MOTT MACDONALD

Stip Wind Farm, North Macedonia

Vol II - Environmental and Social Impact Assessment (ESIA)

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Vol II - Environmental and Social Impact Assessment (ESIA)

February 2026

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Glossary

Issue and Revision Record

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Glossary

Term	Definition
Abiotic ecosystem services	Services arising from geophysical processes (e.g. wind, geomorphology) not dependent on short-term biological processes.
Accumulated hours per year	Annual sum of shadow flicker hours at a receptor; compared to limits (e.g. 30h/y worst-case; 8h/y real-case).
Acute hazards	Short-duration events with immediate severe impacts (e.g. heavy rainfall/flood, wildfire, extreme winds, extreme heat).
Ad hoc engagement	Informal or opportunistic interaction with local residents or institutions encountered during site visits or project fieldwork, used to gather context-specific insights. These interactions often happen without prior planning and are usually non-recurring.
Adaptive capacity / embedded measures	Design and operational allowances that moderate vulnerability (e.g., drainage, materials/coatings, SCADA monitoring).
Adaptive Management	Framework for adjusting mitigation during operation in response to monitoring results.
Adaptive Monitoring	Operational protocols (e.g. bird/bat collision monitoring, IAS control) with triggers for corrective actions (curtailment, shutdown-on-demand).
Additive Risk Concept	Principle that collision risk accumulates across multiple turbines unless mitigated, as birds experience exposure per rotor transit.
Administrative Disputes Procedure	Legal process for appealing decisions of administrative bodies, relevant for land and permitting disputes.
Aesthetic experience	Non-material cultural service derived from landscape qualities and natural features
Air absorption	Reduction of sound with distance due to atmospheric humidity & temperature
Ampacity & thermal sag (OHL)	Current-carrying capacity and conductor sag behaviour under higher temperatures; managed via monitoring and ratings.
Annex I Habitat	EU Habitats Directive priority or non-priority habitats requiring strict conservation consideration.
Area of Influence (AoI)	The geographical area likely to be affected by Project activities and associated facilities, including direct, indirect and cumulative effects.
At-risk Flight	Any bird movement recorded within the rotor-swept height band (30–210 m), used to determine eligibility for collision modelling.
Automated Bat Detector	Static acoustic recorder used for long-term activity monitoring across turbine clusters.
Avoidance Behaviour	Movement or flight adjustment made by a bird to avoid turbine blades; incorporated into final collision probability.
Avoidance Rate	Percentage of birds actively avoiding collision during turbine encounters
Background noise level	Typical underlying noise (LA90) without distinct intrusive sources
Band Model	Widely used model for calculating collision risk based on flight activity and turbine parameters
Barotrauma	Injury to wildlife (esp. bats/birds) from rapid pressure changes near turbine blades
Barrier attenuation	Reduction of noise due to blocking by terrain or objects
Baseline	Pre-project condition of natural capital stocks and ecosystem services
Baseline Conditions	Environmental and social conditions prior to the start of project construction or operation, used as the reference point for impact assessment.
Baseline noise characteristic	Derived relationship between measured noise and wind speed at each MP location
Baseload Power	Electricity generation capable of running continuously at a stable output (e.g. geothermal, thermal).
Bat Activity Index	Number of bat echolocation contacts per hour used to quantify bat activity and risk.

