissioning.

5.5.23 The effect of disturbance is therefore considered to be of low magnitude and **moderate to minor** significance.

Habitat loss

5.5.24 It is considered that the proposed development is of value to this species and as such the construction of wind turbines is likely to result in habitat loss for marsh harrier. During the construction phase of the development any effect of habitat loss will be temporary and as such of low magnitude and **moderate to minor** significance.

Montagu's harrier

Displacement and Disturbance

5.5.25 Montagu's harrier have been rarely observed during the course of the ornithological surveys and it is therefore considered that the site does not form an integral part of any territory and is of limited value to this species. Given the limited observation of this species any potential impact arising from the development will be of negligible significance. Nevertheless should birds continue to pass through the area during the construction of wind farm these birds may be disturbed as a result of construction

activities. The effect of any disturbance would be temporary, of negligible magnitude and of **negligible** significance.

5.5.26 No further potential impacts upon this species are considered likely during the construction, operation or decommissioning phases of the proposed wind farm.

Saker falcon

Displacement and Disturbance

5.5.27 This species is known to occupy the site with at least one territory recorded during the course of the ornithological surveys. The construction of the wind farm is therefore likely to lead to disturbance of birds resulting in potential abandonment of territories due to increased noise, vibration and human presence. The abandonment of a single breeding territory however is unlikely to result in nationally significant effects but may lead to more localised changes in the distribution of the species. This effect will be temporary during the course of the construction and decommissioning phases.

5.5.28 The effect of disturbance on saker falcon is therefore considered to be low magnitude and **moderate to minor** significance.

Habitat loss

5.5.29 In addition to disturbance effects it is considered likely that during the construction phase habitat loss as a result of constructing wind turbines within the known territory will occur. The construction of wind turbines will result in a reduction in the available habitat for this species with the site. However, the proposed wind farm represents around 0.86% of the total area within the South Banat District of Serbia and as such substantial suitable habitat that will not be affected by the development is present within the immediate surrounding area. Therefore given the temporary nature of this effect during the construction phase the magnitude of impact will be low and of **moderate to minor** significance.

Merlin and Peregrine Falcon

Displacement and Disturbance

5.5.30 Both of these species have been rarely recorded during the ornithological surveys. In addition neither species are known to have or attempted to breed within the site and the wider study area. It is therefore considered that the proposed wind farm site is of limited value to both species offering potentially hunting habitat only. Nevertheless both species, which are sensitive to anthropogenic influences, may be disturbed during the construction of the wind as a result of increased noise levels and human presence in the area. This effect will however only be temporary during the course of the construction and decommissioning phases. The effect of disturbance and displacement upon both merlin and peregrine falcon is therefore considered to be of negligible magnitude and **negligible** significance.

5.5.31 No further potential impacts upon either species are considered likely during the construction, operation or decommissioning phases of the proposed wind farm.

Eurasian Hobby

Displacement and Disturbance

5.5.32 Eurasian hobby has been regularly observed during the course of the ornithological studies with birds being recorded in the summer and early autumn periods. Although no evidence of breeding by this species within the site or wider study area was recorded it is likely that the site forms part of a territory offering good foraging and hunting habitat for this species. It is likely that construction of wind turbines will disturb this species as a result of increased noise levels and as such birds may abandon territories. This effect would have greatest impact during the breeding season potentially leading to failed breeding attempts. Any effect of disturbance would however be temporary during the construction and decommissioning phases and as such would be of low magnitude and **minor** significance.

Habitat loss

5.5.33 In addition to disturbance effects it is considered likely that during the construction phase habitat loss as a result of constructing wind turbines will occur. The construction of wind turbines will result in a reduction in the available habitat for this species with the site. The effect of habitat loss during the construction phase will be temporary and of low magnitude and **minor** significance.

Common Kestrel

Displacement and Disturbance

5.5.34 Common kestrels have been regularly observed within the proposed wind farm area. In addition this species is known to have bred within the site and as such it is considered that the site is of value to this species. It is therefore certain that birds will be disturbed by construction activities with this disturbance leading to potential displacement of birds form territories. The effect of displacement would be greatest during the breeding season with potential abandonment of nest leading mortality of any chicks. Nevertheless disturbance would be temporary whilst the construction activities are on-going and therefore the overall effect would be of low magnitude and **moderate to minor** significance.

Habitat loss

5.5.35 In addition to disturbance effects it is considered certain that during the construction phase habitat loss as a result of constructing wind turbines will occur. The construction of wind turbines will result in a reduction in the available hunting habitat for this kestrel with the site. The effect of habitat loss during the construction phase will be temporary and of low magnitude and **moderate** to **minor** significance.

Red-footed Falcon

Displacement and Disturbance

5.5.36 It is considered likely that the birds observed during the course of the ornithological surveys are those on migration rather than resident individuals holding territories within the site and the wider study area. Nevertheless, birds visiting the site during the summer months (as indicated by the surveys) may still be disturbed by construction activities should the construction period overlap with the time of year that red-footed falcon are at the site. Construction activities will lead to increased noise levels and human presence which may dissuade birds form the area. However any effect would be temporary, of low magnitude and **minor** significance.

Habitat loss

5.5.37 In addition to disturbance effects it is considered certain that during the construction phase habitat loss as a result of constructing wind turbines may occur. The construction of wind turbines will result in a reduction in the available hunting habitat for this species within the site. The effect of habitat loss during the construction phase will be temporary and of low magnitude and **minor** significance.

White-tailed Eagle and European honey-buzzard

Displacement and Disturbance

5.5.38 Both species were rare visitors to the site with only two observations of each made over the course of the ornithological studies. It is unlikely that any impacts upon this species will occur as a result of construction of the wind farm however should the construction period coincide with the period of the year when these species visit the site then disturbance of birds may occur. This effect will be temporary of negligible magnitude and **negligible** significance.

5.5.39 No further potential impacts upon either white-tailed eagle or European honey-buzzard are considered likely during the construction, operation or decommissioning phases of the proposed wind farm.

Owls

Long-Eared Owl and Little Owl

Displacement and Disturbance

5.5.40 Both species were rarely observed during the course of the vantage point studies at the site. However both species are considered to have bred or occupied breeding territories which encompassed the site and as such it was considered that the site is of vale to both. It is therefore likely that disturbance of both may occur during the construction of the proposed wind farm. The disturbance as a result of human presence and noise from construction activities may lead to abandonment of breeding territories leading to displacement of birds form the site and the wider area. In addition this effect would be greatest during the breeding season. However, any effect would however be temporary or low magnitude and minor significance.

Habitat loss

5.5.41 In addition to disturbance effects it is considered certain that during the construction phase habitat loss as a result of constructing wind turbines may occur. The construction of wind turbines will result in a reduction in the available hunting habitat for both species within the site. The effect of habitat loss during the construction phase will be temporary and of low magnitude and minor significance.

Geese and swans

Greater White-fronted Goose, Greylag Goose, Bean Goose and Mute Swan

Displacement and Disturbance

5.5.42 All three species of goose and one species of swan were rarely observed over the course of the ornithological surveys. These species were primarily observed over the autumn and winter months albeit infrequently and in small flock sizes. It is likely that the recorded birds were migrants however there is no evidence to suggest that eth site is along a habitually used continental flyway for any species. In addition there is no evidence of the use of the site by any species as a stopping off feeding area for geese or swans. Nevertheless birds flying over the area may from time to time stop at the wind farm site to rest and feed (geese are known to utilise agricultural fields for wintering feeding). It is therefore possible that if birds do stop at the site that the construction activities may lead to birds being disturbed and displacement form the wind farm area and the wider environment. This effect is not certain to occur but should it arise it would be temporary and of negligible magnitude and **negligible** significance.

5.5.43 No further potential impacts upon geese and swans are considered likely during the construction, operation or decommissioning phases of the proposed wind farm.

Storks and cranes

Black Stork, White Stork and Common Crane

Displacement and Disturbance

5.5.44 All three species have been rarely recorded at the proposed development site. It is considered that the site is of very limited value to these species and as such the proposed development will have limited impact upon all of them. It is considered that should any impact arise these will be limited to temporary disturbance during the construction of the wind farm only. This effect would be of negligible magnitude and of **negligible** significance.

5.5.45 No further impacts upon storks or cranes are considered likely during the construction, operation or decommissioning of the proposed development.

Waders

Displacement and Disturbance

5.5.46 The wader assemblage recorded at the site comprises six species including dotterel, common sandpiper, snipe, curlew, wood sandpiper and lapwing, all of which are of some level of conservation

concern. However, all six species have been rarely recorded indicating that the site is of limited value to all six species. Nevertheless waders are known to be particularly sensitive to anthropogenic impacts such as wind farm construction. It is therefore likely that wader species will be disturbed by construction activities due to the increased levels of noise and human presence associated with construction. This effect will however be temporary, of low magnitude and **negligible** significance.

5.5.47 No further impacts upon waders are considered likely during the construction or decommissioning of the proposed development.

Farmland and woodland bird assemblage

Displacement and Disturbance

5.5.48 The farmland and woodland bird assemblage comprises 69 different species. This assemblage is considered to hold species typical of open agricultural habitats with scattered woodland. It is likely that all of the birds utilise the site for breeding and foraging and as such the site is considered to be of value to this assemblage. It is therefore considered likely that disturbance of such species as a result of construction activities will occur. This disturbance would be greatest during the breeding season with an increased potential for abandonment of breeding territories. This impact will however be temporary of low magnitude and of **minor** significance.

Habitat loss

5.5.49 In addition to disturbance effects it is considered certain that habitat loss as result of construction , albeit it minimal in comparison to remaining suitable habitat for this assemblage, will occur in all three phase of the development. The construction of turbines will lead to the loss of suitable foraging and nesting habitat for birds. This effect will be both temporary during construction and decommissioning and also permanent during operation. This effect during construction will be of low magnitude and **minor** significance.

Direct mortality

5.5.50 Direct mortality of birds may occur during the construction phase especially if activities occur during the breeding season. Accidental destruction of ground nesting birds nest or collision with on-site vehicles may occur. This effect will be permanent of moderate medium magnitude and moderate significance.

Operation

5.5.51 Operational effects on ornithological receptors are considered to include potential direct morality and on-going disturbance and displacement and habitat loss and fragmentation. It is likely that these potential impacts will be limited to only certain species groups including some raptors, waders and the farmland and woodland bird assemblages as discussed under each receptor below.

Raptors

Saker falcon

Direct mortality

5.5.52 Saker falcons have been recorded flying and hunting low over the open fields within the site. In total 35 observations of Saker falcon have been recorded at the proposed windfarm since June 2012. Total flight time recorded 13,110 seconds with 14 flights for a total of 2580 seconds at potential collision height. A Collision Risk Model (CRM) was undertaken following best practice guidance (SNH, 2000).

5.5.53 The results of the CRM are presented in Table 16 in Appendix 5.3 and summarised below.

5.5.54 The predicted theoretical annual collision rate ranges from 6.77 collisions assuming no avoidance by birds to 0.12 assuming 98% avoidance[2]. Over the lifespan of the proposed development (assumed to be 25 years) the predicted theoretical collision rate will be 2.88 birds.

[2] The level of avoidance behaviour by saker falcon is also an unknown as this species is not found in the UK for which the CRM model was developed. Consequently no information of avoidance behaviour by this species at wind farms is available. However given the similarities between saker falcon and other species such as peregrine falcon it is likely that an avoidance rate of 98% is appropriate (SNH, 2010).

5.5.55 The most recent population estimate of Saker falcon in Serbia was 52 to 64 pairs in 2002 (Birdlife International, 2004). Therefore the overall population number in Serbia is between 104 and 128 birds (Birdlife International, 2004). The population was also estimated to be in a stable condition. However given the endangered status of Saker falcon a precautionary approach should be taken when putting the predicted theoretical collision rate into the context of the population of this species in Serbia; therefore the lower figure of 104 birds is taken to be the population size.

5.5.56 The predicted annual collision rate assuming 98% avoidance would represent 0.11% of the Serbian national population of Saker falcon. The predicted collision rate over 25 years assuming 98% avoidance would represent 2.76% of the national population of the national population.

5.5.57 The predicted annual collision rates is below 1% (the threshold value for assessing impacts upon qualifying species for Special Protection Areas (SPA) of the national population) and as such are unlikely to be considered a significant impact upon the population of saker falcon in Serbia. However the collision rates over the lifespan of the project is over 1% and as such this level of impact is likely to represent a significant impact upon the national population of saker falcon. It should be noted however that the CRM results present above are based upon less than 50% of the observed flights by this species over 12 months where at potential collision risk height. Therefore the observed behaviour of saker falcons at the proposed development site indicates that birds are flying at lower heights below collision height and as such may be at lower risk of collision than indicated by the CRM.

5.5.58 Therefore taking the above into consideration the magnitude of impact of direct mortality on saker falcon is considered to be medium magnitude and **major** significance.

Habitat loss

5.5.59 In addition to direct mortality during the operational phase it is likely that habitat loss will also occur. The wind farm will result in permanent loss of suitable hunting habitat for saker falcons; albeit minimal in comparison to the extensive suitable habitats in the surrounding environment. The wind farm site represent less than 1% of the South Banat region and as such significant areas of habitat not directly affected by the proposed wind farm remain within the region. Therefore this impact will be of low magnitude and of **moderate-minor** significance.

Northern Goshawk

Direct mortality

5.5.60 Flights of goshawk were observed on the southern portions of the site with only a single flight of 15 seconds recorded at PCH. This level of flight activity is considered insufficient to undertake a CRM. In addition the typical flight patterns of this species are such that goshawks fly at lower altitudes whilst hunting. It is therefore considered that direct mortality during operation of the wind farm is very unlikely and the impact is one of **negligible** magnitude and significance.

Habitat Loss and Habitat Fragmentation

5.5.61 The suite of ornithology surveys identified that the site is infrequently used by goshawk. The site occupies an area of sub optimal habitat for goshawk comprising of monoculture agricultural land. Goshawk is a species more commonly associated with forestry and as such is unlikely to utilise habitats present within site. Consequently, it is unlikely that operation of the proposed development would result in the significant loss of suitable breeding and foraging habitat.

5.5.62 Impacts during operation are considered to be of **negligible** magnitude and significance.

Eurasian sparrow hawk

Direct mortality

5.5.63 Although flights of sparrow hawk were recorded regularly over the course of the ornithological surveys none of these were at PCH and as such it is not predicted that direct mortality as a result of collision with turbines is unlikely. Therefore effects of direct mortality are considered to be of **negligible** magnitude and significance.

Habitat loss and habitat fragmentation

5.5.64 The ornithological studies indicated the regular use of the site by sparrow hawk. This species is commonly associated with open fields and woodland and as such the habitats within the site represent appropriate habitat. The presence of wind turbines within the landscape will therefore result in the permanent loss of suitable habitat for this species. However substantial similar habitat is present within the wider landscape for this species and as such the loss of habitat in the context of this will be minimised. Impacts during operation with regards to habitat loss are therefore considered to be of low magnitude and **minor** significance.

Displacement and Disturbance

5.5.65 During the operational phase of the Proposed Development it is assumed that infrequent maintenance visits will be undertaken and therefore the increased human presence will be minimal. The disturbance during the operational phase of the development is considered to be similar to that of the existing disturbance levels as result of on-going agricultural practices. Therefore it is predicted that disturbance and displacement during the operational phase is unlikely to be at significant level.

5.5.66 Effects during operation are considered to be of **negligible** magnitude and significance.

Common buzzard

Direct mortality

5.5.67 Common buzzard was regularly recorded flying through the wind farm during the ornithological studies. In total some 193 flights were recorded with five of these at PCH. A CRM was therefore undertaken following best practice guidance (SNH, 2000; SNH, 2010). It is predicted that 0.03 collisions will occur annually and that over the lifetime of the Proposed Development (25 years) this will result in 0.81 collisions assuming avoidance rate of 98%.

5.5.68 In light of the above assessment, effects during operation are therefore considered to be of **negligible** magnitude and significance.

Habitat loss and habitat fragmentation

5.5.69 Habitat loss during the operation of the wind farm is likely to occur. The wind farm will result in permanent loss of suitable hunting for this species. The impact of this is likely to be low however given the availability of suitable like for like replacement habitat out with the wind farm area. The effect of habitat lo is therefore considered to be of **negligible** magnitude and significance.

Marsh harrier

Direct mortality

5.5.70 Only a single flight of marsh harrier was recorded at PCH over the course of the ornithological surveys. It was therefore considered not possible to run a CRM based on a single flight. Given the observed flight patterns of this species it is anticipated that direct mortality as a result of collision with wind turbines during the operational phase of the project is unlikely. Effect of direct mortality is of **negligible** magnitude and significance.

Habitat loss and habitat fragmentation

5.5.71 The site occupies an area of sub optimal habitat for marsh harrier comprising of monoculture agricultural land. This species is more commonly associated with wetlands which are not present within the wind farm site. Such areas are present to the west of the site and as such it is unlikely that the operation of the wind farm will result in the significant loss of habitats used for breeding and foraging by marsh harrier. Effects of habitat loss are therefore considered to be of **negligible** magnitude and significance.

Hen Harrier

Direct mortality

5.5.72 Although flights of hen harrier were recorded regularly over the course of the ornithological surveys none of these were at PCH and as such it is not predicted that direct mortality as a result of collision with turbines is unlikely Therefore effects of direct mortality are considered to be of **negligible** magnitude and significance.

Habitat loss and habitat fragmentation

5.5.73 The site occupies an area of sub optimal habitat for hen harrier comprising of monoculture agricultural land. This species is more commonly associated with open habitats especially moorland and steppe which are not present within the wind farm site. It is unlikely that the operation of the wind farm will result in the significant loss of habitats used for breeding and foraging by hen harrier. Effects of habitat loss are therefore considered to be of **negligible** magnitude and significance.

Montagu's harrier

Direct mortality

5.5.74 Although flights of Montagu's harrier were recorded regularly over the course of the ornithological surveys only one of these was at PCH and as such it is not considered possible to undertake a CRM. Therefore effects of direct mortality are considered to be of **negligible** magnitude and significance.

Habitat loss and habitat fragmentation

5.5.75 This species was infrequently observed at the site over the course of the ornithological studies indicating that the area is of limited value to this species. As such habitat loss during the operational phase of the project is considered to be of **negligible** magnitude and significance.

Displacement and disturbance

5.5.76 This species is thought to be prone to displacement as a result of operational wind farms (EC, 2011). However the limited occurrence of Montagu's harrier at the site indicates that any disturbance or displacement is likely to be minimal and as such any effect will be of **negligible** magnitude and significance.

Common kestrel

Direct Mortality

5.5.77 Common kestrel was regularly recorded flying through the wind farm during the ornithological studies. In total some 203 flights were recorded with five of these at PCH. A CRM was therefore undertaken following best practice guidance (SNH, 2000; SNH, 2010). It is predicted that 0.05 collisions will occur annually and that over the lifetime of the Proposed Development (25 years) this will result in 1.14 collisions assuming avoidance rate of 98%.

5.5.78 In light of the above assessment, effects during operation are therefore considered to be of **negligible** magnitude and significance.

Habitat loss and habitat fragmentation

5.5.79 Habitat loss during the operation of the wind farm is likely to occur. The wind farm will result in permanent loss of suitable hunting for this species. The impact of this is likely to be low however given the availability of suitable like for like replacement habitat out with the wind farm area. The effect of habitat lo is therefore considered to be of **negligible** magnitude and significance.

Owls

Direct mortality

5.5.80 No flights of either long-eared or little owl were recorded at PCH. Therefore the wind farm is unlikely to pose a risk to these species in relation to collision with wind turbines during the operational phase of the project. Therefore any effect will be of **negligible** magnitude and significance.

Habitat loss and habitat fragmentation

5.5.81 Habitat loss and fragmentation is likely to occur during the operational of the project. Both species are thought to breed and hunt within the site and the wider study area. The loss of this hunting habitat will however be minimal and once the site has settled following construction these species may still be able to hunt within the wind farm area. As such the effect of habitat loss and fragmentation during the operational phase is considered to be of **negligible** magnitude and significance.

Disturbance and displacement

5.5.82 Disturbance during the operational phase of the project is likely to be minimal limited to occasional maintenance visits. The disturbance during the operational phase of the development is considered to be similar to that of the existing disturbance levels as result of on-going agricultural practices. Therefore it is predicted that disturbance and displacement during the operational phase is unlikely to be at significant level.

5.5.83 Effects during operation are considered to be of **negligible** magnitude and significance.

Waders

Direct mortality

5.5.84 Direct mortality as a result of construction activities is assessed as being likely with an estimated loss of wader territories. If the construction work is undertaken within the bird breeding season it may result in the mortality of dependant young.

5.5.85 Waders were observed flying at heights that may result in collision with rotating blades. However, as all of the wader species recorded by the surveys are common and widespread they were only noted as 'Secondary Species'. Consequently, flight heights and duration were not recorded as part of the VP surveys. As such, a CRM was not undertaken.

5.5.86 In light of the above assessment, effects during construction, operation and decommissioning are considered to be of high magnitude and **moderate - minor** significance.

Habitat Loss and Habitat Fragmentation

5.5.87 The proposed development will result in both temporary habitat loss (during construction) and permanent habitat loss (during operation). It is anticipated that the development will result in the loss of suboptimal value habitats for waders which are likely to be utilised by the breeding waders and provide potential breeding sites. However, these habitats are of suboptimal value for these species and therefore effects (during all three development phases) are considered to be of **negligible** magnitude and significance.

Disturbance and Displacement

5.5.88 Limited disturbance within the site, in comparison to existing levels of disturbance (associated with agriculture), is predicted during operation of the proposed development which is unlikely to result in significant disturbance or displacement.

5.5.89 Effects during operation are considered to be of **negligible** magnitude and significance.

Farmland and woodland bird assemblage

Direct mortality

5.5.90 Direct mortality as a result of construction activities during the breeding season is assessed as being likely. If construction works are undertaken during the bird breeding season they may result in the mortality of dependant young. These effects during construction and decommissioning are considered to be of high magnitude and **moderate to minor** significance; effects during operation are considered to be of **negligible** significance and magnitude.

Habitat loss

5.5.91 The Proposed Development will result in both temporary habitat loss (during construction) and permanent habitat loss (during operation). The habitat lost will be of value for this bird assemblage being utilised for potential breeding sites. Therefore effects during operation are considered to be of **medium** magnitude and **moderate** significance.

Disturbance and displacement

5.5.92 Limited disturbance within the site, in comparison to existing levels of disturbance (associated with agriculture), is predicted during operation of the Proposed Development which is unlikely to result in significant disturbance or displacement.

5.5.93 Effects to breeding birds during operation are considered to be of **negligible** magnitude and significance.

Bats

Construction, Decommissioning and Operation

5.5.94 The Proposed Development has been assessed as being a medium risk site for bats following Hundt (2012) and Eurobats (Rodriguez et al 2008) and based upon the data collected during the bat surveys. The potential impacts upon the species recorded will depend upon the use of the site by each species. Table 5.5 below outlines the use of the site by each of the species and species groups.

Table 5.5: Overview of the importance of the wind farm site for bat species (high, medium, low and negligible).

Species	Roosts	Flight paths	Feeding areas	Migratory influx	Migration routes	Activity levels	Relative abundance
Kuhle's pipistrelle	Not present	Medium	Medium	Does not migrate		Occasionally high	High
Nathusius pipistrelle	Low to medium	Medium	Medium	High	Probably negligible	Occasionally high	High
Noctule bat	Occasionally medium	Occasionally medium	Occasionally medium	High	Probably negligible	Occasionally high	Occasionally high
Leisler's bat	Probably negligible	Occasionally medium	Occasionally medium	High	Probably negligible	Occasionally high	Occasionally high
Serotine bat	Probably negligible	Occasionally low	Occasionally medium	Does not migrate		Occasionally medium	Occasionally medium
Brandt's bat/Parti-coloured bat/Alcathoe whiskered bat	Not present	Negligible	Negligible	Does not migrate		Negligible	Negligible
Other species	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

5.5.95 Using the information in Table 5.5 and the known risk posed by wind farms to bat species (Table 5.6) it is then possible to determine the likely impacts arising from the proposed development upon the bat species recorded at the Kovacica site (Table 5.7).

Table 5.6: Behaviour of bats at wind farms adapted from Wind energy developments and Natura 2000 Guidance Document (European Commission 2011).

Species	Period	Protected in Europe	Listed in Annex II of EU Habitats Directive	Hunting close to habitat structures	Migration or long distance moving	High Flight (<40m)	Low flight	Possibly disturbed by turbine ultrasounds	Attracted by light	Roosting in nacelles	Known loss of hunting habitat	Risk of loss of hunting habitat	Known collision	Risk of collision
Rhinolophus ferrumequinum		Yes	X	X			X							
Myotis mystacinus		Yes		X			X							
Myotis alcathoe		Yes		X			X							
Myotis blythii		Yes	X		X	X	X							X
Myotis Myotis		Yes	X		X	X	X						X	X
Myotis bechsteinii		Yes	X	X			X							
Myotis emarginatus		Yes	X	X	?	X	X							
Myotis nattereri		Yes		X			X							
Myotis daubentonii		Yes		X		X	X						X	X
Myotis dasycneme		Yes	X		X	X	X						X	X
Plecotus auritus		Yes		X		X	X						X	X
Plecotus austriacus		Yes		X			X							X
Barbastella barbastella		Yes	X	X			X							
Pipistrellus kuhlii		Yes		X		X	X	?	X				X	X
Pipistrellus pipistrellus		Yes		X		X	X	?	X				X	X
Pipistrellus pygmaeus		Yes		X	X	X	X	?	X				X	X

Species	Period	Protected in Europe	Listed in Annex II of EU Habitats Directive	Hunting close to habitat structures	Migration or long distance moving	High Flight (<40m)	Low flight	Possibly disturbed by turbine ultrasounds	Attracted by light	Roosting in nacelles	Known loss of hunting habitat	Risk of loss of hunting habitat	Known collision	Risk of collision
Hypsugo savii		Yes		X		X	X	?	X				X	X
Nyctalus leisleri		Yes			X	X		X	X	?		X	X	X
Nyctalus noctule		Yes			X	X		X	X	?		X	X	X
Vespertilio marinus		Yes			X	X			X			X	X	X
Eptesicus serotinus		Yes			?	X		X	X		X		X	X

Table 5.7: Potential impacts of the wind farm on local and migratory populations of bat species and the assessment of impact significance.

Species	During construction		During operation			Population
	Habitat loss (foraging, commuting habitat)	Loss of roosts	Habitat loss due to disturbance	Loss/disturbance of flight paths	Direct mortality (collision and barotrauma)	
Kuhle's pipistrelle	Negligible	Moderate-Minor	Negligible	Moderate-Minor	Moderate-Minor	Local
Nathusius pipistrelle	Minor	Minor	Negligible	Moderate-Minor	Major-Moderate	
Noctule bat	Negligible	Negligible	Negligible	Negligible	Minor	
Leisler's bat	Negligible	Negligible	Negligible	Negligible	Negligible	
Serotine bat	Negligible	Negligible	Negligible	Negligible	Moderate-Minor	
Brandt's bat/Parti-coloured bat/Alcathoe whiskered bat	Negligible	Negligible	Negligible	Negligible	Negligible	

Species	During construction		During operation			Population
Other species	Negligible	Negligible	Negligible	Negligible	Negligible	
Nathusius pipistrelle	Minor	Minor	Negligible	Minor	Major-Moderate	Migratory
Noctule bat	Minor	Negligible	Negligible	Minor	Major-Moderate	
Leisler's bat	Negligible	Moderate-Minor	Negligible	Minor	Major-Moderate	

Direct Mortality

5.5.96 Direct mortality as a result of the operation of the proposed wind farm could potentially occur through collision with moving turbine blades or through a process called barotrauma. The risk posed by the proposed wind farm will depend upon the ecology of individual species with some species known to be high flyers at a higher risk of collision with operational wind turbines than those who tend to fly lower to the ground. With respect to the wind farm site the local behaviour of bat species and their preferred areas of habitat will also have an impact upon the risk posed through direct mortality. Using the information provide in Table 5.5 and 5.6 along with Table 5.2 and an understanding of the ecology of species concerned and their use of the wind farm site it is possible to conclude that the following species are at risk form collision and/or barotrauma at the site: Kuhle's pipistrelle; Nathusius pipistrelle and Serotine bat. In addition the following species would be at risk whilst undertaking migration Nathusius pipistrelle, Noctule bat and Leisler's bat (Table 5.7).

5.5.97 It is considered that for Nathusius pipistrelle given the use of the site by this species that the impact of direct mortality during operation would be of medium magnitude and therefore of **major-moderate** significance. For Kuhle's pipistrelle and Serotine bat the impact of direct mortality during operation is considered to be of low magnitude and of **moderate-minor** significance. For all other bat species the magnitude of impact of direct mortality during construction is considered to be of negligible with **negligible** significance.

5.5.98 For species that are likely to migrate through the area including the proposed wind farm site the magnitude of impact of direct mortality is considered to be high and the of **major-moderate** significance.

5.5.99 Impacts from direct mortality during construction and decommissioning of the Proposed Development are considered to be unlikely and therefore of negligible magnitude leading to effects of **negligible** significance.

5.5.100 The habitat profiling surveys did not identify any buildings suitable for roosting bats within the site boundary. The results of a series of emergence and re-entry surveys concluded that none of the buildings supported maternity roosts and therefore that these roosts were used by males and/or non-breeding females. As none of the identified roosts will be destroyed during construction, operation and/or decommissioning, the impact is assessed on the whole as being of negligible magnitude and the effect of **negligible** significance.

Habitat Loss and Disturbance

5.5.101 In the absence of mitigation, the Proposed Development could result in potential effects through the direct loss of suitable foraging habitat, and loss and/or disruption (disturbance) of commuting habitat due to barrier effects. The wind turbines will be constructed in up to five linear rows across the site with the exception of the north western and northern boundaries of the site.

5.5.102 From the survey undertaking it is clear that although the entire site is used for foraging; certain areas of the site are of higher value to bats and are more than likely used as preferred feeding areas. These areas include the valley with associated forest-steppe and forest fragments especially in the north and north east of the site along with the rough tracks particularly where tracks are in close proximity to woody and shrub vegetation. Outside of these areas in the open agricultural fields which comprise the majority of the site low to very low levels of activity were recorded. Therefore any loss of habitat within the areas of greater value to bats (woodland along the valleys and roads) will be of higher significance than the loss of open agricultural fields.

5.5.103 At least five turbines are within close proximity to the areas of higher value along the valley and rough tracks in the central eastern and north eastern portions of the site. If woodland and shrub removal is planned as part of construction works then the proposed development will potentially result in the loss of higher value habitat for bats. At first glance this impact would therefore appear to be of some

significance. However current plans for the project do not include any significance woodland removal which coupled with the fact that the majority of the habitat loss will occur in habitats of lower value to bats (open agricultural fields) and the presence of substantial like for like replacement habitat in the wider area the magnitude of impact of habitat loss for bat on the whole is considered to be low and of **negligible** significance.

Disturbance to flight paths

5.5.104 The construction and operation of the proposed wind farm could potentially in the absence of mitigation lead to disturbance to flight paths habitually used by bats species. This effect in turn could lead to a displacement and barrier effect. As detailed in Table 5.7 this effect is considered on the whole to be of **negligible** significance with the exception for the local population Kuhle's pipistrelle and Nathusius pipistrelle. The placement of turbines within the areas of higher value to this species may in the long term lead to disturbance of flight lines for these species especially along the woody valleys and rough tracks. However as highlight above the majority of turbines will be placed out with the areas of highest value to both of these species and as such the magnitude of impact is considered to be low and of **moderate to minor** significance.

Mitigation

5.5.105 This section details the mitigation measures that will be implemented to ameliorate identified effects associated with the construction, operational and decommissioning phases of the proposed development. These measures are aimed to prevent, reduce or offset any likely significant effects of the proposed development on identified ornithological and ecological receptors. This approach is in accordance with best practice guidance.

5.5.106 Mitigation will follow a hierarchical approach that should, where possible, be adopted in the following order:

- avoid adverse impacts in the first instance;
- where avoidance is not possible, reduce the adverse impacts with the aim of avoiding or reducing effects; and
- where significant adverse residual effects remain, measures to offset the adverse effects at a site specific level will be required.

5.5.107 Mitigation includes best practice methods and principles applied to the Proposed Development as a whole (generic measures), as well as site specific mitigation measures applied to individual locations (specific measures).

5.5.108 All ecological mitigation will be incorporated into a Construction Environmental Management Plan (CEMP). This CEMP will outline all required mitigation and provide details on timelines for undertaking mitigation for each identified ornithological receptor. This CEMP will also outline a timetable of actions and form part of the contract documents to ensure delivery of mitigation specified in this ES. In addition, the CEMP will incorporate the provision of an Ecological Clerk of Works (ECoW) to oversee the implementation of recommended mitigation.

Generic Mitigation

5.5.109 Generic mitigation measures that apply to all ornithological and ecological receptors across the Proposed Development are outlined below:

- Not more than 12 months prior to construction and/or decommissioning of the Proposed Development, the Applicant will engage a Suitably Qualified Ecologist (SQE) to act as the ECoW who's responsibility will include a requirement to undertake a series of repeat ornithological surveys to update the baseline information reported in this chapter. The aim of these surveys will be to provide up to date information in order to finalise required mitigation proposals through

consultation with the Institute for nature Conservation, in addition to completing a final check prior to construction / decommissioning for protected species.

- Adherence to Serbian Pollution Prevention Guidance (PPG) in respect to working in and around watercourses.
- It is advised that where practicable construction works will be undertaken outside the main breeding seasons for ground nesting birds. However it is understood that this is unlikely to be achievable and as such prior to any vegetation clearance or ground breaking a check for **ground nesting** birds will be undertaken. Should nest be discovered then a suitable buffer will be established by the ECoW and no work will be undertaken until the areas is deemed to be no longer in use by the nesting birds.
- Avoidance of unnecessary disturbance to habitats by minimising the extent of ground clearance and other construction practices, and restoration works during decommissioning as far as practicable.
- Plant and personnel will be constrained to a prescribed working corridor through the use of temporary barriers, thereby minimising damage to habitats and potential direct mortality and disturbance to bird species.
- Works compounds, storage sites and access tracks will avoid, as far as practicable, areas of woodland and or any other habitat identified as being of ornithological value by the ECoW.
- Reduction of in-channel works and translocation of channel substrate.
- Adherence to best practice guidance with respect to culvert design.
- Regular ecological toolbox talks will be given to all site personnel on the potential presence of protected bird and bat species and any measures that need to be undertaken should such species be discovered during construction / decommissioning activities.

5.5.110 As part of the Proposed Development, it will be necessary to develop and implement a Site Restoration Plan (SRP) as part of the CEMP to ensure those areas of habitat that have been temporarily lost through development can regenerate.

5.5.111 In order to facilitate restoration, disturbed ground will be restored as soon as practicably possible using materials removed during the construction of access tracks, excavation of cable trenches and turbine foundations. To achieve this any excavated soil will be stored in such a manner that is suitable to facilitate retention of the seed bank. This will aid site restoration and help conserve the pre-construction floristic interests at the site.

5.5.112 Where re-seeding is required then seed mixes of local provenance will be used.

Specific Mitigation

Iterative design process

5.5.113 As part of the development of the design of the proposed wind farm it is important to note that the developer, Electrawinds, undertook an iterative design process. This process utilised the information emerging form the ornithological and bat studies to feed any constraints into the design. By undertaking this important step it was possible to take into account sensitive species and sensitive areas of the site for such species. The outcome of the process was that the original number of 78 turbines was greatly reduced to a final number of 38. The removal of 40 turbines from the design is considered to have greatly reduced any potential impacts and their significance of effect.

Saker Falcon

5.5.114 The suite of ornithological studies indicated that saker falcon occupy a single territory in the central and southern portion of the site to the south of the road bisecting the central part of the site. Although there is no direct evidence of this species breeding, attempting to breed or successfully rearing chicks, the occupation of this territory indicates the value of the site for the birds. It is therefore reasonable to

assume that given the occupation of this territory that this species may at times fly at heights across the site that would potentially lead to collision (as indicated by the CRM). Therefore direct mortality for this species is a risk and as such specific mitigation for this species will be undertaken to reduce any potential impact in the first place and minimise and offset any effects. In addition to direct morality it is likely that habitat loss and fragmentation as a result of a barrier effect along with potential disturbance of birds due to construction activities will arise as a result of the proposed development.

5.5.115 As part of the design iteration process for the proposed wind farm the developer recognised at an early stage that saker falcon were present on the site. As such wind turbines were removed from areas of high activity from the original wind farm design. Given the highest frequency of observations of this species was from VP6 wind turbines 36,41,48,49 in the central part of the site were removed from the final design. It is considered that this will reduce the potential for collision in this key part of the site for this species reducing the overall impacts of the proposed development.

5.5.116 In order to mitigate the potential impacts upon saker falcon a dedicated species protection plan (SPP) will be prepared. This species protection plan will be developed through consultation with the key stakeholders for the project and will be place prior to construction works staring. The SPP will outline the specific measures necessary to protect this species during the construction, operational and decommissioning phase of the proposed wind farm.

5.5.117 In order to reduce potential effects of disturbance (albeit considered to be minimal), which are likely to be of highest significance when birds are sitting on nests, construction works **where practicable** will be undertaken outside the recognised breeding season for this species. Should this not be achievable then consideration of the establishment of suitable buffer zones within which works will be minimised will be undertaken. In order to establish a suitable buffer zone a number of factors will be considered such as existing levels of disturbance at the site, site use and behaviour of the saker falcon at the proposed wind farm and the availability of replacement habitat within the wider area. In addition the appointed ECoW/suitably qualified ecologists will use their professional judgement to weigh up the risk posed by individual turbines (not all turbines pose a risk) to the saker falcon in order to establish a suitable buffer. It should be noted that a buffer of 400m around the overhead lines is in place and as such this will provide an existing level of mitigation.

5.5.118 An examination of scientific studies undertaken in the UK by Ruddock and Whitfield (2007) on behalf of SNH provides examples of suitable buffer zones. Although Saker falcon does not occur in the UK similar species with similar habits do, for example Marsh Harrier, Goshawk, Peregrine Falcon and Hen Harrier. The recommended buffers for these species are outlined below (Ruddock and Whitfield 2007):

- Marsh Harrier – up to 500 m
- Goshawk – up to 500m
- Peregrine Falcon – up to 750 m (possibly extending to 1km)
- Hen Harrier – up to 750m

5.5.119 Given the above estimates for these species, the endangered status of saker and the strict legal protection afforded and the pre-existing 400m buffer around the overhead lines on which the saker falcon nest is located an initial additional buffer of 150m around the nest is considered appropriate. This would give a total buffer around the nest of 550m. This distance will be reviewed by the ECoW/or suitably qualified ecologists as disturbance at different stages of the breeding cycle with birds potentially less prone to disturbance once chicks are off the nest but not fully fledged. It is envisioned that the buffer distance could be reduced down to 400m in such an instance. In addition, it will be necessary to take into account the behaviour of the recorded birds as given the disturbed nature of the site the saker falcon recorded within the wind farm area may be tolerant of some level of disturbance already and as such construction works may not lead to an additional significant increase in disturbance. It is considered that the implementation of this buffer distance would reduce any potential

disturbance effects during the construction, operation and decommissioning phase of the proposed wind to a level of low significance.

5.5.120 It is considered that direct mortality of saker falcon may occur due to collisions with wind turbines. In the absence of mitigation the effect of this would be of major significance. However it is also recognised that the suite of ornithological studies did indicate that this species tends to fly at low altitudes beneath PCH, rarely flying at heights that would potentially lead to mortality. Nevertheless given the endangered conservation status of saker falcon any mortality could potentially affect regional and national populations of this species. Mitigation to reduce mortality will include consideration of switching turbines off at certain times of day and during critical periods of annual cycle (e.g. when adults are feeding dependent young or when young have just fledged). In order to confirm which turbines have the potential to cause mortality, areas of highest value for this species will be identified utilising the flight line data collected during the ornithological surveys and a series of maps will be produced and included in the SPP and CEMP. This mitigation will reduce the potential likelihood of collisions occurring and therefore limit mortality risk.

5.5.121 The proposed development will potentially result in the loss of suitable hunting habitat for saker falcon. This effect will be over the lifespan of the project. It is however considered that the amount of direct habitat loss will be minimal as the site represents less than 1% of the South Banat region. In addition it is important to note that suitable foraging habitat for this species will remain in the north west and northern areas of the site as no turbines will be constructed in these locations. Mitigation will therefore seek to maintain these areas in their current state under existing management. This will ensure that prey abundance (such as small passerine birds and small mammals) will continue to utilise the site and as such will offer suitable hunting habitat for saker falcon.

5.5.122 Further mitigation for saker falcon to reduce the potential effect of habitat loss will include the consideration of off-site mitigation by the developer. This will include the commitment to investigate the feasibility of provision of artificial nesting sites in the wider region. This approach will be discussed with key stakeholders and developed over time. The combination of habitat management onsite and offsite will reduce any potential effect of habitat loss to a level of low significance.

Sparrowhawk, Common Buzzard and Common Kestrel

5.5.123 As outlined previously the proposed development is likely to result in habitat loss during the construction phase of the development. This effect is considered to be of moderate significance. The operation of the proposed development will also result in permanent loss of habitat albeit it reduced form the level during the construction phase of the project. It is considered likely that sparrow hawk, common buzzard and common kestrel will be utilising the site to hunt and to breed and as such mitigation will focus on the reduction of any impacts of habitat loss during the breeding season. Consequently, Electrawinds will seek to ensure all vegetation clearance will be undertaken out with this period. If this is not possible the adverse impacts will be reduced by undertaking detailed surveys of areas earmarked for clearance. Should a nest be located at this time the ECoW will enforce a suitable stand-off area in which no works will take place. Through the application of these measures mitigation requirements for this species will be achieved.

Waders

5.5.124 Mitigation for waders will focus on the reduction of direct mortality and disturbance as a result of the proposed development especially during the breeding season. It is considered possible that waders, which are predominantly, ground nesting species will be susceptible to the propose development through accidental killing of chicks by construction activities. A species protection plan for waders will be developed which will outline the specific mitigation measures for wader species. This SPP will include measures such as undertaking of all vegetation clearance outside the bird breeding season. If this is not possible the adverse impacts will be reduced by undertaking detailed surveys of areas

identified for clearance. Should a nest be located at this time the ECoW will enforce a suitable stand-off area in which no works will take place.

Farmland and woodland bird assemblage

5.5.125 As with the specific measures for waders mitigation for this bird assemblage will focus on the reduction of direct mortality and disturbance as a result of the proposed development especially during the breeding season. It is considered possible that ground nesting birds will be susceptible to the propose development through accidental killing of chicks by construction activities. A species protection plan for this assemblage will be developed which will outline the specific mitigation measures for wader species. This SPP will include measures such as undertaking all vegetation clearance outside the bird breeding season. If this is not possible the adverse impacts will be reduced by undertaking detailed surveys of areas earmarked for clearance. Should a nest be located at this time the ECoW will enforce a suitable stand-off area in which no works will take place.

5.5.126 Additionally mitigation will also focus on habitat enhancement for species to offset any habitat loss through the creation of new or enhancement of existing habitats, Measure will include new native woodland planting and active management of scrub.

Bats

5.5.127 An assessment of the Proposed Development for its importance to bat populations determined that the site supported habitats that were of medium value for bats. It is considered likely that the proposed wind farm will on the whole have moderate effects on the local and regional bat populations. It will therefore be necessary to develop and establish suitable mitigation and/or compensation measure to reduce any potential effects to a level of low or negligible ecological significance.

5.5.128 It is important to note that throughout the project design phase the developer, Electrawinds DOO, have wherever possible adopted a precautionary approach with pre-emptive planning of the project layout in order to reduce any potential impacts. This approach was utilised emerging information from the bird and bat surveys to highlight areas of risk for the proposal and as such amendments to design have been made. This iterative approach to project design has on the whole reduced the potential impacts on bats.

Loss of potential roost sites and feeding areas during construction

5.5.129 In order to reduce the potential effects of habitat loss including those areas potentially used for roosting and areas known to be of value for foraging the construction works will be undertaken in such a way to minimise disturbance to these habitats as far as possible. Removal of the woodland in the valley and along the rough tracks will be avoided where possible unless a reduction in woodland cover is required in order for safe construction of wind turbines and tracks.

5.5.130 During the design phase of the project it was suggested that turbine 64 was moved from its current location based on the emerging information relating to bats. This turbine was moved in latter stages of the design and as such reduced the potential impact of this turbine with regards to habitat loss and loss of potential roosts.

5.5.131 During the design phase the position of wind turbine 47 which had high levels of activity by bats recorded during the activity and static detector surveys was considered. However removal of the woodland in this location by local farmers to improve the agricultural productivity of this area was undertaken post monitoring. This was undertaken not in conjunction with the wind farm proposals. This has led to the reduction in the value of this part of the site for bats and as such the potential effect of having a turbine placed here has been reduced significantly.

5.5.132 All other turbines within the wind farm are located in areas away from high value habitats for bats in terms of foraging and roosting potential and therefore no mitigation is proposed for them.

5.5.133 Removal of woodland and shrub fragments along the rough tracks will be avoided where practicable during the construction of the wind farm. This will reduce any impact of the loss the foraging resource that these habitats provide.

5.5.134 Given the absence of roosting habitat within the site boundary, no further survey effort (in respect to the identification of bat roosts) is proposed. However, given the period of time that will elapse between the current surveys and construction of the proposed development, a preliminary check will be undertaken within and adjacent to the site boundary (prior to construction) in order to determine if any new roosting opportunities for bats have developed. The results of the surveys will be communicated to Electrawinds by the ECoW and fed into the CEMP for the proposed development. This commitment will ensure compliance with the Serbian national and international legislative requirements in respect to protection of bats.

Loss of and disturbance of flight paths

5.5.135 With respect to effects resulting from direct mortality, disturbance, and disruption and fragmentation of commuting routes, as outlined under the assessment of potential ecological effects, a hierarchy approach to mitigation provision will be undertaken to ensure that turbines and other infrastructure avoided high value areas for bats.

5.5.136 Where possible all turbines, access tracks and other infrastructure have been placed a minimum of 200m away from features deemed to be of higher value to bats such as existing roads, scrub woodland and tree lines. This mitigation measure is informed by Eurobats guidance (Rodrigues et al. 2008). This will not only reduce the potential disturbance effect but also any longer term barrier effects to bat movement across the site. In addition the establishment of a 200m buffer will reduce the potential risk of fatality.

5.5.137 Additional mitigation through the consideration of the provision of new woodland edge habitats in areas not to be developed will further seek to re-enforce and enhance existing linear habitat providing new foraging and commuting resource for bats.

5.5.138 The use of lighting during construction will be minimised as far as practicable with construction work being limited to daylight hours. During the winter month the use of directional lighting will minimise disturbance associated with light spillage to areas of high value habitats such as scrub woodland edge, existing roads, located adjacent to the working area.

Direct mortality

5.5.139 In order to reduce the risk posed by turbines with respect to direct mortality all turbines (as mentioned previously) have been located, where practicable, away form areas of high value to bats such as the forest and forest steppe fragments and the woodland associated with eh rough tracks. A distance of 200m was applied during the design phase.

5.5.140 In addition to appropriate positing of turbine mitigation will consider measures to lower the prey abundance on site in the immediate vicinity of wind turbines. It will be important to ensure that any measures do not lead to a reduction in prey across the site as a whole as this would lead to an overall loss of feeding areas. Therefore mitigation will include the use of lighting that does not attract insects to turbines; lighting used for safety during construction will not be left on all night; around each turbine the vegetation will be managed as to not attract insects especially in any drainage ditches. Drainage ditches will be designed in order to reduce the potential for standing water which would attract insects as well as be managed to remove any vegetation growth.

Residual Effects

5.5.141 An assessment of the residual ornithological and ecological effects after the implementation of mitigation outlined in previously is presented below. The assessment considers the potential residual effects for the construction, operation and decommissioning phases of the Proposed Development. It

should be noted that in terms of this assessment, minor to negligible residual effects are not considered significant.

5.5.142 Adverse residual effects of low magnitude and **minor to negligible** significance would remain for raptor species, waders and breeding / wintering farmland and woodland bird assemblages in respect to disturbance/displacement and habitat fragmentation during construction and decommissioning. However, the effect would be short-term and would remain only for the duration of the construction and/or decommissioning periods and therefore is not considered significant in the long-term. Similarly, adverse residual effects of low magnitude and **minor to negligible** significance would remain during operation for raptors and breeding / wintering bird farmland and woodland assemblages in respect to habitat fragmentation. In comparison to construction and operation, these effects are likely to be medium to long-term although it is likely the significance of the effect will decrease over time as birds become habituated to the presence of the proposed development.

5.5.143 Adverse residual effects of low magnitude and minor significance would remain for saker falcon in respect to potential direct mortality during the construction, operation and decommissioning. However, the effect is considered to be uncertain to occur given the observed flight behaviour at the site (i.e. flying below PCH) and as such would not be significant in the long term. It is considered likely that saker falcon will become habituated to the presence of the wind turbines in the long term and will show avoidance behaviour further reducing the potential for collision with turbine blades as has been illustrated by studies in Bulgaria at the Cape Kaliakra wind farm (Saker Life Project, 2012). However it is also recognised that the presence of the wind turbines may in the long term lead to permanent displacement of the observed birds from the site due to a barrier effect. Conversely this may further reduce the risk posed to this endangered species as birds move away from the wind farm. In addition the presence of suitable habitat in the wider area would reduce any potential impact on this species in the context of the regional/national population.

5.5.144 A minor beneficial residual impact will remain in respect to the potential habitat management and enhancement for a variety of bird species as well as bats. The creation of new woodland and scrub in areas not to be developed (i.e. the north western corner of the site) would provide suitable nesting and foraging habitats for such species. In addition careful management of the existing habitat on site would allow species that are currently present to remain on site after initial disturbance effects had diminished.

5.5.145 All remaining potential significant effects will be reduced by the proposed mitigation to a magnitude of negligible resulting in effects of **negligible** significance.

Monitoring and Follow Up

5.5.146 It is proposed that post construction ecological monitoring will be undertaken at the wind farm site for an initial period of five years. This monitoring will focus on determining the success of the proposed mitigation outlined above and an examination of the mortality rates for birds and bats at the proposed development. Monitoring will be undertaken in all season when these species are present.

5.5.147 With specific regard to saker falcon the monitoring will focus on determining the extent to which construction activities have influenced behaviour on site and whether birds have been displaced. Monitoring for saker falcon will also seek to further clarify the use of the site by this species in order to identify potential the turbines which have the potential to result in significant mortalities which can be switched off during critical periods of the annual lifecycle of this species i.e. breeding.

5.5.148 With regards to bats post construction monitoring of turbine 47 should be undertaken to determine whether bat activity at this location has significantly reduce following the removal of woodland adjacent to the turbine and as such whether this turbine does pose a threat to bats.

5.5.149 It is also proposed that should a significant period of time (i.e. greater than 18 months) lapse between the conclusion of the studies presented in this ESIA (i.e. August 2013) and granting of planning

permission then a prolonged period of monitoring for certain bird and bat species will be undertaken. This is to ensure that the most accurate baseline information is available to inform the potential impacts of the proposed development allowing for a robust and accurate impact assessment.

5.5.150 It may also be of benefit to undertake a survey of prey abundance for raptor species in particular. A survey for small mammals and other prey items would allow a further analysis of the value of the site to certain species i.e. should the site support large numbers of small mammals and small passerines then it is likely that the site is of value for saker falcon for example.

Limitations and Assumptions

5.5.151 This assessment focussed on the identification of bird and bat species utilising the site and as such no assessment of the potential impacts upon other ecological receptors has been undertaken such as mammals, freshwater fish and water environment and reptiles and amphibians. Although it is considered that the given the intensive agriculture land use of the site that the proposed wind farm will be of limited value to these species and surveying for them may not have returned any useful results. As such not undertaking assessments for these species groups will have not resulted in a significant limitation on the overall ESIA.

5.5.152 With regards to the surveys undertaken to determine the use of the site by bats it is recognised that the southern portion of the site to the south of the main dirt road bisecting the central part of the site was not surveyed. Therefore no information on the use of this part of the site by bats was available to inform this impact assessment. However given the fact that this part of the site is under the same land use (i.e. monoculture) that the bat species recorded to the north of the road are likely to be the same utilising the habitat to the south of the road with similar levels of activity. Therefore it is not considered that the absence of survey data from the south of the road has resulted in a significant limitation.

5.5.153 There are no other significant limitations identified with the survey effort and methods for either birds or bats.

Cumulative Impacts

5.5.154 This section provides a summary assessment of the potential cumulative ecological impacts on ecology and nature conservation resulting from construction, operation and decommission of the proposed development in-combination with other wind farm developments proposed, consented or operational within 20km of the Proposed Development.

5.5.155 Information on wind farms within 20km of the proposed development indicated that there are up to four wind farms within this distance. Only one of these, Alibunar, is within 10km for the proposed development at Kovacica Alibunar located some 9km to the east of the proposed development.

5.5.156 The Alibunar wind farm is still to be constructed. The proposal includes the construction of 21 turbines of maximum height of 160m with maximum blade length of 60m. The site comprises intensive agricultural land use habitats subject to existing level of disturbance. It was concluded that the project will have no impacts upon any protected areas for nature conservation. The ecological studies undertaken for the identified that 81 bird species and 5 bat species use the proposed wind farm site. No bat roosts were identified within the site with no evidence of the use of the site as migration flyway for birds or bats. It was concluded that collisions with turbines by bats and birds may occur however the level of mortality was not determined. It was also concluded that the disturbance associated with the construction of the wind farm may lead to potential impacts upon birds and bats. As mentioned previously the distance between the Alibunar site and the Kovacica site is such that it is unlikely that any in-combination effects will arise as a result of construction of both developments even for species potentially migrating through the region.

5.5.157 No other in-combination effects with any other proposed, constructed or operational wind farms are predicted.

5.6 Summary

5.6.1 The chapter presents the ecological impact assessment for birds and bat species in respect to the proposed wind farm development at Kovacica.

5.6.2 The ecology assessment covers the site of the proposed development and an area up to 2km from the site.

5.6.3 The site comprises mostly intensively cultivated monoculture agricultural fields which lack structural complexity. Towards the centre of the site, within a natural depression in the landscape (valley), there are small areas of woodland. These woodland areas have been subsequently reduced for agricultural purposes. Along the eastern border of the future wind park there is a narrow tree line of acacia trees. The site does not fall within the boundary of any known nationally or internationally designated site for nature conservation although small areas of the site locally designated habitat.

5.6.4 Specialised surveys indicated that the site is currently used by 110 different bird species and 18 bats species. Of the bird species recorded 84 are strictly protected in Serbia, with 15 protected and the remaining 11 species not listed. In total 16 raptor species were recorded, two owl, three species of goose, two species of stork, one species of crane and one species of swan along with a diverse assemblage of woodland and farmland passerines and water fowl and a small assemblage of wader species. Included in the raptor assemblage are species of national and international conservation concern including saker falcon, white-tailed eagle, common kestrel, red-footed kestrel, hen harrier and Montagu's harrier. Of particular importance to the development and this assessment has been the presence of saker falcon.

5.6.5 The suite of ornithological studies did not indicate that the site is along the route of any habitually used migration pathway for any birds including migratory raptors, wild fowl, water fowl and storks.

5.6.6 The surveys indicated that the site is used for breeding by a number of species of birds including raptors such as common kestrel, Eurasian sparrow hawk and common buzzard along with owl species; long-eared owl and little owl. Forty-nine different species of common wader, farmland and woodland birds are thought to have bred within the site including such as lapwing, skylark, siskin, pipits, turtle dove, corn bunting, hooded crow and goldfinch for example.

5.6.7 With regards to bats all species recorded within the site are strictly protected in Serbia as well as being included in Annex IV of the Habitat Directive which affords all species protection at a European level. Of the species recorded at the site at least eight species or species groups' populations are known to stable in Serbia with only two species or groups though to be in decline. The surveys did not indicate that there are any roosts within the site.

5.6.8 Potential impacts of the proposed development on birds and bats include habitat loss, habitat fragmentation, disturbance and displacement and direct mortality during the construction, operation and decommissioning of the wind farm. It is considered that habitat loss and fragmentation along with disturbance and displacement as a result of construction and operation of the windfarm is likely to arise for raptor species including saker falcon, common buzzard, common kestrel and sparrow hawk along with the wader and farmland and woodland bird species. During construction these effects are considered to be temporary for the duration of the construction phase. With specific regard to saker falcon it is considered that these effects will be moderate significance.

5.6.9 During the operational phase of the project it is considered possible that direct mortality will occur for waders, farmland and woodland birds and saker falcon. No other species including raptors, geese and swans had significant flights at Potential Collision Risk Height (PCH). The effect of direct mortality is uncertain for saker falcon as there were limited flights at PCH indicating that this species at the site tends to fly at lower altitudes. Nevertheless the effect of any collision would be of major significance in the absence of mitigation.

5.6.10 In relation to bats potential effects include habitat loss and disturbance and displacement during construction/decommissioning along with the risk of direct mortality during the operation phase of the project. These effects are considered to be of moderate to minor significance in the absence of mitigation.

5.6.11 It is proposed that both generic and species specific mitigation is implemented for the project to reduce any effects to a level of minor or negligible significance. Specific mitigation has been suggested for saker falcon, common buzzard, Eurasian sparrow hawk, common kestrel and all bats species. Mitigation will include the development of Species Protection Plans (SPP) and the engagement of a suitably qualified ecologist to act as an Ecological Clerk of Works to oversee construction. The SPPs will outline the protection measures to be implemented in order to limit any effect on sensitive species. Mitigation will also include the establishment of buffer zones or varying radius depending upon species to ensure disturbance to birds during the breeding season is minimised. Mitigation for bats will follow best practice guidance and seek to minimise effects as much as possible. Measures have included micrositing of turbines away from areas of high bat activity during the planning processes thus reducing potential effects. It is also considered that ecological enhancement is undertaken through new habitat creation such as woodland planting to improve the ecological diversity of the site.

5.6.12 Overall residual effects of minor significance will remain in respect to direct mortality and habitat loss and disturbance for saker falcon, common kestrel, common buzzard, Eurasian sparrow hawk, wader, woodland and farmland birds and bats.

5.6.13 Further monitoring of saker falcon and other valued ornithological and ecological receptors are considered necessary in order to understand the use of the site by these species. Data from this can be used to inform the wind farm design going forward which will further ensure that species protection is central to the development of the site.

5.6.14 Through the incorporation of all the mitigation measure outlined above the proposed development will be in line with the conditions set out by the Institute for Nature Conservation of Vojvodina Province.

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6 Landscape and Visual Effects

6.1 Introduction

6.1.1 This chapter assesses the effects of the proposed development on the landscape and on visual amenity. It describes and analyses the existing landscape of the area, and considers its sensitivity to the changes that might arise from the introduction of the Kovačica wind park. It defines the extent to which the proposed turbines would be visible and illustrates and analyses a representative sample of views to give a clear picture of what the development would look like and the effect it might have on visual amenity.

6.1.2 Landscape and visual assessments are separate although linked processes, describing closely related but distinct sets of effects.

6.1.3 Landscape impact assessment considers the effects of the development on the landscape both directly and indirectly. Direct effects are physical changes to the landscape as a whole or its constituent parts. Indirect effects are how the development might change the character of the landscape - how it is perceived.

6.1.4 Visual impact assessment is about the effects on the people who would see the development. It considers changes in the composition and character of views available in the area affected by the proposed development, and people's responses to these changes. The assessment considers the overall consequence of the effects on the visual amenity - the pleasantness of the view or outlook – that the people affected enjoy. Whilst it is people who are affected it is the places that they may occupy that are considered as the receptors for the assessment.

6.1.5 This chapter and its associated figures are not intended to be read as a stand-alone assessment but should be read in conjunction with Chapter 4 which describes the proposed development in detail.

6.1.6 This assessment is structured as follows:

- introduction;
- legislation, policy and guidance;
- assessment methodology and significance criteria;
- the proposed development (summary description);
- mitigation (summary of mitigation incorporated into the design);
- landscape impact assessment;
- visual impact assessment;
- summary & conclusions;
- Appendix 6.1: significance criteria; and
- Appendix 6.2: wind park landscape sensitivity.

6.2 Legislation, Policy and Guidance

Serbian Legislative Framework

National Legislation

6.2.1 Serbia is a signatory to the European Landscape Convention (ELC), the fundamental point of which is that all landscapes are important, not just in special places and whether beautiful or degraded. Contracting Parties undertake to: recognise landscapes in law; establish and implement landscape protection, management and planning policies and; establish procedures for public participation.

6.2.2 The implementation of the ELC is included in the Spatial Plan of the Republic of Serbia 2010-2020 (Official Gazette RS, no. 88/10), which includes a section on the Protection and Development of Landscapes. This states that "The basic goal of protection and development of landscapes in Serbia is to achieve various high quality and adequately used landscapes and physically developed rural and urban settlements pleasant for living and leisure, with rich identity based on respect and affirmation of natural and cultural values".

6.2.3 The strategic priority under this is a programme of landscape character identification and assessment, with the aim of creating a basis for the valorisation and protection of natural and cultural landscapes, and for planning and controlling their quality. Pilot projects are highlighted for a number of areas considered as a priority because of their particular value and importance, for areas requiring restoration, and for areas under special development pressure. Included in the last category is South Banat, because of pressure for wind energy development. However, at the time of writing this pilot project has not been undertaken.

6.2.4 The Law on Environment Protection 2004 is the framework national environmental law. Article 1 states "This Law shall regulate the integral system of environmental protection which shall ensure human right to live and develop in healthy environment as well as balanced economy growth and protection of the environment in the Republic".

6.2.5 EU Directive 97/11/EC was transposed into Serbian legislation in 2004, by the Law on Environmental Impact Assessment (OJ RS, No. 135/04, 36/09). Public institutions and those competent for the environment provide their requirements/opinions on the proposed plans and are taken into consideration in the planning process. Once the plans and programmes have been adopted, the general public is informed about the decision and the decision making procedure. The objective of the environmental impact assessment is to involve the general public and integrate environment related elements in the planning process. This realises the set principles of sustainable development.

Regulations

6.2.6 The Rules on the Content of the Environmental Impact Assessment Study ("Official Journal RS", No. 69/05) prescribes in more detail the content of the Environmental Impact Assessment.

6.2.7 Article 3 requires a description of the site designated for the implementation of the project, including an "overview of the main properties of the landscape".

6.2.8 Article 6 requires a description of the environmental factors that are likely to incur significant risk due to proposed construction projects including landscape.

6.2.9 Article 7 requires a description and assessment of the potential impacts of the project on the different aspects of the environment, including "landscape features of the area and similar."

Provincial Legislation

6.2.10 Vojvodina Autonomous Province is the responsible authority for the proposed development, with the responsible department being the Provincial Secretariat for Environmental Protection and Sustainable Development [Provincial Secretariat for Urban Planning, Construction And Environmental Protection].

Policy

European Bank for Reconstruction and Development (EBRD)

6.2.11 The EBRD Environmental and Social Policy (2008) considers landscapes specifically in terms of its tangible (physical) cultural heritage value to which their Performance Requirements 1 & 10 apply. The specific objectives of Performance Requirement 1 are:

- to identify and assess environmental and social impacts and issues, both adverse and beneficial, associated with the project;
- to adopt measures to avoid, or where avoidance is not possible, minimize, mitigate, or offset/compensate for adverse impacts on workers, affected communities, and the environment;
- to identify and, where feasible, adopt opportunities to improve environmental and social performance; and

- to promote improved environmental and social performance through a dynamic process of performance monitoring and evaluation.

6.2.12 The specific objectives of Performance Requirement 10 are:

- to identify people or communities that are or could be affected by the project, as well as other interested parties;
- to ensure that such stakeholders are appropriately engaged on environmental and social issues that could potentially affect them through a process of information disclosure and meaningful consultation; and
- to maintain a constructive relationship with stakeholders on an ongoing basis through meaningful engagement during project implementation.

Guidance

National guidance

6.2.13 Guidelines on the Environmental Impact Assessment for Wind Parks were produced in 2010 by the Republic Ministry of Environment and Spatial Planning. These give no specific guidance on landscape and visual impacts beyond:

"When selecting a site, developers have to take into consideration the potential landscape and visual impact"

and

"The competent authorities should assess the potential impact of the proposed wind energy development on the architectural heritage of the locality and its landscape context, where relevant."

6.2.14 For this reason, as explained below, international and UK best practice has been followed for this chapter.

6.3 Assessment Methodology and Significance Criteria

Introduction

6.3.1 This assessment has been prepared with reference to the above-mentioned Serbian EIA guidance and to guidelines produced in the United Kingdom (UK) by the Landscape Institute and the Institute of Environmental Management and Assessment and it is generally in accordance with Scottish Natural Heritage (SNH) best practice guidance on the visual assessment and visual representation of wind parks.

Sources of Information

6.3.2 Information has been gathered from a structured site survey supplemented by desk top study.

6.3.3 The sources of information include Republic Geodetic Authority mapping, aerial photography, web resources including Google Maps, Bing Maps and Google Earth, Serbian guidelines on EIA for wind parks and 1:50,000 scale maps from the US Defence Mapping Agency[1].

Study Area

6.3.4 Serbian guidance for EIA provides no specific recommendations for the study area for landscape and visual impacts. UK (SNH) guidance suggests that the landscape and visual study area for turbines over 100m to tip should extend to 35 km from the proposed development. Experience shows, however, that significant effects rarely extend beyond 20 km from the site. Given the size of the proposed turbines for Kovačica (up to 190m to tip), the initial study area for this assessment covers an area 30 km radius from the site centre.

[1] http://www.lib.utexas.edu/maps/topo/former_yugoslavia/

6.3.5 This initial study area was refined through initial assessment and fieldwork to focus on the area within which significant effects may occur.

6.3.6 The study area for the both the landscape and visual assessment is the area from which the proposed development may be seen (by definition, visual effects are a function of the development being visible) out to the 30 km cut-off noted above, beyond which any visibility is considered very unlikely to be significant. It is therefore defined straightforwardly by visibility mapping (see below).

6.3.7 The study area for sequential effects is extended to allow the assessment of coherent sections of routes that extend beyond the area from which the proposed development would be visible.

Visibility Mapping

6.3.8 The zone of theoretical visibility (ZTV) is the area from which it is predicted the proposed development may be visible. The ZTVs in this assessment were produced by computer modelling using ArcGIS software and the STRM 90m digital elevation model[2].

6.3.9 Figure 6.1 shows the full extent of the 'bare ground' ZTV at tip height (190 m) on a single A3 sheet at 1:275,000 scale and Figure 6.2 shows the bare ground ZTV for hub height (120 m).

6.3.10 The ZTV plans give a good indication of the area from which the turbines may be visible but the ZTV is referred to as "theoretical visibility" to highlight the shortcomings in computer modelling. There will be places shown as having visibility of the turbines that, in reality, will have no view (e.g. from within most parts of the surrounding towns and villages, where trees and buildings block the view) and places where there is a view but it is so marginal as to be negligible.

6.3.11 The ZTV is banded in colours to indicate the number of turbines that may be seen from any given point. This needs to be used with caution, however, because there is a wide range of variation of extent of visibility that cannot be accurately depicted. For example, within the area shown as having visibility of all the turbines there may be places from which just the blade tips are visible, whilst in the area shown as having visibility of 11-20 turbines there may be places from which 20 full turbines can be seen.

Fieldwork and Photography

6.3.12 Detailed landscape and visual site survey work and photography were carried out in the field by an experienced landscape architect on a site visit in August 2013. The visit was sufficiently extensive to ensure the assessor had a full understanding of both the landscape of the study area and of the overall extent of visibility (i.e., not simply from the assessed viewpoints).

6.3.13 A combination of wire-line drawings and photomontages are used to illustrate the proposed development.

6.3.14 Visualisations produced using turbines modelled into Google Earth drawings were used during the assessment to help the assessor understand the potential landscape and visual impacts of the proposed development.

6.3.15 All viewpoints within 10 km of the proposed development are illustrated with a photograph centred on the proposed development and printed at a size so that when viewed from a comfortable distance objects in the image appear the size that they would when viewed in real life[3].

6.3.16 Where the turbines are seen in a broad landscape and a panoramic view would better help the understanding of the potential impact, a wider panorama has also been included.

6.3.17 360° panoramic wire-line drawings are provided as a series of 60° panoramas to illustrate the full extent of potential cumulative development. One 360° panorama is included for each settlement affected, except for Belgrade, where because of distance, only a 180° panorama looking towards the site is included.

[2] Shuttle Radar Topography Mission 90m digital elevation model v 4.1, obtained from the Consortium for Spatial Information (CGIAR-CSI) http://www.cgiar-csi.org/data/srtm-90m-digital-elevation-database-v4-1

[3] The viewpoint image is a 45° wide extract from a 180° cylindrical panorama printed 39cm wide on an A3 page. Viewed from a distance of 45 cm this image occupies 45° of your field of view: the image appears 'full size' and can be used in the field to compare the existing view with the development as illustrated.

6.3.18 Despite their photo-realistic nature, it should be noted that photomontages can only 'illustrate the likely view of a proposed development as would be seen within a photograph (not as would appear to the human eye in the field)[4]. A photographic print can never be as clear and sharp as the real world, and moving objects tend to attract the eye. The turbines could, therefore, be more noticeable in reality than they are in the photomontages. On the other hand wireline images can overemphasise the visibility of thin structures such as turbines, making them appear more prominent than they would in the landscape. The visualisations in this assessment should thus be considered as artist's impressions rather than as true representations.

Assessment Process

6.3.19 For both the landscape and visual assessments, the significance of the various effects of the proposed development derives from the combination of the magnitude of impact and the sensitivity of the landscape affected or the sensitivity of those who benefit from a given view or series of views.

Sensitivity of the Landscape

6.3.20 Sensitivity is primarily about the nature of the landscape receptor: its susceptibility to the type of change proposed and the qualities and values attached to the landscape. The degree of sensitivity is about the degree to which the introduction of a certain amount of a given development affects the way that the landscape is perceived.

6.3.21 Sensitivity varies according to the type of development (its particular form and characteristics) and how this affects the landscape both directly (physical changes) and indirectly (perceptual effects on how the character of the landscape is appreciated). The strength of the indirect element is related to the quality of the landscape and the manner and extent to which it is valued.

6.3.22 A methodology for the consideration of the sensitivity of landscape to the introduction of wind parks has been developed in the UK[5] and is summarised at Appendix 6.2.

Magnitude of Landscape Impact

6.3.23 Magnitude is primarily about the nature of the effect: a function of the size and scale of the proposed change or impact and the geographical extent of the area influenced. Consideration is given to the way in which the development would create a new component in the landscape, and how the change may alter the way the landscape as a whole is perceived. It takes account not only of the turbines themselves but also ancillary development (such as access tracks) and consequential changes.

6.3.24 Magnitude is also a function of the scale at which the landscape character is considered: a development may totally alter the character of the landscape very locally whilst having a non-material effect on the wider landscape. In accordance with best practice, this assessment considers the landscape at the scale of coherent areas of similar character.

Sensitivity to Visual Change

6.3.25 Whilst it is clearly people who are affected, it is the places that they may occupy that are considered as receptors in the assessment. Sensitivity is about the nature of the visual receptors - the expectations of the people affected and their reasons for being at a particular receptor location, together with: the importance and value of the landscape viewed; the nature and context of the viewpoint and; the importance of the view.

6.3.26 Factors that affect the sensitivity visual receptors (the people who may see the proposed development) include:

- the period of exposure to view;
- the degree of exposure to view;
- the activity and expectations of receptor; and

[4] Visual Representation of Windfarms Good Practice Guidance, SHN 2006

[5] Carol Anderson & Alison Grant, Landscape Architects, numerous wind farm landscape capacity studies, here taken from the Dumfries and Galloway Wind Farm Landscape Capacity Study, January 2011

- the nature of the view.

6.3.27 In general terms, the most sensitive receptors are those for whom visual amenity can be considered important: people at home (particularly the main outlook from a house) and people involved in outdoor recreation with a focus on appreciating the landscape or views. The least sensitive are those whose attention can reasonably be expected to be focussed away from any actual view: users of indoor recreation facilities and industrial and commercial workplaces. Between these are receptors of moderate sensitivity: those working outdoors who whilst focussed on their activity also see the surrounding landscape and; those driving through the area – again focussed on the road but also able to consider the views around them.

Magnitude of Visual Change

6.3.28 The magnitude of impact is a function of the scale and type of change to the view under consideration. Factors taken into account may include:

- scale of change (distance, the extent of development or change visible, the proportion of the view affected);
- context of the view and whether the development contrasts or integrates in the scene; and
- nature of the view (ranging from full view from a static receptor to a glimpse from a moving one).

6.3.29 Weather and lighting conditions can have a substantial effect on turbine visibility and thus on apparent visual change. The photographs used in this assessment were taken in times of clear visibility to show the worst case scenario, however timing of site survey work has meant that these are also taken in summer when vegetation is in full leaf and functioning at its most effective as a screen to views. Furthermore, for some of the viewpoints, the angle of view means that the turbine would be backlit or silhouetted against the sky, potentially causing them to appear darker in colour and thus more prominent.

Significance of Effects

6.3.30 The magnitude of change or impact and the sensitivity of the receptor are considered together to derive the assessment of effect significance. The matrix in Chapter 1 (Table 1.1) shows in general terms how sensitivity and magnitude inter-relate but it must be emphasised that assessing the effect significance is not a mechanistic process of multiplying impact magnitude by sensitivity: there is a continuum of impacts and the steps in the categories are guideline thresholds.

6.3.31 Details of the guideline criteria used in the consideration of both landscape and visual sensitivity and magnitude are given as part of the full methodology in Appendix 6.1.

6.3.32 Assessments of magnitude and sensitivity, as well as the choice of the significance category into which a given effect should be placed, are all matters of common sense and professional judgement, carried out by skilled observers working in the field.

6.3.33 As noted above, the landscape is considered at the scale of areas of consistent and coherent character and although locally significant effects may be mentioned, judgements of significance are made on the effect on the landscape as a whole.

6.3.34 Effects that are assessed as being moderate or major are considered significant.

Nature of the Effects

6.3.35 Wind turbines can be a controversial form of development. There is insufficient experience in Serbia to know whether the introduction of wind turbine developments will be perceived positively or negatively. In most parts of Europe with turbine developments, public reaction tends to be polarised. Some people consider them to be positive elegant structures. Some see them as symbols of progress or symbols of a move to renewable energy and welcome them as such. Others vehemently oppose the erection of such tall and widely visible structures.

6.3.36 In this assessment, partly to avoid complex subjective issues and partly to ensure that a ‘worst-case scenario’ is considered, the introduction of a large structure into a view or any change in the overall

character of a landscape brought about by the proposed development is considered to be an effect that is adverse in nature.

Stages of the project lifecycle and duration of the effects

6.3.37 ESIA considers the effects arising from the construction of a development, its permanent effects and the effects arising from its operation, and eventual decommissioning. It also considers whether those effects are temporary or permanent and whether they are short, medium or long-term.

6.3.38 The design life of a turbine is normally taken to be 25 years. This is temporary, and most effects of the proposed development can be reversed through decommissioning and reinstatement (see below). It is however a sufficiently long proportion of a human life that most people are likely to perceive the proposed development as permanent. The landscape and visual effects would last for the entire duration of the existence of the development and are therefore considered as long-term.

6.3.39 It should be noted that people habituate to change. Anything new is noticed and reactions, whether negative or positive, tend to be stronger shortly after a development is constructed. Over time, people get used to the existence of the development and the strength of reaction tends to diminish.

6.3.40 Each stage of this assessment considers the 'permanent' effects (effects over the life of the proposed development including operational effects) first, then the effects of construction and decommissioning.

Cumulative Effects

6.3.41 Cumulative assessment considers the effects of the proposed development when seen in context or in combination with other similar developments. In the absence of specific Serbian guidance the cumulative landscape and visual impact assessment (CLVIA) follows the SNH guidance 'Assessing the Cumulative Impacts of Onshore Wind Energy Developments' (SNH 2012).

6.3.42 This states:

- "The purpose of a CLVIA is to describe, visually represent and assess the ways in which a proposed wind park would have additional impacts when considered in addition to other existing, consented or proposed wind parks. It should identify the significant cumulative effects arising from the proposed wind park".
- "The key principle for all cumulative impact assessments is to focus on the likely significant effects and in particular those which are likely to influence the outcome of the consenting process."

Cumulative Landscape Effects

6.3.43 The SNH 2012 guidance states:

- "Cumulative effects on landscape character arise when two or more developments introduce new features into the landscape. In this way, they can change the landscape character to such an extent that they create a different landscape character type, in a similar way to large scale afforestation. That change may not be adverse; some derelict or degraded landscapes may be enhanced as a result of such a change in landscape character."

6.3.44 In their guidance on siting and designing wind parks[6] SNH note that there can be different categories of cumulative landscape effect, as follows:

- "The wind parks are seen as separate isolated features within the landscape character type, too infrequent and of insufficient significance to be perceived as a characteristic of the area;
- The wind parks are seen as a key characteristic of the landscape, but not of sufficient dominance to be a defining characteristic of the area;
- The wind parks appear as a dominant characteristic of the area, seeming to define the character type as a wind park landscape character type".

Cumulative Visual Effects

[6] Scottish Natural Heritage, Siting and Design Windfarms in the Landscape, Version 1, 2009.

6.3.45 Cumulative visual effects are the additional responses to the proposed introduction of a number of similar developments into a given view or view sequence. These may be classified as:

- simultaneous or combined (where two or more developments may be viewed from a single fixed viewpoint simultaneously, within the viewer's field of view and without requiring them to turn their head);
- successive or repetitive (where two or more developments may be viewed from a single viewpoint successively as the viewer turns their head); or
- sequential (where a number of developments may be viewed sequentially or repeatedly from a range of locations when travelling).

Significance Criteria

6.3.46 The significance criteria for the cumulative assessment are generally the same as those for the assessment of the proposed development in itself. In considering the magnitude of impacts or change and thus in judging the effect significance, the assessor is considering each time the combined effect.

6.3.47 For the cumulative visual assessment the parameters used in consideration of the magnitude of impact include:

- the number of other wind parks in the view or view sequence;
- the distance to the other wind parks;
- the direction of the other wind parks relative to the viewpoint and the view of the proposed development;
- the horizontal angle of view occupied by each of the other wind parks; and
- the composition and scale of the other wind parks, how they relate to each other and how they interact visually with the proposed development.

Wind parks included in the cumulative assessment

6.3.48 There are no existing wind parks within sight of the proposed Kovačica Wind Park.

6.3.49 According to the Vojvodina Provincial Secretariat web site in August 2013, the wind turbine developments currently proposed or under construction in the Autonomous District are as shown in Table 6.1 and figure 6.3.

Table 6.1 wind parks in the Autonomous District of Vojvodina

Development	No of turbines	Turbine size (* assumed where information not clearly available	Distance from Kovačica (approximate, centre to centre)
Cibuk	57	180m to blade tip, assumed 120m hub height	21 km
Plandiste	34	112m hub height, 168m to blade tip	30 km
Alibunar (Electrawinds)	21	100m hub height, 150m to blade tip	16 km
Alibunar 1 (WindVision)	33	112m hub height, 168m to blade tip*	15 km
Malibunar	4	100m hub height, 150m to blade tip	20 km
Kosava 1 & 2	41	175m to blade tip, 119m hub height*	35 km

6.3.50 Kosava 1 & 2 wind parks, over 30 km from Kovačica and the far side of the Deliblato Sands are considered unlikely to give rise to additional cumulative effects beyond those arising from Alibunar I and II. They have therefore not been included in the cumulative assessment, and are not illustrated in the cumulative wire-line visualisations.

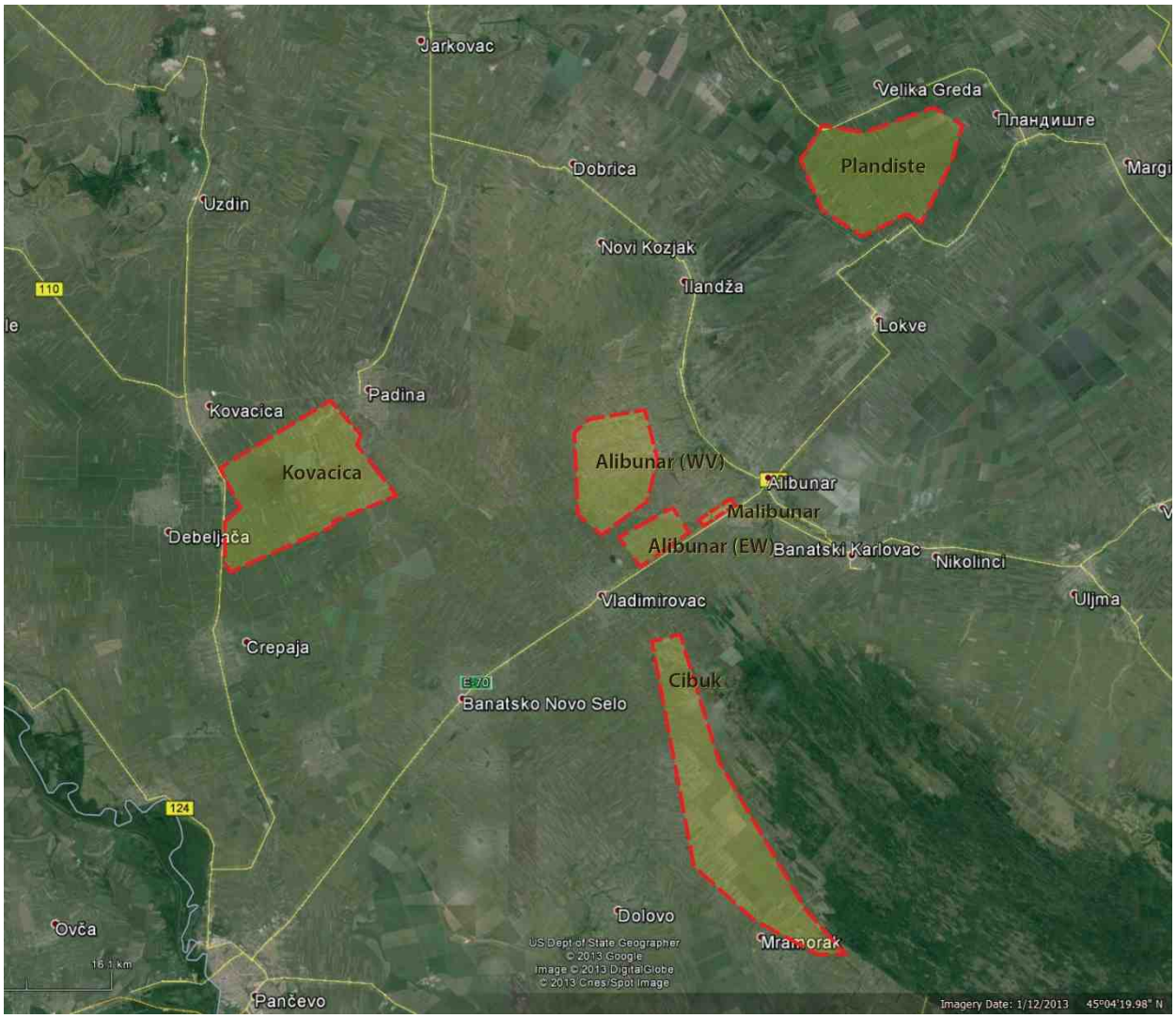

Figure 6.3 Wind parks in the Autonomous District of Vojvodina included in the cumulative assessment.

6.4 The Proposed Development

6.4.1 The proposed development comprises 38 turbines with a height to blade tip of up to 190 m. The site layout is shown on Figure 4.1.

6.4.2 Full details are given in Chapter 4. In summary the development would consist of:

- 38 wind turbines, including concrete turbine foundations, transformer kiosks and associated crane pads at each location;
- substation building and cabling;
- upgrade of the site access junction;
- new and upgraded on-site internal access tracks;
- temporary works (temporary access tracks, construction compound, site offices and temporary laydown areas next to each turbine);
- up to three on-site borrow pits;
- 1.4 km overhead power line connection (in the centre of the site); and
- one 120 m high anemometry mast.

6.4.3 The construction, operation and decommissioning of the proposed development are anticipated to cover a period of up to 28 years in total (up to 2 years to construct, 25 years operation, 1 year decommissioning).

6.5 Mitigation

6.5.1 The potential for mitigation measures to reduce the landscape and visual effects of wind park development is relatively limited.

6.5.2 Key measures that can be incorporated in a wind park design[7] are:

1. Layout design taking account of visual effects, to create a coherent and balanced development form in key views;
2. Maintain uniform size and design of turbines (e.g. direction of rotation, type of turbine and tower, and height);
3. Paint the turbines a uniform colour, typically matching the sky (light grey or pale blue), while observing marine and air navigational marking regulations;
4. Careful design and implementation of construction access and building operations to limit the extent of vegetation cleared to facilitate the works;
5. Consultation with the community on the location of the wind park to incorporate community values into design;
6. Minimize presence of ancillary structures on the site by avoiding fencing, minimising roads and burying power lines within the site;
7. Avoid including lettering, company insignia, advertising, or graphics on the turbines; and
8. Off-site mitigation planting to screen views from particularly sensitive receptors.

Mitigation included in the design and assessment of residual effects

6.5.3 The design of the Kovačica Wind Park incorporates points 2, 4, 5, 6, and 7 from this list. This assessment is therefore an assessment of the residual impacts of a design including these mitigation measures.

Mitigation not included in the design

6.5.4 The wind park layout has been driven primarily by the grid-like nature of the strip field pattern and network of existing access tracks, with the aim of minimising the extent of additional tracks and loss of productive parkland. As there are no specific viewpoints in the surrounding landscapes or particular places from which the view is more important than others (“key views”) it was not considered justifiable to over-ride this aim with aesthetic design considerations by developing alternative layouts which optimise the visual composition of the wind park. (Point 1, above).

Recommended additional mitigation

<u>Turbine colour</u>

6.5.5 Point 3, painting the turbines a uniform colour matching the typical sky colour, is very valuable in reducing both landscape and visual impacts. However, The blades of wind turbines 2, 3, 4, 5, 6, 7, 9, 11, 13, 14, 16, 18, 30, 31, 32, 33, 36, 37, 39, 40, 46, 47, 63, 64, 65, 66 and 70 shall be marked as obstacles to flying, to be made visible by day with alternate bands of red and white colour, so the band at the top of the blade is red and the total number of red bands equals two. The height the band shall be one-seventh of the total length of the rotor blade (Regulation of Airports “Official Gazette of the Republic of Serbia”, No. 23/12).Due to the limitations of computer modelling, all the visualisations in this assessment show the turbines as a uniform light grey colour.

[7] This list includes relevant points from the IFC Environmental, Health, and Safety Guidelines for Wind Energy, 2007

Off-site planting

6.5.6 Finally, there are a small number of houses on the south-western edge of Padina, from which there would be an open view at a distance of less than two kilometres. It is recommended that specific consultation is undertaken with these residents and that consideration is given, where possible, to planting belts of screening scrub and woodland, similar to that along the line of the former river valley south of Ulica Zeleni Veniec. It is acknowledged however that land-ownership measures may preclude this.

6.6 Landscape Impact Assessment

Introduction

6.6.1 This section describes the location of the proposed development, sets out the study area and describes and analyses the existing landscape. It considers the sensitivity of the landscape to development, the landscape changes that might arise from the introduction of the proposed development alone and the cumulative effects that might arise from the introduction of the proposed development along with the other wind turbine developments proposed in the surrounding area.

6.6.2 Preliminary assessment in the field showed that indirect effects on the landscape beyond about 10 km from the proposed development are unlikely. Within this area, the landscape is comparatively homogeneous. With the exceptions of the Deliblato Sands and the valleys of the Tamis and the Danube, similar landscapes stretch for at least 30 km in all directions.

6.6.3 This section considers the landscape of the site itself and surrounding area within 10 km of the site boundary.

Figure 6.5 View of the site, looking southwest from the II-110 road between Kovačica and Padina. The roadside trees are unusual in this landscape.

6.7 Baseline conditions

6.7.1 The site lies at the southern edge of the Pannonian plain (Panonska nizija, sometimes called the Great Hungarian Plain) an extensive fertile region extending from Hungary to western Romania and northern Serbia. The landscape, both of the site itself and of the wider area around the site is virtually flat, very gently rolling and intensively parked. The area is moderately populated, with settlement almost entirely concentrated into small towns and villages generally separated by 5 to 10 km of open and virtually unpopulated countryside.

6.7.2 The following section describes the existing landscape in terms of its constituent parts (landform; land cover and pattern and; settlement and communication structure).

Landform

6.7.3 The area as a whole is almost entirely flat or very gently rolling. The itself site falls very gently from the northeast to the southwest, from a high point at about 120m near Padina to a low about 80m along the II-111 road by Debeljača. Two shallow former river valleys cut across the eastern half of the site, running north and northeast into Padina, providing slight variation in the local topography.

6.7.4 Considering the area more widely, the landscape continues virtually flat almost as far as the eye can see – the horizon in all directions is virtually horizontal. About 15 km west of the site, the gently meandering shallow valley of the Tamis and some of its abandoned meanders again provide slight variation in the topography. The nearest hills are at Belgrade, some 30 km southwest of the site.

Figure 6.6: View east towards the site from north of Sefkerin, emphasising the flat nature of the landscape and the absence of tree cover

Land cover and pattern

6.7.5 The site and the wider surrounding landscape are intensively parked arable land, cultivated under an open field (“strip parking”) system, where strips of land of varying width and with no obvious demarcation are under a variety of arable crops (primarily wheat, maize and sunflower).

6.7.6 There are no hedges and few trees or woodlands in the open countryside. The main areas of woodland and trees in the site and its vicinity are some blocks of experimental woodland along the former river

valley in the centre of the site, a line of acacia trees along the former valley that forms the eastern boundary, and trees lining the road between Kovačica and Padina.

6.7.7 From ground level in summer, when the crops are well grown, it is difficult to discern any obvious pattern to the landscape. From air photos, and probably in winter and spring when the field pattern is more visible, the landscape can be seen to be divided by a regular grid of roads and access tracks.

6.7.8 Overhead power lines criss-cross the landscape, in no obvious pattern, and their pylons provide the main vertical element in most views.

Figure 6.7: A minor road in Debeljača, showing the typical urban structure of one and two storey houses set back from the road, with broad tree-covered verges

Settlement

6.7.9 The area is well populated with settlement, including the parks, almost exclusively concentrated in small towns and villages fairly evenly spaced across the region, an average of about 7 km apart.

6.7.10 Because the parks are located within the villages themselves there are only very occasional isolated properties between the villages. The one exception to this is an area of [former?] vineyards immediately south of Kovačica, where there are in the order of a hundred individual houses with smallholding plots.

6.7.11 The towns and villages mostly have a similar structure: a regular grid of streets around a centre with church, community and municipal buildings and shops. The streets tend to be composed mainly of one and two storey houses set back behind broad grass verges containing trees – most often productive species (apple, plum, walnut etc.). Communal areas and open spaces tend to be well furnished with trees, either as shade or shelter round the edges.

6.7.12 This urban structure means that the settlements tend to be inward-facing. Most houses look in to the broad streets or to their own gardens. Only a few houses at the edges of villages look towards the surrounding landscape: most village edge houses are surrounded by shelter and productive trees.

6.7.13 Seen from the wider landscape, it is the trees and the church spires or towers that are noticeable, with some particular spires such as that at Padina forming widely visible minor landmarks.

6.7.14 The main town of the region, the capital of South Banat District, is Pančevo, which is located at the confluence of the Tamis and the Danube, about 20 km south of the site.

6.7.15 There is little industry visible in the area with the notable exception of the sugar plant on the II-111 road between Debeljača and Kovačica. This is a large complex, covering some 40 hectares, with a tall silo.