Term	Definition
Beneficiaries	People receiving benefits from ecosystem services.
Biodiversity	The variety and abundance of species, habitats, and ecological processes within the Project area.
Biodiversity Offsetting	Habitat creation or enhancement used as a last resort to counter residual impacts.
Biodiversity Study Area (BSA)	Large-scale 50 km study radius used to identify protected areas, IBAT layers, and landscape-level ecological features.
Biosphere Reserve	Biosphere reserves are designated areas that promote sustainable development, conservation of biodiversity and the harmonious coexistence of people and nature, recognised under UNESCO's Man and the Biosphere Programme.
Bird Collision Risk	The likelihood of avifauna colliding with wind turbine blades or overhead lines; investigated through collision risk modelling.
Blade	One of the aerodynamic components of a wind turbine rotor designed to capture wind energy.
Breeding Bird Survey (BBS)	Systematic transect-based method for determining breeding birds and territories.
Calibration drift	Change in measurement accuracy checked before/after surveys
Capacity Factor	Ratio of actual energy produced over time to the maximum possible output; used in technology comparison.
Carbon Footprint	The amount of greenhouse gas emissions associated with Project activities, also representing emissions avoided by renewable energy generation.
Carbon sequestration	Capture and long-term storage of carbon in habitats such as woodland and grassland
Chronic hazards	Gradual shifts in climate variables over time (e.g., mean temperature or precipitation change, average wind-speed change).
Climate benefits (net GHG savings)	Annual avoided emissions from project generation (e.g., 674,644 tCO2e/year based on 808,000 MWh and 743 gCO_2/kWh).
Close / Mid-distance / Distant view	Qualitative distance bands used in the chapter to describe proximity of receptors to turbines (e.g., up to ~500 m; 0.5–1 km; >1 km).
CMIP6 ensemble percentiles (10th/50th/90th)	Statistical spread used to capture model uncertainty for future projections.
Collision Risk Assessment (CRA)	Assessment used to quantify potential bird mortality caused by interaction with wind turbines and overhead lines, integrating survey data and predictive modelling.
Combined margin grid factor	Emission factor combining operating and build margins used to estimate avoided GHG from grid-connected renewables.
Community Health and Safety (CHS)	Measures to safeguard residents from environmental, health, and safety risks during construction and operation.
Composite blades (end-of-life)	Turbine blades made of composites that may require specialised recycling/re-processing outside the local area due to limited capacity.
Concession land	State-owned land allocated through formal concession agreements for agriculture or pasture.
Concrete washout area	Impermeable, designated area where concrete equipment is washed and residues are captured to avoid soil/groundwater contamination.
Construction noise buffer	Distance at which daytime threshold of 65 dB is exceeded for each construction activity
Construction Phase	Period during which all physical works required for the wind farm are carried out, including civil works, installation, and grid connection.
Consultation event	Structured meeting with affected and interested parties to present Project information, collect feedback, validate concerns and inform ESIA scope or findings. Public consultation sessions in February 2025 fall under this category.
Critical Habitat (CH)	Habitat meeting lender criteria (IFC/EBRD/EIB) due to irreplaceability or vulnerability—e.g. priority habitats or areas regularly supporting qualifying species or processes.
Cultural Heritage	Archaeological, architectural, and cultural resources requiring protection from Project impacts.

Term	Definition
Cultural heritage site (local significance)	Place of cultural, religious or traditional value used by local communities (e.g., fountains, ceremonial sites).
Cultural services	Non-material benefits such as recreation, heritage, sense of place, aesthetic values.
Curtailment	Wind turbine curtailment refers to the intentional reduction of electricity generation from a turbine. Curtailment can be applied for different reasons, such as lowering noise during sensitive periods, or reducing turbine operation at specific times to protect birds and bats (for example during peak migration or high bat-activity nights).
Cut-off Date	Official date after which newly created assets or claims are not eligible for compensation; established during census.
Cut-off distance (10RD)	Practical limit beyond which shadow flicker is considered negligible; used to define the Area of Influence.
Daily sunshine hours	Observed sunshine statistics used to derive cloudiness reduction factors in real-case modelling.
Dawn chorus filtering	Removal of early-morning bird noise peaks from dataset.
Decommissioning	End-of-life dismantling of turbines, removal of infrastructure, and restoration of land.
Derating / cut-out (wind)	Operational responses to extreme winds (pitch control, shutdown above rated/cut-out speeds ~25 m/s) to prevent damage.
Design Optimisation	Engineering refinement process to minimise environmental and social impacts (e.g., road realignments, WTG relocation, avoiding PV plant, avoiding trees).
Disclosure (Project information)	Process of making ESIA-related information accessible to stakeholders (online and hard copy), including scoping reports, brochures, presentations, and LRP materials.
Downwind propagation	Worst-case assumption where noise travels from turbine toward receptor with wind assistance.
EBRD PR / ESR	EBRD Performance Requirements / Environmental and Social Requirements.
ECMWF / ERA5	Global reanalysis data provider and dataset used to derive long-term wind direction distributions (e.g., 2000–2024 at 100 m AGL).
Ecological Connectivity	Functional linkages allowing wildlife movement between habitats (key for MAK-NEN and CH/PBF).
Ecologically Appropriate Assessment Area (EAAA)	Area defined for assessing PBF/CH thresholds for species groups as per EBRD guidance.
Economic displacement	Loss of access to income-producing land or livelihood resources due to project land acquisition, without requiring physical relocation.
Ecosystem services	Benefits people obtain from natural capital stocks.
Effect / Impact	A change to the baseline environment caused by Project activities, evaluated in terms of magnitude and receptor sensitivity.
Embedded mitigation	Design-integrated measures applied early in project planning to avoid or reduce impacts at source.
Energy Import Dependency	Degree to which a country must rely on electricity or fuel imports to meet demand; cited as a justification for Project need.
Energy Mix	Proportion of different fuel types in national energy generation (coal, oil, gas, hydro, solar, wind).
Energy Transition	National shift from carbon-intensive to renewable energy systems; central to the NECP and PPCA context.
Enhancement measures	Actions taken to increase or expand beneficial impacts, or to distribute benefits more equitably across stakeholders.
Environmental and Social Management Measures	Actions designed to minimise, mitigate or manage potential environmental and social impacts.
EPC Contractor	Engineering, Procurement and Construction Contractor.
Erosion control	Regulation of soil erosion by vegetation and landform.