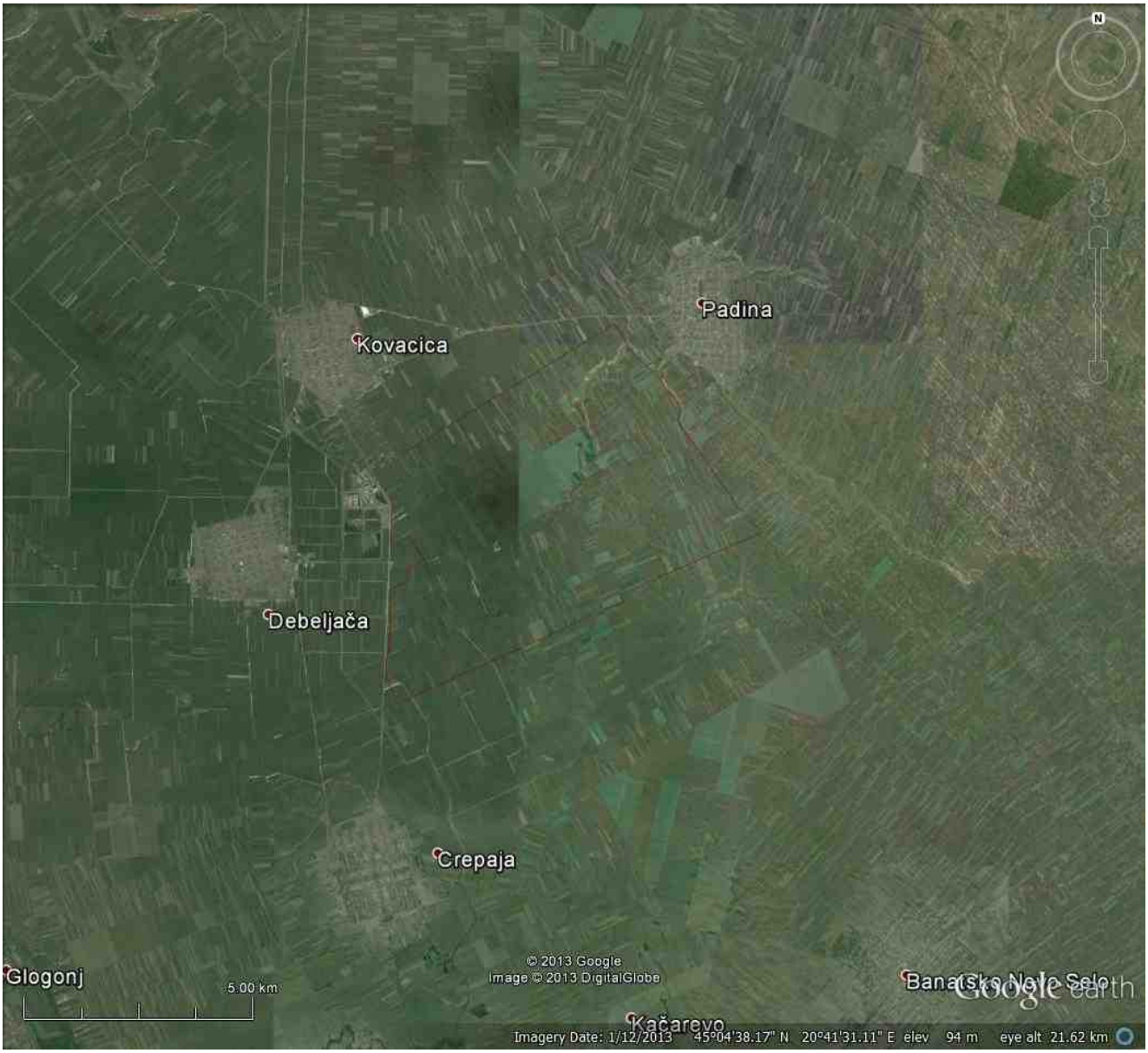

Figure 6.8: Aerial view of the site (© Google Earth) showing the field pattern and how settlement is clustered

Roads and Infrastructure

6.7.16 The two main through routes in the vicinity of the site are the II-111 from Pančevo through Crepaja and Kovačica and the II-110, from Kovačica to Padina and on to Samos. The II-111 runs north-south, just under half a kilometre west of the nearest turbine. The II-110 runs east-west approximately 1.5 km north of the nearest turbine.

6.7.17 The main trunk road in the region, the IA-3 (E70) from Belgrade to Timoşoara (Romania) runs through Banatsko Novo Selo, about 10 km southeast of the site.

6.7.18 Within the site itself there is a grid of dirt roads separating the strip fields, at about 400 m centres.

6.7.19 A single-track rail line linking Belgrade to Zrenjanin runs north-south, approximately 2 km west of the nearest turbine.

Designated Landscapes

6.7.20 No part of the site or the surrounding area is designated for landscape or scenic value.

Summary

6.7.21 The landscape of the site, as of much of South Banat district, is an open, large scale landscape of generally large agricultural fields in an area of very gently undulating - almost flat - topography. Settlement is almost entirely limited to within the villages and towns.

6.7.22 The landscape is well-managed and tidy, but there is little of scenic interest and few trees outside the settlements. There are long open views but no specific viewpoints and few focal points. There is no sign of recreational use of the countryside: the countryside appears to be a place of agricultural production rather than a place to be specifically looked at or enjoyed recreationally.

Figure 6.9: View east towards the site from the edge of Debeljača

6.7.23 The key aspects of the landscape character of the site and the surrounding area can be summarised as:

- the landscape is very open and large scale, with long views but few focal points, and the sky is very much dominant in the view;
- the topography is almost flat – very gently rolling, with local slight variation provided by former river valleys;
- the area is under intensive arable agriculture, parked in an open field (strip-parking) system with no distinct separation between fields, and with bands of strip fields separated by dirt tracks at approximately 400 m centres;
- settlement is almost entirely concentrated into villages and small towns, with very few isolated properties in the countryside; and
- overhead power lines criss-cross the landscape.

Landscape sensitivity

6.7.24 As noted at Appendix 6.1, the consideration of landscape sensitivity takes into account:

- scale and openness;
- landform;
- land cover and landmark features;
- settlement pattern and archaeology;
- landscape context; and
- perceptual qualities.

6.7.25 The proposed Kovačica wind park is located in a geographically extensive, large scale landscape with long open views and few focal points. So large and so open that even the largest turbines such as those proposed would relate to the scale of the landscape.

6.7.26 The landform both of the site and the wider area is very simple, with no distinctive features to be adversely affected by the introduction of turbines. There are no landscape designations, no specific viewpoints, and no sign of recreational use. Within the site itself there are almost no houses or other buildings, so little which might be seen in direct contrast to the turbines themselves. In other words there is little on the site that would make the comparative scale of the proposed turbines evident to any viewer.

6.7.27 In perceptual terms, the landscape is intensively managed. There is no sense of remoteness, naturalness or wilderness that could be adversely affected by the introduction of the proposed development.

6.7.28 It is therefore considered that the landscape is of low sensitivity to the introduction of large wind turbines.

Magnitude of impact and significance of effect

6.7.29 The 38 turbines, associated tracks and infrastructure (including a new substation and overhead power line) would constitute a large scale development, covering an area of over 20 km2.

6.7.30 The proposed development would have a direct effect on a very small proportion of this landscape: the turbine bases, access tracks and substation would all directly remove a small amount of existing land cover. However, the site is an area of intensely parked agricultural fields in a strip pattern with undefined boundaries, so the proposed development would not result in the loss of any landscape features or vegetation of particular value to the landscape as a whole. The direct impact of the development on the wider landscape would be negligible.

6.7.31 The relevant effect of the proposed development is its indirect effect on the landscape – how its introduction affects the character of the landscape and how it is perceived. It would be a new landscape feature predominantly of tall moving objects with a clear vertical emphasis; a clearly man-made, and to some industrial, element in a large-scale predominantly horizontal rural landscape. The landscape already contains vertical elements in the form of electricity pylons and telephone poles but these would be dwarfed by the scale of the turbines.

6.7.32 The proposed development would become a dominant feature, a key characteristic of the local landscape. This would inevitably be a change of high magnitude to the landscape of the site itself and the immediate vicinity, although the degree of change and thus impact perceived would fall with increasing distance from the site.

6.7.33 Considered very locally, on the scale of the site itself and out to about two kilometres, the development would have a high magnitude of impact on the character of a landscape judged to be of low sensitivity, thus a **moderate adverse** landscape effect.

6.7.34 Considering the landscape on the scale of communes affected (Debeljača, Kovačica, Padina, Crepaja) the proposed development would have a medium magnitude of impact, thus a minor adverse effect on

the character of the landscape. Considering the landscape more widely still, the proposed development would have a minor to negligible effect on the landscape of South Banat District.

Effects during construction

6.7.35 The landscape effects during the construction of a wind park are generally less widespread because of the absence of the moving turbine blades, but greater locally because of the extent of ground disturbed by the construction process, the presence of construction compounds, the movement of large construction vehicles across the site and the active change of the turbines being erected in stages.

6.7.36 The temporary construction compounds, the temporary parts of the access tracks and the laydown and construction areas at each turbine location would all directly affect small areas of land cover – mainly parkland. In total, several hectares of parkland would be removed for the construction works, a very small proportion of the overall site area. The vast majority of the site area would remain parked, and most of the affected areas would be restored on completion so the loss would be only temporary. The magnitude of impact would be negligible to low and the direct landscape effect negligible to minor, and of relatively short duration.

6.7.37 In terms of landscape character, the works would add temporary built development and a focus of activity to an arable landscape that is generally quite tranquil, although subject to bursts of activity (ploughing, seeding, spraying and harvesting) and which changes noticeably with the seasons. The works would give rise to a moderate to major adverse effect on landscape character very locally but in the context of the area as a whole, a minor adverse effect of relatively short duration.

Effects of decommissioning

6.7.38 The landscape effects from decommissioning would be similar to those during construction, but with less ground disturbance as the works compounds and working areas would be smaller in extent.

6.7.39 Following the completion of the dismantling works, the ground areas would, unless otherwise requested by the landowners, be reinstated and returned to agriculture.

6.7.40 The removal of the turbines would remove the landscape impacts on the wider landscape, leading to a position of no change when compared to the pre-construction baseline, but locally a **moderate beneficia**l effect when compared to the operational period.

Cumulative landscape effects

6.7.41 As set out above, the introduction of the Kovačica wind park on its own has been assessed to have a moderate adverse effect on the landscape of the site itself and out to about two kilometres around. Considering the landscape at the scale of communes affected (Debeljača, Kovačica, Padina, Crepaja) it has been assessed as having a minor adverse effect and, at the scale of South Banat District as a whole, a minor to negligible effect.

6.7.42 If all five potential cumulative developments (Cibuk, Plandiste, Electrawinds Alibunar, WindVision Alibunar 1 and Malibunar) were to be constructed, wind turbines would become a characterising feature of a large crescent of landscape in the northern half of South Banat District: an arc stretching from Plandiste, through Vladimirovac to Mramorak and wrapping around north and west of the Deliblato Sands. This would give rise to a moderately significant landscape effect (considered as being adverse in nature) over some 12% of the District. This would be a cumulative change of high magnitude to the character of a landscape judged to be of medium to low sensitivity, thus a **moderate adverse** cumulative landscape effect.

6.7.43 The addition of the Kovačica wind park would have the effect of spreading this effect to the west, enlarging the area affected by some 10%. However, the level of cumulative landscape effect on the District as a whole would remain the same: moderate adverse. In other words, the addition of Kovačica wind park would increase the area affected but it would not in itself increase the significance of the effect of wind park development on the landscape of South Banat District.

6.7.44 Looked at more locally, in the area immediately south of Padina, the introduction of the Kovačica wind park to a landscape containing the proposed Alibunar developments would change the landscape from

one “with a view of a wind park” to one “surrounded by wind parks”. This would be a change of high magnitude to a landscape of low sensitivity, **locally a moderate adverse** cumulative effect.

6.8 Visual Impact Assessment

Introduction

6.8.1 In principle, the study area for the visual assessment is the area from which the Proposed Development may be seen, because visual effects are a function of the development being visible.

6.8.2 In practice, the study area is cut off at a radius sufficient to include all potential significant effects. There is no Serbian guidance on the study area for the visual impact of wind parks. UK guidance suggests a study area of 35 km for turbines over 100 m to tip. Experience however shows that significant effects rarely extend beyond 20 km even in the most sensitive locations. Given the 190 m proposed maximum height of the turbines for the Kovačica Wind Park and the potential for these to be seen from Belgrade, this study has adopted a 30 km study area radius.

6.8.3 The Zone of Theoretical Visibility (ZTV) for the Proposed Development is illustrated in the following Figures:

- Figure 6.1: ZTV Tip height (190 m), bare ground.
- Figure 6.2 ZTV Hub height (120 m), bare ground.

6.8.4 The ZTV maps give a good indication of the area from which the turbines may be seen although they are the product of computer modelling and have a number of limitations, which should be clearly understood.

- The ‘bare ground’ ZTV map indicates potential theoretical visibility based on the shape of the land alone, taking no account of the screening provided by trees and woodland or by buildings, walls and other structures or artefacts.
- The accuracy of the ZTV is limited by the data used to generate it: even the best digital terrain model doesn’t show the shape of the ground with complete accuracy. These ZTVs have been generated using the data.

6.8.5 The ZTV is based on the Shuttle Radar Topography Mission 90m Digital Elevation Model v4.1, obtained from the Consortium for Spatial Information (CGIAR-CSI)[8].

Overview of Visibility

6.8.6 In general terms, because of the flat and open nature of the site and the surrounding landscape, there would be extensive visibility in all directions.

6.8.7 The proposed development would be theoretically visible from virtually the entire area within 10 km, with the exception of a small area of valley southeast of Uzdin.

6.8.8 Between 10 and 20km of the site, there would be theoretical visibility from about 90% of the entire area with the exception of:

- small areas west of the Tamis where extensive blocks of woodland along the river valley and the slight valley of the river and its former meanders provide localised screening; and
- a broad area along the valley between Alibunar and Ilandža, where topography provides more substantial screening.

6.8.9 Between 20 and 30km of the site, there would be theoretical visibility from over 80% of the area. The areas with no visibility being: small areas along the Danube and Tiszo river valleys; areas screened by the hills at Belgrade; former river valleys between Pančevo and Mramorak; most of the Deliblato Sands and; the valley around Banatski Karlovac.

[8] http://www.cgiar-csi.org/data/srtm-90m-digital-elevation-database-v4-1

6.8.10 The ZTVs are based on a digital elevation model (a surface model) so take account of large blocks of woodland but not of smaller screening elements such as houses, walls and lines and small groups of trees.

6.8.11 In practice, because of the way settlement in South Banat District is very much concentrated into villages and small towns, there would be very little visibility from residential properties. In general, the wind park would be visible from the houses on the very edge of each village or town, on the side towards the development, but not from within the town itself. This is demonstrated by Figures 6.11, 6.17 and 6.26.

Viewpoint Selection

6.8.12 The visual impact assessment is illustrated from 13 viewpoints (Figures 6.11 to 6.49) designed to give a balanced representation of potential views of the proposed development: a mix of representative views, intended to illustrate the effects from different directions and different distances, and key views – views from particular places considered important.

6.8.13 The final precise viewpoint locations were determined on the ground as the assessment proceeded. All viewpoints are publicly accessible: on roads, tracks, footpaths or open ground.

6.8.14 Viewpoint locations are shown on Figure 6.10, and set out in the table below.

Table 6.2 Viewpoint locations

Viewpoint Number	Location	Distance from nearest proposed turbine	Reason for selection
1a	Kovačica, town centre (Ulica Marsala Tita)	5.7 km	View from the town centre
1b	Kovačica (edge of town) - road to Padina	4.4 km	Representative of views from the edge of town and views for road users
2a	Padina, Ulica Dolna Dolina	2 km	Representative of views from open areas within town
2b	Padina, Namastie Oslobodenia	2.3 km	View from the town centre
2c	Padina, Ulica Športova	1.7 km	Representative of views from the edge of town
3	Crepaja	3.4 km	Representative of views from the edge of town and views for travellers on the II-111 road
4a	Debeljača Ulica Lole Ribara	3.6 km	Representative of views from the edge of town
4b	Debeljača Ulica Kis Ferenca, by church	3.7 km	View from the town centre
4c	Debeljača (edge of town)	2.5 km	Representative of views from the edge of town and views for travellers on the road out of Debeljača
5	Idvor (edge of town)	16 km	Representative of views from the edge of town and views for travellers on the II-110 road

Viewpoint Number	Location	Distance from nearest proposed turbine	Reason for selection
6	Uzdin	12.2 km	Representative of views from the edge of town and views for travellers on the II-111 road
7	Samos	11.2 km	Representative of views from the edge of town and view for travellers on the II-110 road
8	Vladimirovac	11 km	View from the town centre
9a	Banatsko Novo Selo (centre)	10 km	View from the town centre
9b	Banatsko Novo Selo (roadside E-70)	9.6 km	Representative of views from the edge of town and view for travellers on the IA-3 road
10a	Kačervo (view towards site from centre)	8.3 km	View from the town centre
10b	Kačervo edge	9.6 km	Representative of views from the edge of town
11	North of Pančevo	14.5 km	Representative of views from the scattered houses north of the town, and view for travellers on the II-111 road
12	Sefkerin	14 km	Representative of views from the edge of town, and view for travellers on the II-124 road
13	Beograd (Kalemagdan)	29.6 km	View from an important tourist and cultural heritage viewpoint

6.9 Visual Effects Overview

6.9.1 The visual effects of the Proposed Development are illustrated in a series of photomontages, with cumulative wire-line visualisations accompanying one viewpoint from each settlement affected. (Figures 6.11 to 6.49).

6.9.2 In accordance with best practice, the viewpoint photographs are taken from places where there would be clear, unobstructed views of the proposed development, except for the views from town centres, which are a typical view from the town.

6.9.3 Due to the open nature of the landscape, outside the towns and villages there are almost no features that screen views of the proposed development. The degree visual effect is therefore almost entirely a function of distance from the site.

6.9.4 Research on the effect of distance on perception of wind parks has been undertaken by various groups. Whilst there is no definitive consensus, the Scottish Planning Advice Note 45 gives good general guidance. This was based on turbines 110 m high to tip, so has been extrapolated in the table below for towers the size of those proposed for Kovačica Wind Park.

Table 6.3 Perception of wind parks

Perception	Distance from turbine (110 m high)	Distance from turbine (190 m high)
Likely to be a prominent feature	Up to 2 km	Up to 3 km
Relatively prominent	2-5 km	3-8 km
Only prominent in clear visibility – seen as part of the wider landscape	5-15 km	8-25 km
Only seen in very clear visibility – a minor element in the landscape	15-30 km	25 km +

6.9.5 Consideration of the proposed development in the field and consideration of the photomontages confirms these distances. In general, significant visual effects would be experienced by less sensitive receptors out to about 3km from the proposed development and from more sensitive receptors out to 8 or 10 km.

6.9.6 Within the core of the study area (out to 10 km from the site boundary) there are three main types of receptor which are potentially subject to significant visual effects: residential properties (mainly in towns and villages); road users and; agricultural workers in the fields.

6.9.7 Within this area there are also other types of receptor; industrial properties (e.g. the Sugar factory), offices, schools and commercial buildings. However all of these are less sensitive than the residential properties that surround them, so they have not been separately assessed.

6.9.8 The following table summarises the effect from the main receptors in the core of the study area.

Table 6.4 Summary of visual effects

Type of receptor	Current Situation	Visual Effect of the Kovačica Wind Park
Residential properties in towns and villages. High sensitivity		
Kovačica Padina Debeljača Crepaja Kačervo Banatsko Novo Selo Vladimirovac	Towns and villages are generally laid out on a regular grid, with one and two storey residential properties around a core of commercial and communal buildings. Occasional commercial buildings outside the centre. Generally a good cover of shade and productive trees throughout the settlements, including in public open spaces. Few clear views out from within towns and villages.	Views of the proposed development would be restricted to a small number of houses on the edges of the settlement, on the side towards the site. Sometimes (but not always) views filtered by local scrub and trees The wind turbines would be clearly visible and prominent in the view from the edges of Kovačica, Padina, Debeljača and Crepaja: a change of high magnitude giving rise to a **major adverse** effect on a small number of properties. However, from the town as a whole there would be little or no view, and thus a negligible effect. From the edges of Kačerevo, Banatsko Novo Selo and Vladimirovac, the houses that have a direct view would be subject to a change of

Type of receptor	Current Situation	Visual Effect of the Kovačica Wind Park
	Some houses on the edges of the settlement have wider views, although scrub and shrubs around the edges of villages, and productive trees around the houses tend to filter the view. No houses noticed that have been built to take advantage of a view	medium to low magnitude and thus a minor adverse effect, whilst again for the town as a whole a negligible effect. The grids of Banatsko Novo Selo and Debeljača are both oriented such that there is a view of the proposed development down the line of some streets. In Debeljača this would give rise to a minor adverse visual effect from some parts of the town and from Banatsko Novo Solo a minor to negligible effect.
Residential properties in open areas. High sensitivity		
One area immediately south of Kovačica, scattered houses north of Crepaja	In the order of 100 houses occupy an area of [former] vineyard south of Kovačica. Most houses have productive trees around them so do not have a fully open view, but they are generally not screened by other development in the way hoses in the towns and villages are. There are a small number of isolated houses north of Crepaja, with a similar degree of local screening	The wind turbines would be clearly visible and prominent in the view from the houses in the south and east of the area south of Kovačica, and from the isolated houses north of Crepaja. This would be a change of high magnitude, giving rise to a **major adverse** visual effect. For the houses in the north and west of the area of old vineyards south of Kovačica, there would be both a greater distance and more screening, primarily by trees. For these it would be a change of medium magnitude, giving rise to a **moderate adverse** visual effect.
Road users. Moderate sensitivity		
Main national through route: IA-3 (Belgrade to Timosoara via Pančevo, Banatsko Novo Solo and Vladimorovic) Local main routes: II-111 (Pančevo to Ečka, via Crepaja and Kovačica); II-110 Kovačica to Perlez via Idvor and Kovačica to Samos via Uzdin)	Between towns the roads are generally relatively straight and level with grass verges Views from the road are generally broad and open, only significantly contained whilst passing through the towns and villages. In some places scrub and young trees along the road edges intermittently interrupt the view, but even here open views predominate. In some places (for example along the II-110 between Kovačica and	The proposed development would be visible from some 18 km of the IA-3. (from slightly west of the junction with the minor road to Kačerevo to the point where it crosses the railway and starts to drop into the valley some 4 km west of Alibunar, excluding the sections of road through towns). Example viewpoint 9b (roadside east of Banatsko Novo Selo) In these views, the introduction of the proposed development would be a change of low magnitude, and thus a minor adverse visual effect. Travelling north along the II-111 road, the proposed development would become visible north of the settlement around the junction with Kacerevo, then be screened by Crepaja, becoming clearly visible and prominent as the view opens up on leaving Crepaja.

Type of receptor	Current Situation	Visual Effect of the Kovačica Wind Park
	Padina) there are broad verges with lines of trees, which filter the view of the wider countryside and tend to reinforce the normal driver focus on the road. Traffic volumes are moderate on the IA-3 and low on the local main routes	<u>Example viewpoints 11 and 3</u> Travelling south on the II-111, the proposed development would start to become evident a short distance south of Uzdin. It would become clearly noticeable from a few kilometres north of Kovačica, the screened through the town and very prominent in views from immediately south of Kovačica and past the site itself. The nearest turbine would be in the order of 500 m from the road. <u>Example viewpoint 6 (Uzdin)</u> The visual effect from the II-111 road is dependent on distance. Beyond about 5 km from the site, there would be a visual impact of low magnitude and thus a minor adverse effect. Between Kovačica and Crepaja, there would be a high magnitude of visual impact, giving rise to a **moderate to major adverse** visual effect, rising to **major adverse** around the site entrance opposite the road to Debeljača. On the II-110 road, the experience would be similar to that from the II-111 road. Travelling south-east from Idvor, the proposed development would become evident a short distance out of the town, then steadily more visible although partly screened by Kovačica and by the sugar factory. Likewise travelling south from Samos, the turbines would become evident a short distance out of the town, then steadily more visible until screened by buildings and trees a short distance north of Padina. Between Padina and Kovačica the turbines would be clearly noticeable, although views would be filtered by the line of roadside trees. <u>Example viewpoint 1b</u> This viewpoint is from alongside the II-110 between Padina and Kovačica, although south of the line of trees to show a clearer view. Again, the visual effect is dependent on distance. Beyond about 5 km from the site, there would be a visual impact of low magnitude and thus a minor adverse effect. Between Padina and Kovačica, there would be a medium to high magnitude of visual impact, giving rise to an **adverse** visual effect between **moderate** and **moderate to major**.

Type of receptor	Current Situation	Visual Effect of the Kovačica Wind Park
People in work in the open countryside (mainly agricultural workers). Moderately sensitive		
The countryside is intensively farmed and there are regularly agricultural workers in the open countryside throughout the area.	Although naturally focussed on the activity at hand, agricultural workers will normally have a clear view of the countryside around them.	As with the view from the road, the visual effect is dependent on distance. Beyond about 5 km from the site, there would be a visual impact of low magnitude and thus a minor adverse effect. Between about 2 and 5 km there would be a medium magnitude visual impact, giving rise to a **moderate** adverse visual effect. Within 2 km of the site there would be a high magnitude visual impact, giving rise to a **moderate to major** adverse visual effect, rising to **major** adverse within and immediately adjacent to the site.

6.10 Cumulative visual effects

6.10.1 The introduction of the Kovačica wind park on its own has been assessed (above) to have a significant visual effect on a small number of residential properties at the edges of Kovačica, Padina, Debeljača and Crepaja, and to some houses in open areas south of Kovačica and north of Crepaja. It has also been assessed to have a significant effect on road users between Crepaja and Kovacica and between Padina and Kovačica.

6.10.2 The following table summarises the cumulative visual effect of the introduction of the Kovacica wind park. It sets out what the effect of Kovacica would be in addition to the five potential cumulative developments (Cibuk, Plandiste, Electrawinds Alibunar, WindVision Alibunar 1 and Malibunar), assuming these are all constructed.

Table 6.5 Summary of cumulative visual effects

Type of receptor	Current Situation	Cumulative Visual Effect of the Kovačica Wind Park
Residential properties. High sensitivity		
Settlements: Kovačica Padina Debeljača Crepaja Kačervo Banatsko Novo Selo Vladimirovac Houses in open areas: Area of old vineyard south of Kovačica and isolated houses north of Crepaja	See table 6.4 for details Few clear views out from within towns and villages. Some houses on the edges of the settlement have wider views, although scrub and shrubs around the edges of villages, and productive trees around the houses tend to filter the view. No houses noticed that have been built to take advantage of a view	In addition to Kovacica wind park, there would be distant views of the Alibunar and Malibunar wind parks, and of the Cibuk wind park from the edges of Kovačica, Padina, Debeljača and Crepaja. From Kovacica and Debeljaca, the other developments would be seen distantly beyond the Kovacica wind park, so far that there would be little visual confusion. From Padina and Crepaja, they would be seen separately, extending the extent of view with wind turbines from around 60° to around 120°. However, because the other wind parks are so distant, this would be a cumulative change of low to medium magnitude: a **moderate adverse** cumulative effect to a small number of houses on the

Type of receptor	Current Situation	Cumulative Visual Effect of the Kovačica Wind Park
		edges of the settlements and those in the open areas. From the edges of Kačerevo and Banatsko Novo Selo there would be mid-range views of the Alibunar, Malibunar and Cibuk wind parks, taking up between 90° and 120° of the arc of view. The introduction of the Kovacica wind park would increase this to between 150° and 180° of the arc of view. This would be a cumulative change of medium magnitude: a **moderate to major adverse** cumulative effect to a small number of houses on the edges of the settlements. From the edges of Vladimirovac, the Alibunar and Cibuk wind parks would be seen in mid-range to close proximity. The addition of Kovacia to the view would be a negligible change. In all cases, the effect from within the settlement would be nil or negligible.
Road users. Moderate sensitivity		
Main national through route: IA-3 (Belgrade to Timosoara via Pančevo, Banatsko Novo Solo and Vladimorovic) Local main routes: II-111 (Pančevo to Ečka, via Crepaja and Kovačica); II-110 Kovačica to Perlez via Idvor and Kovačica to Samos via Uzdin)	See table 6.4 for details Traffic volumes are moderate on the IA-3 and low on the local main routes	Travellers on the IA-3 would be subject to moderate adverse visual effect from the Alibunar and Malibunar wind parks. The addition of Kovacica to these views would have a neglible cumulative effect. Travelling on the II-111 and II-110 roads, the change would be similar to that described above for residential properties on the edges of Kovačica, Padina, Debeljača and Crepaja. There would be a cumulative change of low to medium magnitude which, on road users of moderate sensitivity would be a minor to moderate adverse cumulative effect.
People in work in the open countryside (mainly agricultural workers). Moderately sensitive		
The countryside is intensively parked and there are regularly agricultural workers in the open countryside throughout the area.	Although naturally focussed on the activity at hand, agricultural workers will normally have a clear view of the countryside around them.	People working in the fields south of Padina would have views of the Alibunar wind parks in relatively close proximity to the east. The introduction of Kovačica would add turbines a similar distance to the west. This would be a medium to high magnitude of change, giving rise to a **moderate to major** adverse cumulative visual effect.

6.11 Summary

6.11.1 The landscape of the Kovačica site and its surroundings is typical of that of South Banat District: very open, horizontal and large scale, with big skies. It is composed of large strip fields with no enclosure, in a semi-regular pattern across an area of very gently undulating - almost flat - topography. The field patterns take no account of variations in the underlying topography. There are few trees and little woodland, and the main vertical elements are the pylons of the various overhead electricity lines that cross-cross the area. Settlement is almost entirely limited to within the villages and towns.

6.11.2 The landscape is well-managed and tidy, but there is little of scenic interest and few trees outside the settlements. There are long open views but no specific viewpoints and few focal points. There is no sign of recreational use of the countryside: the countryside appears to be a place of agricultural production rather than a place to be specifically looked at or enjoyed recreationally. It is a landscape of low sensitivity to the introduction of large wind turbines

6.11.3 The 38 turbines, associated tracks and infrastructure would constitute a large scale development, covering an area of over 20 km2. However, it would have a direct physical effect on a very small proportion of this landscape – the existing landscape and land uses would continue to exist between and around the turbines. It would however become a dominant feature, a key characteristic of how the landscape is perceived locally. This would inevitably be a change of high magnitude to the landscape of the site itself and the immediate vicinity, although the degree of change and thus impact perceived would fall with increasing distance from the site.

6.11.4 Considered very locally, on the scale of the site itself the development would have a moderate adverse landscape effect. Considering the landscape on the scale of communes affected (Debeljača, Kovačica, Padina and Crepaja) the proposed development would have a minor adverse effect and, considering the landscape more widely still, it would have a minor to negligible effect on the landscape of South Banat District as a whole.

6.11.5 The wind turbines would be clearly visible and prominent in the view from a small number of houses on the edges of Kovačica, Padina, Debeljača and Crepaja, and from some of the few houses in the countryside around Kovačica and Crepaja. Where there is a view, the development would give rise to a major adverse effect. However, from the towns as a whole there would be little or no view, and thus a negligible effect.

6.11.6 From the settlements further afield (Kačerevo, Banatsko Novo Selo and Vladimirovac) the turbines would similarly be visible from houses on the edges of the towns, but not prominent and thus not significant.

6.11.7 There would be a significant adverse visual effect on travellers on the sections of road that bound the site, particularly the II-111 between Kovačica and Crepaja and the II-110 road between Padina and Kovačica. From the former there would be a moderate to major adverse visual effect, rising to major adverse around the site entrance opposite the road to Debeljača. From the latter, there would be an adverse visual effect between moderate and moderate to major. With the exception of these areas, the visual effect on road users would be minor or negligible.

6.11.8 The countryside is intensively farmed and there are regularly agricultural workers in the open countryside throughout the area. Although focussed on the activity at hand, they will normally have a clear view of the countryside around them. Beyond about 5 km from the site, workers in the open would be subject to a minor adverse effect, between about 2 and 5 km a moderate adverse visual effect and within 2 km of the site a moderate to major adverse visual effect, rising to major adverse within and just around the site.

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7 Noise and Vibration

7.1 Introduction

7.1.1 This chapter assesses the potential noise and vibration impacts from of the proposed development on the local environment during both the construction and operational phases.

7.1.2 This chapter (and its associated figures and appendices) is not intended to be read as a standalone assessment and reference should be made to the Front End of this ES (Chapters 1 – 4).

7.1.3 This chapter is necessarily technical in nature so to assist the reader, a glossary of terminology relating to noise and vibration is provided within Appendix 7.1.

7.2 Legislation, Policy and Guidance

Serbian Legislative Framework

Law on protection from noise in the environment (Official Journal RS, No. 36/2009, 88/2010) & Decree on environmental noise indicators, limit values, assessment method of the noise indicators, the nuisance and the harmful effects (Official Journal of RS No. 75/2010)

7.2.1 The Law on protection from noise in the environment (Official Journal RS, No. 36/2009, 88/2010) constitutes the main legislation with respect to environmental noise in Serbia. This document references the key legislative bodies and their rolls in the control of environmental noise, as well as providing advice covering a number of different areas. The areas covered include environmental noise protection, including spatial acoustic planning, sound insulation measures, compliance, noise indicators, values and limits, acoustic zoning, noise mapping, noise action plans, noise measurement, environmental noise inspection and the resolution of complaints, amongst other matters.

7.2.2 With regards to permitted noise levels, these are defined within the by-law Decree on environmental noise indicators, limit values, assessment method of the noise indicators, the nuisance and the harmful effects (Off. Journal of RS No. 75/2010). This decree stipulates the noise levels in Table 7.1, which must not be exceeded, although a specific noise index is not referenced. Annex 2 of the decree states that the defined noise limits are applied to the all-encompassing noise generated by all noise sources at the site. However, it is not stated what the appropriate noise limit is in the case of a new development, where the prevailing noise levels already exceed the stated values.

Table 7.1: Noise Levels in Open Spaces (Limits as Defined in Serbian Legislation)

Zone	Purpose of the area	Noise Level [dB(A)]	
		Daytime and evening	Night-time
1	Recreation areas, health institution areas, cultural and historical sites, large parks	50	40
2	Tourist areas, schools, camps	50	45
3	Residential areas	55	45
4	Commercial and residential areas, children playgrounds	60	50
5	City centre, workshop area, commercial area, administrative area with apartments, zones along highway, regional roads and city streets	65	55

Zone	Purpose of the area	Noise Level [dB(A)]
6	Industrial areas, warehouse and service areas, transport terminals with no residential buildings	Noise level at the boundary of this zone shall not exceed the limit value defined for the zone it borders

Regulation on methods of measuring noise, the content and scope of the noise measurement report (Official Journal RS, No. 72/2010)

7.2.3 This is a brief document which provides advice on environmental noise measurement, with the subjects covered including the purpose of the measurement and the requirements for measurement conditions and the stipulation of results in terms of reporting.

Policy

European Bank for Reconstruction and Development

7.2.4 The European Bank for Reconstruction and Development (EBRD) publication Environmental and social policy (2008) has been a key consideration in the production of this chapter. Performance Requirement 1 (Environmental and social appraisal and management) of this policy is considered relevant. The specific objectives of Performance Requirement (PR) 1 are summarised below:

- To identify and assess environmental and social impacts and issues, both adverse and beneficial, associated with the project.
- To adopt measures to avoid, or where avoidance is not possible, minimize, mitigate, or offset/compensate for adverse impacts on workers, affected communities, and the environment.
- To identify and, where feasible, adopt opportunities to improve environmental and social performance.

7.2.5 In the supporting text to PR 1 it is stated that:

> *"The appraisal should also identify applicable laws and regulations of the jurisdictions in which the project operates that pertain to environmental and social matters, including those laws implementing host country obligations under international law 2 (for example commitments related to land use planning and protected area management)."*

7.2.6 It is therefore appropriate and clear that there is a requirement for the proposed development to comply with Serbian legislative requirements (which are detailed above).

7.2.7 In addition to this, the EBRD promotes compliance with international best practice, which is referenced within PR 3: Pollution prevention and abetment, the supporting text for which states:

> *"5. Subject to paragraph 6 below, projects will be designed to comply with relevant EU environmental requirements as well as with applicable national law, and will be operated in accordance with these laws and requirements.*
>
> *6. It is acknowledged that EU environmental requirements for the pollution prevention and abatement measures are based on the best available techniques, without prescribing the use of any technique or specific technology, but taking into consideration the technical characteristics of the installation concerned, its geographical location and local environmental conditions so as to ensure a high level of protection for the environment as a whole. ESAP provisions to achieve compliance with these requirements should take into account any nationally agreed time frame to bring about compliance with EU legislation (for example, in EU candidate countries). For projects in countries other than EU members, candidate and potential candidate countries, the time frame set in the ESAP for achieving compliance with EU environmental requirements should be consistent with any bilateral agreements or action plans agreed between the EU and the relevant country, but may take into account the cost of application and the local conditions that prevail.*
>
> *7. Where EU environmental requirements do not exist, the client will apply other good international practice such as the World Bank Group Environmental Health and Safety Guidelines. In such cases the Bank will agree the applicable requirements with the client on a*

project by project basis.

8. When host country regulations differ from the levels and measures presented in EU environmental requirements or requirements agreed pursuant to paragraph 7, projects will be expected to meet whichever is more stringent.

9. For each project, the Bank will identify and agree with the client the relevant applicable environmental requirements and guidelines."

International Finance Corporation (IFC) (World Bank Group)

7.2.8 Section 1.7 of the IFC Environmental, health and safety (EHS) guidelines, General EHS guidelines is pertinent to noise and addresses the impacts of noise beyond the property boundary of the facilities. It is stated that noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most sensitive point of reception.

7.2.9 Potential sensitive receptors are stated to include permanent or seasonal residences, hotels, motels, schools, 'daycares', hospitals and nursing homes, 'place of worship' and parks and campgrounds.

7.2.10 Advice is provided on noise mitigation measures and the following noise level guidelines are stated:

Table 7.2: Noise Level Guidelines (as Stipulated by the IFC)

	One Hour L_{Aeq}, (dB(A)[1]	
	Daytime 07:00 to 22:00	**Night-time 22:00 to 07:00**
Residential, institutional, educational[2]	55	45
Industrial, commercial	70	70

[1] Guideline values are for noise levels measured outdoors. Source: Guidelines for community noise, World Health Organisation (WHO), 1999.

[2] For acceptable indoor noise levels for residential, institutional and educational settings refer to WHO (1999)

7.2.11 It is advised that the criteria stipulated in the above table should not be exceeded, "or result in a maximum increase in background levels of 3dB at the nearest receptor location off-site".

7.2.12 This document goes on to provide guidance on noise monitoring for the purposes of establishing existing conditions in the area, or for verifying operational phase noise levels. The following is stated in this regard:

"Noise monitoring programs should be designed and conducted by trained specialists. Typical monitoring periods should be sufficient for statistical analysis and may last 48 hours with the use of noise monitors that should be capable of logging data continuously over this time period, or hourly, or more frequently (or else cover differing time periods within several days, including weekday and weekend workdays). The type of acoustic indices recorded depends on the type of noise being monitored, as established by a noise expert. Monitors should be located approximately 1.5m above the ground and no closer than 3m to any reflecting surface (e.g. wall). In general the noise level limit is represented by the background or ambient noise levels that would be present in the absence of the facility or noise source(s) under investigation."

7.2.13 Section 1.1 of the IFC Environmental, health and safety guidelines for Wind Energy includes a sub-section on noise. This is duplicated below:

"Noise

Wind turbines produce noise when operating. The noise is generated primarily from mechanical and aerodynamic sources. Mechanical noise may be generated by machinery in the nacelle. Aerodynamic noise emanates from the movements of air around the turbine blades and tower.

The types of aerodynamic noise may include low frequency, impulsive low frequency, tonal and continuous broadband. In addition, the amount of noise may rise with increasing rotation speed of the turbine blade, therefore turbine designs which allow lower rotational speeds in higher winds will limit the amount of noise generated.

Measures to prevent and control noise are mainly related to the engineering design standards. For example, broad band noise is generated by air turbulence behind the blades and increases with increasing blade rotational speed. This noise may be controlled through the use of variable speed turbines or pitched blades to lower the rotational speed.

Additional recommended noise management measures include:

- *Proper sitting of wind farms to avoid locations in close proximity to sensitive noise receptors (e.g. residences, hospitals and schools);*
- *Adherence to national or international acoustic design standards for wind turbines (e.g. international Energy Agency, International Electrotechnical Commission (IEC), and the American National Standards Institute."*

Guidance

Guidelines on the environmental impact assessment for wind farms (Belgrade June 2010)

7.2.14 The document was prepared by United Nations Development Programme (UNDP) Serbia, on behalf of the Ministry of Environment and Spatial Planning of the Republic of Serbia. It should be noted that wind farm development in Serbia is in its infancy, and this document was the first prepared for Local Authorities and other interested parties to assist with the EIA process. Compliance with this document does not constitute a legislative requirement, but it does still provide some useful background and context for wind farm noise assessment.

7.2.15 The noise section of this document (Section 4.5) includes a description of the nature of wind farm noise. It is acknowledged that wind farm noise constitutes a combination of aerodynamic noise caused by the blades passing through the air, and mechanical noise created by mechanical elements of the nacelle (generator, gearbox and other parts of the drive chain).

7.2.16 It is recognised that the noise from wind turbines generally increases with increasing wind speeds and that this is also the case for background noise levels. It is suggested that the impact of wind turbine noise is likely to be greater at low wind speeds when the difference between the noise of the wind turbine and the background noise is likely to be greater. However, at lower wind speeds the levels generated from the turbine can be lower, and at moderate speeds background noise levels can still be low, so the point of greatest potential noise impact can, in fact, be at moderate, or even high wind speeds.

7.2.17 It is recognised that noise impact should be assessed with reference to the nature and character of the noise sensitive locations and in accordance with the laws and regulations in the field. Example noise sensitive receptors are stated as being occupied dwellings, hostels, health buildings or places of worship, and may include areas of particular specific quality or specific recreational amenity importance. It is suggested that noise limits should be applied at those areas used for relaxation or activities for which a quiet environment is highly desirable.

7.2.18 Whilst noise level limits are proposed (35dB(A) at night-time and 40 dB(A) during the daytime outside public buildings and 30dB(A) night-time and 35 dB(A) daytime inside public buildings), these are based on the guidance that was contained within Rules on permitted noise levels in the environment (Official Gazette RS No. 54/92), which is now outdated and which has been replaced by the Law on Protection from noise in the environment (Official Journal RS, No. 36/2009, 88/2010) and the associated Decree on environmental noise indicators, limit values, assessment method of the noise indicators, the nuisance and the harmful effects (Off. Journal of RS No. 75/2010). These latest documents are summarised above. It is also stated that "in areas nearby wind farms where the noise level is less than allowed, a maximum increase of 5dB(A) above the existing noise is considered acceptable in ensuring protection of inhabitants in the area".

7.2.19 It is therefore of note, that whilst this guidance identifies that noise emission levels and potential noise impacts are dependent upon wind speed, including a suggestion that higher impacts will be generated at lower wind speeds (where turbine noise levels are also lower), the stipulated criteria do not reflect this.

ETSU-R-97 – The assessment and rating of noise from wind farms (UK)

7.2.20 Published in 1996, ETSU-R-76 reports the consensus view of a group of experts experienced in assessing and controlling noise from wind farms, who at the behest of the then Department of Trade and Industry (DTI) (United Kingdom), formed a 'Working Group on Noise from Wind Turbines'. The report was prepared in order to present a common approach to the assessment of noise from wind farms.

7.2.21 Subsequent to publication of this document, additional guidance on the application of the assessment methods which it prescribes has been published. These later documents are summarised below. ETSU-R-97 and the guidance contained within the subsequent publications constitute the current best practice for the assessment of wind farm noise within the United Kingdom (England, Wales, Scotland and Northern Ireland) and also the Republic of Ireland.

7.2.22 The fundamental approach of ETSU-R-97 is the determination of appropriate allowable noise level limits with which a wind turbine development should comply. ETSU-R-97 states that the noise limits devised *"offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding to the costs and administrative burdens on wind farm developers or local authorities".*

7.2.23 The document presents two approaches for limiting wind turbine noise:

- For single wind turbines, or for wind farms with large separation distances to the nearest receptors, if it can be shown that the noise from the turbines will not exceed 35 dB LA90,10min for 10 m height wind speeds of up to 10 ms-1 then the amenity of the neighbours affected may be considered to be sufficiently protected, and further assessment is unnecessary.
- Where the provisions for the above approach do not apply, or are not met, a full assessment including determination of representative background noise levels and associated limiting values for wind farm noise is required.

7.2.24 The ETSU-R-97 assessment method highlights the relationship between wind and outdoor ambient noise; as wind speed increases, the outdoor ambient noise level usually rises, due to air turbulence around obstacles, ground topography and vegetation, and the excitement of foliage. It follows that in most cases there will be a relationship of proportionality between wind speed and ambient noise. Levels of noise generated by wind turbines also generally increase with increasing wind speed. This situation provides a mechanism for 'masking' wind turbine noise by the ambient noise. The ETSU-R-97 assessment method accounts for this by forming a link between the background noise levels encountered over the range of wind speeds relevant to the wind turbine operation, and the limits to permissible levels of turbine noise.

7.2.25 These noise level limits are related to the prevailing background noise levels, but also incorporate absolute lower limits, the omission of which could otherwise be unduly restrictive on development in particularly quiet areas. The guidance is that it is unnecessary to restrict wind turbine noise below certain fixed limits in order to provide a reasonable degree of protection. ETSU-R-97 requires the noise level limits to be applied to external areas used for relaxation or where a quiet noise environment is highly desirable. It is required that the noise limits be determined for wind speeds up to 12 ms-1.

7.2.26 Separate limits are required for night-time and daytime hours, with the latter based on the background noise levels determined for 'quiet daytime' periods:

- The night-time period is defined as 2300 – 0700 hrs on any day.
- Quiet daytime periods are defined as 1800 – 2300 hrs on all days, as well as 1300 – 1800 hrs on Saturdays and Sundays, and 0700 – 1300 hrs on Sundays.

  [NB. These periods are referred to as 'night-time hours' and 'amenity hours' respectively within the IOA GPG document discussed below.]

7.2.27 The 'prevailing background noise levels' from which the noise limits are derived should be determined from measurements of LA90,10min for both quiet daytime and night-time periods. The prevailing background noise levels are determined by correlating the LA90,10min noise measurements taken over a period of time with the average wind speeds measured over the same 10minute period, with wind speed measured or determined for 10m height at the location of the proposed turbines. A line of best fit, representing the prevailing background noise levels, is then established for the correlated data. The noise limit is then also defined in terms of the LA90,10min, and set at 5 dB above the background noise level at each wind speed (as defined by the line of best fit) or a fixed lower noise level limit, whichever is the higher, subject to the absolute lower limiting values discussed below.

7.2.28 For the daytime period, the absolute lower limiting values are set at a level between 35 and 40 dB LA90,10min. The selection of an appropriate limit within this range depends on consideration of the following factors:

- the number of dwellings in the neighbourhood of the wind farm;
- the effect of noise limits on the number of kWh generated; and
- the duration and level of exposure.

7.2.29 For the night-time, the absolute lower limiting value is 43dB LA90,10min. The night-time lower limit value is set higher than that for the daytime because the derivation is based on the prevention of sleep disturbance inside a building; the daytime values are based on occupation of external spaces used for relaxation.

7.2.30 Where a property has a financial involvement in the development, ETSU-R-97 recommends a relaxation of the derived noise limits, stating that, "it is widely accepted that the level of disturbance or annoyance caused by a noise source is not only dependent upon the level and character of noise but also the receiver's attitude towards the noise source in general. If the residents at the noise-sensitive properties were financially involved in the project then higher noise limits will be appropriate". The guidance goes on to state that it is recommended that "both the day and night-time lower fixed limits can be increased to 45 dB(A) and that consideration should be given to increasing the permissible margin above background where the occupier of the property has some financial involvement in the wind farm".

7.2.31 The ETSU-R-97 guidance states that the derived limits apply to noise from the proposed wind farm or turbines in terms of the LA90,T index, and that the LA90,T of wind farm noise is typically 1.5 to 2.5 dB less that the LAeq,T measured over the same period.

7.2.32 The derived noise limits are applicable to both the aerodynamic (e.g. 'blade swish') and mechanical (e.g. generator-related) components of the wind farm noise. However, due to advancements in technology, for most modern designs of wind turbine the mechanical noise is insignificant relative to the aerodynamic noise (European Wind Energy Association, 2006).

7.2.33 Where noise from the wind farm is determined as tonal, ETSU-R-97 requires a sliding penalty correction of 2 – 5 dB to be applied to the wind farm noise. Guidance is provided on how to determine tonality and the level of correction required, but typically, for proposed developments, the need for any applicable correction is confirmed by the turbine manufacturers.

7.2.34 It is stated within ETSU-R-97 that

> *"the Noise Working Group is of the opinion that absolute noise limits and margin above background should relate to the cumulative effect of all wind turbines in the area which contribute to the noise received at the properties in question. It is clearly unreasonable to suggest that, because a wind farm was constructed in the vicinity in the past which resulted in increased noise levels at some properties, that residents of those properties are now able to tolerate still higher noise levels. The existing wind farm should not be considered as part of the prevailing background noise".*

7.2.35 Accordingly, where an existing wind farm contributes to the prevailing background noise levels, it is necessary to either include for the contribution of the wind farm when comparing against the allowable noise limit or correct for this contribution when deriving a limit applicable to the Proposed Development acting alone.

Institute of Acoustics - A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise (IoA GPG) (UK)

7.2.36 Published in May 2013, the IOA GPG presents the report of a 'noise working group' (NWG) assembled in response to a request from the Department of Energy & Climate Change (DECC). The guide is intended to represent current good practice in applying the ETSU-R-97 method to assessing the noise impact of wind turbine developments with a power rating of over 50 kW.

7.2.37 In addition to a discussion of the various factors, considerations and current 'state of the art' knowledge of UK wind turbine noise issues taken into account by the NWG in preparing the guidance, the IOA GPG provides 'summary boxes' (SBs) highlighting key guidance points.

7.2.38 The SBs provide clarification and updated guidance on a range of matters relating to ETSU-R-97 noise assessments, including consultation with relevant stakeholders, background noise survey methodology, noise survey data analysis, derivation of noise limits, noise prediction model input data, algorithms and parameters, cumulative impact assessment procedures, assessment reporting, planning conditions and amplitude modulation. A set of supplementary guidance notes are also referenced within the IoA GPG. These supplementary guidance notes have recently been issued in draft, for consultation.

IOA Acoustics Bulletin Volume 34 No. 2

7.2.39 In 2007, the DTI set up a NWG to settle a number of disputes about the factors that should be taken into account when assessing wind farm noise. The recommendations of this working group were published in an article in the March/April 2009 edition of the IOA 'Acoustics Bulletin' journal (Bowdler et al, 2009) and have largely been incorporated into the IOA GPG document summarised above.

7.2.40 The article summarised the results of research studies into ground-borne vibration, infrasound and low-frequency noise. Based on the results discussed, the authors concluded that *"there is no robust evidence that low-frequency noise (including infrasound) or ground-borne vibration from wind farms generally has adverse effects on wind farm neighbours".*

BS 5228-1: 2009 – Noise and vibration control on construction and open sites, Part 1 - Noise

7.2.41 This document provides guidance on appropriate methods for minimising noise from construction activities.

7.2.42 Techniques for predicting the likely noise effects from construction works are given; these are based on detailed information on the type and number of plant items being used, their location and the length of time they are in operation. The noise prediction method is used to establish likely noise levels in terms of the LAeq,T over the core working day. A database of information is also provided, including measured noise data for a variety of different construction plant undertaking various common activities, which can be used to estimate levels of noise generated by typical construction works.

7.2.43 Three methods are presented for the assessment of the significance of noise effects. In summary, the assessment could adopt either a series of fixed noise limits, be concerned with ambient noise level changes as a result of the construction operations, or consider a combination of these approaches.

7.2.44 With respect to absolute fixed noise limits, BS 5228:2009 discusses those included within the Department of the Environment Advisory Leaflet 72: Noise control on building sites (1976). These limits are presented according to the nature of the surrounding environment, for a 12 hour working day. The presented limits are:

- 70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise; and
- 75 dB(A) in urban areas near main roads and heavy industrial areas.

7.2.45 The Standard goes on to provide methods for determining the significance of construction noise levels considering the change in the ambient noise level with the construction noise. Two example assessment methods are presented. These are the ABC method (as summarised in Table 7.3) and the 5 dB(A) change method (described further below).

Table 7.3: Example Threshold of Significant Effect at Dwellings – ABC Method (BS 5228-1: 2009)

Assessment Category and Threshold Value Period	Threshold Values, in decibels (dB)		
	Category (A)[A]	Category (B)[B]	Category (C)[C]
Night-time (2300 – 0700)	45	50	55
Evenings and Weekends[D]	55	60	65
Daytime (0700 – 1900) and Saturdays (0700 – 1300)	65	70	75

NOTE 1: A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2: If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3dB due to construction activity.

NOTE 3: Applies to residential receptors only.

[A)] Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

[B)] Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Category A values.

[C)] Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Category A values.

[D)] 1900 – 2300 weekdays, 1300 – 2300 Saturdays and 0700 – 2300 Sundays.

7.2.46 With respect to the 5 dB(A) change method, the guidance states,

> *"Noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB LAeq from construction noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant impact."*

BS 5228-2: 2009 – Noise and vibration control on construction and open sites, Part 2 - Vibration

7.2.47 BS 5228-2 (British Standards Institution, 2009) provides recommendations for basic methods of vibration control relating to construction and open sites. The legislative background is described and guidance is provided on methods of measuring vibration and assessing its effects on the environment.

7.2.48 Guidance criteria are suggested for the assessment of both human and building response to vibration. The criteria are stated in terms of Peak Particle Velocity (PPV); those concerned with human response to vibration are shown in Table 7.4.

Table 7.4: Guidance Criteria for the Assessment of Vibration (BS 5228-2:2009)

Vibration PPV (mms^{-1})	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments.
1.0	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

7.2.49 The BS 5228-2 criteria applicable to the vibration response of buildings are presented in Table 7.5. It should be noted that the values in Table 7.5 are applicable to cosmetic damage only. It is stated within BS 5228-2:2009 that minor damage is possible at vibration magnitudes greater than twice those given in the table.

Table 7.5: Guidance Criteria for the Assessment of Vibration (BS 5228-2:2009)

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures	50 mms^{-1} at 4 Hz and above	50 mms^{-1} at 4 Hz and above
Industrial and heavy commercial Unreinforced or light framed structures	15 mms^{-1} at 4 Hz increasing to 20 mms^{-1} at 15 Hz	20 mms^{-1} at 15 Hz increasing to 50 mms^{-1} at 40 Hz and above
NOTE 1: Values referred to are at the base on the building. NOTE 2: At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.		

7.3 Assessment Methodology and Significance Criteria

Scope of the Assessment

7.3.1 This chapter considers the following potential noise and vibration impacts on the environment as a result of the development proposals:

- Construction noise (including construction traffic noise) on existing local noise sensitive receptors;
- Construction vibration on existing local noise sensitive receptors; and
- Operational phase turbine noise on existing local noise sensitive receptors.

7.3.2 The proposed development is not considered to be noise sensitive in nature, and impacts on the scheme have therefore not been considered. In addition, the following potential impacts have been scoped out of the assessment:

- Operational phase development generated road traffic noise. It is anticipate that road traffic movements associated with the operation of the proposed development would constitute occasional service and maintenance visits and would be sufficiently low that an assessment is not warranted.
- Operational phase fixed plant (i.e. non turbine) noise. It is anticipated that there will be sufficient flexibility in the scheme design to ensure that any control or sub-station with associated fixed plant can be located remote from existing noise-sensitive receptors.
- Turbine generated low frequency noise, infrasound and groundborne vibration. The IoA Acoustics Bulletin article (Volume 34 No. 2) concluded that "there is no robust evidence that low-frequency noise (including infrasound) or ground-borne vibration from wind farms generally has adverse effects on wind farm neighbours".
- Turbine generated amplitude modulation (AM). The proposed turbines are located at distance from existing noise sensitive receptors, which limits the potential for noise impacts associated with AM. In addition, it should be noted that this area is subject to on-going research and there is currently no well recognised method for the prediction and assessment of such impacts.

Extent of the Study Area

7.3.3 The study area has been defined by the closest noise sensitive receptors to the site, and drawing on the proposed construction traffic access route for the development. Consideration has also been given to the presence of other proposed wind farm developments across the local area. Further detail is presented below.

Method of Baseline Data Collation

Desk Study

7.3.4 Initially, a desk based assessment was undertaken to determine the presence of noise sensitive receptors and key environmental noise sources in the vicinity of the site. The following data sources were reviewed.

- 1:25k mapping for the site and surrounding area (Izdaje I stampa Vojnogeografski Institute Beograd, Borj lista 380-3-4);
- 1:50k mapping for the site and surrounding area; and
- freely available aerial photography for the site and surrounding area, including that available through Google Earth®.

Noise Sensitive Receptors

7.3.5 The desk review identified a series of potential noise sensitive receptors, which were then checked on-site, to confirm their nature (i.e. whether residential dwellings, barns, agricultural buildings etc), and a confirm list of noise sensitive receptors was finalised.

7.3.6 A summary of the closest identified receptors (dwellings) to the proposed development is presented in Table 7.6. Also presented are the approximate grid co-ordinates for each receptor, the distance to the closest turbine and the corresponding turbine reference number.

7.3.7 The receptors detailed within Table 7.6 below constitute a sample of the closest identified receptors within the vicinity of the proposed development. The closest noise sensitive receptors to the proposed development are located to the south-west, west, north-west and north-east of the site boundary. These receptor locations can also be seen on Figure 7.1

7.3.8 The sample receptor locations as detailed in the following table were confirmed by site walk-over in advance of the commencement of the baseline noise survey. The site walk-over was undertaken by representatives of Zaštita Beograd (who undertook the baseline noise survey) and representatives of ElectraWinds who already had significant familiarity with the site and its environs. It was confirmed that the receptors detailed in the following table constituted a representative sample of the closest noise sensitive receptors to the proposed development.

7.3.9 None of these receptors have a financial involvement in the proposed development

Table 7.6 Summary of Noise Sensitive Receptors in the Vicinity of the Site

Receptor Ref.	Receptor Co-ordinates (Universal Transverse Mercator (UTM))		Closest Turbine Ref.	Distance to Closest Turbine
	X	Y		
1	472188	4985273	T2	3200m
2	471622	4985428	T2	3250m
3	472116	4987038	T2	1600m
4	469528	4990065	T33	2700m
5	470005	4990864	T33	2600m
6	471499	4992453	T36	2650m
7	471615	4992972	T36	2880m
8	471456	4993141	T36	3110m
9	471384	4993740	T36	3600m
10	471145	4994160	T36	4085m
11	471061	4994276	T36	4220m
12	471093	4994419	T36	4350m
13	471535	4994907	T36	4520m
14	471810	4994950	T36	4440m
15	477500	4995923	T70	1550m
16	477748	4995921	T70	1670m
17	477872	4995400	T70	1370m
18	477903	4995183	T70	1270m
19	477982	4995092	T70	1300m

7.3.10 Whilst the desk review identified various buildings across the site, as shown on aerial photography, these have been confirmed to be illegal farmers dwellings, barns or derelict buildings. An additional building within the north-eastern portion of the site was identified to be an existing distillery. However, this facility is not subject to legal residency. Accordingly the receptors detailed in Table 7.6 have been adopted for this assessment. These are considered to be of 'high' sensitivity.

Key Local Noise Sources

7.3.11 Local noise sources can be split into two categories, those which occur naturally, and those which are generated by human activity.

7.3.12 Local sources generated by human activity include road traffic, industrial noise, rail noise and sporadic noise associated with farm workings.

7.3.13 The key road traffic route in the vicinity of the site is the II-111. This route is located adjacent to the western site boundary and links Crepaja in the south with Kovacica in the north. To the north of the site is the road that connects Kovavica in the west with Padina in the east. These routes are both well-established main connection routes, and are subject to reasonable, but not very high traffic flows. Other roads in the vicinity of the site can reasonably be described as minor rural roads.

7.3.14 Beyond the western site boundary (approximately 2.5km west of T36) is an industrial sugar factory with unknown operating hours. Further to the west is a train line which links Crepaja in the south with Kovacica in the north passing through Debaeljaca. This railway is approximately 2.3km west of T33.

7.3.15 Natural noise sources in the vicinity of the site include bird song, noise from animals, the wind rustling through trees and vegetation, noise from rainfall, noise from animals and noise from watercourses. Background noise levels in the vicinity of the site will vary depending on the wind speed as an increased in wind speed gives rise to higher noise levels generated by vegetation etc.

Cumulative Developments

7.3.16 The desk study was also used to establish base information on other proposed wind farm developments across the local area. The following proposed wind farm developments were identified (distances are stated between the closest proposed turbine of each scheme, unless otherwise advised):

- The Alibunar 1 wind farm, approximately 8km east.
- The Alibunar 2 wind farm, approximately 5.5km east.
- The Dolovo wind farm, approximately 18km to the south-east (distance to approximate site location).
- The Cibuk wind farm, approximately 18.5km to the south-east (distance to approximate site boundary).
- The Kosava wind farm, approximately 29km to the south-east (distance to approximate site boundary).
- The Pladniste wind farm, approximately 25km to the north-east (distance to approximate site boundary).
- The Alibunar (ElectraWinds) wind farm, approximately 11.5km to the east.
- The Malibunbar wind farm, approximately 15km to the east.

7.3.17 All of the above developments are located at significant distances from the proposed development. Of the identified developments, Dolovo, Cibuk, Kosava, Pladniste, Alibunar (ElectraWinds), and Malibunar have been discounted due to distance alone and have not been considered further in terms of potential cumulative noise impacts.

7.3.18 With regards to Alibunar 2, it has been advised that this scheme is in the early stages of development

and is not subject to an operation permit. In addition, there is insufficient information in the public domain to facility an assessment. Accordingly, it is appropriate that potential cumulative noise impacts are addressed within the noise assessment work undertaken as part of that development, accounting for the status of the proposed Kovacica wind farm at that point.

7.3.19 In contrast, there is more certainty over the proposed Alibunar 1 development, which is at a later stage of development and for which there is information in the public domain. However, the Alibunar 1 wind farm remains well removed from the proposed development. Notwithstanding this, it has been given further consideration below.

7.3.20 To allow a greater understanding of the proposed Alibunar 1 development, the following information source was reviewed:

- The WindVision website for the proposed Alibunar Wind Farm developments (http://www.windvision.com/english/projects-in-serbia).

7.3.21 The above website confirms that the Alibunar 1 development comprises 33 turbines, each with a 3MW rating, giving rise to a total capacity of 99MW. The site location is also presented.

7.3.22 The location of the Alibunar 1 development is such that it is well removed, and to the east of the proposed Kovacia wind farm. The closest receptor to the east of the Kovacica wind farm, and therefore in the direction of the Alibnar 1 wind farm, is receptor reference 19 (see Table 7.6), which is at a distance of 1.3km from the closest Kovacia wind farm turbine. In contrast this receptor is located approximately 10km from the closest proposed Alibunar 1 turbines. This separation distance, in comparison to the proximity to the Kovacica wind farm, is such that no significant cumulative noise impacts are anticipated to arise from the Kovacica and Alibunar 1 developments operating simultaneously.

7.3.23 It should be noted that the IoA GPG states that:

> *"During scoping of a new wind farm development consideration should be given to cumulative noise impacts from any other wind farms in the locality. If the proposed wind farm produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary.*
>
> *Equally, in such cases where noise from the proposed wind farm is predicted to be 10 dB greater than that from the existing wind farm (but compliant with ETSU-R-97 in its own right), then a cumulative noise impact assessment would not be necessary"*

7.3.24 The separation distances and locality of Receptor 19 are such that it is anticipated that noise levels generated by the proposed Kovacica wind farm would be at least 10dB greater than those generated by the Alibunar 1 development (at Receptor 19). Accordingly, the Alibunar 1 wind farm development warrants no further consideration.

7.3.25 Drawing on the results of the above review work, no further consideration of potential cumulative noise impacts is considered warranted.

Site Visit / Other Assessment

7.3.26 As detailed above, the list of the closest noise sensitive receptors (as detailed in Table 7.6) to the proposed development was finalised drawing upon the results of a site visit. The site visit was undertaken by representatives of Zaštita Beograd (who undertook the baseline noise survey) and representatives of ElectraWinds who already had significant familiarity with the site and its environs.

Assessment Methodology

Construction Noise

7.3.27 Construction noise assessment criteria have been derived drawing upon the guidance contained within BS5228-1 2009. The three assessment methods detailed within BS5228 have been reviewed and the lowest criteria applicable to the core working daytime have been determined. Further detail is presented within the Significance Criteria section.

7.3.28 A qualitative assessment of construction noise has then been undertaken drawing upon likely key construction operations, construction areas, and proximity to identified local noise sensitive receptors. The assessment has been further supported with the completion of a series of sample construction noise level calculations, undertaken for typical working operations associated with wind farm development.

7.3.29 The impact magnitude and resulting significance of effect have been determined following the approach described in the Significance Criteria section below.

7.3.30 Qualitative comment has been included regarding potential construction traffic noise impacts. This assessment has drawn upon available baseline traffic movement data for the proposed construction traffic access route, and construction traffic flow numbers prepared for the proposed development.

Construction Vibration

7.3.31 The assessment of groundborne vibration associated with typical construction activities has been undertaken drawing upon the guidance in BS 5228 2: 2009.

7.3.32 Predictions have been conducted in order to determine the likely levels of vibration produced by typical construction activities at varying distances. Predictions have employed the empirical methods detailed in BS 5228-2: 2009, in the Transport and Road Research Laboratory Research Report 246: Traffic induced vibrations in buildings (TRRL RR 246: 1990), and within the Transport Research Laboratory Report 429 (2000): Groundborne vibration caused by mechanical construction works. The distances at which different degrees of impact arise have been determined for a sample of working operations.

7.3.33 Potential impacts at noise sensitive receptors have been determined by comparing the receptor set-back distances from the closest construction working operations to the set-back distances determined for different degrees of vibration impact.

7.3.34 The impact magnitude and resulting significance of effect have been determined following the approach described in the Significance Criteria section below.

Operational Turbine Noise

7.3.35 The following assessment methodology has been adopted

- A baseline noise survey has been undertaken to establish the prevailing background and ambient noise levels at a sample of locations considered representative of the closest noise sensitive receptors to the proposed development. Measurements have been undertaken under a range of different wind speed conditions and during daytime, evening and night-time periods.
- Separate noise level criteria have been determined for daytime, evening and night-time periods, drawing upon the guidance presented within Serbian Legislation, IFC guidance and ETSU-R97.
- A detailed noise model has been prepared for the proposed development, covering the site and the surrounding area.
- Noise level predictions have been undertaken based on manufacturer's warranted noise emission data for the candidate turbine for this development.
- The scheme noise model has been used to predict the operational noise levels that would be generated at a sample of the closest noise sensitive receptors to the development, over a range of operational wind speeds, up to 12m/s (at 10m height).
- The predicted operational noise levels have been compared against the adopted noise level

criteria, in graphic form.

- Daytime, evening and night-time assessment graphs have been prepared for each measurement location used during the baseline noise survey. The graphs have been prepared to also include the measured background noise levels for each period.
- The impact magnitude and resulting significance of effect have been determined following the approach described in the Significance Criteria section below.

Assessment Modelling

Adopted Modelling approach

7.3.36 In order to determine the noise levels that would be generated by the proposed wind turbines, a detailed three-dimensional noise prediction model has been prepared for the site and the surrounding area. The prediction model uses the calculation algorithms from ISO 9613-2: 1996, as implemented in CadnaA® v4.3 software.

7.3.37 The IOA GPG confirms that the ISO 9613-2 calculation standard can be used to make realistic predictions of noise from onshore wind turbines during worst-case propagation conditions (i.e. including the long-distance effects of downwind conditions and temperature inversions). A number of the parameters / settings that are required as input for the ISO 9613-2 calculations are specified in the IOA GPG to ensure that accurate worst-case predictions are achieved. These parameters and settings have been complied with and include the following:

- The local topography was not incorporated into the model so that no attention due to screening was included. (The IOA GPG states that such screening affects should be limited to 2dB at most, unless there is significant screening from a landform barrier, in which case an increase in the degree of attenuation, up to -10dB, may be appropriate and would require full justification).
- The noise model was configured such that air absorption was accounted for, assuming a typical temperature of 10°C and humidity of 70%.
- All receptor heights were set to 4m above local ground.
- Ground absorption was set to 0.5.
- The resulting turbine noise levels in terms of the LA90,T noise index were calculated by subtracting 2dB from the predicted LAeq,T noise levels.

7.3.38 The ISO 9613-2 model allows sound pressure levels to be predicted for either short-term downwind conditions or long-term averages based on the prevailing winds. It should be noted that only downwind propagation is considered in this assessment (i.e. wind blowing from each proposed turbine in all directions towards every receptor) to represent a worst case.

Wind Turbine Noise Emission Data

7.3.39 To inform the noise level predictions, it is necessary to adopt noise emission data for the turbines proposed as part of the development. Presented below is the warranted noise emission data that has been adopted for each development within the completed noise level predictions.

Candidate Wind Turbine Noise Emission Data

7.3.40 The candidate turbine for the proposed development is the GE 2.5–120 with a hub height of 110m. This turbine has a blade length of 58.7m, and therefore an overall tip height of approximately 169m, which falls within the turbine envelope for the project.

7.3.41 Sound Power Level Data for this turbine has been taken from the GE Technical Document entitled: Wind turbine generator systems 2.5-120 - 50Hz and 60Hz, Product acoustic specifications, Normal operation according to IEC Incl. Octave band spectra Incl. 1/3rd octave band spectra (document reference number: 2.5-120_xxHz_SCD_allComp_NO_ IECxxxxxx.ENxxx.01). This document is not dated, but is copyrighted in 2012. A copy of the report can be seen in Appendix 7.2.

7.3.42 This document states that it presents turbine sound power level data which have been determined in accordance with IEC 61400-11 Ed 2.1: 2006. Apparent sound power level data are presented for the turbine for hub heights of 110m and 139m. The reported data for a hub height of 110m are duplicated in Table 7.7 below, but with the addition of a +2dB correction for uncertainty. The report references the addition of this uncertainty for a confidence interval of 95%.

7.3.43 The presented data includes octave band spectra which have also been included within Table 7.7. The data is pertinent to the turbine operating in 'normal operation', i.e. not operating within a management mode where less noise is generated with an associated loss of energy generation.

Table 7.7: Sound Power Level Data for the GE 2.5-120 Turbine with 110m Hub Including Uncertainty Correction, 'Normal Operation', Including Octave Band Spectra, LWA, dB

Standardized wind speed at 10m (m/s)	Frequency (Hz)										Sound Power Level (L_{WA}) (dB)
	32	63	125	250	500	1k	2k	4k	8k	16k	
3	70.7	79.6	84.0	87.5	91.3	91.8	88.5	80.3	62.1	15.1	96.6
4	74.0	83.0	87.4	91.0	95.4	95.1	91.6	84.3	64.4	20.7	100.2
5	78.9	88.1	92.6	95.9	100.7	101.1	96.7	89.8	70.9	27.1	105.7
6	80.9	90.2	95.1	99.2	103.5	103.0	98.0	91.3	73.3	30.0	108.0
7	81.0	90.5	95.7	98.8	102.3	103.5	99.7	92.7	73.9	31.0	108.0
8	81.0	90.4	95.4	98.2	101.7	103.5	100.9	93.6	74.5	30.4	108.0
9	80.9	90.3	95.4	97.9	101.1	103.5	101.6	93.9	73.8	29.3	108.0
10-Cutout	80.8	90.2	95.2	97.6	100.9	103.7	101.7	94.0	73.9	30.0	108.0
All data taken from GE 2.5 – 120 – 50Hz and 60Hz Technical Documentation and includes a +2dB uncertainty correction (Document reference no. 2.5-120_xxHz_SCD_allComp_NO_IECxxxxxx.ENxxx.01)											

7.3.44 The above data have been used within the completed noise level predictions.

Significance Criteria

Significance of Effect

7.3.45 The significance of effect has been categorised on the following scale:

- Major effect: where the Proposed Development could be expected to have a very significant impact (either positive or negative) on the identified noise and vibration sensitive receptors;
- Moderate effect: where the Proposed Development could be expected to have a noticeable impact (either positive or negative) on the identified noise and vibration sensitive receptors;
- Minor effect: where the Proposed Development could be expected to result in a small, barely noticeable impact (either positive or negative) on the identified noise and vibration sensitive receptors; and
- Negligible effect: where no discernible impact is expected as a result of the Proposed Development on the identified noise and vibration sensitive receptors.

7.3.46 The significance of effect has been determined drawing upon both the sensitivity of the receptor and the impact magnitude, according to the following impact matric.

Table 7.8: Impact Significance Matrix

Impact Magnitude	Receptor Significance		
	High	Medium	Low
High	Major	Moderate	Minor
Medium	Moderate	Minor	Negligible
Low	Minor	Negligible	Negligible
Slight	Negligible	Negligible	Negligible

7.3.47 It can be seen from Table 7.8 that receptor sensitivity and impact magnitude are determined on a scale of Slight, Low, Medium and High. The methods for determining these grades are detailed below.

Sensitivity of Receptor

7.3.48 In the case of this development, the closest receptors to the proposed development are residential dwellings, which are considered to be of High sensitivity.

Impact Magnitude - Construction Noise

7.3.49 Construction noise has been assessed based on noise level criteria determined following a worst case interpretation of the guidance contained within BS 5228 1: 2009. As detailed above, this Standard details three example methods for determining the significance of potential construction noise impacts. With regards to the presented absolute noise level criteria (example method 1), following a worst case approach, the lowest absolute noise level criteria for the daytime period (07:00 to 19:00) is 70dB LAeq,T façade, (equivalent to 67dB(A) free-field), which is stated to apply in rural areas.

7.3.50 Following the ABC assessment method (example method 2), the most stringent assessment criteria (Category A), applies during the daytime (07:00 to 19:00 weekdays and 07:00 to 13:00 Saturdays) where the measured prevailing ambient noise levels are up to 62.4dB LAeq,T. Where Category A applies, the allowable noise levels arising from the combined effect of both the prevailing ambient noise and the construction noise is 65dB(A). Assuming a worst case ambient noise level of 62.4dB(A), the allowable construction only noise level is calculated to be 61.5dB LAeq,T.

7.3.51 With regards to the 5dB(A) change method (example method 3), the allowable construction noise level during the daytime is 65dB(A), or higher where the resulting ambient noise level change would be less than +5dB(A). Accordingly, the most stringent allowable 'construction only' noise level following this approach is 65dB(A).

7.3.52 With regards to the above, it can be seen that applying the ABC method gives rise to the most stringent daytime construction noise level criteria of 61.5dB LAeq,T.

7.3.53 Accordingly, where construction noise levels are anticipated to be above 61.5dB LAeq,T over the core working day, significant noise impacts are registered. Such impacts are classified as Moderate or High, depending upon the levels of anticipated exceedance. Where construction noise levels are anticipated to comply with 61.5dB LAeq,T over the core working day, insignificant noise impacts are registered. Such impacts are classified as Slight or Low, depending upon the levels of anticipated exceedance.

7.3.54 With regards to construction traffic noise, impact magnitude has been based on a qualitative appraisal of available data.

Impact Magnitude - Construction Vibration

7.3.55 The magnitude of impact has been determined according to the resulting construction vibration levels in absolute terms, as presented in Table 7.9, based on the guidance contained within BS 5228-2: 2009 for human perception.

Table 7.9: Criteria Used to Determine Impact Magnitude for Construction Vibration (Human Perception, Absolute Levels)

Vibration Level (PPV)	Effect	Impact Magnitude
< 0.3mm s^{-1}	Unlikely to be perceptible in residential environments	Slight
0.3 to 1.0mm s^{-1}	Onset of perceptibility in residential environments	Low
1.0 to 10.0mm s^{-1}	Onset of complaints in residential environments	Medium
> 10.0mm s^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	High

Impact Magnitude - Wind Turbine Noise

7.3.56 The impact magnitude associated with operational wind turbine noise has been determined drawing upon:

- whether the adopted absolute noise level criteria are predicted to be exceeded;
- consideration to the predicted operational wind turbine noise levels in absolute terms, e.g. whether they are high or low; and
- a comparison of the predicted operational noise levels within the measured background noise levels

7.3.57 Where the operational turbine noise levels are in compliance with appropriate absolute noise level criteria, an impact magnitude of Slight or Low results, depending upon the level of compliance.

7.3.58 Where an exceedance of appropriate absolute noise level criteria is identified an impact magnitude of Medium or High results, depending on the degree of exceedance.

7.3.59 Whilst the impact magnitude has been based on compliance with appropriate absolute noise levels criteria, comparison has also been drawn against the prevailing background noise levels, or all assessment against the IFC requirement of an increase in background noise levels no greater than 3dB[1]

7.4 Baseline Conditions

Baseline Nosie Survey

7.4.1 A baseline noise survey was undertaken to establish the prevailing background and ambient noise levels at a sample of the closest noise sensitive receptors to the proposed development. Measurements were undertaken between the 7 November 2013 and the 11 December 2013.

7.4.2 The baseline noise survey comprised fully attended 10 minute measurements undertaken during daytime, evening and night-time periods. For each adopted measurement location, three series of measurements were undertaken, each series comprising 2×10 minute measurements undertaken for each period of the day (daytime, evening and night-time). For each measurement location, a series of measurements was undertaken during low wind speed conditions (circa 0 to 5m/s), medium wind speed conditions (circa 5 to 8m/s), and high wind conditions (circa 9 to 12 m/s) (i.e. 3 series in total), such that the variation in the prevailing environmental noise conditions, with varying wind speed, could

[1] It should however be noted that this criteria is not appropriate for wind farm development, which might regularly generate notable changes in background levels, but at levels which are low in absolute terms. To assess simply on this criteria would result in unnecessary constraint to wind energy development. It is more appropriate to assess based on appropriate absolute noise level criteria which are concordant with WHO criteria, as also referenced for use by the IFC.

be accounted for. Therefore, in total, each measurement location was subject to eighteen 10 minute measurements.

7.4.3 A detailed specification for the baseline noise survey was prepared by WSP Acoustics, with the survey work being undertaken by Zaštita Beograd. The full baseline noise survey report, prepared by Zaštita Beograd can be found in Appendix 7.3. This report presents the full findings of the baseline noise survey, with a short summary of the key information is presented below. Appended to the baseline noise survey report is the survey specification prepared by WSP Acoustics.

Measurement Locations

7.4.4 Baseline noise measurements were undertaken 5 locations, as depicted in Figure 7.1, and as described below:

- Measurement Location 1 “Crepeja”: UTM co-ordinates 472194,49686930, selected as representative of the closest receptors to the south-west of the development, R1 to R3, which are to the north of Crepeja
- Measurement Location 2 “Debeljača”: UTM co-ordinates 472194,49686930, selected as representative of the closest receptors to the west of the development, R4 and R5, which are on the east side of Debeljača
- Measurement Location 3 “Sugar Plant-Kovačica”: UTM co-ordinates 472194,49686930, selected as representative of the closest receptors to the north-west of the development, R6 to R9, which are the closest of a group of scattered dwellings south of Kovačica (R6 to R9)
- Measurement Location 4 “Kovačica”: UTM co-ordinates 472194,49686930, selected as representative of the closest receptors to the development which are on the southern edge of Kovačica, north-west of the development (R10 to R14)
- Measurement Location 5 “Padina”: UTM co-ordinates 472194,49686930 selected as representative of the closest receptors to the north-east of the development, R15 to R19, which are to the south-west of Padina.

7.4.5 All measurement locations were subject to free-field conditions with the microphone mounted 1.5m above local ground.

7.4.6 Measurement locations were selected away from any water courses, or strenuous noise sources such as atypical industrial / commercial activates, plant, or boiler flues etc.

Meteorological conditions

7.4.7 Over the course of the baseline, meteorological conditions remained dry. The survey measurements were timed such that a full measurement set was gained for each wind speed condition (low, medium and high), based on meteorological measurement data obtained from the on-site meteorological mast. The 100m height anemometer was used to inform the timing of the survey measurements (further detail is presented in the Meteorological Survey section below).

Measurement Equipment

7.4.8 Type 1 specification sound pressure level measurement equipment was used, as defined within BS EN 61672-1. A summary of the equipment used is detailed in Table 7.10

Table 7.10: Noise Measurement Equipment

Item	Make and Model	Serial Number
Sound Level Analyser	B&K 2270	2664116
Preamplifier	B&K ZC 0032	10174
Microphone	B&K 4189	2650957
Hand Held Acoustic Calibrator	B&K 4230	1206421

7.4.9 The sound pressure measurement system had been laboratory calibrated within the previous 2 years, and the hand held acoustic calibrator had been laboratory calibrated within the previous 12 months. The laboratory calibration had been carried out by the by Technical Test Centre of the Military Scientific Research Institution of the Serbian Army, which is in charge of running the final, verification testing and homologation of arms and military equipment as well as metrological support of the defence system.

7.4.10 The measurement system was calibrated with the hand held calibrator prior to and following completion of each measurement, no significant drifts in calibration arose.

7.4.11 The time clock on the measurement system was synchronised with the on-site meteorological station (as described below).

Measurement Results

7.4.12 A summary of the measurement results is presented in Tables 7.11 to 7.15

Table 7.11: Summary of Measurement Data, Measurement Location 1, Free-field, dB

Wind Speed	Daytime (07:00 to 18:00)		Evening (19:00 to 23:00)		Night-time (23:00 to 07:00)	
	$L_{Aeq,10mins}$	$L_{A90,10mins}$	$L_{Aeq,10mins}$	$L_{A90,10mins}$	$L_{Aeq,10mins}$	$L_{A90,10mins}$
Low	39.0	36.1	40.0	33.2	36.2	25.1
	35.8	33.0	42.4	39.1	40.1	29.0
Medium	44.3	41.0	42.3	31.7	41.8	40.2
	42.2	39.9	39.5	30.7	44.6	42.7
High	40.7	37.9	42.6	35.5	33.5	29.3
	40.9	39.2	43.5	41.6	44.5	40.5

Table 7.12: Summary of Measurement Data, Measurement Location 2, Free-field, dB

Wind Speed	Daytime (07:00 to 18:00)		Evening (19:00 to 23:00)		Night-time (23:00 to 07:00)	
	$L_{Aeq,10mins}$	$L_{A90,10mins}$	$L_{Aeq,10mins}$	$L_{A90,10mins}$	$L_{Aeq,10mins}$	$L_{A90,10mins}$
Low	41.2	35.8	41.2	35.8	30.5	24.6
	36.6	34.0	36.6	34.0	42.4	22.0
Medium	37.8	34.4	37.8	34.4	37.6	34.8
	40.1	37.1	40.1	37.1	37.0	34.1
High	42.0	37.5	42.0	37.5	30.3	24.5
	41.2	37.5	41.2	37.5	29.6	27.4

Table 7.13: Summary of Measurement Data, Measurement Location 3, Free-field, dB

Wind Speed	Daytime (07:00 to 18:00)		Evening (19:00 to 23:00)		Night-time (23:00 to 07:00)	
	$L_{Aeq,10mins}$	$L_{A90,10mins}$	$L_{Aeq,10mins}$	$L_{A90,10mins}$	$L_{Aeq,10mins}$	$L_{A90,10mins}$
Low	52.2	50.1	40.9	25.1	39.6	22.3
	54.9	50.7	45.9	41.1	42.9	25.7
Medium	46.8	42.9	47.2	29.6	46.2	43.7
	49.4	45.0	49.0	42.3	46.0	44.4
High	49.7	47.1	57.1	55.8	41.5	30.7
	48.9	46.4	45.7	43.2	46.1	41.4

Table 7.14: Summary of Measurement Data, Measurement Location 4, Free-field, dB

Wind Speed	Daytime (07:00 to 18:00)		Evening (19:00 to 23:00)		Night-time (23:00 to 07:00)	
	$L_{Aeq,10mins}$	$L_{A90,10mins}$	$L_{Aeq,10mins}$	$L_{A90,10mins}$	$L_{Aeq,10mins}$	$L_{A90,10mins}$
Low	40.1	37.1	37.3	30.4	35.3	27.3
	38.2	36.1	35.1	28.9	34.5	26.8
Medium	40.1	37.8	42.8	33.8	40.1	34.9
	46.9	44.0	36.4	27.6	41.9	40.3
High	45.0	41.6	42.7	39.5	31.0	25.6
	46.0	43.4	36.6	31.8	33.2	26.8

Table 7.15: Summary of Measurement Data, Measurement Location 5, Free-field, dB

Wind Speed	Daytime (07:00 to 18:00)		Evening (19:00 to 23:00)		Night-time (23:00 to 07:00)	
	$L_{Aeq,10mins}$	$L_{A90,10mins}$	$L_{Aeq,10mins}$	$L_{A90,10mins}$	$L_{Aeq,10mins}$	$L_{A90,10mins}$
Low	46.5	38.6	29.1	21.4	37.9	20.8
	38.3	29.9	31.4	21.3	30.4	23.9
Medium	44.7	38.6	41.0	27.3	42.8	36.7
	44.9	40.0	28.3	22.7	43.2	38.0
High	47.8	39.9	42.0	34.6	25.0	21.6
	48.4	39.8	29.7	24.1	36.9	29.7

On-site Meteorological Survey

7.4.13 For the duration of the baseline noise survey, simultaneous 10 minute meteorological measurements were undertaken towards the centre of the site (approximate grid coordinates 226700, 567300). Measurements included average wind speed and wind direction.

7.4.14 Wind speed measurements were undertaken at heights of 60m, 80m, 100m and 120m above local ground level. To allow for the assessment of site specific wind shear, the measurement data obtained at heights of 80m and 100m have been used to determine the corresponding standardised wind speed at 10m height. The standardise wind speed at 10m height has been determined following the method described within the IoA GPG and the IoA Bulletin Article. Further details are provided in Appendix 7.4.

Future Baseline

7.4.15 The future baseline is envisaged to remain as described above should there be no development.

7.5 Assessment of Impacts, Mitigation and Residual Effects

Construction Noise

Construction Noise – Impact Magnitude

7.5.1 At this stage, whilst the proposed turbine locations, internal access road layout, and vehicular access points for the site have been fixed, the precise construction methodology and phasing is yet to be finalised. This detail will be subject to the final winning construction tenderer and will likely be confirmed following scheme approval. It is therefore appropriate that the construction noise assessment comprises a qualitative assessment, but with supporting example quantitative calculations.

7.5.2 Drawing on experience from other similar projects, it is anticipated that the key works associated with the construction of the proposed development will include the following:

- Construction of on-site access tracks, laydown areas / construction compounds, vehicle turning areas, and junction works associated with the connection to the existing highway network. It is anticipated that this would include the use excavators, lorries and dumper trucks / tipper tucks etc.
- Excavation and backfilling of cable trenches and excavation of drainage ditches, including use of excavators (it is assumed that this would primarily be routed adjacent to the internal access tracks for easy access).
- Installation and operation of concrete batching plant, or concrete deliveries with use of mixer trucks.
- Construction of crane pad foundations including use of excavators and delivery of materials with lorries / dumper trucks and tippers etc.
- Construction of turbine foundations including use of excavators, delivery of materials with lorries / dumper trucks / tippers, possible piling rig (auger or driven) and concrete pour from batching plant or delivery by mixer trucks.
- Operation of possible on-site borrow pits including use of excavators.
- Operation of a construction compound together with arrival and departure of vehicles including deliveries.
- Installation of turbines, including the use of a mobile crane.

7.5.3 Three vehicular access points are proposed for the site, all on the western site boundary and linking with the II-111. These access points are all well removed from the identified noise-sensitive receptors. The closest to any noise sensitive receptor is the southern access point which is approximately 780m from Receptor R3. This means that there will be a considerable distance between the identified noise sensitive receptors, and works associated with the formation of the site access roads.

7.5.4 This distance, in conjunction with soft ground attenuation will afford significance noise attenuation. Drawing upon the soft ground distance attenuation correction detailed within BS5228-1:2009, an attenuation of 45.2dB would be afforded (over the level experienced at 10m from the source), as a result of soft ground and distance. Additional attenuations would also arise from screening (where present) as well as air absorption.

7.5.5 Drawing upon Table 7.6 above, it can be seen that the closest receptor to a proposed turbine, and therefore turbine construction works is R18, which is at a distance of approximately 1270m from Turbine T70. Again therefore simple distance and soft ground affects will afford significance noise attenuation for the turbine construction works. Drawing upon the soft ground distance attenuation correction detailed within BS5228-1:2009, an attenuation of 50.6dB would be afforded (over the level experienced at 10m from the source), as a result of soft ground and distance. Additional attenuation would also arise from screening (where present) as well as air absorption.

7.5.6 On this basis, it is considered that construction noise levels would fall well below the adopted 61.5 dB LAeq,T noise level criterion at noise sensitive receptors, giving rise to an impact magnitude of ‘Slight’.

7.5.7 Notwithstanding this, a series of example construction noise calculations have been undertaken for typical access track and turbine construction operations

7.5.8 Tables 7.16 presents a sample of construction working operations and a typical range of associated sound pressure levels at 10m (obtained from BS 5228-1:2009).

Table 7.16: Sample of Construction Activities and Associated Typical Sound Pressure Level Data at 10m (BS 5228-1:2009), Free-field dB(A)

Plant / Operation	Sound Pressure Level ($L_{Aeq,T}$ / L_{AFmax} at 10m) from BS 5228 – L_{AFmax} level denoted by*
Tracked Excavator - Trenching	71 - 77
Tracked Excavator - Earthworks	68 - 80
Tracked Excavator - Dumping / Spreading Load / Compacting	78 - 86
Driven Piling Rig	61 – 101[1]
Auger Bore Piling Rig	73 - 83
Dumper Truck - Distribution	56* - 92*
Dumper Truck - Tipping / Load	74 - 86
Lorry - Pass-by / Movement of Materials	76* - 88*
Mixing Concrete – Truck discharging / idling / mixing	71 - 80
Wheeled Crane	70 - 78
1 Of 44 examples of driven piling detailed within BS5228-1, there is one with a sound power level of 107dB(A), this is considered atypical and has not been included. The second highest sound power level of 101dB(A) has been included within this table	

7.5.9 Drawing on the data presented in Table 7.16, construction noise calculations have been undertaken for working operations associated with access track construction (a distance of 780m has been used), and for those operations associated with turbine installation (a distance of 1270m has been used). The calculated receptor noise levels are presented in Tables 7.17 and 7.18 respectively.

7.5.10 The completed calculations assume that each plant item would be operational for 100% of the working day, and do not include for attenuation due to screening, or due to atmospheric absorption.

Table 7.17 Sample of Construction Activities and Associated Worst Case Sound Pressure Levels for Access Road Construction Operations at 780m, Free-field dB(A)

Plant / Operation	Predicted Sound Pressure Level ($L_{Aeq,T}$ or L_{AFmax}) at Closest Receptor (R3) to Access Road Works – L_{AFmax} Level Denoted by*
Tracked Excavator – Trenching	25.7 – 31.7
Tracked Excavator – Earthworks	22.7 – 34.7
Tracked Excavator - Dumping / Spreading Load / Compacting	32.7 – 40.7
Dumper Truck – Distribution	10.7* – 46.7*
Dumper Truck - Tipping / Load	28.7 – 40.7
Lorry - Pass-by / Movement of Materials	30.7* – 50.2*

Table 7.18 Sample of Construction Activities and Associated Worst Case Sound Pressure Levels for Turbine Installation Operations at 1270m, Free-field dB(A)

Plant / Operation	Predicted Sound Pressure Level ($L_{Aeq,T}$ or L_{AFmax}) at Closest Receptor (R3) to Access Road Works – L_{AFmax} Level Denoted by*
Tracked Excavator – Trenching	20.4 – 26.4
Tracked Excavator – Earthworks	17.4 – 29.4
Tracked Excavator - Dumping / Spreading Load / Compacting	27.4 – 35.4
Driven Piling Rig[1]	15.7 – 55.7
Dumper Truck – Distribution	5.4* – 41.4*
Dumper Truck - Tipping / Load	23.4 – 35.4
Lorry - Pass-by / Movement of Materials	25.4* – 45.9*
Mixing Concrete – Truck discharging / idling / mixing	20.4 – 37.9
Wheeled Crane	19.4 – 27.4
[1] A driven rather than auger piling rig has been included as a worst case.	

7.5.11 It can be seen from Tables 7.17 and 7.18, that at the distance of the closest receptors, the noise levels associated with each individual construction operation fall considerably below the adopted assessment criteria of 61.5dB LAeq,T.

7.5.12 Even if all of the events presented within each table were to occur simultaneously, worst case noise levels of 52.5 and 56.4 dB(A) are calculated for access road works and turbine installation respectively. These levels remain below the adopted 61.5dB(A) noise assessment criteria by a significant margin.

7.5.13 In addition, it should also be noted that the calculated combined noise level includes operations for which BS 5228-1:2009 only presents noise data in terms of the LAmax noise index. Noise levels adopting this noise index will typically be significantly higher than the corresponding LAeq,T noise levels, and strictly should therefore not be compared against a noise level criterion adopting the LAeq,T noise index. Including such noise levels within the calculation (as above) therefore this represents a worst case.