Term	Definition
European Waste Catalogue (EWC/LoW codes)	EU standard six-digit codes classifying waste types for handling, reporting and compliance.
Exposure (CRVA)	Degree/frequency with which project receptors (assets, people) could be affected by a climate hazard over the design life.
Expropriation	Legal process enabling compulsory acquisition of land in the public interest, with compensation not below market value, as per national law.
Extended Producer Responsibility (EPR/PER)	Policy framework that places end-of-life management obligations on producers (North Macedonia's PER harmonises with EU EPR).
Extraneous noise filtering	Removal of noise unrelated to wind (e.g., birdsong, human activity) during analysis.
Far-field noise	Outdoor sound measured >3 m from reflective surfaces per IFC/ISO guidance.
Field Survey Area	On-site footprint plus 500m where primary ecological data (habitats, flora, fauna) were collected.
Flight Seconds (b)	Total seconds of bird activity recorded.
Forced Eviction	Removal of people from land or assets without due process, consultation or adequate compensation; explicitly avoided by the Project.
Forced labour risk	Possibility of coercive labour conditions in supply chains (e.g. withholding documents, unsafe conditions, bonded labour).
Framework ESMP	High-level management plan consolidating all mitigation and monitoring requirements from the ESIA, guiding Contractors' detailed site-specific plans.
Free-field measurement	Noise measured ≥3 m away from reflective surfaces.
Full Replacement Value	Comprehensive valuation including market value, transaction costs, taxes, fees, and restoration measures.
GDPR-aligned Data Protection Principles	Requirements on personal data rights, lawful processing, data minimisation, security and remedies, as reflected in North Macedonia's LDP.
Gender-based vulnerability	Disadvantage experienced by women and girls due to social norms, lower economic power, and unequal division of labour.
Greenhouse mode (WindPRO)	Omnidirectional point-receptor configuration in WindPRO that simulates potential exposure from all directions.
Grievance Mechanism	A formal process enabling community members to raise concerns and receive responses from the Project.
Ground roughness length (z_0)	Surface roughness constant (0.05 m) used for wind speed standardisation
Habitat Loss (Permanent vs Temporary)	Reduction in habitat extent due to project footprint (permanent) or construction disturbance (temporary).
Hazard–Exposure–Vulnerability (HEV) framework	Qualitative risk framework used in EP4: Risk = Hazard × Exposure × Vulnerability.
Hazardous waste	Wastes with hazardous characteristics (explosive, flammable, oxidising, toxic, corrosive) or defined as hazardous by law.
Heat-resistant materials/coatings	Materials and protective finishes on blades/towers/insulators to reduce thermal degradation and corrosion under higher temps.
High-voltage Transmission Line (HVTL)	Electrical infrastructure used to evacuate generated power; in this Project, relevant to site selection due to need for proximity. (HVTL not abbreviated but used conceptually).
Hub height	Vertical distance from ground to rotor hub; a key geometric parameter affecting shadow envelope extent.
Human rights risk	Potential infringement on dignity, health, or freedoms of workers, communities or supply chain actors due to project activities.
Hydrological regulation	Regulation of runoff, baseflow, and peak flows by habitats and terrain.
Hydrophobic/galvanised components	Insulators and protected metals used to limit water accumulation and corrosion under heavy precipitation/flooding.
IFC Guidelines	International Finance Corporation Guidelines defining sector specific good practices.

Term	Definition
IFI GHG Accounting (grid-connected RE)	Methodology to quantify net avoided emissions from renewables against combined margin grid factors (e.g., 2021 factor for MK).
ILO Core Labour Standards	Eight fundamental conventions addressing forced labour, child labour, discrimination, freedom of association, collective bargaining and occupational health and safety.
Impact evaluation process	Structured identification, prediction and assessment of Project impacts across construction, operation and decommissioning.
Important Bird and Biodiversity Area (IBA)	Site recognised for importance to bird conservation; used to assess collision risk and habitat effects.
Indirect Area of Influence (Indirect AoI)	Wider area experiencing secondary, indirect or supply-chain related social effects.
Inert construction waste	Wastes that do not undergo significant physical/chemical/biological change after disposal (e.g. excavated soil, concrete, unpainted metals).
Informal land user	Person using land without registered or legally recognised rights; common due to historical land reforms.
Initial Scoping Meeting	Early-stage meeting (Oct–Nov 2024) intended to introduce the Project, gather preliminary issues, and establish channels for follow-up engagement.
Intermittent occupancy	Settlement pattern where homes are occupied only seasonally or on weekends, affecting true exposure to project impacts.
Intermittently Flowing Watercourse	Temporary Mediterranean-type streams relevant as Annex I habitat and PBF.
International Bill of Human Rights	Collective term for UDHR, ICCPR and ICESCR (and optional protocols), forming the foundation of internationally recognised human rights.
Intersectional vulnerability	Overlapping vulnerabilities (e.g. disabled elderly women in rural areas) that amplify risk of harm.
Invasive Alien Species (IAS)	Non-native species that can outcompete native biodiversity; monitoring required during construction.
Involuntary Resettlement	Physical or economic displacement occurring without the right of refusal, subject to IFC PS5 / EBRD ESR5 requirements.
Irremediability	Ability (or inability) to restore pre-impact conditions after a human rights harm occurs.
Istanbul Convention	Council of Europe treaty on preventing and combating violence against women and domestic violence.
IUCN RLE	IUCN Red List of Ecosystems.
Key Evolutionary Processes (C5)	Landscape features/processes essential for genetic diversity/speciation; qualitatively assessed in CH determinations.
Key Informant Interview (KII)	One-on-one interview with people holding specific local knowledge (e.g. religious leaders, affected landowners, community representatives), used to verify social baseline and contextual risks
Land Acquisition	Obtaining rights to use or access land for Project activities.
Landscape Character Area (LCA)	A geographically distinct area with broadly homogeneous landscape character used as a unit of assessment.
Landscape condition	The state of repair and intactness of landscape elements and features, including evidence of detractors.
Legally Protected & Internationally Recognised Areas	Designations such as Natura 2000 (SCI/SPA), KBA/IBA, Ramsar, WHS, Biosphere Reserves considered alongside CH criteria in lender assessments.
Licensed carrier / authorised facility	Contractor or facility holding valid permits for collection, transport, treatment or disposal of wastes.
Line-of-sight check (ZVI)	Visibility/topographic screening to confirm whether a receptor can see a turbine (and therefore potentially experience flicker).