7.5.14 The resulting impact magnitude is therefore 'Slight' adverse. For a receptor sensitivity of 'High', as present in this case, this corresponds to an adverse effect significance of 'Negligible'. Such impacts would be local, short term and temporary in nature.

7.5.15 The proposed construction traffic route for the development is along the II-111 from the south. Turbine components would be delivered to the port at Pancevo, and would initially use the 1-9 (Prvomajska) road before joining the II-111. Other construction traffic would access the II-111 form the wider area. Table 7.19 presents the estimated HGV movement numbers associated with the construction of each turbine, as provided by the scheme Transport Consultant. Also presented in this table are the calculated two-way movement numbers, and the calculated typical HGV movement numbers per day.

Table 7.19: Construction Traffic Movement Numbers

Works	Number of HGVs per Turbine	Number of Turbines	Total number of HGVs (all turbines)
Roads and hard standing	60	38	2280
Cleaning works	20	38	760

Works	Number of HGVs per Turbine	Number of Turbines	Total number of HGVs (all turbines)
Iron plating for piling	5	38	190
Making 30 piles	120	38	4560
Piling rig	5	38	190
Concrete	56	38	2128
Iron plating for foundation	5	38	190
Support materials	2	38	76
Crane	30	38	1140
Blades	3	38	114
Nacelle	3	38	114
Hub	1	38	38
Tower (steel)	3	38	114
Total	-	-	**11894**
Total 2 way movements	-	-	**23788**
Construction Programme		104 weeks	
Working days assuming 6 day week		624 days	
Typical HGVs movements per day		**38**	

7.5.16 Existing / baseline traffic flows for the II-111 has been obtained from the Annual Report for 2012 from Public Enterprise Roads of Serbia.

7.5.17 Baseline traffic flow data has been provided in the form of annually averaged 24 hour flows for sections of the II-111 with route section references 2139 and 2140:

- 2139 (Kovacica to Jabuka) – Total flow = 4269 of which HGVs = 41, buses = 67 and articulated vehicles = 356 (total heavy vehicles = 464)
- 2140 (Jabuka to Pancevo) – Total flow = 4959 of which HGVs = 48, buses = 71 and articulated vehicles = 430 (total heavy vehicles = 549)

7.5.18 The addition of a further 38 HGVs per day to the existing traffic flows constitutes a very small increase over the existing 24 hour traffic flows. In acoustic terms, provided that the composition of the traffic remains broadly the same, an approximate increase of 100% in traffic flow would be require to give rise to a 3dB increase whilst an approximate 25% increase is required to give rise to a 1dB noise level increase.

7.5.19 A 3dB noise level change is commonly considered to be the smallest change perceptible to humans under typical listening conditions, whilst a 1dB change is commonly considered to be the smallest change perceptible to humans under controlled (e.g. laboratory) listening conditions. It can therefore be seen that the change in traffic flows arising from construction traffic is very small in acoustic terms, and there is significant capacity to account for daily variations in the intensity of construction traffic movements as the project progresses through different stages of work / development.

7.5.20 It is anticipated that the majority of the construction traffic movements will be generated during daytime hours, when baseline traffic flows are anticipated to be higher compared to the night-time (therefore giving rise to lesser noise impacts). Whilst some night-time movements are anticipated, (e.g. to minimise road traffic disruption which could arise from the delivery of the larger items such as the blades and towers etc), these movements constitute only a small component of the total construction

traffic.

7.5.21 Overall, it is anticipated that the impact magnitude as a result of construction traffic noise would be 'Slight'. For a receptor sensitivity of 'High', as present in this case, this corresponds to an adverse effect significance of 'Negligible'. Such impacts would be local, short term and temporary in nature.

Construction Noise - Mitigation

7.5.22 Given that an effect significance of only 'negligible' has been identified, consideration to specific noise mitigation measures is not considered warranted. Notwithstanding this, it should be noted that there are a number of safeguards / noise mitigation measures that are available for the control of noise during the construction phases. These include the following:

- The various EC Directives that limit noise emissions of a variety of construction plant.
- Appropriate training of construction site workers at the beginning of the construction contract, and throughout, in noise minimisation.
- The use of silenced or sound reduced compressors.
- The use of silencers or mufflers for pneumatic tools.
- Maintaining the plant items in good order, and operating according to manufacturers' recommendations, in such a manner as to avoid causing excessive noise.
- Restricting construction working operations to an appropriate working daytime period, e.g. 07:00 to 19:00 hours Monday to Fridays, 08:00 to 13:00 on Saturdays with no Sunday or public holiday working.
- Establishing and maintaining effective liaison with the local community throughout the construction period. Such measures could include provision of information on the on-going activities and provision of contact telephone numbers for the site for use during operational hours, as well as identifying a person with appropriate authority to resolve any identified noise problems.
- Timing of HGV movements during the daytime period where ever possible.

Construction Noise - Residual Effects

7.5.23 It is anticipated that the residual effects of Negligible significance will remain for construction noise and construction traffic noise. Such effects would be local, short term, and temporary.

Construction Vibration

Construction Vibration – Impact Magnitude

7.5.24 Table 7.20 below presents the possible distances at which the adopted magnitude of effect criteria may be registered (BS5228-2) based on a specified confidence limit (where applicable), and the empirical prediction procedures presented within the same document, TRRL RR 246 (applicable to HGV induced vibration), and TRL Report 429 (applicable to vibratory rollers).

Table 7.20: Predicted Groundborne Vibration Levels Applicable to Typical Vibration Generating Construction Activities

Operation	Confidence Limit	Distance (m)	PPV (mm/s)
Vibratory Rollers – start and end	95	60	0.3
	95	23	1.0
Vibratory Rollers – steady state[1]	95	3.3	10
Piling – Driven cast in place	95	215	0.3
	95	85	1.0

Operation	Confidence Limit	Distance (m)	PPV (mm/s)
	95	15	10
Rotary Bored Piling - Augering	N/A	20	≤0.3
	N/A	6	≤1.0
	N/A	0.6	≤10
Rotary Bored Piling – Auger hitting base	N/A	45	≤0.3
	N/A	14	≤1.0
	N/A	1.4	≤10
Rotary Bored Piling – Driving casing	N/A	75	≤0.3
	N/A	23	≤1.0
	N/A	2.3	≤10
HGV's[2]	N/A	50	0. 3[3]
	N/A	17	1.0[3]
	N/A	2.5	10[3]

[1] Assumes 2 rollers, 0. 4mm amplitude, drum width of 1.3m, e.g. heavy duty ride on roller

[2] Assumes max height / depth of surface defect of 50mm, max speed of 30km/h, and that surface defect occurs at both wheels.

[3] Where alluvium soils are present, higher vibration levels can be expected.

7.5.25 It should be noted that there may be a variety of different potential vibration generating activities employed during the construction phase, other than those presented above. The data presented within Table 7.20 are general in nature and not specific to any one site. However, the vibration levels and associated distances can be used to determine the typical distances at which specific impacts may be registered.

7.5.26 Based on a receptor distances of 780 and 1270m (to the closest site access road and turbine installation works), Table 7.21 below presents the impact magnitude that would arise at the closest sensitive receptors.

Table 7.21: Predicted Groundborne Vibration Impact from Construction Operations

Activity	Impact Magnitude
Vibratory Rollers	Slight
Piling – Driven cast in place	Slight
Rotary Bored Piling - Augering	Slight
HGVs	Slight

7.5.27 It should be noted that the impact magnitudes presented within this table, in some cases, have been generated based on a 95% confidence limit. In reality it is likely that lower vibration levels will prevail for the majority of activities.

7.5.28 The resulting impact magnitude is therefore 'Slight' adverse. For a receptor sensitivity of 'High', as present in this case, this corresponds to an adverse effect significance of 'Negligible'. Such impacts would be local, short term and temporary in nature.

7.5.29 The completed assessment has considered the potential impact on the closest identified dwellings to the proposed development. In addition, consideration should be given to potential impacts on structures in close proximity to proposed construction workings, although it should be noted that higher assessment criteria apply to cosmetic building damage, to those corresponding to human perception / comfort. A series of vibration mitigation measures have been included in the following section, which should be employed to ensure potential impacts are minimised.

Construction Vibration - Mitigation

7.5.30 The following vibration mitigation measures should be employed during the construction works:

- Adoption of low vibration working methods, with consideration given to use of the most suitable plant.
- Prior to the commencement of groundborne vibration generative construction operations (e.g. use of vibratory rollers, ground compaction works, HGV movements over uneven or pitted ground, and piling works), the closest buildings / structures (including underground structures such as pipelines etc) should be identified, and a predictive assessment of potential damage undertaken.
- Where such an assessment indicates potential for damage (cosmetic or greater), the methods of construction should be revised accordingly.
- Where appropriate, the refined working operations should be reassessed and if necessary, progressed with a simultaneous vibration monitoring survey.
- Such survey works should be undertaken in accordance with the guidance detailed within BS7385-1:1990: Evaluation and measurement for vibration in buildings - Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings.
- Works should initially be undertaken at distance from the identified receptors and survey results checked for compliance prior to works in closer proximity.
- The results of the survey should be assessed in accordance with BS7385-2:1993: Evaluation and measurement for vibration in buildings - Part 2: 1993: Guide to damage levels from groundbourne vibration.
- Where results indicate a potential for damage (cosmetic or otherwise), the working methods should be revisited and updated again.

Construction Vibration - Residual Effects

7.5.31 With regards to potential impact on residential dwellings, it is anticipated that the residual effects of Negligible significance will remain. Such effects would be local, short term, and temporary.

7.5.32 Appropriate vibration mitigation measures have been stipulated such that cosmetic building damage can be avoided. On this basis, the impact magnitude would be Slight corresponding to an effect significance of Negligible. Such effects would be local, short term and temporary.

Operational Turbine Noise

Operational Turbine Noise - Impact Magnitude

Adopted Assessment Criteria

7.5.33 The predicted operational turbine noise levels detailed in Table 7.22 have been assessed against a series of different absolute noise level criteria derived from Serbian legislation, and International guidance, including that stated by the IFC and within ETSU-R-97.

7.5.34 The following noise level limits have been assessed:

Daytime and Evening

- A fixed absolute noise level limit of 53 dB(A) LA90,T. This is the 55dB(A) daytime limit stated within Serbian legislation, reduced by 2 dB to reflect the LA90,T noise index which is being adopted in this assessment for wind turbine noise[23] .
- Fixed absolute noise level limits of 35 dB(A) (Lower) and 40dB(A) (Upper) which are the fixed elements of the daytime noise level limits stipulated within ETSU-R-97, below which consideration need not be given the prevailing background noise levels, because the absolute turbine noise levels are appropriately low.

Night-time

- A fixed absolute noise level limit of 43 dB(A) LA90,T. This is the 45dB(A) daytime limit stated within Serbian legislation, reduced by 2 dB to reflect the LA90,T noise index which is being adopted in this assessment for wind turbine noise23. This limit is also the fixed element of the night-time noise level limit stipulated within ETSU-R-97, below which consideration need not be given the prevailing background noise levels, because the absolute turbine noise levels are appropriately low.

7.5.35 In addition to the above absolute noise level limits, operational turbine noise levels have also been assessed by comparison against the measured prevailing background noise levels, as required by the IFC guidance and suggested within the UNDP guidance document. It should however be noted that in accordance with ETSU-R-97 where the absolute noise level criteria stipulated in the bullet points above are achieved, turbine noise levels are considered sufficiently low that consideration need not be given to the prevailing background noise levels.

Calculated Operational Noise Levels

7.5.36 The detailed scheme noise model has been used to determine the operational turbine noise levels that would arise at each of the considered noise sensitive receptors, for integer wind speed between 4 and 10 m/s (at 10m height). In accordance with ETSU-R-97, the predicted LAeq,T turbine noise levels have been reduced by 2dB, such that they are presented in terms of the LA90,T noise index. The predicted operational turbine noise levels are detailed in Table 7.22.

Table 7.22: Predicted Operational Wind Turbine Noise for Proposed Development, Free-field, LA90,T, dB

Receptor	Wind speed at 10m (m/s)						
	4	5	6	7	8	9	10
1	19.9	25.1	27.7	27.5	27.1	26.9	26.7
2	19.7	24.8	27.4	27.3	26.9	26.7	26.5
3	25.6	30.9	33.5	33.2	32.8	32.6	32.5
4	21.0	26.2	28.8	28.6	28.2	28.0	27.8
5	21.9	27.1	29.8	29.5	29.1	28.9	28.7
6	23.4	28.6	31.2	31.0	30.6	30.3	30.2
7	22.7	27.8	30.5	30.2	29.8	29.6	29.4
8	22.0	27.2	29.8	29.6	29.2	29.0	28.8
9	20.9	26.1	28.7	28.5	28.1	27.9	27.7
10	19.9	25.0	27.7	27.5	27.1	26.9	26.7

[2] Whilst not stated within the Serbian legislation, it is assumed that the 55dB(A) limit adopts an LAeq,T noise index.

[3] Correction stated within ETSU-R-97 for correction for LAeq,T to LA90,T for wind turbine noise.

Receptor	Wind speed at 10m (m/s)						
	4	5	6	7	8	9	10
11	19.6	24.7	27.4	27.2	26.8	26.6	26.4
12	19.5	24.6	27.2	27.1	26.7	26.5	26.3
13	19.5	24.6	27.2	27.1	26.7	26.5	26.3
14	19.8	24.9	27.6	27.4	27.1	26.8	26.7
15	25.9	31.1	33.7	33.5	33.1	32.8	32.7
16	25.6	30.8	33.4	33.1	32.8	32.5	32.4
17	27.8	33.1	35.6	35.4	35.0	34.8	34.6
18	28.8	34.1	36.6	36.4	36.0	35.8	35.7
19	29.0	34.3	36.9	36.6	36.2	36.0	35.9

Operational Turbine Noise Assessment

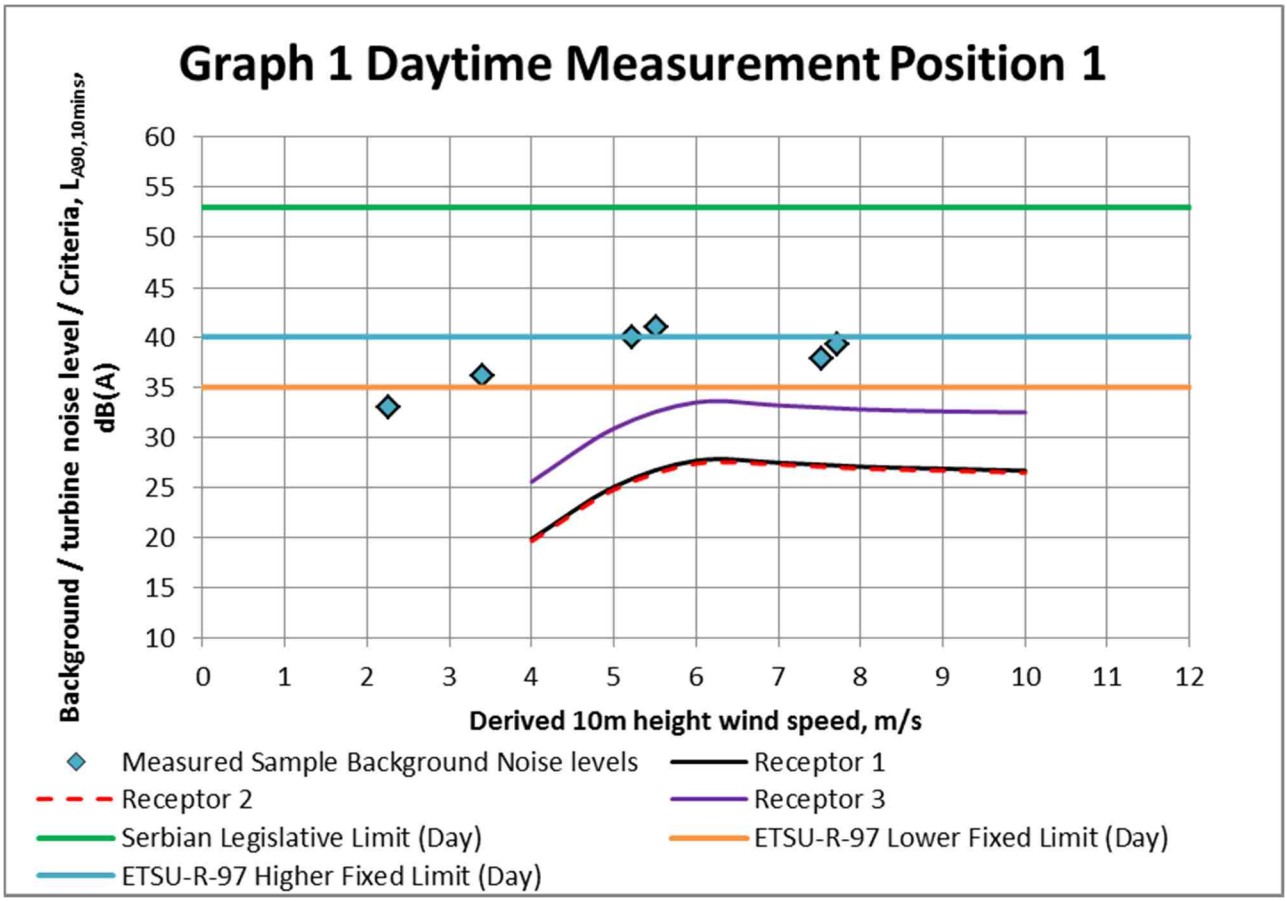
7.5.37 The predicted turbine noise levels have been plotted in graphic from, against the absolute noise level assessment criteria detailed above. This approach allows simple visual inspection to determine whether each assessment criterion is complied with over a range of wind speeds.

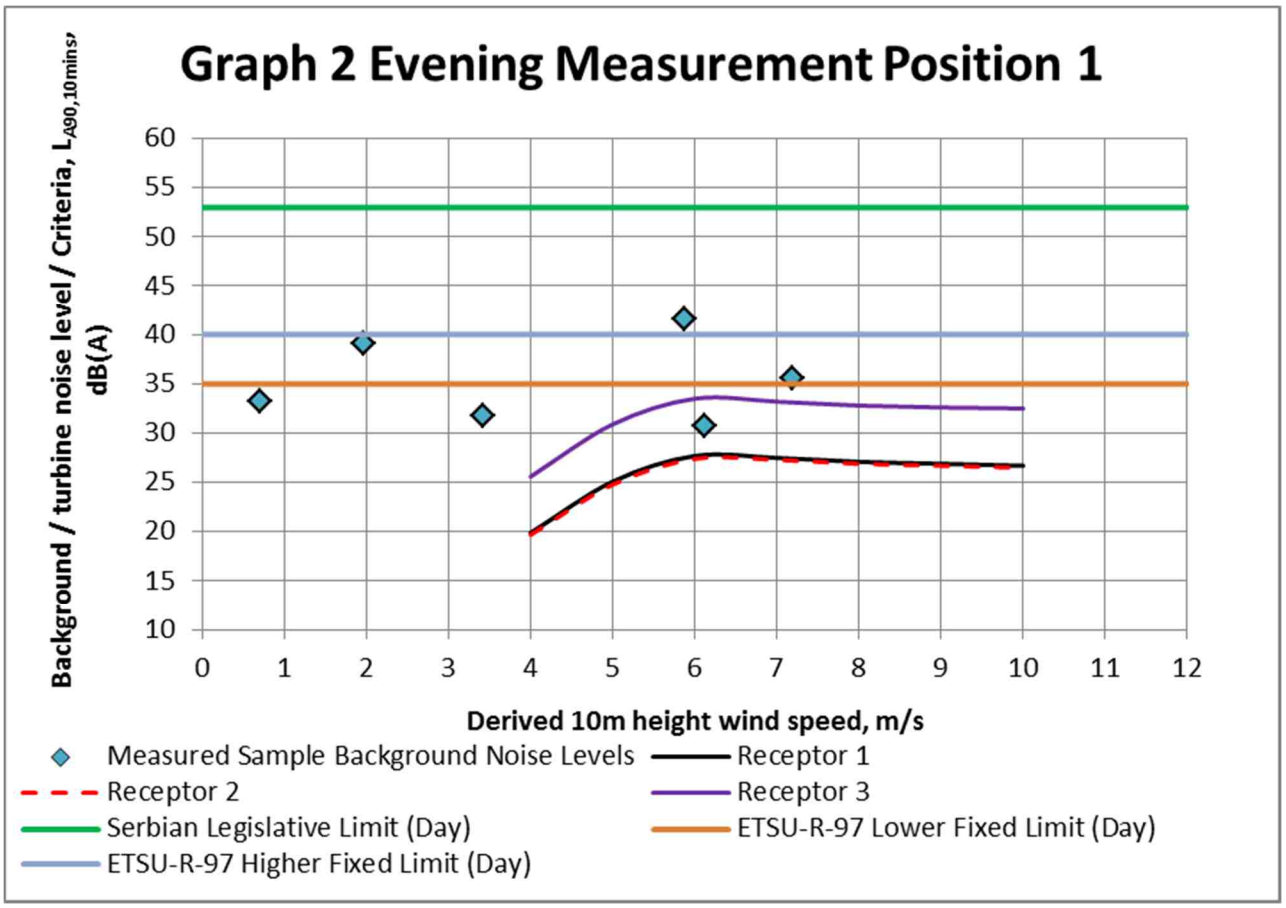
7.5.38 The graphs also present the measured background noise levels for each location. The measured background noise levels have been plotted against wind speed at the time of the measurement (standardise to 10m in height).

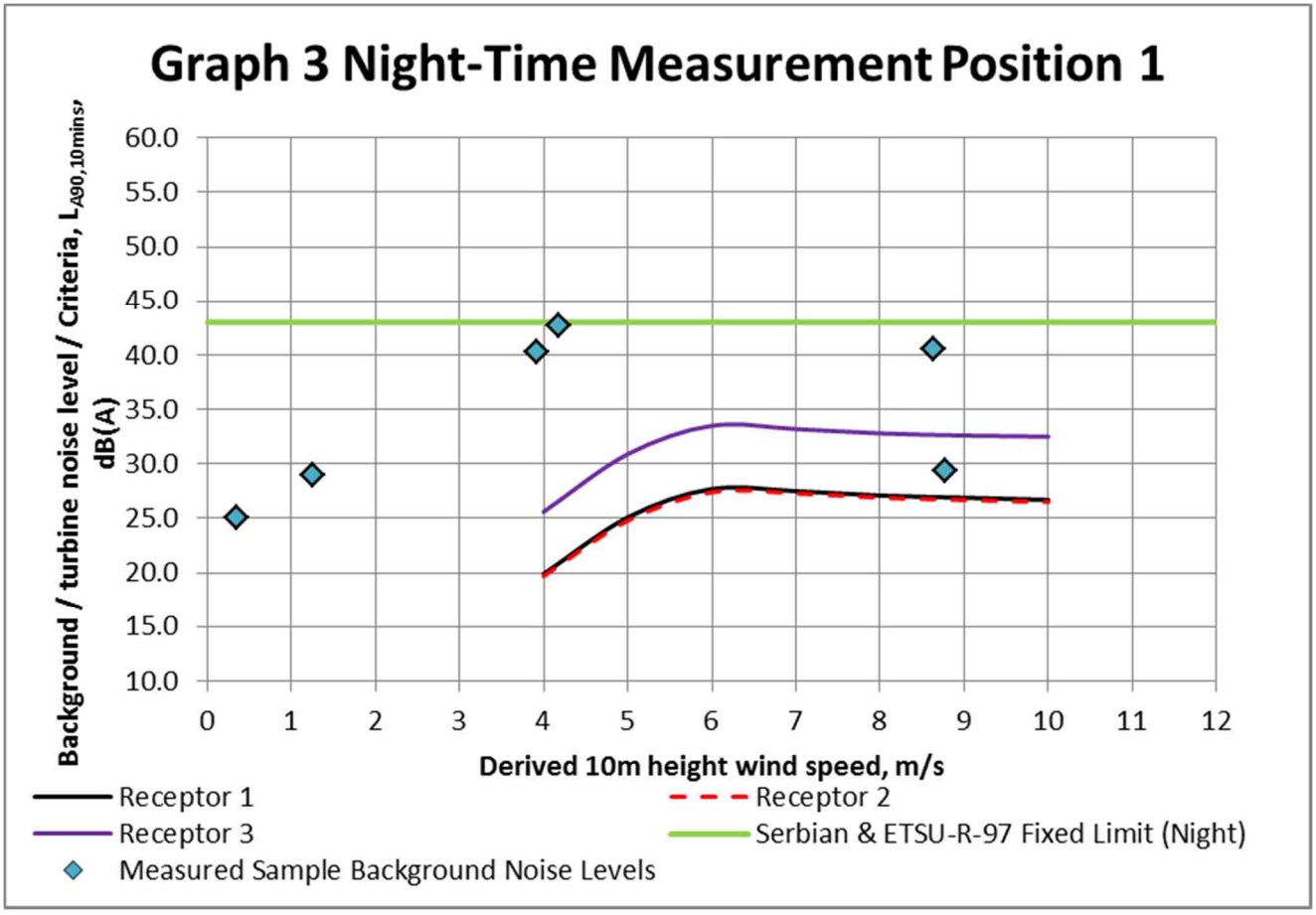
7.5.39 For each measurement location, separate graphs have been prepared for daytime, evening and night-time periods. The predicted receptor turbine noise levels have been plotted on the graphs for the closest of the 5 baseline noise survey measurement location. Accordingly, receptors are grouped as follows:

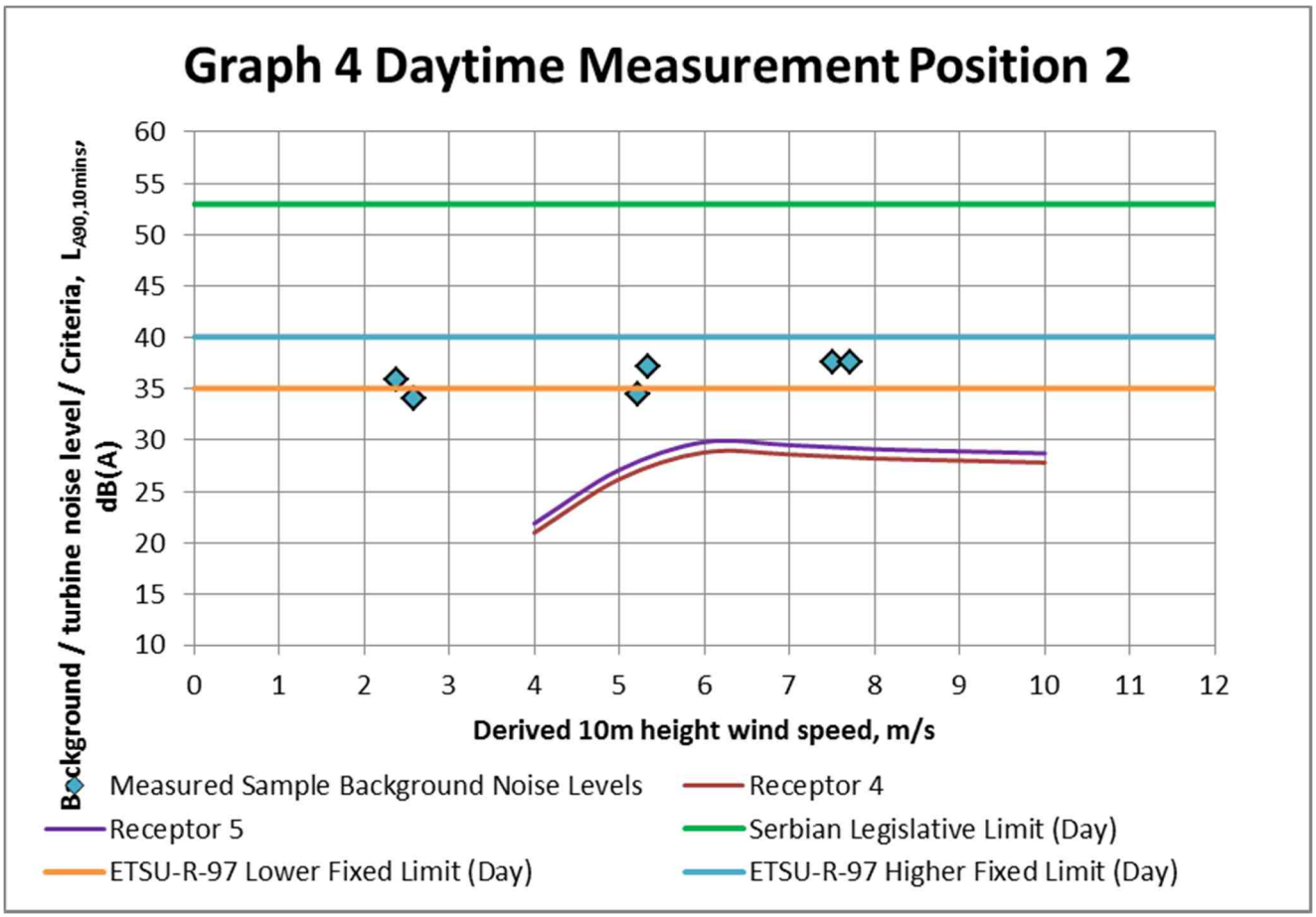
- Measurement Location 1: Receptors R1 to R3;
- Measurement Location 2: Receptors R4 and R5;
- Measurement Location 3: Receptors R6 to R9;
- Measurement Location 4: Receptors R10 to R14; and
- Measurement Location 5: Receptors R15 to R19.

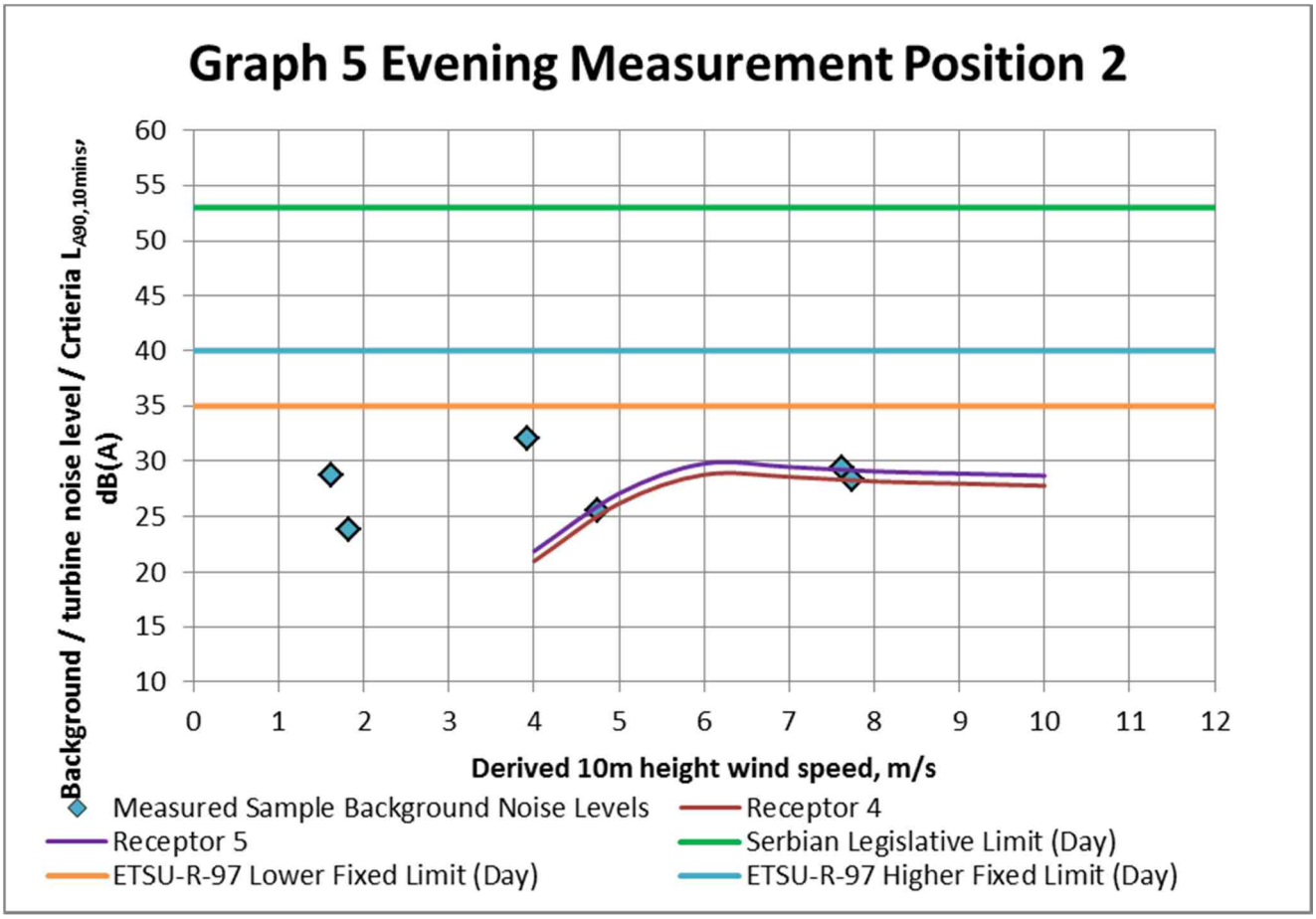
7.5.40 The resulting assessment graphs are presented below:

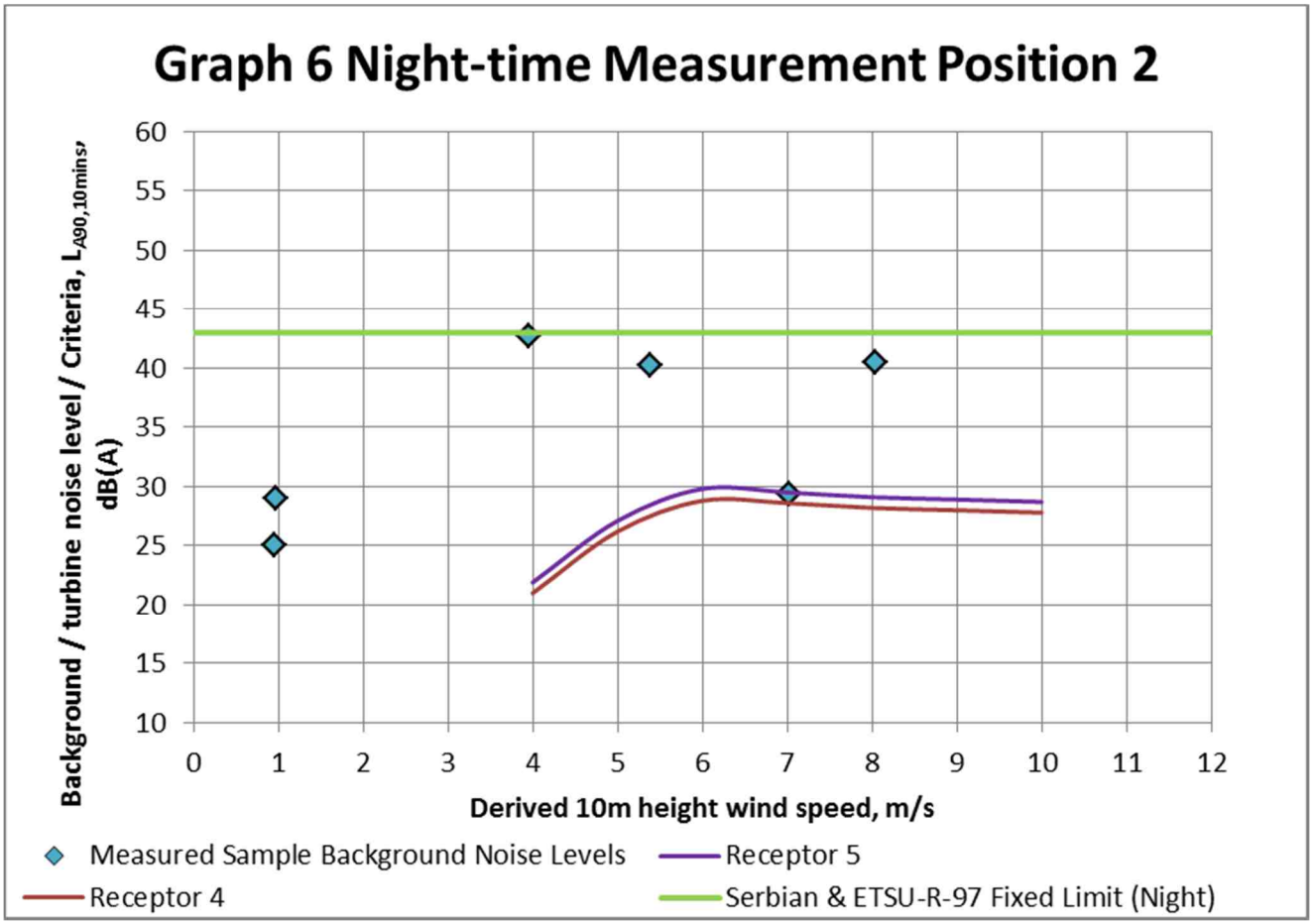

Graph 1 Daytime Measurement Position 1
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0 1 2 3 4 5 6 7 8 9 10 11 12
Derived 10m height wind speed, m/s
Measured Sample Background Noise levels
Receptor 1
Receptor 2
Receptor 3
Serbian Legislative Limit (Day)
ETSU-R-97 Lower Fixed Limit (Day)
ETSU-R-97 Higher Fixed Limit (Day)

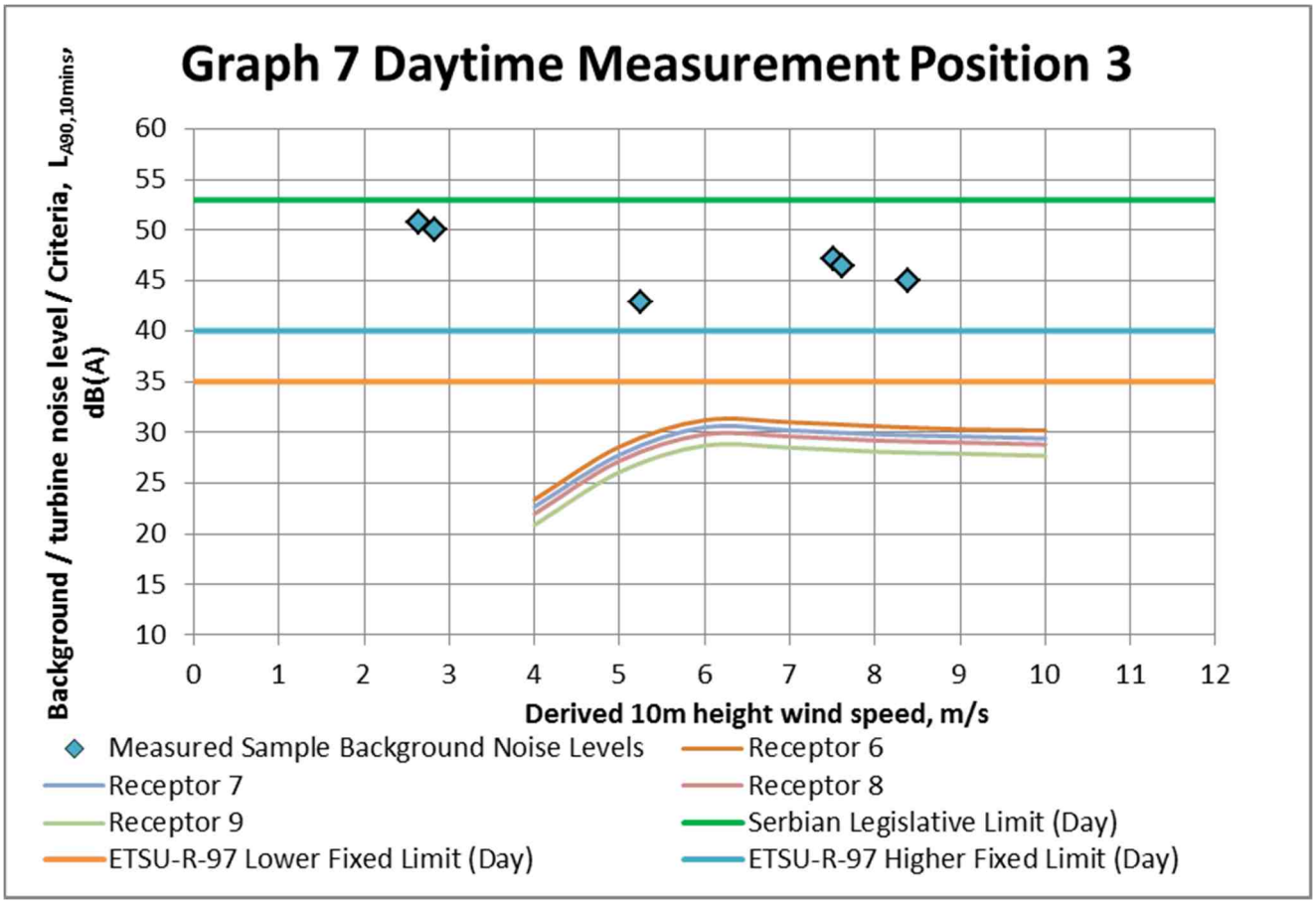

Graph 2 Evening Measurement Position 1
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0 1 2 3 4 5 6 7 8 9 10 11 12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 1
Receptor 2
Receptor 3
Serbian Legislative Limit (Day)
ETSU-R-97 Lower Fixed Limit (Day)
ETSU-R-97 Higher Fixed Limit (Day)

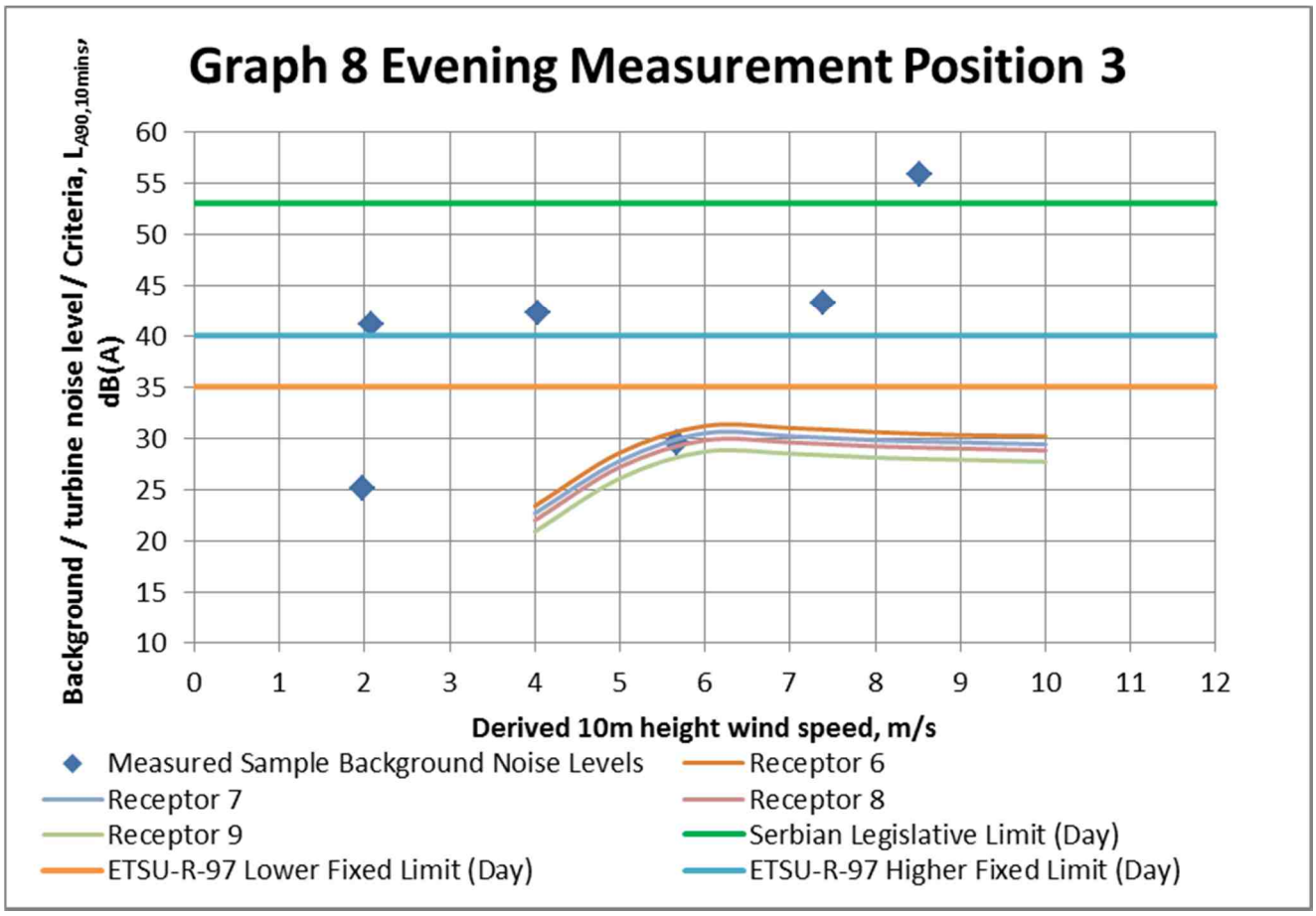

Graph 3 Night-Time Measurement Position 1
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
0
1
2
3
4
5
6
7
8
9
10
11
12
Derived 10m height wind speed, m/s
Receptor 1
Receptor 2
Receptor 3
Serbian & ETSU-R-97 Fixed Limit (Night)
Measured Sample Background Noise Levels

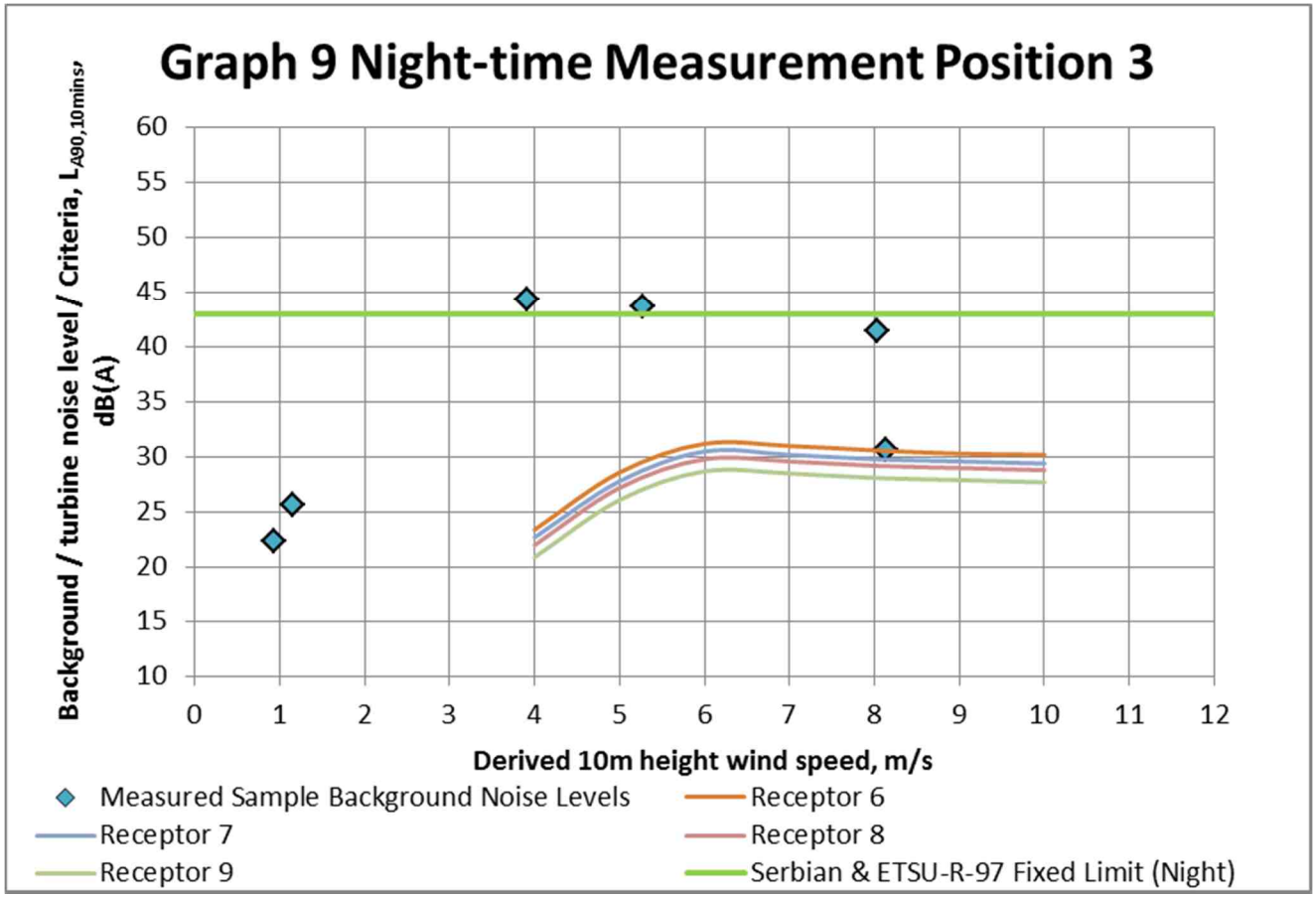

Graph 4 Daytime Measurement Position 2
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0
1
2
3
4
5
6
7
8
9
10
11
12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 4
Receptor 5
Serbian Legislative Limit (Day)
ETSU-R-97 Lower Fixed Limit (Day)
ETSU-R-97 Higher Fixed Limit (Day)

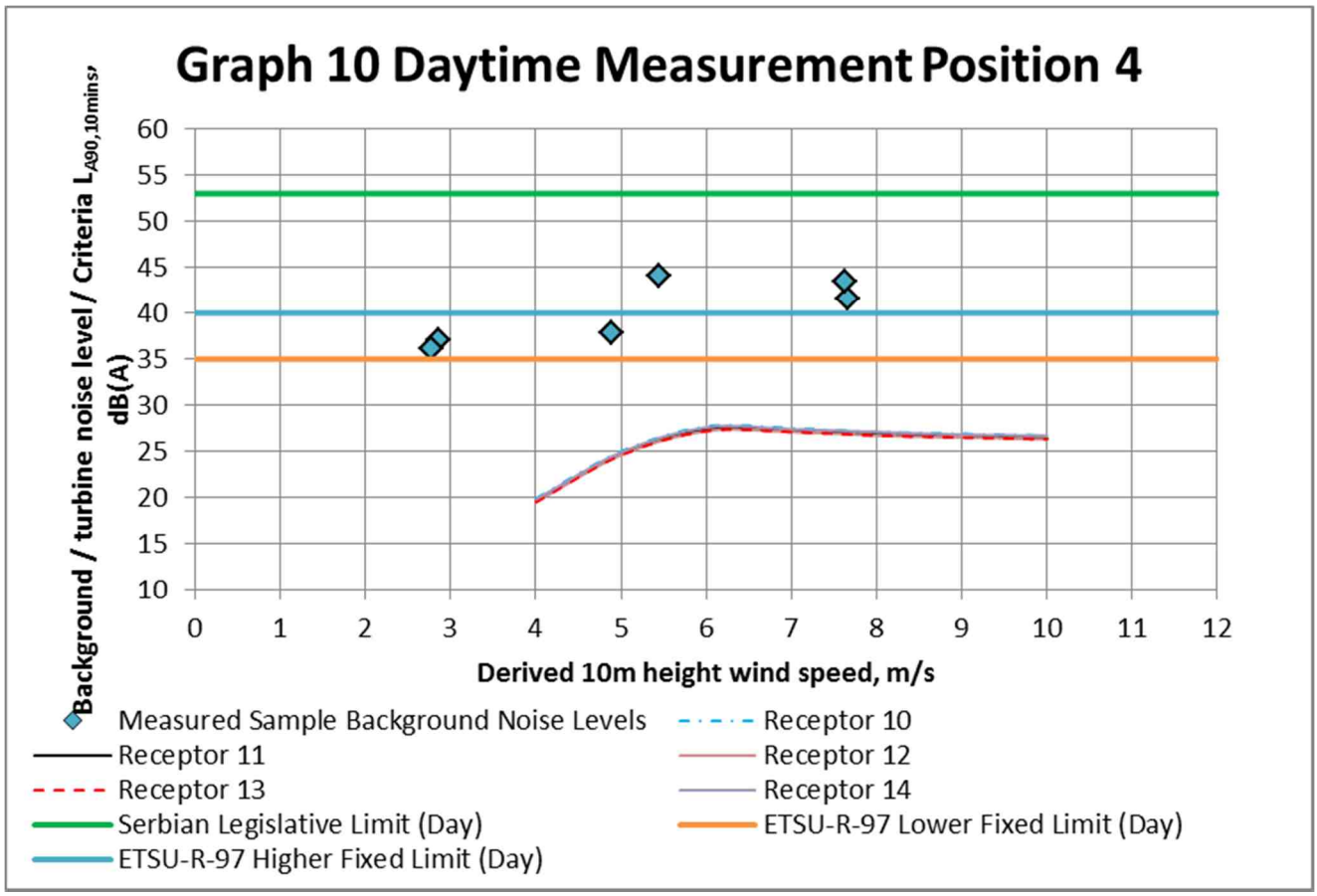

Graph 5 Evening Measurement Position 2
Background / turbine noise level / Crtieria $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0 1 2 3 4 5 6 7 8 9 10 11 12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 4
Receptor 5
Serbian Legislative Limit (Day)
ETSU-R-97 Lower Fixed Limit (Day)
ETSU-R-97 Higher Fixed Limit (Day)

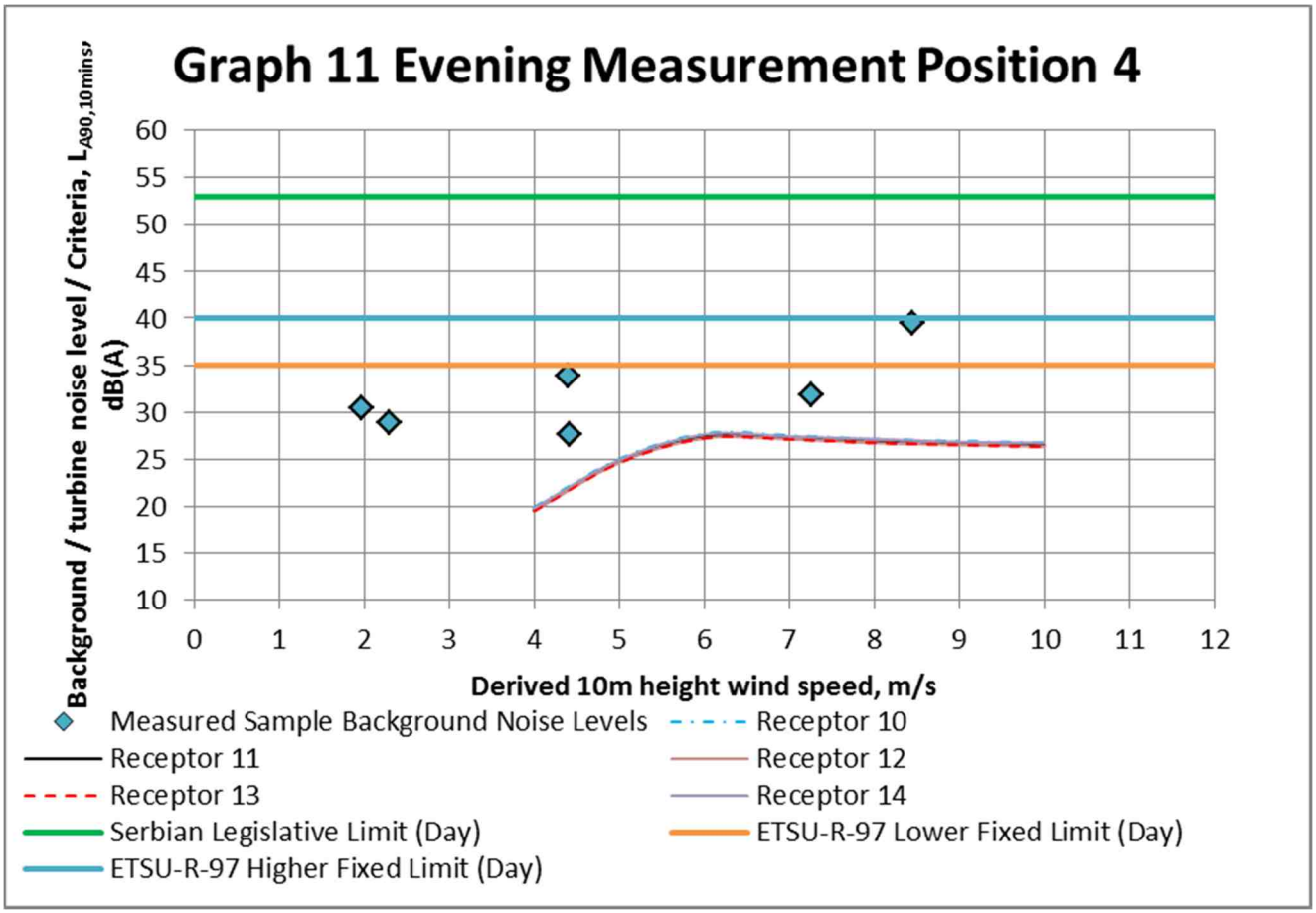

Graph 6 Night-time Measurement Position 2
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0 1 2 3 4 5 6 7 8 9 10 11 12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 5
Receptor 4
Serbian & ETSU-R-97 Fixed Limit (Night)

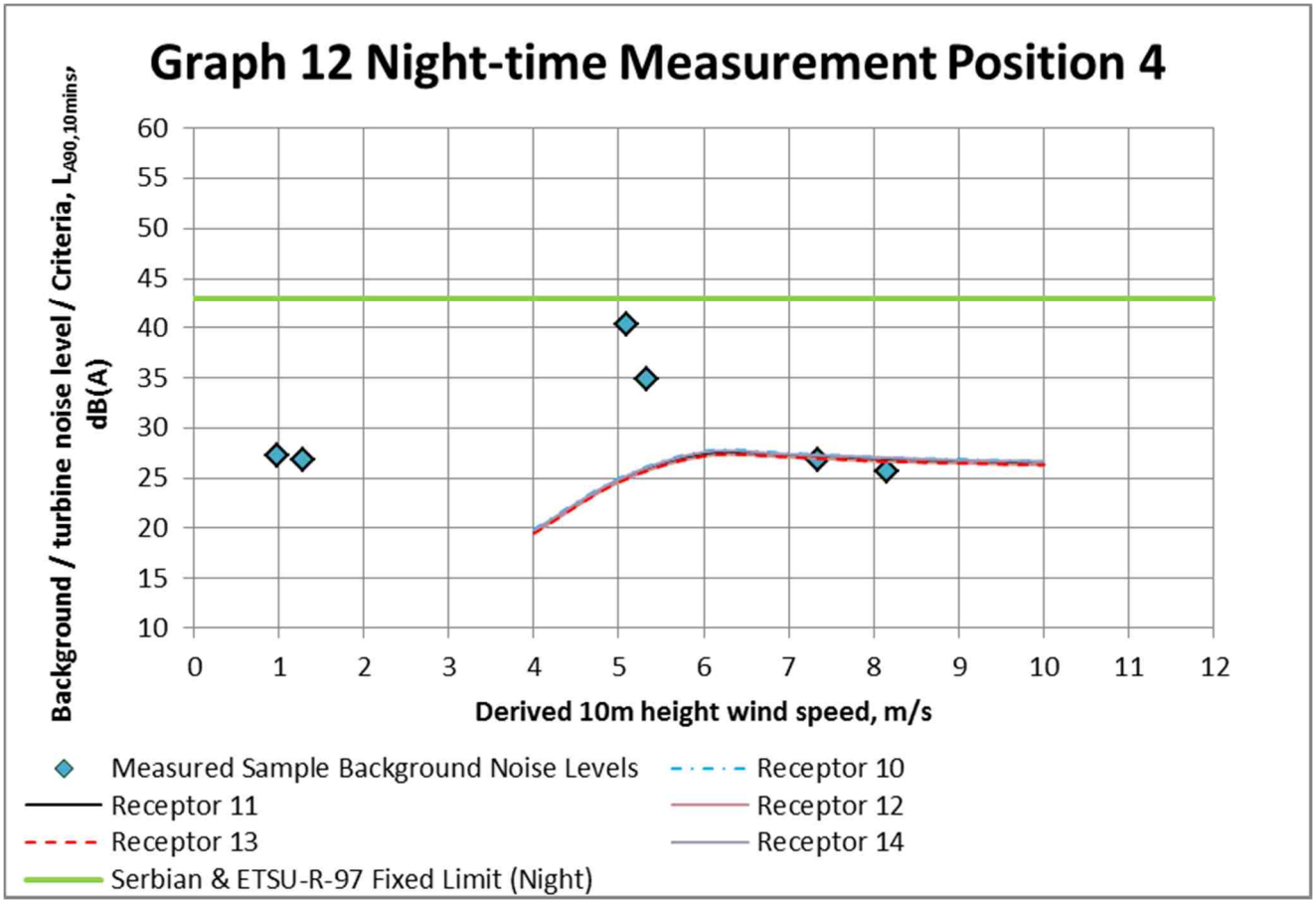

Graph 7 Daytime Measurement Position 3
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0 1 2 3 4 5 6 7 8 9 10 11 12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 6
Receptor 7
Receptor 8
Receptor 9
Serbian Legislative Limit (Day)
ETSU-R-97 Lower Fixed Limit (Day)
ETSU-R-97 Higher Fixed Limit (Day)

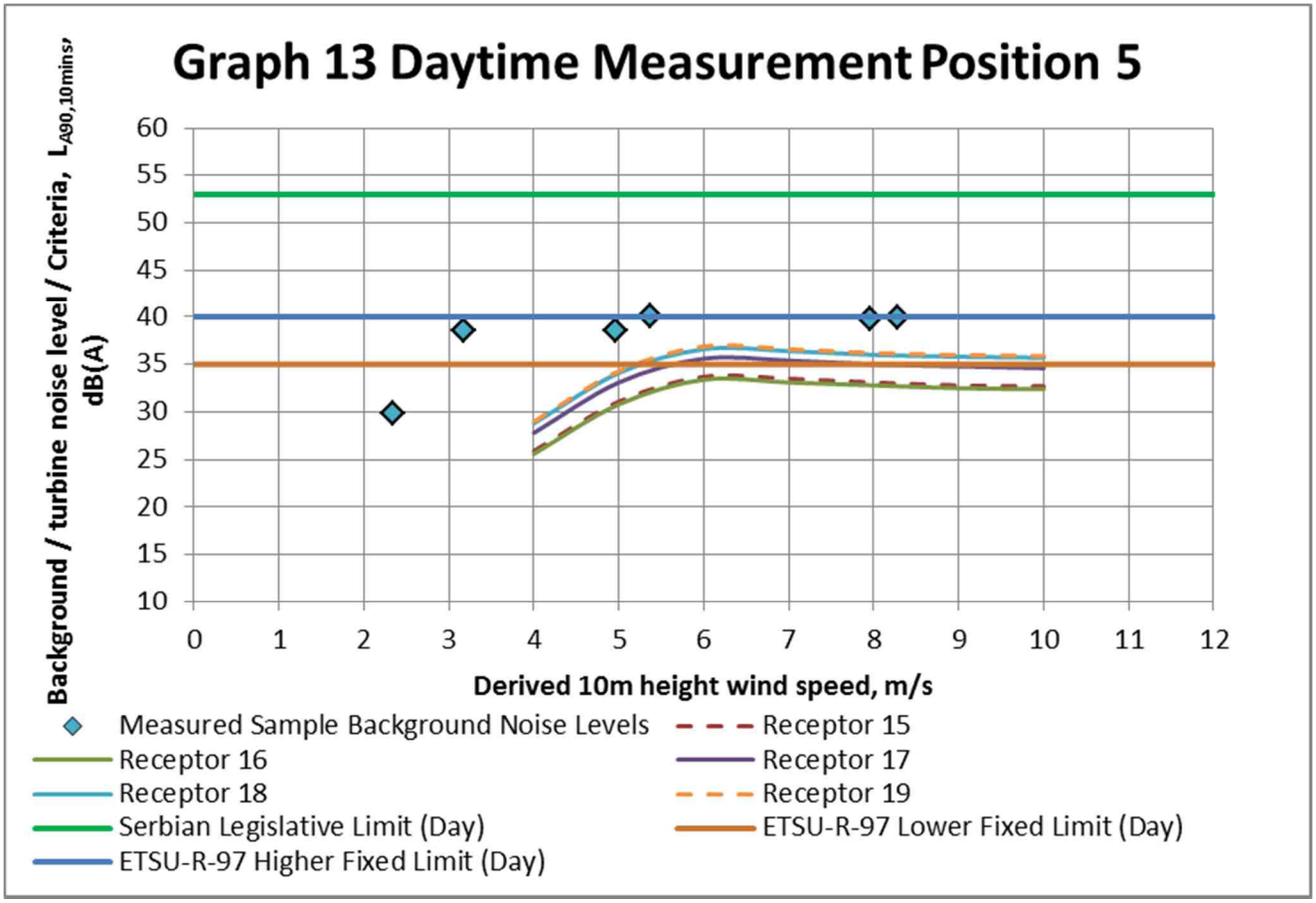

Graph 8 Evening Measurement Position 3
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0 1 2 3 4 5 6 7 8 9 10 11 12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 6
Receptor 7
Receptor 8
Receptor 9
Serbian Legislative Limit (Day)
ETSU-R-97 Lower Fixed Limit (Day)
ETSU-R-97 Higher Fixed Limit (Day)

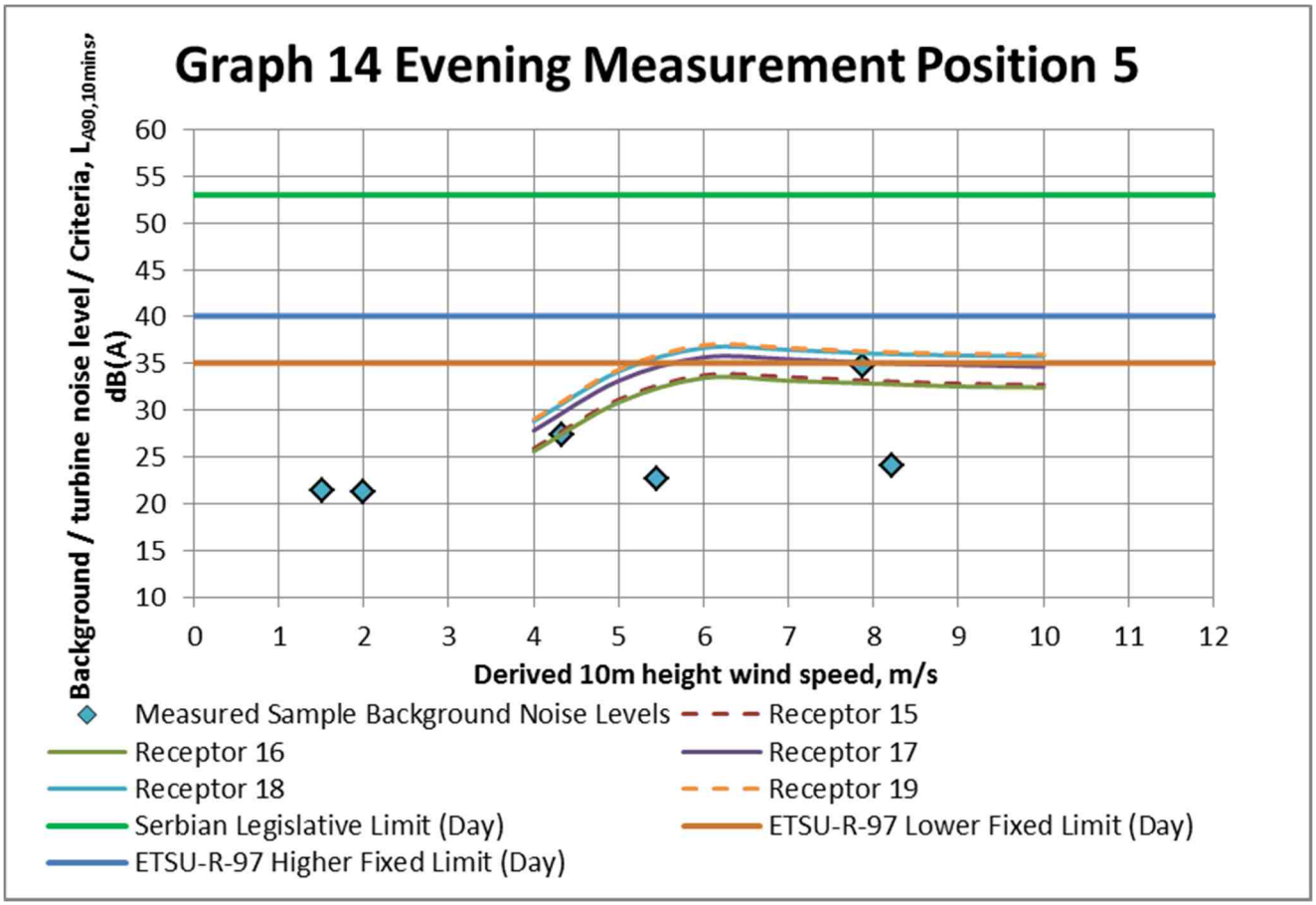

Graph 9 Night-time Measurement Position 3
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0
1
2
3
4
5
6
7
8
9
10
11
12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 6
Receptor 7
Receptor 8
Receptor 9
Serbian & ETSU-R-97 Fixed Limit (Night)

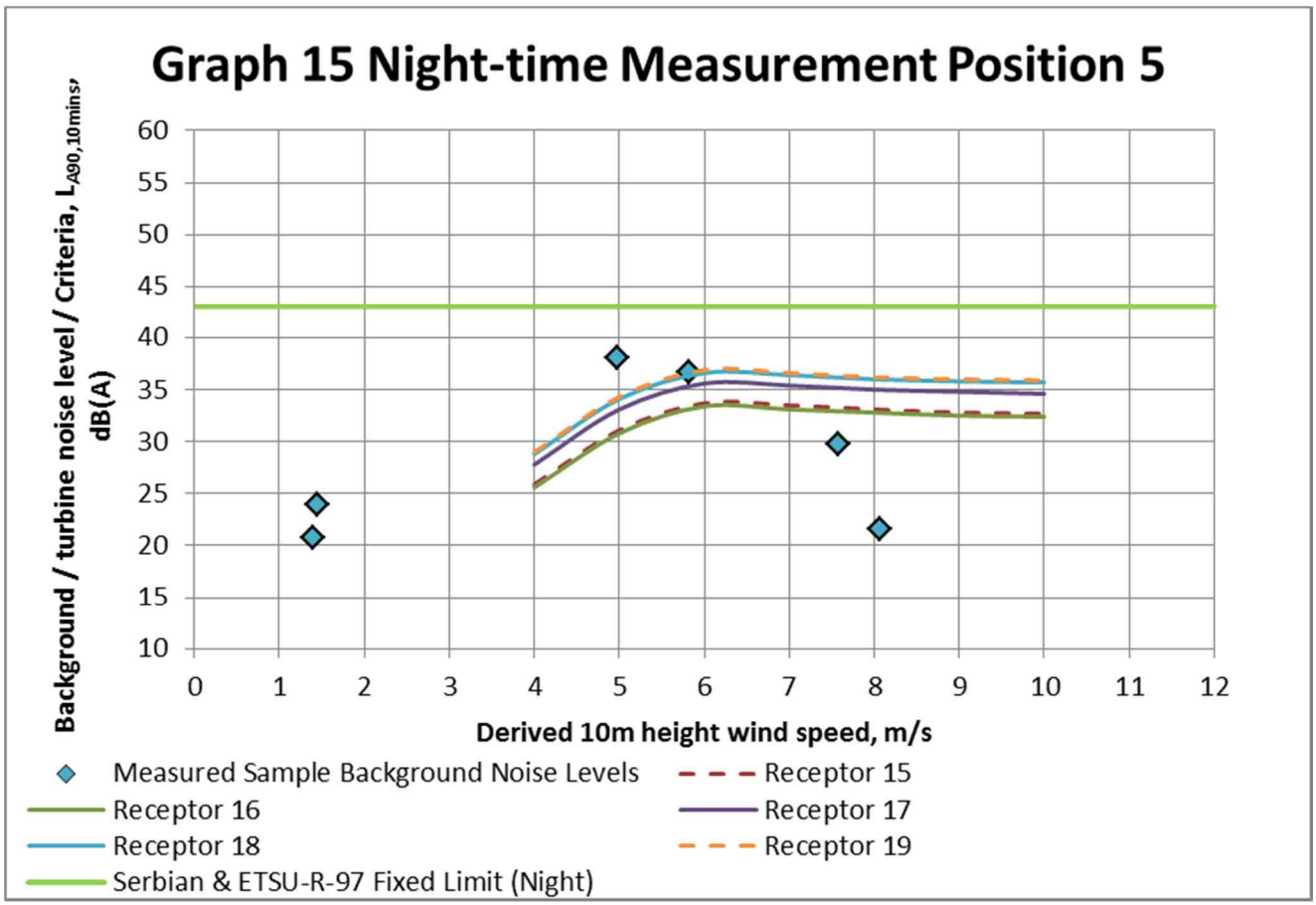

Graph 10 Daytime Measurement Position 4
Background / turbine noise level / Criteria $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0
1
2
3
4
5
6
7
8
9
10
11
12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 10
Receptor 11
Receptor 12
Receptor 13
Receptor 14
Serbian Legislative Limit (Day)
ETSU-R-97 Lower Fixed Limit (Day)
ETSU-R-97 Higher Fixed Limit (Day)


Graph 11 Evening Measurement Position 4
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0 1 2 3 4 5 6 7 8 9 10 11 12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 10
Receptor 11
Receptor 12
Receptor 13
Receptor 14
Serbian Legislative Limit (Day)
ETSU-R-97 Lower Fixed Limit (Day)
ETSU-R-97 Higher Fixed Limit (Day)


Graph 12 Night-time Measurement Position 4
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0 1 2 3 4 5 6 7 8 9 10 11 12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 10
Receptor 11
Receptor 12
Receptor 13
Receptor 14
Serbian & ETSU-R-97 Fixed Limit (Night)


Graph 13 Daytime Measurement Position 5
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0 1 2 3 4 5 6 7 8 9 10 11 12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 15
Receptor 16
Receptor 17
Receptor 18
Receptor 19
Serbian Legislative Limit (Day)
ETSU-R-97 Lower Fixed Limit (Day)
ETSU-R-97 Higher Fixed Limit (Day)


Graph 14 Evening Measurement Position 5
Background / turbine noise level / Criteria, $L_{A90,10mins}$, dB(A)
60
55
50
45
40
35
30
25
20
15
10
0 1 2 3 4 5 6 7 8 9 10 11 12
Derived 10m height wind speed, m/s
Measured Sample Background Noise Levels
Receptor 15
Receptor 16
Receptor 17
Receptor 18
Receptor 19
Serbian Legislative Limit (Day)
ETSU-R-97 Lower Fixed Limit (Day)
ETSU-R-97 Higher Fixed Limit (Day)



7.5.41 Considering the daytime and evening periods, from inspection of Graphs 1, 2, 4, 5, 7, 8, 10, 11, 13 and 14 it can be seen that for all receptors, the Serbian legislative limit (green solid line) is complied with. It is acknowledged that the Serbian legislative limit applies to the all-encompassing noise, but it should be noted that for all receptors, the predicted operational turbine noise levels fall at least 10dB below this limit. This means that even if the prevailing ambient noise levels (in absence of the proposed development) are bordering with this limit, the addition of the operational turbine noise level will not give rise to a significant change in conditions. Notwithstanding this, an inspection of Tables 7.11 to 7.15 shows that the daytime and evening ambient (LAeq,T) noise levels fall below the Serbian legislative limit of 55dB, and the addition of the predicted turbine noise levels will therefore not give rise to an exceedance of this limit.

7.5.42 It can also be seen from these graphs that for the daytime and evening, the ETSU-R-97 upper fixed limit (40dB(A)) is achieved for all receptors (blue solid line). For measurement locations 1, 2, 3 and 4, the ETSU-R-97 lower fixed limit is also complied with. For all of these locations, predicted turbine noise levels are generally below the measured prevailing background noise levels, complying with the IFC requirements (background noise levels to not increase by more than 3dB).

7.5.43 For location 5, predicted turbine noise levels fall marginally above the ETSU-R-97 lower fixed limit for the daytime and evening, but during the daytime, levels fall below the measured prevailing background noise levels. During the evening the predicted turbine noise levels are generally above the prevailing background noise levels, and exceed the IFC requirement related to background levels. However, this must be viewed in the context that the predicted turbine noise levels are generally low, and well within Serbian legislative requirements.

7.5.44 It must also be noted that ETSU-R-97 states that the daytime fixed limit element must be selected with consideration to the number of receptors affected, the effect of the noise limits on the number of kWh generated and the duration and level of exposure. It is therefore clear that for large scale wind farm

development which has large potential energy generation, but for which relatively few receptors are affected, a higher fixed limit element should be selected, whilst for a small scale development with the potential to affect a large number of receptors, a lower fixed limit element should be selected. In the case of this development it is considered more appropriate to adopted the ETSU-R-97 Higher fixed limit (40dB(A)) rather than the Lower fixed limit (35dB(A)), which is not predicted to be exceeded.

7.5.45 Furthermore, the ETSU-R-97 assessment method acknowledges that seeking to ensure minimal background noise level increases at low wind speeds is not necessary for the protection of residential amenity and would be unduly restrictive to renewable energy generation projects. It is discussed further above how, in accordance with ETSU-R-97, where the appropriate absolute noise level criteria is achieved, turbine noise levels are considered sufficiently low that consideration need not be given to the prevailing background noise levels. This is because it would be unduly onerous on the developer given that sufficient protection of amenity is already afforded to the noise-sensitive receptors.

7.5.46 With regards to the night-time, from inspection of Graphs 3, 6, 9, 12 and 15 it can be seen that for all receptors, the Serbian legislative limit (green solid line) is complied with. Again, it is acknowledged that the Serbian legislative limit applies to the all-encompassing noise, but similarly to the daytime and evening periods, for locations 1 (Graph 3), 2 (Graph 6), 3 (Graph 9) and 4 (Graph 12), the predicted operational turbine noise levels fall around 10dB or more below this limit. Accordingly, for these locations, even if the prevailing ambient noise levels (in absence of the proposed development) are bordering with this limit, the addition of the operational turbine noise level will not give rise to a significant change in conditions. Notwithstanding this, an inspection of Tables 7.11 to 7.14 shows that the night-time ambient (LAeq,T) noise levels generally fall below the Serbian legislative limit of 45 dB(A), and the addition of the predicted turbine noise levels will therefore not give rise to an exceedance of this limit[4] .

7.5.47 For Location 5 (Graph 15), consideration can again be given to the measured prevailing ambient noise levels as detailed in Table 7.15. This shows that the night-time ambient noise levels fall below the Serbian legislative limit of 45 dB(A) with a margin of 2dB available for future increases. The addition of the predicted turbine noise levels to the prevailing measured ambient noise levels would not give rise to an exceedance the Serbian legislative night-time limit.

7.5.48 It should also be noted that the 43dB(A) limit presented on the graphs is also the fixed element of the night-time noise level limit detailed within ETSU-R-97, and this is not predicted to be exceeded.

7.5.49 Finally, comparing the predicted operational turbine noise levels against the measured background noise levels, it can be seen that for Location 1, 2, 3 and 4 the turbine noise levels are generally below, or around the prevailing background noise levels, and therefore compliant with the IFC requirement relating to background noise levels.

7.5.50 For Location 5, the predicted turbine noise levels are generally above the measured background noise levels and exceed the IFC requirement relating to background levels. However, this should again be viewed in the context that the predicted levels are compliant with the fixed element of the ETSU-R-97 night-time noise level limit. Below this limit, the ETSU-R-97 assessment does not require assessment against prevailing background noise levels, because compliance with this limit alone is considered sufficient to ensure a commensurate level of protection to local residents.

7.5.51 In addition, it should be noted that the predicted turbine noise levels are generally low and assuming a 10dB loss through a partially open window, the predicted turbine noise levels are within the World Health Organisation guidance criteria for bedrooms, which is also referenced for use by the IFC.

7.5.52 Overall, it is considered that the resulting impact magnitude will range from Slight to Low. For a receptor sensitivity of ‘High’, as present in this case, this corresponds to an adverse effect significance of ‘Negligible’ to ‘Minor’. Such impacts would be local, long term and permanent in nature.

[4] For Location 1, a single 10 minute measurement was on the Serbian limit of 45dB(A), but when reviewing the full set of measurement data it is apparent that this is not generally the case.

Operational Turbine Noise - Mitigation

7.5.53 Given that a significance of effect of up to Minor at worst case has been identified, consideration to specific noise mitigation measures is not considered warranted.

7.5.54 Notwithstanding this, it should be noted that modern turbines generally come with the option to operate in noise reduced modes. This allows the operator to reduce noise emission (with a compromise in energy generation) should this be identified as necessary in the future.

7.5.55 In addition, the operator should obtain a warranty from the turbine manufacturer that the turbines to be installed are not tonal in nature.

Operational Turbine Noise - Residual Effects

7.5.56 Given that consideration to noise mitigation measures is not considered warranted, the identified effects of negligible to minor significance will remain. Such effects would be local, long term and permanent in nature.

Monitoring and Follow Up

7.5.57 There are recognised procedures for the monitoring of wind farm noise, and if necessary post completion surveys could be undertaken, although it should be noted that these are likely to require continuous extended monitoring periods.

Limitations and Assumptions

7.5.58 Detailed information on techniques and equipment for the construction phase of the Proposed Development is not available. The potential impacts associated with the construction phase of the Proposed Development have therefore been assessed based on qualitative appraisals with supporting qualitative assessments based on assumed operations considered appropriate to the works required. Determination of the actual construction processes and machinery will be the task of the appointed contractor.

7.5.59 Baseline traffic data have only been provided for annually averaged 24 hour periods, not separate daytime and night-time periods. Accordingly, detailed consideration to daytime and night-time construction traffic movements (and for other time periods) has not been possible.

7.5.60 The assessment of operational impacts associated with the wind turbines has been undertaken adopting source noise levels for a candidate turbine. Following completion of the tendering process, it is possible that the precise turbine make/model adopted and/or the operational mode will change from that adopted within the assessment. It should, however, be noted that it is expected that there are a number of options available that would produce noise at a level equal to or lower than the candidate turbine. It will be appropriate to select a turbine that does not give rise to the need to apply a tonal.

Cumulative Impacts

7.5.61 It has been identified that other proposed wind farm developments are sufficiently remote not to require consideration to cumulative noise impacts.

7.6 Summary

7.6.1 This chapter has considered the potential noise and vibration effects that could arise as a result of the proposed development during both construction and operational phases. The following potential impacts on noise and vibration sensitive receptors in the vicinity of then site have been considered:

- construction noise (including construction traffic noise) on existing local noise sensitive receptors;
- construction vibration on existing local noise sensitive receptors; and
- operational phase turbine noise on existing local noise sensitive receptors.

7.6.2 For construction noise, a qualitative appraisal has been undertaken, drawing upon the guidance contained within BS 5228-1:2009. This assessment has been further supported with example quantitative noise level predictions undertaken in accordance with the methodologies also presented within this document.

7.6.3 It has been identified that at the closest noise sensitive receptors, construction noise levels will fall below appropriate criteria by substantial margins. The significance of effect associated with construction noise has therefore been identified as 'Negligible'. Such impacts would be local, short term and temporary in nature.

7.6.4 Consideration has also been given to potential impacts as a result of construction traffic movements associated with the formation of the proposed development. It has been identified that typical daily construction traffic movements will fall well below the current baseline traffic flows for the proposed construction traffic access route. It has been identified that the change in traffic flows arising from typical construction traffic is very small in acoustic terms, and that there is significant capacity to account for daily variations in the intensity of construction traffic movements as the project progresses (e.g. through different stages of work). The significance of effect associated with construction traffic noise has therefore been identified as 'Negligible'. Such impacts would be local, short term and temporary in nature.

7.6.5 With regards to potential construction vibration, it has been identified that dwellings are sufficiently removed from areas requiring construction works that resulting levels would be sufficiently low as to not give rise to perceptibility; even during driven piling works (should these be necessary).

7.6.6 It is acknowledged that there are a number of existing structures in closer proximity to construction working areas than the considered dwellings. These have the potential to be impacted by vibration from construction works. Accordingly, a series of mitigation measures have been proposed, the implementation of which would ensure that building damage could be controlled to within acceptable levels.

7.6.7 The significance of effect associated with construction vibration has been identified to be 'Negligible' with the implementation of the proposed mitigation measures. Such impacts would be local, short term and temporary in nature.

7.6.8 An assessment of operational turbine noise has been undertaken for a sample of the closest identified noise-sensitive receptors to the proposed development. This assessment has drawn upon the results of a baseline noise survey. The survey included measurements at 5 locations. At each location, daytime, evening and night-time sample measurements were undertaken during low, medium and high wind speeds. Background noise measurements were synchronised with on-site wind speed measurements, which have been used in the subsequent analysis. Account has been taken of site specific wind shear.

7.6.9 A series of detailed noise level predictions have been undertaken for the proposed development, in accordance with the methodology detailed within ISO9613-2. Predictions have been based on the manufacturer's octave band noise emission data for a candidate turbine, and have included corrections for measurement uncertainty.

7.6.10 It has been identified that predicted operational turbine noise levels would achieve appropriate absolute noise criteria during daytime, evening and night-time periods. Such criteria have been derived in accordance with Serbian legislation, IFC guidelines, and ETSU-R-97 (which is applied as best practice in the UK and the Republic of Ireland).

7.6.11 The results of the operational turbine noise levels have also been compared against the results of the baseline noise survey. It has been identified that for the vast majority of locations and periods of the day, operational turbine noise levels would not exceed the prevailing background noise levels, or that the prevailing background noise level would not be subject to significant increase. At Location 5, it has been identified that the operational turbine noise levels would be notably above the evening and night-

time background noise levels. However, this must be viewed in the context that appropriate absolute noise level criteria would be complied with and that the resulting turbine noise levels are low.

7.6.12 ETSU-R-97 confirms that compliance with the adopted absolute noise level criteria is sufficient to ensure a commensurate level of protection against noise for existing residents. In summary, it is confirmed that seeking to avoid increases to existing low background noise levels (as present at Location 5) would constitute an un-necessary constraint to wind farm development, which is not necessary in order to achieve appropriate protection of public amenity.

7.6.13 The significance of effect associated with operational turbine noise has therefore been identified to be 'Negligible' to 'Minor' at worst. Such impacts would be local, long term and permanent in nature.

7.7 References

Documentary sources

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Hiller, D.M. and Crabb, G.I. (2000). Transport Research Laboratory Report TRL 429: Groundborne vibration caused by mechanised construction works.

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- Google Earth® Freely available aerial photography

8 Archaeology and Cultural Heritage

8.1 Introduction

8.1.1 This chapter assesses the impact of the proposed development on archaeological and cultural heritage assets.

8.1.2 This chapter is not intended to be read as a standalone assessment and reference should be made to the Front End of this ES (Chapters 1 – 4).

8.2 Legislation, Policy and Guidance

European Treaty

8.2.1 The EU does not have decision making power on cultural heritage but the Treaty of Lisbon states in Article 3.3. TEU "The Union shall respect its rich cultural and linguistic diversity, and shall ensure that Europe's cultural heritage is safeguarded and enhanced". (http://ec.europa.eu/culture/our-policy-development/cultural-heritage_en.htm)

Serbian Legislative Framework

8.2.2 The Serbian Cultural Property Law regulates the system of the protection and use of cultural property and defines conditions for the implementation of activities relating to the protection of cultural property. Cultural property can be of exceptional or great importance in which case it is subject to the provisions of the Cultural Property Law.

8.2.3 None of the assets identified in the course of this study are of exceptional or great importance – simply previously or identified cultural property.

Article 109 of the Cultural Property Law provides that:

8.2.4 If archaeological sites or archaeological artefacts are found in the course of execution of construction and other works, the executor of works shall immediately and without delay suspend works and inform the competent institute for the protection of cultural monuments, and take measures so that the finding is not destroyed and damaged, and that it is preserved in the place and position where it was found.

8.2.5 In the event of immediate danger of damaging the archaeological site or artefact, the competent institute for the protection of cultural monuments shall temporarily suspend the works until it is established, based on this Law, whether the immovable property or object are cultural property or not.

8.2.6 If the competent institute for the protection of cultural monuments fails to suspend the works, the works will be suspended by the Republic Institute for the Protection of Cultural Monuments.

Policy

European Bank for Reconstruction and Development

8.2.7 The European Bank for Reconstruction and Development (EBRD) publication 'Environmental and Social Policy' (2008) has been a key considered in the production of this chapter. Performance Requirement 1 (Environmental and Social Appraisal and Management) of the EBRD Environmental and Social Policy (2008) is considered relevant. The specific objectives of Performance Requirement 1 are summarised below:

- To identify and assess environmental and social impacts and issues, both adverse and beneficial, associated with the project;
- To adopt measures to avoid, or where avoidance is not possible, minimize, mitigate, or offset/compensate for adverse impacts on workers, affected communities, and the environment;

- To identify and, where feasible, adopt opportunities to improve environmental and social performance; and
- To promote improved environmental and social performance through a dynamic process of performance monitoring and evaluation.

8.2.8 A review of the Performance Requirements within the EBRD has been undertaken to identify any key heritage impacts that should be considered. Performance Requirement 8 Cultural Heritage aims to:

- Support the conservation of cultural heritage in the context of ERBD-financed projects;
- Protect cultural heritage from adverse impacts of project activities;
- Promote the equitable sharing of benefits from the use of cultural heritage in business activities; and
- Promote the awareness and appreciation of cultural heritage wherever possible.

8.2.9 The Project Requirement sets a framework for the protection of cultural heritage through the avoidance, and where avoidance is not feasible, the reduction and mitigation of any potential adverse impacts by ERBD-financed activities, in an appropriate and proportionate manner.

The International Finance Corporation

8.2.10 Performance Standard 8 of the International Finance Corporation Sustainability Framework recognizes the importance of cultural heritage for current and future generations. Its objectives are:

- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To promote the equitable sharing from the benefits of the use of cultural heritage.

8.2.11 It requires the protection of cultural heritage in project design and execution with stipulations for chance find procedures, consultation, community access, removal of replicable cultural heritage, removal of non-replicable public heritage and critical cultural heritage. It goes on to provide guidance on the project's use of cultural heritage. (http://www.scribd.com/fullscreen/84697434?access_key=key-1do8v46kzf4u4h6nu17e)

8.3 Assessment Methodology and Significance Criteria

Scope of the Assessment

8.3.1 This chapter considers the following potential cultural heritage impacts on the environment as a result of the development proposals. ERBD PR 8 defines cultural heritage as tangible and intangible. This assessment considers the effects on tangible/physical cultural heritage which are movable or immovable objects sites, groups of structures and natural features and landscapes that have archaeological, palaeo-ontological, historical, architectural, religious, aesthetic or other cultural significance. Any visual effects on the settings of immovable cultural heritage assets outside the development area are considered in the Landscape and Visual Impacts Assessment chapter.

Extent of the Study Area

8.3.2 This ES chapter considers the area of the proposed development.

Consultation

8.3.3 A separate consultation chapter will be provided in the introductory chapters. The Institute for the Protection of Cultural Monuments Pancevo were consulted on the archaeological fieldwork the report of which they approved,

Method of Baseline Data Collation

Desk Study

8.3.4 A desk study has been undertaken which identifies any cultural heritage assets recorded by the Institute for the Preservation of Cultural Monuments Pancevo.

Site Visit / Other Assessment

8.3.5 A field survey was undertaken to identify any heritage assets in the area of the proposed turbines, route of installation and the site of the sub-station.

Significance Criteria

8.3.6 The assessment of potential impacts as a result of the Proposed Development has taken into account both the construction and operational phases. The significance level attributed to each impact has been assessed based on the magnitude of change due to the development proposals, and the sensitivity of the affected receptor/receiving environment to change, as well as a number of other factors that are outlined in more detail in Chapter 1 of this ES. Magnitude of change and the sensitivity of the affected receptor/receiving environment are both assessed on a scale of high, medium, low and negligible (as shown in Table 1.1 in Chapter 1).

Impact Significance

8.3.7 The following terms have been used to define the significance of the impacts identified:

- **Major impact:** where the Proposed Development could be expected to have a very significant impact (either positive or negative) on heritage assets of extraordinary or special cultural importance;
- **Moderate impact:** where the Proposed Development could be expected to have a noticeable impact (either positive or negative) on heritage assets of previously established or recently identified cultural heritage importance;
- **Minor impact:** where the Proposed Development could be expected to result in a small, barely noticeable impact (either positive or negative) on heritage assets of previously established or recently identified cultural heritage importance; and
- **Negligible:** where no discernible impact is expected as a result of the Proposed Development on heritage assets.

8.4 Baseline Conditions

8.4.1 Field survey of the route of installation between the turbines showed obvious areas (in the map attached marked blue (Appendix 1)) which contain movable surface sites mostly belonging to the period of Turkish domination, but the parts of the route located on previously known archaeological sites and the newly discovered site, show presence of the movable material belonging to prehistoric, Sarmatian and medieval period.

8.4.2 Based on the above, it is evident that the field survey of future locations of turbines 4, 5, 9, 19, 20, 21, 32, 44, 46 and 70 and the installation route between them recorded the movable archaeological material belonging to the period of prehistoric, Sarmatian and medieval period and the period of Turkish domination.

8.4.3 Therefore the following zones have been identified as being of established or recently discovered importance:

- **Zone of Protection I** (zone marked red in the attached map) – area which includes the wind turbines No. 5 and 32;
- **Zone of Protection II** (zone marked blue in the attached map) – area which includes the wind turbines No. 4, 9, 19, 20, 21, 44, 46, and 70 and the routes of installations between them;
- **Zone of Protection III** – area which includes the remaining part of the wind park

Future Baseline

8.4.4 Were the development not to proceed there would be continuing agricultural impact on the archaeological material resulting in its incremental erosion.

8.5 Assessment of Impacts, Mitigation and Residual Effects

Construction

8.5.1 Construction unmitigated would destroy heritage assets from the prehistoric, Sarmatian and medieval period and the period of Turkish domination. This would have a moderately adverse impact significance.

Mitigation

8.5.2 The following mitigation should be undertaken in the areas identified as containing cultural heritage assets.

8.5.3 Zone of Protection I (zone marked red in the attached map (Appendix 8.1)) – area which includes the wind turbines No. 5 and 32, where the measures of protection at the Investor's expense shall include the archaeological excavations, undertaken prior to the commencement of any type of groundworks, earthworks or other activity which might potentially disturb sub-ground archaeological remains. The archaeological excavations would include the area of the locality endangered by the development of foundation footings of towers and the route of installation in the length of about 25m to either side of the towers;

8.5.4 Zone of Protection II (zone marked blue in the attached map (Appendix 8.1)) – area which includes the wind turbines No. 4, 9, 19, 20, 21, 44, 46, and 70 and the routes of installations between them where the measures of protection shall include the permanent archaeological supervision of earthworks during construction of wind turbines, routes of installations and other infrastructure, and in the event of finding particularly interesting and valuable chance findings during the execution of earthworks, it is necessary to undertake protective archaeological excavations in the immediate area of the findings, at the Investor's expense;

8.5.5 Zone of Protection III – area which includes the remaining part of the wind park where the measures of protection shall include the contractor's obligation to immediately stop the works in case of finding archaeological sites or archaeological objects during the execution of construction or other works and to immediately notify the Institute for the Protection of Cultural Monuments in Pančevo thereof, and to take measures to prevent destruction or damage to the findings and to keep them at the exact place and in the position in which they were found, all in accordance with Article 109, paragraph 1 of the Law on Cultural Heritage (see above).

8.5.6 It is proposed that the above archaeological requirements be set out in a Construction Environmental Management Plan (CEMP) for the construction phased of the development.

Residual Effects

8.5.7 It is likely that the residual impacts will remain the same as those outlined above.

Operation

8.5.8 No heritage assets are likely to be affected by the operation of the wind farm.

Monitoring and Follow Up

8.5.9 Once all works are complete the cultural heritage material identified should be assessed, analysed and appropriately published.

Limitations and Assumptions

8.5.10 This assessment is limited by the available records and the survey which has been undertaken prior to the development under the aegis of the Institute for the Preservation of Cultural Monuments Pancevo.

Cumulative Impacts

8.5.11 No cumulative effects have been identified.

8.6 Summary

8.6.1 Survey work at the site of the wind park has established the presence of archaeological remains of local significance. Three areas have been identified where differing levels of mitigation are required.

8.7 References

Documentary sources

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Table 8.3: Summary of Effects Table for Archaeology and Cultural Heritage

Description of Likely Significant Effects	Significance of Impacts					Summary of Mitigation / Enhancement Measures	Significance of Residual Effects				
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)
Construction											
Excavation of heritage assets from the prehistoric, Sarmatian and medieval period and the period of Turkish domination	Moderate	Negative	P	D	LT	Archaeological recording	Moderate	negative	P	D	LT
Operation											
No additional impacts											

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term

N/A = Not Applicable

9 Socio Economic Issues

9.1 Introduction

9.1.1 This chapter assesses the impact of the proposed development on communities and individuals, as well as social and economic assets within the Project area of influence.

9.1.2 This chapter (and its associated figures) is not intended to be read as a standalone assessment and reference should be made to the Front End of this ES (Chapters 1 – 4).

9.2 Legislation, Policy and Guidance

Serbian Legislative Framework

9.2.1 In relation to territorial organisation, Serbia has two autonomous provinces – Vojvodina in the north and Kosovo and Metohija in the south, as defined by the Law on Territorial Organisation of the Republic of Serbia (Official Gazette of the RS No. 129/2007). The country is divided into 150 municipalities, 23 cities and the City of Belgrade, which is a separate administrative unit. Units of local self-government are municipalities, cities and the City of Belgrade, as defined by the Law on Local Self Government (Official Gazette of the RS No. 129/07). Their bodies of government include: municipal (city) assembly, president of the municipality (mayor) and municipal (city) administration. Key responsibilities of the local self-governments include: urban and town planning, housing, communal services, local economic development, use and protection of agricultural land, local roads, primary health care, public information, etc. Some responsibilities are shared with central and/or provincial government, in the areas of education, social welfare, health protection, etc. Local self-governments are financed out of: (i) own revenues, (ii) shared national taxes, and (iii) a share of revenues assigned to local government units and determined by unique criteria (grant funds). Local self-governments can establish local communities on their territories to facilitate the fulfilment of general, common and every day needs of citizens. Local communities are governed by the Local Community Council, supervised by the Local Community Supervisory Board, both elected directly by citizens.

9.2.2 Land acquisition in Serbia is primarily governed by the Expropriation Law of the Republic of Serbia (Official Gazette of the RS 53/95, Official Gazette of the FRY 16/01, Official Gazette of the RS no. 20/09, 55/13). According to this law, privately owned companies cannot be beneficiaries of expropriation and have to acquire land through voluntary transactions regulated by the Law on Obligations (Official Gazette of the SFRY No. 29/78, 39/85, 45/89, 57/89 and FRY No. 31/93). However, the Law on Planning and Construction (Official Gazette of the RS 72/09, 81/09, 64/10, 24/11) provides for certain statutory easements specifically in relation to wind farms and other energy objects. These include oversailing of wind turbine blades and power lines over adjacent land as well as the right of way through neighbouring land during construction. Affected users of land are to be compensated at market prices for any lost crops and damages. Similarly, the Energy Law (Official Gazette of the RS No. 84/04, 57/11, 80/11) provides for the right to access energy facilities for repair or maintenance through neighbouring land. Again, affected users of land are to be compensated at market prices for lost crops and damages, primarily through negotiations and if these fail, through the courts. In addition, during operations, users of neighbouring land plots could become subject to certain use restrictions (e.g. planting trees).

9.2.3 Serbian legislation guarantees that everyone shall have the right to be informed accurately, fully and timely about issues of public importance. These provisions are included in the Constitution of the Republic of Serbia: (Official Gazette of the RS, No. 98/2006), as well as in the Law on Free Access to

Information of Public Importance (Official Gazette of the RS, No. 120/04, 54/07, 104/09, 36/2010). The Law on Planning and Construction of the Republic of Serbia regulates the development and adoption of spatial and urban plans in Serbia, which are all subject to a public disclosure and consultation process. By adopting the Law on Confirming the Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters (Official Gazette of the RS, No. 38/09), Serbia ratified the Aarhus Convention. Provisions of the Aarhus Convention were then incorporated into the main environmental protection laws, described in Chapter 2. This includes obligations to disclose information and organise public consultations.

Policy

European Bank for Reconstruction and Development

9.2.4 The European Bank for Reconstruction and Development (EBRD) publication 'Environmental and Social Policy' (2008) has been a key consideration in the production of this chapter. Performance Requirement 1 (Environmental and Social Appraisal and Management) of the EBRD Environmental and Social Policy (2008) is considered relevant. The specific objectives of Performance Requirement 1 are summarised below:

- To identify and assess environmental and social impacts and issues, both adverse and beneficial, associated with the project;
- To adopt measures to avoid, or where avoidance is not possible, minimize, mitigate, or offset/compensate for adverse impacts on workers, affected communities, and the environment;
- To identify and, where feasible, adopt opportunities to improve environmental and social performance;
- To promote improved environmental and social performance through a dynamic process of performance monitoring and evaluation.

9.2.5 A review of the Performance Requirements within the EBRD has been undertaken to identify any key social impacts that should be considered.

EBRD's Performance Requirement 5 (Land Acquisition, Involuntary Resettlement and Economic Displacement)

9.2.6 The key objectives and requirements of this Performance Requirement, applicable to this project can be summarised as follows:

- avoid, or at least minimise, permanent or temporary project induced economic displacement whenever feasible by exploring alternative project designs;
- develop appropriate livelihood restoration action plans where significant displacement is unavoidable;
- improve or, at a minimum, restore to pre-project levels livelihoods and income earning capacity of affected persons, including those who have no legally recognisable rights or claims to land and support them during the transition period;
- mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of and access to land, physical assets or natural resources by:
    - providing compensation for loss of assets at replacement cost prior to taking possession of acquired assets; and
    - ensuring that compensation and livelihood restoration activities are planned and implemented with appropriate disclosure of information, consultation, and the informed participation of those affected,
- make special provisions for assisting disadvantaged or vulnerable individuals or who may be more adversely affected by economic displacement than others and who may be limited in their ability to claim or take advantage of compensation, livelihood assistance, and related benefits;

- establish a grievance mechanism to receive and address in a timely fashion specific concerns about compensation and relocation that are raised by displaced persons; and
- monitor and evaluate the implementation and results of implementation measures.

EBRD's Performance Requirement 10 (Information Disclosure and Stakeholder Engagement)

9.2.7 The EBRD policy considers stakeholder engagement an ongoing process which involves:

- the client's public disclosure of appropriate information so as to enable meaningful consultation with stakeholders
- meaningful consultation with potentially affected parties, and
- a procedure or policy by which people can make comments or complaints (grievance mechanism).

9.2.8 EBRD's Performance Requirement 2 (Labour and Working Conditions) has also been reviewed and compared to Serbian labour legislation requirements, to cover any gaps relating to employment issues, through mitigation measures.

International Finance Corporation

9.2.9 The International Finance Corporation (IFC) publication 'Policy on Environmental and Social Sustainability' (2012) has been a key consideration in the production of this chapter. Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts) of the IFC is considered relevant. The specific objectives of Performance Standard 1 are summarised below:

- To identify and assess environmental and social risks and impacts of the project;
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise, and, where residual impacts remain, compensate/offset for risks and impacts to workers, the Affected Communities, and the environment
- To promote improved environmental and social performance of clients through the effective use of management systems;
- To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately; and
- To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

9.2.10 A review of the Performance Standards within the IFC has been undertaken to identify any key social impacts that should be considered.

IFC's Performance Standard 5 (Land Acquisition, Involuntary Resettlement)

9.2.11 The key objectives and requirements of this Performance Standard, applicable to this project can be summarised as follows:

- To avoid, and when avoidance is not possible, minimise the displacement by exploring alternative project designs.
- To avoid forced eviction.
- To anticipate and avoid, or where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.
- To improve, or restore, the livelihoods and standards of living of displaced persons.
- To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

IFC's Policy on Disclosure of Information

9.2.12 The IFC Policy on Disclosure of Information considers stakeholder engagement as an ongoing process which involves:

- the client's public disclosure of appropriate information so as to enable meaningful consultation with stakeholders
- meaningful consultation with potentially affected parties, and
- a procedure or policy by which people can make comments or complaints (grievance mechanism).

9.2.13 IFC's Performance Standard 2 (Labour and Working Conditions) has also been reviewed and compared to Serbian labour legislation requirements, to cover any gaps relating to employment issues, through mitigation measures.

9.3 Assessment Methodology and Significance Criteria

Scope of the Assessment

9.3.1 This chapter considers the potential socio economic impacts as a result of the proposed development, associated with the following issues:

- Land use
- Employment and procurement opportunities
- Livelihoods
- Community health, safety and security
- Revenue generation for the local government / community
- Infrastructure

9.3.2 Impacts and mitigation measures associated with community health, safety and security, as well as occupational health and safety are addressed in Chapter 10, while this Chapter focuses on social impacts associated with the influx of labour and the increase in traffic and heavy vehicles.

Extent of the Study Area

9.3.3 The primary area of influence considers all project impacts on local resources and receptors and it is the focus of the impact assessment. It encompasses the Project site, as well as the local communities surrounding and closest to the Project site – Padina (1km to the northeast), Debeljača (1.75km to the southwest) and Kovačica (2.5km to the northwest). The nearby local community Crepaja is also included in the primary area of influence, as a number of affected land users are residing there and the settlement is crossed by the main transportation route to be used for the Project (the II-111 road). (see Figure 9.1)

9.3.4 The secondary area of influence considers larger scale economic and infrastructure impacts on a wider, regional level. This area comprises Kovačica Municipality (see Figure 9.1).

9.3.5 The tertiary area of influence considers Project impacts on a national scale.

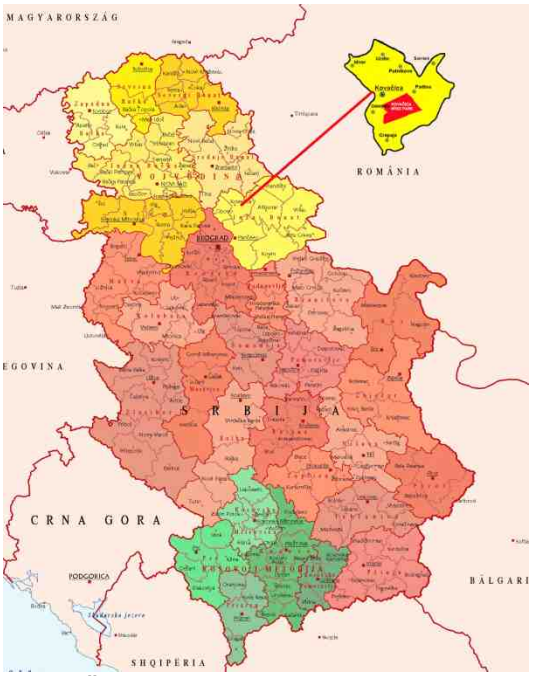

Figure 9.1 – Kovačica Wind Park site location in the Republic of Serbia

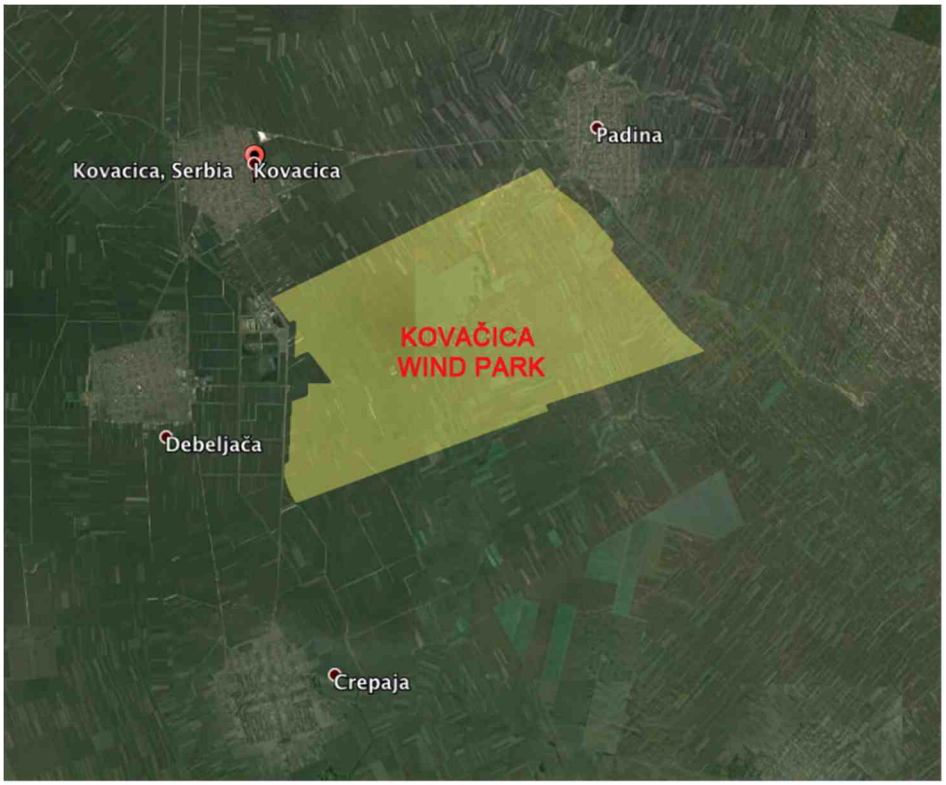

Figure 9.2 – Kovačica Wind Park site location in the Kovačica municipality.

Consultation

9.3.6 Electrawinds has been present in the project area, communicating with local authorities and residents of directly affected communities since 2012. The company has been meeting with various stakeholders, participating in or sponsoring community events and meeting with directly affected landowners in connection to land acquisition for the project. Consultations in developing relevant project plans and the

EIA scoping report were undertaken with various local authorities, statutory departments and other stakeholders.

9.3.7 During the development of the ESIA chapter on socio economic issues, meetings were organised by Electrawinds with directly affected landowners and owners of surrounding land plots, in four communities: Kovačica, Padina, Debeljača and Crepaja[1]. In Padina, the team also met with members of the local community Padina and a representative of the Kovačica municipality. The purpose of these meetings was to inform members of the affected local communities on the project and its current development and permitting status, to describe what the construction process will look like and the possible consequences in relation to damage of crops, to discuss traffic related impacts and the reconstruction of roads, as well as to show photomontages of what the wind farm will look like once construction is completed. Project information leaflets were also distributed to participants and a grievance mechanism presented.

9.3.8 Further details on information disclosure and planned consultations are provided in the Project Stakeholder Engagement Plan.

Method of Baseline Data Collation

Desk Study

9.3.9 Secondary data for this chapter was collected via a desk study mainly of statistical information available from the latest population census carried out in the Republic of Serbia in 2011. Additional data was obtained from relevant municipal or regional studies, reports and plans, as well as other documents and sources provided by Electrawinds.

Site Visit / Other Assessment

9.3.10 As part of developing the socio economic issues chapter for the ESIA, two site visits were undertaken to the project affected area. The first was carried out on July 31st 2013 and the second on October 21st and 22nd 2013, as previously described in the section on consultation. In addition, extensive consultation meetings have been held local landowners since 2012, during which information on the proposed development and its programme have been provided.

Significance Criteria

9.3.11 The assessment of potential impacts as a result of the Proposed Development has taken into account both the construction and operational phases. The significance level attributed to each impact has been assessed based on the magnitude of change due to the development proposals, and the sensitivity of the affected receptor/receiving environment to change, as well as a number of other factors that are outlined in more detail in Chapter 1 of this ES. Magnitude of change and the sensitivity of the affected receptor/receiving environment are both assessed on a scale of high, medium, low and negligible (as shown in Table 1.1 in Chapter 1).

Impact Significance

9.3.12 The following terms have been used to define the significance of the impacts identified:

- **Major impact:** where the Proposed Development could be expected to have a very significant impact (either positive or negative) on communities and individuals or social and economic assets;
- **Moderate impact:** where the Proposed Development could be expected to have a noticeable impact (either positive or negative) on communities and individuals or social and economic assets;
- **Minor impact:** where the Proposed Development could be expected to result in a small, barely noticeable impact (either positive or negative) on communities and individuals or social and economic assets; and

[1] Electrawinds invited participants by post and through posters placed in key community information boards, however the turn out was very low, particularly in Kovačica where no one came. In total, 18 people participated in the consultation meetings.

- **Negligible:** where no discernible impact is expected as a result of the Proposed Development on communities and individuals or social and economic assets

9.4 Baseline Conditions

Socio – Economic Environment

Local context

9.4.1 The project site is located in the Kovačica municipality, surrounded by three local communities – Debeljača, Padina and Kovačica, including a nearby community Crepaja. Kovačica municipality has an area of 419 km2 and territorially belongs to the South Banat Region. It is located 50 km from the capital of Serbia, Belgrade and 90 km from the capital of the Vojvodina Province, Novi Sad. The municipality is characterised by an interesting mix of nationalities and ethnicities and consequently has four official languages – Serbian, Hungarian, Slovakian and Romanian. The economy is dominated by agriculture although each local community also has industrial facilities, which are important for its residents' livelihoods. The municipality is also widely known for naïve art.

9.4.2 As determined by the Ministry of Regional Development and Local Self Government, based on the Law on Regional Development of the Republic of Serbia (Official Gazette of the RS 51/09,30/10), Kovačica municipality belongs to category three (out of four), with a level of development between 60 and 80% of the republic level average. The total budget of the Kovačica Municipality for 2013 is 706,000,000 RSD (approx. 6,140,000 EUR).

Demography

9.4.3 Kovačica Municipality has a population of 25,973, living in 9,137 households. Table 9.1 below provides information on population in each of the affected communities.

Table 9.1: Population in the Affected Local Communities (source: Statistical Office of the Republic of Serbia, 2011 census)

Local community	Population	Number of households
Padina	5,517	1,978
Debeljača	4,910	1,843
Kovačica	6,264	2,336
Crepaja	4,364	1,452
Total	21,055	7,609

9.4.4 As opposed to the national make-up of the population at the republic level, where Serbs are the majority (83%), the majority of the population in the affected Kovačica municipality are Slovaks (42%). Serbs are the second largest population group (33%) followed by Hungarians, Romanians and other nationalities. Roma are present in the municipality with less than 3%.

Table 9.2: Nationalities in the Affected Areas (source: Statistical Office of the Republic of Serbia, 2011 census)

Kovačica Municipality	Local community Padina	Local community Debeljača	Local community Kovačica	Local community Crepaja
42% Slovak 33% Serbian 10% Hungarian 6% Romanian 3% Roma 6% other	The majority of the population are Slovaks, followed by Serbs.	The majority of the population are Serbs, with minimal presence of other nationalities, i.e. Slovaks, Romanians.	The majority of the population are Slovaks, followed by Serbs, Romanians, Hungarians, etc.	The majority of the population are Serbs, followed by Roma, Slovaks and Hungarians

9.4.5 In the local communities, there is a different mix of nationalities, whereby in Debeljača and Crepaja the majority of the population are Serbs, while in Kovačica and Padina, the majority of the population are Slovaks.

9.4.6 The population in the municipality is evenly split between men (50%) and women (50%).

Religion

9.4.7 The majority of the population in the municipality is either Protestant (45%) or Orthodox (41%), while 10% declared that they are not religious or did not answer the question during the 2011 population census. Other religions are present with less than 4% in Kovačica Municipality.

Languages

9.4.8 The official language spoken across the country and in the Project area is Serbian. The official alphabet is Cyrillic, while the Latin alphabet is also widely used.

9.4.9 Vojvodina Province, where Kovačica is located, is a multi-ethnic region and is known for the variety of official languages used, apart from Serbian. Citizens have the right to demand communication with authorities in 6 official languages – Serbian, Hungarian, Slovak, Romanian, Ruthenian and Croatian.

9.4.10 In Kovačica Municipality, the majority of the population declared that their mother tongue is Slovak (43%), followed by those who declared Serbian as their mother tongue (37%). 10% declared Hungarian and 6% declared Romanian as their mother tongue, while other languages were recorded at less than 4%.

Housing

9.4.11 One and two storey houses, built of compacted dirt or bricks dominate the Project area. They are often surrounded by walls/fences, connected from house to house, with doors and gates for vehicles to enter and exit courtyards. Small lawns in front of the houses separate them from the streets, while behind the gates, houses have internal courtyards, with animal shelters, storage space, garages, etc. Houses also have small orchards or vegetable and flower gardens. See Figure 9.3 below for a photo of a typical house and courtyard in the Project area (Crepaja).

Figure 9.3 – House and courtyard in Crepaja (Source: http://srbija-nekretnine.org)

Infrastructure

9.4.12 Kovačica Municipality has approximately 74 km of roads infrastructure, of which 38% are regional roads, 49% are local and 14% are small local routes. All inhabited areas, including the affected communities, have access roads. There is existing railway infrastructure (railway Belgrade – Kikinda), however the frequency of transport is very low.

9.4.13 The main road to be used for transportation to and from the Project site will be the category 2 state road -111 Ečka - Kovačica – Pančevo (II-111). It has a single lane in each direction and runs north from Pančevo to Kovačica, passing through Crepaja and along the western border of the project site. According to the 2012 average daily traffic report from the Roads of Serbia, over 4,000 vehicles travel on the section of the road from Kovačica to Jabuka (25.5km) each day. A more detailed overview of the average daily traffic of different categories of vehicles is provided in table 9.3. A significant number of residents of Kovačica municipality are daily commuters, predominantly to Belgrade, but also to Pančevo and Zrenjanin, for work or studies.

Table 9.3: Annual average daily traffic on the II- 111, section from Kovačica to Jabuka (source: Roads of Serbia, 2012 Average Daily Traffic Report)

Total km	private vehicles	buses	light trucks	medium trucks	heavy trucks	trucks with trailers	Total
25.5	3,640	67	65	100	41	356	4,269

9.4.14 The electricity and telecommunications networks are developed in all local communities, however there is no sewage network. Sewage water is discharged into septic tanks. Drinking water is supplied by local groundwater wells, whose capacity is insufficient during periods of increased water consumption. Solid waste disposal is organised in all local communities and all have street lighting. The gas supply network has been constructed only in Crepaja, however it is not yet operational.

Education

9.4.15 In Kovačica Municipality, approximately 19% of people have no education or incomplete primary education (65% of which are women), 33% have basic primary education, 41% have secondary education and 7% have college or university level education (52% of which are women). Only 1.30% of the population is illiterate, predominantly women over the age of 65.

9.4.16 All local communities have preschools and primary schools, while Kovačica also has a secondary school. Teaching is carried out in the four official languages: Serbian, Slovakian, Romanian and Hungarian. Some children attend secondary schools in Pančevo, while the main education facilities for tertiary education are in Belgrade. Some children from the municipality continue their tertiary education abroad, in Slovakia, Romania or Hungary, where they get scholarships and many never return to Serbia.

Local Economy, Employment and Unemployment

9.4.17 Manufacturing, particularly food processing, and agriculture are the dominant economic activities in the municipality. Other economic activity is mostly limited to retail and services (i.e. shops, restaurants, education, health). Kovačica has some tourism infrastructure in place, which includes one hotel (Relax) with a capacity of approx. 100 beds and some private accommodation, with an additional 80 beds. In 2011, a total of 4143 tourists were recorded in the municipality, 17% of which were foreign tourists.

9.4.18 Employment and unemployment statistics are only available at the municipal level (see Table 9.4 below) and not at the local community level.

Table 9.4: Employment and unemployment statistics in Kovačica Municipality (source: Statistical Office of the Republic of Serbia, 2011 census)

Employed		Unemployed			
Total	of that Women	Total	Applying for a first job	No qualifications	Women
2,848	37.3 %	3,708	47.5 %	53.6 %	50.2 %

9.4.19 The average number of employees per 1,000 inhabitants is 110 in Kovačica municipality, while at the level of the republic, that number is more than double – 241. As for the average number of unemployed people per 1,000 inhabitants, in Kovačica municipality it is 143, while at the level of the republic it is 102.

9.4.20 Approximately one fifth of the population in the municipality is self-employed i.e. as entrepreneurs. The rest are employed by legal entities. Of these, the majority are employed in agriculture and particularly manufacturing or services such as education, health and social work. Trade and repairs are also a significant source of employment. A relatively small percentage of employees are engaged in the construction sector – 1.23%. A detailed overview of employment by sectors in the Kovačica municipality is provided in Table 9.5 below.

Table 9.5: Employment by sectors in Kovačica (source: Statistical Office of the Republic of Serbia, 2011 census)

Entrepreneurs	Employees of legal entities							
Total: 577 (20.3%)	Total: 2,271 (79.7%)							
	Agriculture, forestry and water management	Manufacturing	Production of electricity, gas and water	Construction	Wholesale retail and repairs	Transport, and storage	Hotels and restaurants	Information and communication
	15.68%	31.35%	2.55%	1.23%	8.06%	2.86%	0.84%	1.76%

Entrepreneurs	Employees of legal entities							
	Financial intermediation	Administrative and support services	Expert, scientific and technical services	Government and social insurance	Education	Health and social work	Art, leisure and sports	other
	1.06%	0.13%	1.01%	5.28%	16.38%	9.78%	1.72%	0.31%

9.4.21 The average net monthly salary in Kovačica Municipality in 2011 was 234 EUR, while at the level of the republic the average net salary was 333 EUR.

9.4.22 With regards to unemployment figures, according to the data held by the National Employment Service, in September 2013, there were 3,511 unemployed individuals in the Kovačica municipality. A detailed overview of the types of skills that are available among the unemployed population at the level of the municipality is provided in Table 9.6.

Table 9.6: Unemployment by type of qualifications / skills (source: National Employment Service, September 2013)

Type of qualifications / skills of unemployed individuals	September 2013
agriculture, food processing	254
forestry, wood processing	58
geology, metallurgy	5
mechanical engineering	320
electrical engineering	108
chemistry, printing	55
textile and leather	142
utilities, furnishings and painting	40
surveying and construction	59
Transportation	61
trade, tourism, restaurants	186
economics, business administration, law	175
health care	53
Education	29
social science	6
natural science	8
Culture	17
Sports	2
personal services	77
other skilled and unskilled labour	1,856
TOTAL	3,511

Health

9.4.23 Within the Kovačica Municipality, life expectancy is 69.68 years for men and 74.71 years for women. The most significant causes of death in 2011 were cardiovascular diseases (65%) and tumours (16%).

9.4.24 There are two hospitals in the region, one in Pančevo (27 km) and one in Zrenjanin (45 km). The municipality has a primary health care centre including an emergency medical services department, while each local community surrounding the Project site has one small health clinic and a pharmacy.

Land Use and Property

9.4.25 Agriculture is the dominant land use in the Kovačica Municipality composing 89.5% (approx. 37.500 ha) of the total land area. The Project site under the scope of this assessment is 3,711 ha (37 km^2). The Detailed Regulation Plan specifies that almost all of the affected land is agricultural land – 98% while the rest falls into the category of roads and water. The land is predominantly arable land (corn, sunflower, wheat), while a very small percentage is under trees (acacia and black pine) including one small vineyard.

9.4.26 The project requires acquisition of land[2] for 38 wind turbines and crane hardstandings, as well as the on-site substation, maintenance building with welfare facility and OHL foundations. The land acquired for the Project amounts to a total of 7ha (0.18% of the Project site). This includes easement rights over 0.35 ha for the wind turbines including hardstanding areas, purchasing of 4.6 ha for the substation and maintenance building and 2.4 ha for turbine foundations.

9.4.27 At present, it is believed that no additional land will be needed for site entrance and access tracks, on-site access tracks between turbines including passing bays and corners and underground cabling (electrical and fibre optic) between the turbines. Existing roads, access tracks and OHL foundations will only be upgraded, while underground cabling will be installed along existing roads and tracks.

9.4.28 Privately owned land has been acquired for the above components, through voluntary land transactions. Land needed for the substation and maintenance building was acquired by Electrawinds through a sale purchase agreement, without resorting to expropriation or other compulsory purchase procedures. This included 3 land plots (4 ha) all belonging to one owner.

9.4.29 Easement rights have been established on 65 land plots in the period October 2012 to January 2013, belonging to a total of 32 owners (including one private company). Owners are mostly residing in the nearby communities, as follows: 16 from Padina, six from Crepaja and another six from Debeljača, three from Pančevo, and one from Novi Sad and Orlovat each. The owners of land have all received one off payments upon signing contracts, for any damages incurred in connection to preliminary works and explorations until 2015. Starting from 2015 (or the date when the Investor receives the construction permit, if it occurs earlier), each affected owner will receive an annual compensation payment for a period of 25 years, after which new valuations and calculations of the compensation amount will be carried out. Owners of land also have the possibility of choosing to receive a one off payment for the full period of 25 years, in advance which is half of the total amount received in annual instalments.

9.4.30 In addition to these compensation payments, the contracts also specify that any damages that occur to crops or the land during construction or operation (for repairs or maintenance) will be compensated separately, in accordance with reports from court certified valuators, at full market value. Easement rights have been registered upon contract signature in the land cadastre. At present, all land is still available to users of land, who will continue to use it until construction begins, planned for 2015.

9.4.31 Although land was acquired through voluntary land transactions, and therefore EBRD policy requirements in relation to involuntary resettlement do not apply, the main principles for land acquisition required by this policy were adhered to by Electrawinds, including avoidance and minimisation of economic displacement, provision of information and consultations, as well as provision of compensation at full replacement value (including covering the costs of transfer or other taxes associated with contract signature).

9.4.32 Owners of affected land were identified from the cadastre. None of the affected land was registered in the cadastre as being leased or used under any formal arrangement with the owner. However, it is possible that some of the land is informally leased to family members or third parties. Site visits and discussions with local people suggest that this practice exists in the project area. Any such users of

[2] The term land acquisition refers to both outright purchases of property and purchases of property rights (i.e. rights of way), as defined in the EBRD 2008 Environmental and Social Policy, PR5.

land (who are not owners) affected by land acquisition related activities will be considered as being involuntarily resettled in accordance with the EBRD 2008 Environmental and Social Policy (PR5) and will have to be compensated for damaged/lost crops.

9.4.33 It is believed that no additional land will be needed during construction, however it is possible that this may change or that some additional land will be disturbed during the transport and installation of wind turbines, causing damages to crops. In accordance with the provisions of the Law on Planning and Construction, Electrawinds will compensate users of land at market value. Since no other costs are associated with this type of impact (loss of crops), compensation at market value constitutes full replacement cost, as defined by IFI policies.

9.5 Assessment of Impacts, Mitigation and Residual Effects

Construction

Land Use

9.5.1 In total 7 ha of agricultural land (corn, sunflower, wheat, etc.) will be occupied during construction and remain permanently occupied during the operations phase. This translates to 0.18% of the Project site and 0.01% of the total agricultural land in the Kovačica municipality.

9.5.2 Construction is expected to last up to 24 months, however construction of one wind turbine on a particular plot of land will last only two to three weeks. This means that either one season's crops or no crops surrounding the construction area could be affected (depending on the season in which construction is carried out on a particular plot). Land users have however stressed the importance of preserving topsoil during construction and fully reinstating all disrupted land.

9.5.3 The total land which will be affected during construction is only a small portion of agricultural land in the area. This impact is assessed as minor negative.

9.5.4 Before construction, access tracks will be upgraded and then used for the transport of materials, equipment, workers, etc. which will increase the amount of traffic in the construction area. During the upgrading of access tracks, as well as a result of increased traffic, particularly the presence of heavy vehicles some of the local land users may have temporary difficulties accessing plots of land. This impact is assessed as minor negative, as it may occur only occasionally, under certain circumstances.

Employment and Procurement Opportunities

9.5.5 The workforce needed during the construction phase of the Project will be sourced locally (primarily from the Kovačica Municipality[3], including the four directly affected local communities), nationally (from other parts of Serbia) and internationally, through third party construction firms. Due to the technical nature of the Project, it is likely that most of the skilled and semi-skilled labour will be sourced nationally and internationally, however Table 9.6 shows that certain skills are also to be found among the local population residing in the municipality. Construction firms typically employ unskilled labour from the local communities, primarily to reduce costs associated with travel and accommodation.

9.5.6 It is expected that two teams of 25 workers will work during construction. 60% (30) will be unskilled labour while the remaining 40% (20) will be split between semi-skilled and skilled labour. The construction phase will last for about 24 months, however not all workers will be employed all the time. The frequency at which workers will be employed and the duration of their engagement could not be estimated at the time of developing the ESIA and will depend on the contractors' organization of work.

9.5.7 The total working age population (15 to 65) in the municipality is 16,965 and therefore this translates to a generation of employment for 0.18% of the local population. Employment of locals will gave a

[3] The contractual agreement between Electrawinds and the Kovačica Municipality includes a provision by which Electrawinds obliges itself to engage at least 70% of the workforce from the territory of the Municipality, provided that the workforce possesses qualifications needed for certain positions.

significant effect on those who are employed however this will be a small portion of the total population and will not significantly reduce unemployment in the area. The employment of individuals from local communities will however be beneficial as it is expected to lead to improved relationships between the Project and local communities and improved local skill set which may be valuable for future projects. This impact has been assessed as minor positive.

9.5.8 The creation of indirect employment opportunities is associated with:

- the project's supply chain (goods and services)
- spending of project employees in local communities

9.5.9 The wind turbines will be imported and delivered to the site via the port of Pančevo. Materials needed for civil works (i.e. cement, clay), as well as the materials needed for infrastructure improvements, will most likely be procured locally by the selected construction company, as they are available in the area.

9.5.10 Employment of non-locals, as well as the increase of incomes of local employees, may also bring in some minor benefits for local communities, associated with increased spending in the project area, i.e. in small shops, bars and restaurants. Indirect employment is likely to provide more opportunities for women, as opposed to direct employment, which will most likely involve more men.

9.5.11 There is no available data from which to estimate levels of indirect employment in Serbia and the impacts will depend on the nature of the local economy, the availability of required goods and services in the Project area and ways in which employees choose to spend their earnings. However, taking into account the import of turbine components, the technical nature of procurement requirements, the short two year construction timeframe and the number of employment opportunities, impacts related to indirect employment are assessed as minor positive.

9.5.12 Appointed construction contractors and suppliers will have to abide by the Serbian Law on Labour and other relevant legislation, which is mostly in agreement with EBRD's labour related requirements contained in PR 2. Any additional measures that must be undertaken will be described in the mitigation section.

Livelihoods

9.5.13 Involuntary resettlement, possibly leading to economic displacement may occur during construction for persons who are using land plots affected during construction including transportation (damaged crops), but who are not owners of land. As explained in the section on land use, informal renting of land is possible and therefore there is a likelihood of the existence of users of land, who are not owners, in the project area.

9.5.14 The present construction plan includes moving cranes via existing access roads and tracks. In this way, damages to crops and compaction of the agricultural soil will be avoided however they remain possible. In case such an impact materialises, for an average land plot it is expected to last less than one month, although any crops in the ground will be lost.

9.5.15 Electrawinds will compensate all lost crops and damages in accordance with the Serbian Law on Planning and Construction at full market value to land users. In addition, the implementation of the Transport Management Plan, reinstatement of all affected land and provision of information to farmers who will be affected, should assist in managing impacts on livelihoods. This impact is assessed as being minor to moderate negative, as it is presently impossible to determine the number of people who will be affected.

9.5.16 Reduction in land available for agriculture is not expected to have any impact on livelihoods of those farming the land, due to the small scale of land take and the availability of agricultural land in the area.

9.5.17 Increased incomes generated through direct and indirect employment may have a positive effect on livelihoods in the local area. Approximately 30 local households (0.33% of the total number of

households in the municipality) whose members will be employed by the project, will have increased incomes and consequently improved standard of living. Although this may be significant for the households in question, it is not significant to the population as a whole. Some increased spending of these households together with non-local employees in the local area could further positively benefit the local economies, although this is not expected to have a significant effect. This impact is assessed as minor positive.

9.5.18 Transport and increased traffic are not expected to have impacts on livelihoods. Difficulties in accessing land described in the section on land use may only be occasional and may impact only individuals. Transport of materials to and from the Project site, will be done via the II – 111, from the port of Pančevo through the City Pančevo and the village Crepaja. This road is a part of the main regional transport network and traffic volumes are moderate frequented by heavy goods vehicles. According to the 2012 average daily traffic report, the average daily number of buses and trucks is 629 on the II- 111, section from Kovačica to Jabuka. Based on the construction of 38 turbines the estimated total number of trucks which will travel this road for the project during construction (over a period of 24 months) is 11,894, this equates to 23,788 two way trips so approximately 33 vehicles per day, meaning an increase in heavy traffic of only 5.2.% per day. In addition, transport will be carried out outside of peak traffic hours and at night when possible, to reduce impacts on commuters.

9.5.19 Any businesses along this route are not expected to suffer income losses, as a result of project related increased traffic. There may be short term impacts on the quality of life of residents living along the transport route, however impacts on livelihoods are not expected. Appropriate compensation and reinstatement measures have to be implemented once construction is completed. This impact is assessed as negligible.

Community Health, Safety and Security

9.5.20 The availability of temporary construction employment opportunities is sometimes associated with an increase in vulnerability and susceptibility of local communities to increased crime, alcoholism, etc. The project is relatively small and an estimated 30 individuals will be employed from local communities as unskilled labour or as drivers, security personnel, etc. Apart from the local labour, approx. 20 employees will be national or international labour employed on semi-skilled or skilled jobs, who will most likely be housed in larger towns i.e. Pančevo City or the capital Belgrade. Due to the relatively short distances involved[4], these workers will probably commute to the Project site every day. The presence of workers may cause some disturbances in the Project area, however these are expected to be minor and as a result, the impact on local communities in relation to social pathologies is assessed as negligible.

9.5.21 Transport and increased traffic can lead to more possibilities for accidents[5] for the local population as well as to a reduced quality of life. The transport route passes through only one inhabited area, in the local community Crepaja. These impacts have been assessed as minor negative, however accidents involving local community members will have serious effects on the individual or his/her household.

Infrastructure

9.5.22 Construction will require the use of roads and access tracks through agricultural fields. The upgrading and widening of access tracks prior to construction will benefit local farmers as it will lead to improved access to their agricultural plots. The impact has been assessed as minor positive. On the other hand, damages to road surfaces during transport of heavy machinery, leading to damages to motor vehicles, road accidents and the increase in costs for local government, are also possible. Electrawinds is planning to make necessary preparations of roads for heavy transport before construction and therefore this impact has been assessed as minor negative.

[4] Belgrade is approximately 50 km away, while Pančevo is some 30 km away from the Project site.

[5] Cyclists are frequent in the area and it will be particularly important to ensure their safety.

9.5.23 The Project will not place any additional demands on community infrastructure during construction, as utility infrastructure will have to be secured locally on the project site, i.e. water, electricity, sewage.

Mitigation

Land Use

9.5.24 During construction the project will cause a reduction in land available for agriculture. Certain measures will be implemented to mitigate it, as well as prevent any impacts to livelihoods. These measures include:

- Minimise the amount of land occupied during construction
- Upon the completion of construction activities, fully reinstate all land not permanently occupied

9.5.25 Difficulties in accessing land as a result of increased traffic and access track upgrades will be managed by the implementation of following measures:

- Develop and implement a traffic management plan
- Provide timely information to users of land of when access to their land might be more difficult (e.g. scheduled access track upgrades)
- Establish and implement a community grievance mechanism

Employment and Procurement Opportunities

9.5.26 The project will create some direct employment opportunities, however approx. 40% of the opportunities will be for semi-skilled and skilled labour, expected to be largely national and international staff and thus this impact may not be significant for local communities. The engagement of all non employee workers will follow international best practice, with the main measures comprising the following:

- Implement transparent and fair recruitment procedures
- Ensure that all non employee workers are engaged in line with both national legislation and applicable international (ILO) standards and recommendations
- Provide a grievance mechanism for workers

9.5.27 To foster the creation of indirect employment opportunities, the Project will procure goods and services locally whenever possible.

Livelihoods

9.5.28 Economic displacement of persons whose crops may be affected by construction and generally any loss of livelihoods as a result of loss of land available for agriculture will be mitigated by undertaking the following measures:

- Minimise the amount of land occupied / disrupted during construction
- Provide timely information to users of land of when construction is planned to begin and how lost crops and damages will be compensated
- Compensate all users of land for lost crops and any other damages at full replacement value, in accordance with the Serbian Law on Planning and Construction and IFI policies
- Fully reinstate the land after disruption
- Establish and implement a grievance mechanism

9.5.29 To prevent any livelihood losses as a result of transport and increased traffic, the following measures will be implemented:

- Provide timely information to people/households located along selected transport route that there will be increased transport activity in their area.

- Establish and implement a grievance mechanism

Community Health, Safety and Security

9.5.30 The influx of workers into the Project area causing disturbances for the local population, will be minimised by the implementation of the following measures:

- Encourage contractors to hire local workforce, i.e. give preference to suitably qualified and experienced applicants from the local communities.
- Enforce workers code of conduct
- Cooperate and coordinate with local health and safety facilities

9.5.31 Increase in traffic (bringing equipment and materials to the site and employee travel) could lead to more accidents in the local communities and reduced quality of life. These impacts will be managed with the implementation of the following measures:

- Provide timely information to people/households located along the transport route that there will be increased transport activity in their area
- Develop and implement a traffic management plan
- Workers code of conduct (guidance on safe driving)
- Cooperate and coordinate with local health and safety – security facilities

Infrastructure

9.5.32 Transport of heavy machinery could lead to damages of road surfaces, further causing accidents, vehicle damages, etc. The following measures will be undertaken to mitigate these impacts:

- Preparation of roads for heavy transport before construction
- Restoration of roads to at least pre-construction level

Residual Effects

9.5.33 In total 4.35 ha of land will remain permanently unavailable for agriculture after construction.

9.5.34 Even with the implementation of mitigation measures to reduce impacts associated with transport and increased traffic, individuals may still occasionally experience difficulties in accessing land.

9.5.35 Any incidents or accidents involving local community members could lead to tensions between the community and Elecrawinds, which is why they will be prevented to the greatest extent possible.

9.5.36 If roads used during construction are not fully restored, this could also lead to tensions between Electrawinds and the local communities.

Operation

Impacts to Land Use

9.5.37 As mentioned in the construction section of this chapter, 4.35 ha of land previously occupied for construction will remain permanently unavailable for agriculture. No further impacts on land use are foreseen during the project operation phase.

Employment and Procurement Opportunities

9.5.38 The life of the project is expected to be at least 25 years and during that time a small workforce will be needed. Electrawinds estimate that approx. 5 individuals (mostly national) will be employed during operations. This will give long term stability to the full time employees and will have a significant effect on their lives. However, within the local communities and even more at the national level, this number is very low and the impact has been assessed as negligible.

9.5.39 Indirect employment may occur as a result of increased spending of those employed by Electrawinds, however since this number is so low, this is also assessed as a negligible positive impact. The procurement of local goods and services is also likely to be minimal and have a negligible effect on local economies.

Livelihoods

9.5.40 During the operational phase, crops may be damaged or lost if land plots are crossed for repairs of wind turbines. Electrawinds will compensate users of land for all lost crops and damages, in accordance with the Serbian Law on Planning and Construction, at full market value. It is expected that wind turbines will mostly be accessed via existing roads for repairs and therefore this impact is assessed as being negligible.

Revenue Generation for the Local Government / Community

9.5.41 An agreement has been signed between Electrawinds and the Kovačica Municipality foreseeing that the municipality will receive a total of 2% of Electrawinds net income generated through the operation of the wind farm. According to amounts calculated in the Preliminary Project Feasibility Study, this means that the municipal budget will increase by approximately 0.24% in the first year of the wind farm operation, gradually increasing and reaching its peak in year 13 of operations at close to 7%, after which it will fall again to 1.06% again rising to 2.19% in year 25[6].

9.5.42 Prior to the operations phase, Electrawinds offices will move to and register in Kovačica and so the municipality will become the recipient of tax / VAT revenues.

9.5.43 These benefits will be felt by residents of the Kovačica municipality, including the directly affected local communities. Although in terms of percentages this impact may be seen as only minor positive for the Kovačica municipality, in reality any increase in the local budget will have significant benefits. This will allow the municipality to make some important investments and will most likely improve the delivery of certain services to citizens, particularly in terms of infrastructure improvements. Therefore this impact has been assessed as moderate positive.

9.5.44 Representatives of the local community Padina and the municipality mentioned that the construction of the wind farm may be accompanied by increased tourism in the area. Being one of the first wind farms to be constructed in Serbia, local residents are hoping that people may be encouraged to visit the area to see it. The municipality has some tourist infrastructure i.e. hotel, private accommodation, restaurants, and other tourist attractions, including naïve art, which altogether may represent a potential for further development. It is difficult to assess whether the wind farm alone will stimulate tourism in the area further contributing to local economic development and therefore the impact has been assessed as negligible with potential to grow to minor positive.

9.5.45 Electrawinds has already provided some support to various local activities and initiatives at the level of local communities in the areas of sports, education and culture and will continue to do so throughput the life of the Project[7]. Electrawinds is a member of the Serbian Wind Energy Association (SEWEA) whose mission is to cooperate with stakeholders at national and local levels to develop a legal and regulatory environment that supports the construction of wind farms in Serbia[8]. The presence of Electrawinds and the implementation of this project may contribute to attracting foreign and domestic investments in the municipality and the wider area, fostering local economic development. This impact is assessed as minor with potential to grow to moderate positive, once implementation begins.

[6] The basis for calculations was the 2013 Kovačica municipal budget.

[7] For example: support to the Clinical Centre of Serbia through the Serbian Wind Energy Association, sponsoring of musical concerts in Kovačica, sponsoring of the local women's handball team and a competition in the local elementary school with prizes for winners.

[8] The members of SEWEA are planning to invest 1.5 billion Euros in next four years and build wind farms with an installed capacity of over 1000 MW. SEWEA also claims to have the potential to organize a regional center for manufacturing components for wind generators in Serbia, which would bring millions of Euros of additional income to Serbian industry and new job creation.

Infrastructure

9.5.46 Elektrawinds will have to carry out regular maintenance of upgraded and widened access tracks needed to access wind turbines for repairs and maintenance. This in turn will have a minor positive impact on local farmers' access to their plots of land.

9.5.47 The water supply, sewage and electricity supply will be secured locally for the substation and maintenance building and there will be no impacts on community infrastructure.

Mitigation

Employment and Procurement Opportunities

9.5.48 As for construction related employment, the contracting of any individuals for the operation of the wind farm will follow principles of international best practice. To foster the creation of indirect employment opportunities, the Project will continue to procure goods and services locally whenever possible.

Livelihoods

9.5.49 Economic displacement of persons whose crops may be affected by repairs will be mitigated by undertaking the following measures:

- Minimise the amount of land occupied / disrupted during repairs
- Compensate all users of land for lost crops and any other damages at full replacement value, in accordance with the Serbian Law on Planning and Construction and IFI policies
- Fully reinstate the land after disruption
- Implement a grievance mechanism

Revenue Generation for the Local Government / Community

9.5.50 A signed profit sharing agreement between Electrawinds and Kovačica Municipality, as well as registration of the company on its territory and paying VAT, will result in Increased revenue for the municipality and the directly affected local communities. Electrawinds will ensure that all payments are made in a timely and transparent manner.

9.5.51 A possible impact of the Project includes enhanced tourism opportunities for local communities. If such opportunities do present themselves, Electrawinds may decide to support some tourism related initiatives through a community investment programme.

9.5.52 Electrawinds is planning to continue supporting local initiatives and in doing so, it will be important to consult with local communities In order to continue fostering local economic development, it will also be important for Electrawinds to continue participating in investor forums and events, promoting Kovačica as a place for doing business.

Infrastructure

9.5.53 Regular maintenance of access tracks will be carried out to contribute to improved access to agricultural plots.

Residual Effects

9.5.54 If Electrawinds presence in Kovačica attracts other investments or if the project triggers tourism development, a further effect will be local economic development.

Monitoring and Follow Up

9.5.55 Grievance management (both community and workers' grievances) needs to be monitored to ensure that all received complaints are addressed as described in the Project SEP.

9.5.56 Complaints and grievances submitted through the Project grievance mechanism will also be regularly monitored, to alert Electrawinds of any problems or issues that need to be dealt with, on an individual or community level. For example, frequent grievances regarding lost crops may indicate that the contractors are not being careful to minimise the amount of land being disrupted during construction and that their plans and activities need to be re-evaluated. Execution of compensation payments for lost crops and damages must be monitored to prevent any loss of livelihoods.

9.5.57 Reinstatement of land upon completion of construction activities also needs to be monitored. Proper reinstatement is key to ensuring that people can continue to farm their land and expect the same quality of crops, so that their livelihoods do not suffer. The same applies to restoration of roads. This needs to be monitored at the end of construction, to ensure that all roads have been reinstated to at least pre construction level and all throughout operations, i.e. road repairs and maintenance.

Limitations and Assumptions

9.5.58 The key assumptions that have been made and any limitations that have been identified, in producing this ESIA are set out below.

- Third party data that has been supplied to WSP regarding land acquisition, employment estimates, project transport, etc. is complete and accurate;
- The principal land uses in the surrounding area will remain unchanged;
- The scheme description will be as outlined in Chapter 4 'Project Description;
- The statistical data from the 2011 census is available at municipal level and very rarely at local community level. Where possible data specifically relating to affected communities was sought from other sources i.e. official municipal or regional level studies, plans or interviews with affected people, etc. and where this was not possible, the impact assessment was carried out in relation to the municipality as a whole.
- The mitigation and enhancement measures stipulated in this chapter will be implemented as appropriate.

Cumulative Impacts

9.5.59 It is not expected that there will be any cumulative socio economic effects as a result of the proposed development.

9.6 Summary

9.6.1 This chapter has assessed the potential socio economic effects resulting from the construction and operation of the proposed development. This assessment has considered effects on communities and individuals, as well as their social and economic assets, associated with land use, employment and procurement opportunities, livelihoods, community health, safety and security, revenue generation for local communities and infrastructure.

9.6.2 During construction, the proposed development could have minor to moderate impacts on livelihoods resulting from crop damages, depending on the amount of land affected and number of users who will be impacted, which could not be assessed at the time of developing the ESIA. The proposed development will also have negligible or minor negative effects in terms of loss of agricultural land or access to land, as well as in terms of impacts on community health, safety and security, accidents and nuisances associated with transport. All negative impacts can be successfully mitigated through implementation of appropriate measures, primarily compensation of any losses and full reinstatement

of affected land, as well as provision of timely information to affected people, grievance management, etc. On the other hand, the project will also have some minor positive impacts related to creation of direct and indirect employment opportunities and associated positive impacts on livelihoods. To further enhance these impacts, it will be important to foster local hiring and local procurement of goods and services.

9.6.3 During operations, negative impacts on livelihoods associated with damaged crops during repairs of wind towers will be negligible and can be easily mitigated with appropriate compensation measures. At the same time, positive impacts in relation to creation of employment opportunities will also be negligible. However, the proposed development will result in generation of revenue for the local government / communities, enabling improvement of services for local residents. That, together with possible tourism development opportunities and Electrawinds direct support of community initiatives and attraction of new investments, will contribute to further economic development in the municipality. On-going communication and consultation with local communities will be key in enhancing these impacts.

9.7 References

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Photographs of a typical house in the project affected area – Crepaja, available at http://srbija-nekretnine.org [Date accessed: 16.12.13]

10 Health and Community

10.1 Introduction

10.1.1 This chapter assesses the impact of the proposed development on public health. Issues addressed in this chapter include electromagnetic fields, turbine failure, turbine fire, ice throw and air safety.

10.1.2 This chapter (and its associated appendix) is not intended to be read as a standalone assessment and reference should be made to the Front End of this ES (Chapters 1 – 4).

10.2 Legislation, Policy and Guidance

Serbian Legislative Framework

- **The Law on Occupational Health and Safety (Official Gazette of the Republic of Serbia, No. 101/2005)** is the main legislative document regulating occupational health and safety issues in Serbia. The Law was brought into force in 2005 and incorporates the principles of the EU Workplace Health and Safety Directive (89/391/EEC).

  The Law is based on general principles of prevention and requires: avoidance of risks; assessment of unavoidable risks; risk elimination at source; adjustment of working activities and workplace to employees; change hazardous technological processes to safe or less hazardous ones; give priority to collective and not individual operational health and safety measures; and appropriate training of employees.

- **The Law on the Protection from Fire (Official Gazette of the Republic of Serbia, No 111/2009)** entered into force in 2010. This law prescribes the general obligations for the prevention and protection from fire.

  The law requires a Sanitation plan to be enacted for the removal and elimination of the consequences of fire; employees to be trained; capable persons to ensure there is protection from fire; a plan must be in place for the protection from fire; and an obligation to cooperate with the fire brigade.

Policy

<u>European Bank for Reconstruction and Development</u>

10.2.1 The European Bank for Reconstruction and Development (EBRD) publication 'Environmental and Social Policy' (2008) has been a key consideration in the production of this chapter. Performance Requirement 1 (Environmental and Social Appraisal and Management) of the EBRD Environmental and Social Policy (2008) is considered relevant. The specific objectives of Performance Requirement 1 are summarised below:

- To identify and assess environmental and social impacts and issues, both adverse and beneficial, associated with the project;
- To adopt measures to avoid, or where avoidance is not possible, minimise, mitigate, or offset/compensate for adverse impacts on workers, affected communities, and the environment;
- To identify and, where feasible, adopt opportunities to improve environmental and social performance; and
- To promote improved environmental and social performance through a dynamic process of performance monitoring and evaluation.

10.2.2 A review of the Performance Requirements within the EBRD has been undertaken to identify any key health and safety impacts that should be considered. Performance Requirements 2 (Labour and

Working Conditions) and 4 (Community Health, Safety and Security) also relate directly to health and safety impact, while Performance Requirement 3 (Pollution Prevention & Abatement) is indirectly related to health and safety impact.

International Finance Corporation

10.2.3 The International Finance Corporation (IFC) publication 'Policy on Environmental and Social Sustainability' (2012) has been a key consideration in the production of this chapter. Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts) of the IFC is considered relevant. The specific objectives of Performance Standard 1 are summarised below:

- To identify and assess environmental and social risks and impacts of the project;
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise, and, where residual impacts remain, compensate/offset for risks and impacts to workers, the Affected Communities, and the environment
- To promote improved environmental and social performance of clients through the effective use of management systems;
- To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately; and
- To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

10.2.4 A review of the Performance Standards within the IFC has been undertaken to identify any key health and safety impacts that should be considered. Performance Standard 2 (Labour and Working Conditions) and 4 (Community Health, Safety and Security) also relate directly to health and safety impact, while Performance Standard 3 (Resource Efficiency and Pollution Prevention) is indirectly related to health and safety impact.

Guidance

10.2.5 The following guidance documents were consulted during the production of this chapter:

- European Guidance Material on Managing Building Restricted Areas, International Civil Aviation Organization, ICAO EUR Doc 015, September 2009.
- Environmental, Health and Safety (EHS) Guidelines for Wind Energy, IFC, April 2007

10.3 Assessment Methodology and Significance Criteria

Scope of the Assessment

10.3.1 This chapter considers the following potential health and safety impacts as a result of the proposed development:

- Construction health and safety;
- Maintenance and repair worker health and safety;
- Electromagnetic fields;
- Blade shear or breakage and turbine collapse;
- Lightning strike;
- Fire;
- Ice throw;
- Aviation safety; and
- Unauthorised access.

Extent of the Study Area

10.3.2 This chapter considers the area enclosed by the site boundary and the land immediately adjacent to the site boundary.

Consultation

10.3.3 A separate consultation chapter will be provided in the introductory chapters.

Method of Baseline Data Collation

Desk Study

10.3.4 A desk study was undertaken to determine features of the site and the surrounding area which have the potential to pose risks to the health and safety of on-site workers and members of the general public. These features included transmission lines (underground and overhead), road corridors, pipelines and residential properties. Once these features were identified, it was possible to plot these as health and safety constraints and ensure that the proposed turbines were located outwith these areas.

Significance Criteria

10.3.5 The assessment of potential impacts resulting from the proposed development has taken into account both the construction and operational phases. Impacts from the decommissioning phase are assumed to be similar to those identified during the construction phase and are therefore not specifically assessed.

10.3.6 The significance level attributed to each impact has been assessed based on the magnitude of change due to the development proposals, and the sensitivity of the affected receptor/receiving environment to change, as well as a number of other factors that are outlined in more detail in Chapter 1 of this ES. The magnitude of change and the sensitivity of the affected receptor/receiving environment are both assessed on a scale of high, medium, low and negligible (as shown in Table 1.1 in Chapter 1).

Impact Significance

10.3.7 The following terms have been used to define the significance of the impacts identified:

- **Major impact:** where the proposed development could be expected to have a very significant impact (either positive or negative) on health and safety;
- **Moderate impact:** where the proposed development could be expected to have a noticeable impact (either positive or negative) on health and safety;
- **Minor impact:** where the proposed development could be expected to result in a small, barely noticeable impact (either positive or negative) on health and safety; and
- **Negligible:** where no discernible impact is expected as a result of the proposed development on health and safety.

10.4 Baseline Conditions

Existing Site Features

10.4.1 The site is currently crossed by two overhead power lines (OHLs), one of 220 kV and the other of 110 kV. The 110 kV OHL crosses the site on a west-south-west to east-north-east orientation across the centre of the site, whilst the 220 kV OHL follows a south-south-west to north-north-east orientation and also cross the centre of the site.

10.4.2 The Jarkovacki Road also crosses within the site boundary. This road forms minor farm tracks which provide access to the land. Also within the surrounding area are the II-111 which forms the westerns boundary of the site and the II-110 provides a link between the towns of Kovacica and Padina to the north of the site.

Climate

10.4.3 In Kovacica the climate is warm and temperate, typical of a marine moist subtropical mid-latitude climate. Significant rainfall is experienced throughout the year, with approximately 623 mm falling annually. The average temperature is 11.9OC, with temperatures ranging from 0.5OC in January to 21.9OC in August (Climate-Data.org, 2013).

Telecommunication Services

10.4.4 An impact study was undertaken in July 2013 by TSR Research Group, University of the Basque Country to determine whether there was the potential for effects on air traffic control radar systems resulting from the proposed development (Appendix 10.1).

10.4.5 The following telecommunication services were identified as being within the zone of influence of the proposed development:

- Primary Surveillance ATC radar located at Koviona, approximately 51.6 km from the nearest turbine;
- Secondary Surveillance ATC radar located at Koviona, approximately 51.6 km from the nearest turbine;
- Secondary Surveillance ATC radar located at Kosevac approximately 38.1 km from the nearest turbine;
- Instrument Landing Systems (ILS) at Beograd airport, approximately 37 km from the nearest turbine; *and*
- VOR navigation system at Beograd airport, approximately 37 km from the nearest turbine.

10.4.6 Whilst all of the proposed wind turbines are within the line of sight of the radar services under study and the radio-navigation systems of Beograd airport, it was determined that the proposed development will have no impact on flight safety. In particular, the following were highlighted:

- No PSR processing overload is expected;
- No effect for Koviona SSR and Kosevac SSR;
- No effect on Far-Field Monitors for Koviona SSR and Kosevac SSR;
- VOR and ILS facilities at Beograd airport are located further than the safeguarding distance; and
- The proposed turbines do not intersect the clearance volumes defied by International Civil Aviation Organization (ICAO).

10.4.7 Therefore, the potential for impacts on telecommunication services has not been subject to further assessment.

Future Baseline

10.4.8 The future baseline is envisaged to remain as described above should there be no development.

10.4.9 Should the proposed development be constructed, additional power lines will be required. It is however expected that those power lines required to connect the turbines to the substation will be underground, with only the connection from the substation to the existing grid being above ground.

10.5 Assessment of Impacts, Mitigation and Residual Effects

Construction

10.5.1 The construction of the proposed development will pose a number of health and safety (H&S) risks to the construction workers employed on the project, in addition to members of the public who could potentially access the site during the construction phase. These risks include those associated with:

- Working at height;
- Working with large scale structures and plant;
- Ground excavation;
- Working with and around power lines;
- Use of hazardous substances;
- Construction traffic; and
- Unauthorised access.

Construction Workers

10.5.2 Of the issues described above, the potential for falls from a height or electrocution are of particular concern in relation to the construction of wind farms. Whilst there have been reports of incidents associated with falls from height and electrocution during the construction of wind farms, there are no definitive statistics regarding the occurrence these incidents. It is therefore not possible to provide an approximation of the probability of occurrence of these incidents, however it is considered that there is potential for such incidents to occur.

10.5.3 Whilst there is the potential for workers to be exposed to such risks, it is assumed that any incidents causing death or injury are preventable through the implementation of and adherence to appropriate H&S management systems. It is essential for a health and safety culture to be embedded in the workers. In addition, it is expected that the majority of workers associated with the project, and in particular those within site management roles, will be familiar with the appropriate H&S measures for such construction projects.

10.5.4 It is therefore expected that the H&S risk to construction workers negligible.

Unauthorised Access

10.5.5 Where members of the public access the construction site without authorisation, they will potentially be putting themselves at risk. In order to prevent this appropriate security features should be implemented, including the use of a sign in facility, security fencing, sign posting and potentially security personnel. It is therefore expected that the H&S risk to the general public is negligible.

Mitigation

10.5.6 Appropriate H&S management will be incorporated throughout the construction phase, through the implementation of a Construction Environmental Management Plan (CEMP). This process will begin with appropriate risk assessments being undertaken for all activities. This will be followed by appropriate training to ensure that personnel undertaking hazardous activities are certified to do so. It is essential that the project management team ensure that all workers are fully trained, have an appropriate awareness of the hazards of working on such construction sites and are issued with and use the appropriate equipment to undertake their tasks in a safe manner.

10.5.7 In order to prevent unauthorised access to the construction site, appropriate security measures will be put in place, including a sign in facility, security fencing, signposting and the presence of security personnel.

Residual Effects

10.5.8 It is likely that the residual impacts will remain the same as those outlined above.

Operation

10.5.9 During operation of the proposed development risks are posed to both maintenance and repair workers and the general public.

10.5.10 Similar to the construction phase, maintenance and repair workers are exposed to the risks associated with working at height and working with or around power lines. Again, whilst there have been reports of falls from height and electrocution during repair and maintenance work on wind farms, there are the exact statistics for their occurrence. Although these incidents could be classified as high risk with a significant potential for occurrence, they are preventable through the implementation of and adherence to appropriate H&S management systems. It is expected that the workers employed during the operational phase will be familiar with appropriate H&S measures for such projects and competent to undertake such work. In the event that the appropriate measures are implemented, the risk is classified as negligible.

10.5.11 Further H&S risks are posed to both workers and the general public during the operation of the proposed development. These include the following:

- Electromagnetic fields;
- Blade shear or breakage and turbine collapse;
- Lightning strike;
- Fire;
- Ice throw;
- Aviation safety; and
- Unauthorised access.

Electromagnetic Fields

10.5.12 Within the site boundary, the proposed transmission lines (underground and overhead) and substation will be a source of electromagnetic fields, in addition to the pre-existing electricity transmission infrastructure on site (the 110 kV and 220 kV OHLs).

10.5.13 The strength of electromagnetic fields reduces as the distance from the source is increased; at a distance of 100 m the strength of the electromagnetic field is reduced to acceptable levels. Both the substation and proposed transmission lines are located a significant distance, approximately 1.5 km, from the nearest residential receptor and can therefore be screened out.

10.5.14 The 110 kV and 220 kV OHLs which pass within the site are the most significant electromagnetic field sources associated with the proposed project and therefore have the highest potential to lead to human health impact. In order to prevent an increase in the electromagnetic field, the turbines have been located greater than 200 m from these OHLs.

10.5.15 Therefore, it has been determined that there will be no impact on public health as a result of exposure to electromagnetic fields from the proposed development.

Blade Failure/Release or Turbine Collapse

10.5.16 Whilst there are no industry statistics available regarding blade failure/release or turbine collapse, media reports are available which state that such events do occur. Although there is the potential for such events to occur, it is expected that it is unlikely for any persons to be in the vicinity of the proposed development during conditions which may lead to blade failure/release or turbine collapse. The final model of wind turbine chosen for this proposed development will be appropriate for the environmental conditions and wind regime at the site. They will be of a proven design used extensively throughout Europe and will be designed in accordance with the relevant industry standards and guidelines. In order to prevent turbine collapse, the foundations will be suitably designed and constructed in accordance with a detailed method statement and accompanying risk assessment. Whilst the design and construction methods used should ensure blade failure/release and turbine collapse do not occur, if such an incident was to occur, the closest residential property is located approximately 1.5 km from the nearest turbine, the debris should not reach this far. It has therefore

been concluded that the potential risk of blade failure/release or turbine collapse leading to injury or property damage is negligible.

Lightning Strike

10.5.17 Due to the nature of the wind turbine structure, lightning strike is inevitable. However, damage caused to wind turbines by lightning is often attributed to design issues associated with inadequate direct-strike protection, insufficient earthing (grounding) and/or other insufficient protection. In such cases breakup of the turbine structure could potentially result in injury and/or damage to property. However, it is expected that the proposed design will be state of the art and incorporate all possible modern methods to eliminate damage caused by lightning strike. Again, with the closest residential properties being located approximately 1.5 km from the nearest turbine and as it is unlikely for persons to be present in the vicinity of the development during potential lightning strikes, it is unlikely that injury or damage will occur. Based on the above information it is expected that the potential risk of lightning strike leading to damage, injury or property damage is negligible.

Fire

10.5.18 Experience has shown that it is extremely unlikely for a fire to break out within a modern wind turbine structure. The few public reports of such occurrences may be classified as 'freak events' and compared to other power generation structures the risks associated with wind power are extremely small. Due to the nature of the design, a very small amount of readily combustible materials is associated with the wind turbine structure. No incidents have been found where turbine fires have led to injury or property damage.

10.5.19 Fire may also be associated with the substation, and previously reported incidents are more dramatic than those associated with wind turbine structures. In the interests of safety the substation has been located approximately 5 km from the nearest residential property and will be designed with a fire protection system.

10.5.20 In the unlikely event that a fire does occur, an Emergency Response Plan will be implemented detailing the actions to be taken. The Emergency Response Plan will detail methods for detection and communication of fire event, informing the fire brigade, action to be taken by the wind farm operators, restriction of site access, exclusion zones, and training and practicing. Therefore, the risk of a fire leading to injury or property damage is negligible.

Ice Throw

10.5.21 It is considered that the potential ice throw from turbine blades or for ice to fall directly from the turbine structures is low to negligible. Reasons for this conclusion are as detailed below.

- As stated in the baseline conditions, the region in which the proposed development is located does not experience particularly cold climate. This means that the risk of ice build-up will be relatively short term during the winter months, with no on-going risk of ice build-up;
- It is expected that during cold periods it is unlikely that the agricultural fields will be occupied. Land owners will also be made aware of the risk of ice throw/fall during the winter months and signs will be erected to warn of the potential risk during winter months;
- The turbines will be equipped with standard seismic sensors as part of their design to detected imbalances on the turbine blades, which amongst other causes, will indicate ice build-up leading to shut down of the turbines and therefore prevent ice throw;
- Should the safety features fail to shut down the turbines, it is highly unlikely that any residential properties will be affected by ice throw as the closest residential properties are approximately 1.5 km from the nearest turbine; and
- Any workers attending the site during cold conditions will be aware of the potential hazards associated with ice build-up on the turbine structures. Where there *is a potential risk of ice throw/fall, work associated with the turbine structures will be prohibited.*

Unauthorised Access

10.5.22 Whilst access to the general site will not be restricted, the wind turbines themselves will be designed so as to prevent unauthorised access. The substation will be fenced off and locked so as to prevent unauthorised access.

10.5.23 As with all remotely managed technical equipment there is a potential risk of unauthorised access and vandalism, however where the appropriate security measures are implemented the risk should be negligible.

Mitigation

Worker H&S

10.5.24 Appropriate H&S management will be incorporated throughout the operation phase, through the implementation of a Environmental Management Plan (EMP). This process will begin with appropriate risk assessments being undertaken for all activities. This will be followed by appropriate training to ensure that personnel undertaking hazardous activities are certified to do so. It is essential that the project management team ensure that all workers are fully trained, have an appropriate awareness of the hazards of working on such construction sites and are issued with and use the appropriate equipment to undertake their tasks in a safe manner.

Blade Failure/Release or Turbine Collapse

10.5.25 In order to prevent blade failure/release and turbine collapse the chosen turbines will be selected to suit the wind regime at the site and maintained to ensure they are in good working condition.

10.5.26 If blade failure/release or turbine collapse were to occur it is unlikely that any debris would reach residential properties as the closest property is located approximately 1.5 km from the nearest turbine. In the unlikely event that breakage does occur, the operator will ensure that all debris is removed and, where required compensation is paid for damage or injury.

10.5.27 In order to ensure that existing on-site infrastructure is not affected, a setback distance of 200 m has been applied to the state road and existing OHLs.

Lightning

10.5.28 In order to ensure that the turbines are not damaged by lightning strikes, they must have adequate direct-strike protection and a robust connection to its lightning protection (earthing) systems.

Fire

10.5.29 In order to prevent the occurrence of a fire, fire resistant components must be used during construction and maintenance of the proposed development.

10.5.30 In case of a fire occurring, an emergency response plan will be prepared and implemented when required. All staff should be aware of this plan and be fully trained and practiced on its implementation should it be required.

Unauthorised Access

10.5.31 In order to inhibit unauthorised access the following measures should be implements:

- Each turbine access door should be locked;
- The substation should be fenced off and locked; and
- Signposts should be erected detailing the potential dangers of unauthorised access.

Residual Effects

10.5.32 It is likely that the residual impacts will remain the same as those outlined above.

Monitoring and Follow Up

10.5.33 Monitoring must be undertaken to ensure that all the recommended health and safety management measures are implemented on site during construction and operation. Where incidences do occur, these should be recorded in an appropriate manner, with processes and management practices adjusted to ensure that these incidences are not repeated.

Limitations and Assumptions

10.5.34 It is assumed that appropriate health and safety management systems will be prepared and implemented throughout the construction and operation of the proposed developments life time.

Cumulative Impacts

10.5.35 It is not expected that there will be any cumulative health and safety effects as a result of the proposed development.

10.6 Summary

10.6.1 This chapter has assessed the potential health and safety effects resulting from the construction and operation of the proposed development. This assessment has considered effects on workers and the general public from:

- The construction process;
- Repair and maintenance work;
- Electromagnetic fields;
- Blade failure/release or turbine collapse;
- Lightning strike;
- Fire;
- Ice throw;
- Aviation; and
- Unauthorised access.

10.6.2 Whilst several health and safety risks are associated with the construction and operation of the proposed development it is expected that through design management and implementation of appropriate health and safety management systems, the potential for effects are negligible.

10.7 References

Climate-Data.org. (2013). Climate: Kovacica. Available at: http://en.climate-data.org/location/51396/ [Date accessed: 15.10.13]

IFC. (2007). Environmental Health, Safety General Guidelines for Wind Energy. Available at: http://www.ifc.org/wps/wcm/connect/3af2a20048855acf8724d76a6515bb18/Final%2B-%2BWind%2BEnergy.pdf?MOD=AJPERES&id=1323162509197 [Date accessed: 15.10.13]

Table 14.3: Summary of Effects Table for Public Health

Description of Likely Significant Effects	Significance of Impacts					Summary of Mitigation / Enhancement Measures	Significance of Residual Effects				
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)
Construction											
Construction health and safety	Negligible	N/A	N/A	N/A	N/A	Implementation of and adherence to appropriate H&S management systems.	Negligible	N/A	N/A	N/A	N/A
Unauthorised access	Negligible	N/A	N/A	N/A	N/A	Implementation of appropriate security measures, including a sign in facility, security features, signposting and potentially the presence of security personnel.	Negligible	N/A	N/A	N/A	N/A
Operation											
Repair and maintenance worker health and safety	Negligible	N/A	N/A	N/A	N/A	Implementation of and adherence to appropriate H&S management systems.	Negligible	N/A	N/A	N/A	N/A
Electromagnetic field	Negligible	N/A	N/A	N/A	N/A	Appropriate set back distances have been used during the design process to remove this issue.	Negligible	N/A	N/A	N/A	N/A
Blade failure/release or turbine collapse	Negligible	N/A	N/A	N/A	N/A	Selection of an appropriate turbine of a proven design. Foundations designed and constructed in accordance with a detailed method statement and risk assessment.	Negligible	N/A	N/A	N/A	N/A
Lightning strike	Negligible	N/A	N/A	N/A	N/A	Adequate direct-strike protection. A robust connection to the lightning protection systems.	Negligible	N/A	N/A	N/A	N/A

Description of Likely Significant Effects	Significance of Impacts					Summary of Mitigation / Enhancement Measures	Significance of Residual Effects				
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)
Fire	Negligible	N/A	N/A	N/A	N/A	Fire resistant components must be used. Creation of an Emergency Response Plan.	Negligible	N/A	N/A	N/A	N/A
Ice Throw	Low-Negligible	Adverse	P	D	LT	Education of the land owners of the potential risk. Signposts detailing potential risk. Seismic sensors in turbines to detect ice build-up and shut down turbine.	Low-Negligible	Adverse	P	D	LT
Unauthorised access	Negligible	N/A	N/A	N/A	N/A	Security measures including security fencing and locks.	Negligible	N/A	N/A	N/A	N/A

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term

N/A = Not Applicable

11 Shadow Flicker

11.1 Introduction

11.1.1 This chapter describes and assesses potential shadow flicker effects resulting from the Proposed Development on neighbouring residential and commercial receptors.

11.1.2 The effect of shadow flicker is caused when the sun passes behind the wind turbine casting a shadow which passes over the same point. Shadow flicker may become an issue when residential properties are located close to or have a specific orientation towards the wind turbines (IFC, 2007).

11.1.3 Blade or tower glint can also occur when the sun strikes a blade or the tower at a particular orientation. However, this is a temporary effect and it typically disappears within a few months of operation, once the blades have become soiled and is therefore not considered further in this assessment (IFC, 2007).

11.1.4 This chapter (and its associated figure and appendix) is not intended to be read as a standalone assessment and reference should be made to the Front End of this ES (Chapters 1 – 4).

11.2 Legislation, Policy and Guidance

Serbian Legislative Framework

11.2.1 No Serbian legislation specifically relating to shadow flickers impacts has identified as part of this assessment.

Policy

<u>European Bank for Reconstruction and Development</u>

11.2.2 The European Bank for Reconstruction and Development (EBRD) publication 'Environmental and Social Policy' (2008) has been a key consideration in the production of this chapter. Performance Requirement 1 (Environmental and Social Appraisal and Management) of the EBRD Environmental and Social Policy (2008) is considered relevant. The specific objectives of Performance Requirement 1 are summarised below:

- To identify and assess environmental and social impacts and issues, both adverse and beneficial, associated with the project;
- To adopt measures to avoid, or where avoidance is not possible, minimize, mitigate, or offset/compensate for adverse impacts on workers, affected communities, and the environment;
- To identify and, where feasible, adopt opportunities to improve environmental and social performance;
- To promote improved environmental and social performance through a dynamic process of performance monitoring and evaluation.

11.2.3 A review of the Performance Requirements within the EBRD has been undertaken to identify any key environmental impacts that should be considered. Whilst the Performance Requirements do not directly relate to shadow flicker effects there are elements of a number of the Performance Requirements that identify potential shadow flicker impacts.

<u>International Finance Corporation</u>

11.2.4 The International Finance Corporation (IFC) publication 'Policy on Environmental and Social Sustainability' (2012) has also been considered in the production of this chapter. Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts) of the IFC is considered relevant. The specific objectives of Performance Standard 1 are summarised below:

- To identify and assess environmental and social risks and impacts of the project;

- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise, and, where residual impacts remain, compensate/offset for risks and impacts to workers, the Affected Communities, and the environment; and
- To promote improved environmental and social performance through the effective use of management systems.

11.2.5 A review of the IFC Performance Standards has been undertaken to identify any key environmental impacts that should be considered. As with the EBRD Performance Requirements above, whilst the Performance Standards do not directly relate to shadow flicker effects, there are elements of a number of the Performance Requirements that identify potential shadow flicker impacts.

Guidance

- **Environmental, Health, and Safety Guidelines Wind Energy (IFC, 2007):** This guidance document states what is meant by the terms shadow flicker and blade/ tower glint. It also provides preventative and control measures to prevent these effects occurring. These measures include appropriate siting and orientation of wind turbines to avoid impacting residential properties and painting the turbine with non-reflective coating.
- **Guidelines on the Environmental Impact Assessment for Wind Farms (UNDP Serbia, 2010):** This guidance document again states what is meant by a shadow flicker effect. It also sights that careful site selection, design and planning can avoid the effect completely. It is recommended that offices and residential properties within 500 m of the Proposed Development should not be exposed to greater than 30 hours per year or 30 minutes per day of shadow flicker. It is also stated that at distances of greater than 10 rotor diameters from the turbines, the potential for shadow flicker is very low. However, where a problem is detected, calculations should be provided to quantify the effect and where appropriate measures should be recommended to prevent or mitigate the potential effect.

11.3 Assessment Methodology and Significance Criteria

Scope of the Assessment

11.3.1 This chapter considers the following potential shadow flicker impacts on the environment as a result of the Proposed Development.

11.3.2 The shadow flicker assessment has been carried out for the proposed 38 turbines at the locations identified in Chapter 4. As no specific turbine model had been identified by the Applicant when the assessment was progressed, this assessment has chosen the worst case scenario model from a short list of candidate turbines that could be installed at the site. Dimensions of the chosen model used for the purposes of the shadow flicker assessment can be found in Table 11.1.

Table 11.1 - Details of the Turbine Model Used for the Shadow Flicker Assessment (Gamesa G136 4500)

Hub height	120 m
Rotor diameter	120 m
Swept Area	11,310 m²
Rotor Speed Range	5-13 min^{-1}

Extent of the Study Area

11.3.3 The study area within which receptors could potentially be affected by shadow flicker has been set at a distance of 10 rotor diameters from each turbine as noted within Guidelines on the Environmental Impact Assessment for Wind Farms (UNDP Serbia. 2010). In this assessment the study area extends to 1,200 m from each turbine. Figure 11.1 shows the extent of this area. Whilst both receptors are located outwith the study area, it was decided to include them in the assessment due to their close proximity to the study area and their potential to be affected.

11.3.4 The desk based assessment, using OS address data and mapping, identified two potential residential receptors in Padina urban area within the study area and one group of farmhouses just located south of the town. Table 11.2 summarises the locations of the two receptors and the distance from each property to the nearest turbine. It is understood that the group of farmhouses comprises non-residential buildings and has therefore not been considered within this assessment.

Table 11.2 – Receptor Locations

WSP ID	Address	Easting	Northing	Elevation (m)	Approx. Distance to Nearest Turbine (m)	Turbine
A	Padina- House 1	477,953	4,995,178	106.6	1314	T70
B	Padina - House 2	477,926	4,995,232	103.5	1318	T70

Consultation

11.3.5 A separate consultation chapter will be provided in the introductory chapters.

Method of Baseline Data Collation

Desk Study

11.3.6 A desk study was undertaken of the potential receptors using OS Address Data, google earth and cross-referenced with those receptors identified as potential sensitive noise receptors (refer to Chapter 7).

Assessment Modelling

11.3.7 During the assessment of the potential effect of shadow flicker, the commercial software model WindPro 2.8 was used to calculate the expected number of minutes and hours that shadow flicker could occur at each receptor. This model takes into account the movement of the sun relative to the time of day and time of year predicting the time and duration of expected shadow flicker at each window of an affected receptor. The input parameters used in the model are as follows:

- The turbine locations;
- The turbine dimensions;
- The location of the receptors to be assessed;
- The number and size of windows on each receptor and the direction that the windows face; and
- The WindPro model is based upon a Zone of Theoretical Visibility (ZTV) analysis, which in this case was based upon a Digital Terrain Model (DTM) of 10 m resolution.

11.3.8 Calculations were undertaken for predicted shadow hours at each of the receptors for the worst-case scenario. The following assumptions were made:

- All receptors have a 1 m x 1 m vertical window perpendicular the turbines;
- The turbine blades are assumed to be constantly rotating;
- The sun shines all day, from sunrise to sunset;
- Eye height is 1.5 m;
- The rotor plane is always perpendicular to the line from the turbine to the sun;
- More than 20 % of the sun is covered by the blade; (in practice, at a distance, the blades do not cover the sun but only partly mask it, substantially weakening the shadow);
- The receptor is occupied at all times; and

- No screening was present.

11.3.9 The effect of shadow flicker was not calculated where the sun lies less than 3 degrees above the horizon due to atmospheric diffusion, low radiation (intensity of the sun's rays is reduced) and high probability of natural screening. It is generally accepted that below 3 degrees shadow flicker is unlikely to occur to any significant extent.

11.3.10 These assumptions result in a highly conservative assessment for the following reasons:

- In reality, many of the houses within the study area may not directly face the turbines;
- The turbine blades will not turn for 365 days of the year and will turn to face into the direction of the wind, in order to maximise the energy generating potential from the wind;
- It is unlikely that there will be clear skies 365 days a year;
- Receptors may be unoccupied at the time when the shadow flicker impact is experienced; and
- Screening, such as vegetation or curtains, between the window and the turbine is not accounted for within the DTM and model, these could prevent any shadows from being cast onto the window and therefore prevent any flickering effect.

11.3.11 In addition, the distance between the turbine and a window has an impact on the intensity of any shadow flicker that is experienced. The study area has been set at distance of 10 rotor diameters from each turbine as the effects of shadow flicker are shown to be greatly reduced outside this distance.

11.3.12 The assessment carried out is limited to the effects of shadows within buildings. Moving shadows will also be apparent out of doors; however, these do not result in flicker in the same manner or to the same extent, as the light entering windows.

Significance Criteria

11.3.13 The assessment of potential impacts resulting from the Proposed Development has taken into account both the construction and operational phases. The significance level attributed to each impact has been assessed based on the magnitude of change due to the development proposals, and the sensitivity of the affected receptor/receiving environment to change, as well as a number of other factors that are outlined in more detail in Chapter 1 of this ES. The magnitude of change and the sensitivity of the affected receptor/receiving environment are both assessed on a scale of high, medium, low and negligible (as shown in Table 1.1 in Chapter 1).

Impact Significance

11.3.14 The following terms have been used to define the significance of the impacts identified:

- Major impact: where the Proposed Development could be expected to have a very significant impact (either positive or negative) on sensitive receptors.
- Moderate impact: where the Proposed Development could be expected to have a noticeable impact (either positive or negative) on sensitive receptors.
- Minor impact: where the Proposed Development could be expected to result in a small, barely noticeable impact (either positive or negative) on sensitive receptors.
- Negligible: where no discernible impact is expected as a result of the Proposed Development on sensitive receptors.

11.3.15 As per the UNDP Serbia guidelines (2010), this assessment will adopt the maximum acceptable duration of shadow flicker as 30 minutes per day, or 30 hours per year, whichever is greatest.

11.3.16 Within this assessment the sensitivity of the receptors is assumed to be high in all cases.

11.4 Baseline Conditions

11.4.1 The receptors identified within the study area are located to the north-east of the Proposed Development. Neither receptor will be experience shadow flicker impacts within the current baseline environment.

Future Baseline

11.4.2 The future baseline is envisaged to remain as described above should there be no development. However, should the Proposed Development be constructed, there is the potential for the receptors to experience the effects of shadow flicker from the wind turbines.

11.5 Assessment of Impacts, Mitigation and Residual Effects

Construction

11.5.1 No shadow flicker will occur during construction of the Proposed Development.

11.5.2 Given that any occurrence of shadow flicker during the short commissioning period would replicate itself during operation of the wind farm, albeit more frequently, it is considered appropriate to consider the commissioning activities as part of the operational stage of the Proposed Development.

Mitigation

11.5.3 No mitigation measures are required during the construction phase of the Proposed Development as no effects are predicted.

Residual Effects

11.5.4 It is likely that the residual impacts will remain the same as those outlined above.

Operation

11.5.5 The modelling results presented below (Table 11.3) represent the worst-case scenario. The theoretical duration of shadow flicker calculated is indicated to be of no significance at Receptors A and B.

Table 11.3 - Worst-Case Scenario Shadow Flicker Occurrence for each Receptor (hrs/yr)

WSP ID	Address	Shadow hours per year	Max shadow hours per day
A	Padina House 1	9:23	00:22
B	Padina House 2	10:51	00:22

11.5.6 The shadow flicker effect which could potentially occur is solely caused by Turbine 70. Graphs 11.1 and 11.2 within Appendix 11.1 summarise the occurrence of shadow flicker at the receptors and illustrate the times of year and times of day when shadow flicker could theoretically occur. It can be seen that Receptor A is affected from the end of January until the middle of February from approximately 4pm until 4:30pm and from the end of end of October until the middle of November between 3:30pm until 4pm. The case is similar for Receptor 2 where shadow flicker could potentially occur between the middle of January until the beginning of February between 3:30pm until 4:30pm, and in the month of November between 3pm and 4pm.

11.5.7 In reality, it is expected that whilst the exposure levels are already very low, the duration of shadow flicker experienced at each location is likely to be further reduced as the above assessment is based on a worst case scenario.

Mitigation

11.5.8 No mitigation measures are required during the operational phase of the Proposed Development as no significant effects are predicted.

Residual Effects

11.5.9 It is likely that the residual impacts will remain the same as those outlined above.

Monitoring and Follow Up

11.5.10 In the event of any complaints being received following commencement of the operational phase, required mitigation measures will be discussed with the complainant, and agreed on a case-by-case basis. As no significant effects are predicted as a result of the Proposed Development it is expected that these measures could involve the installation of blinds and planting of vegetation.

Limitations and Assumptions

11.5.11 All assumptions made by the WindPro model are outlined above within the assessment modelling section.

Cumulative Impacts

11.5.12 In order to assess the potential for cumulative impact from other wind developments in the surrounding area, any turbines within 2 km of the Proposed Development were noted. It was found that no other wind developments are located within 2 km, with the closest development being the Alibunar (WindVision) Wind Farm which is located approximately 10 km from the Proposed Development. It is therefore unlikely that there will be a cumulative impact from shadow flicker as a result of the Proposed Development.

11.6 Summary

11.6.1 This assessment has considered whether the effect known as 'shadow flicker' is likely to be caused by the Proposed Development and assesses the potential for impact on local residents. The study area within which properties could potentially be affected by shadow flicker covers a distance of 10 rotor diameters from each turbine. In the case of the Proposed Development, this area extends to 1,200 m from each turbine.

11.6.2 No shadow flicker impact can occur during construction and decommissioning of the turbines.

11.6.3 Shadow flicker assessment was undertaken for the two receptors which fall just outside the study area of the Proposed Development. Calculations have shown that the maximum occurrence of shadow flicker at the most affected receptor (Padina House 2) amounts to approximately 0:22 hours per day or 10:51 hours per year, within the accepted limits for shadow flicker of both 30 minutes per day or 30 hours per year.

11.6.4 It is important to note that this assessment is based on a theoretical worst-case scenario and does not take into account average sunshine hours and average turbine operational periods. In addition, no account is taken of any visual obstructions (structures and vegetation) or local mitigation measures such as blinds or curtains. There is also the potential for receptors to be unoccupied during affected times. It is therefore likely that the amount of time during which shadow flicker is actually experienced will be less than which has been predicted.

11.6.5 The residual effect of shadow flicker is therefore expected to be of no significance for all receptors during the operational phase of the Proposed Development.

11.6.6 In addition, turbine components will be covered in industry standard non-reflective paint to reduce the occurrence of glinting, which can also be considered a nuisance.

11.7 References

Document Sources

UNDP Serbia. (2010). Guidelines on the Environmental Impact Assessment for Wind Farms.

Online Sources

IFC. (2007). Environmental, Health, and Safety Guidelines for Wind Energy. Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/sustainability+framework/environmental,+health,+and+safety+guidelines/ehs+guidelines+technical+revision/windenergy_full [Date accessed: 23.10.13]

Table 5.3: Summary of Effects Table for Shadow Flicker

Description of Likely Significant Effects	Significance of Impacts					Summary of Mitigation / Enhancement Measures	Significance of Residual Effects				
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)
Construction											
Shadow Flicker effects on nearby residential properties	Negligible	N/A	N/A	N/A	N/A	N/A	Negligible	N/A	N/A	N/A	N/A
Operation											
Shadow Flicker effects on nearby residential properties	Negligible	Negative	P	D	LT	N/A	Negligible	Negative	P	D	LT

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term

N/A = Not Applicable

WSP UK Limited
WSP House
London
WC2A 1AF
UK
Tel: +44 20 7314 5000
Fax: +44 20 7314 5111
www.wspgroup.co.uk