Term	Definition
Livelihood	The full range of income-generating and subsistence activities used by individuals and households (waged labour, agriculture, natural resource use, informal economy).
Livelihood dependence	Degree to which households rely on local land, crops, livestock or natural resources, which affects sensitivity to displacement.
Livelihood restoration	Support provided to affected households whose land-based or economic activities are disrupted by the Project.
Magnitude of impact	Degree of change to natural capital and ecosystem services, considering scale, duration, reversibility.
Meaningful engagement	Engagement based on principles of respect, accessibility, timely disclosure, avoidance of coercion, and integration of stakeholder inputs into ESIA assessments and mitigation measures.
Medical waste (incl. contaminated PPE)	Clinical and infectious waste requiring dedicated storage, marking and treatment (e.g. incineration) to protect health.
Meteorological Mast	A post installed to measure wind speed, direction, temperature, pressure and other parameters for turbine suitability assessments.
Micro-siting	Fine-scale optimisation of individual turbine locations to reduce environmental, social and technical impacts (e.g. noise, shadow flicker, avifauna sensitivity).
Migratory or Congregatory Species (C3)	Species assessed for regular cyclical use or stress-period congregation thresholds; if met, can trigger CH or PBF outcomes.
Mitigation Hierarchy	Structured approach: Avoid → Minimise → Restore → Offset; used to deliver No Net Loss (PBF) and Net Gain (Critical Habitat).
Mitigation Measures	Actions taken to avoid, reduce or remedy adverse environmental and social effects.
Modified Habitat	Human-altered habitats with limited biodiversity value such as orchards, cropland, roads or quarries.
Monitoring (ESMP context)	Systematic programme of measurement, inspection, and auditing used to evaluate effectiveness of mitigation and verify compliance with ESMP commitments.
Municipal landfill (regional)	Regional facility intended to serve Eastern & Northeastern regions (Sveti Nikole), noted as planned/under development.
Nacelle	Enclosed housing at the top of the turbine tower containing the generator, gearbox and mechanical components.
National Energy and Climate Plan (NECP)	The national framework guiding energy transition and renewable targets.
Natura 2000 SCI	Site of Community Importance
Natura 2000 SPA	Special Protection Area
Natural capital	Stocks of natural resources (biotic & abiotic) generating ecosystem services.
Natural Habitat	Areas with native vegetation and ecological functions largely intact, though not meeting critical habitat thresholds.
Nature-based Solutions (NbS)	Measures using ecological processes (e.g., vegetation/terracing for slope stability, wildfire defensible space) to build resilience.
Negotiated Settlement	Preferred method of obtaining land rights through agreement between Project and landholders prior to compulsory expropriation.
Net Gain / Net Positive Impact (NPI)	Biodiversity outcomes exceeding baseline conditions, required in Critical Habitat under EIB ESS4.
Night-time aviation lighting	Safety lighting on turbines that can introduce additional visual effects after dark.
No Net Loss (NNL)	A measurable outcome where biodiversity losses are balanced by restoration or offsets.
Nocturnal Survey (Playback Survey)	Call-playback method to detect nocturnal birds such as owls and nightjars.
Noise	Unwanted sound generated during construction or by turbine operation.
Noise attenuation	Reduction of sound propagation by vegetation and landform.

Term	Definition
Noise contour map	Spatial plot showing predicted sound levels across the study area.
Non-compliant landfill	Existing local disposal sites (e.g. Treštena Skala, Krstot) lacking sanitary standards; only inert waste allowed at Krstot by local decision.
Non-hazardous waste	Wastes that are neither hazardous nor inert (e.g., domestic refuse, office waste, packaging, treated sewage).
OECD Due Diligence Guidance (minerals)	Standards for responsible sourcing from conflict-affected and high-risk areas.
OECD Guidelines for Multinational Enterprises	International principles for responsible business conduct covering human rights, labour, environment and supply chains.
Operational Downtime	Periods when turbines are not spinning due to insufficient wind or maintenance, reducing collision exposure time.
Operational Phase	Period after construction is completed and the wind farm generates electricity and routine maintenance activities occur.
Parcelisation	Subdivision of land plots, often relevant for land acquisition or ownership considerations.
Pasture concession	Grazing rights granted by the state for livestock use; may overlap with project land needs.
Perceptual value	Experiential qualities of a landscape (e.g., openness, tranquillity, wildness) as perceived by people.
Physical climate risk	Risk arising from acute (event-driven) and chronic (long-term trend) climate hazards impacting assets, operations or people.
Pollution Prevention	Measures to avoid or minimise emissions, spills, or contamination of soil, water, or air.
Polynomial best-fit curve	Statistical trendline used to derive baseline noise–wind speed relationships.
Priority Biodiversity Feature (PBF)	High-value biodiversity features under EBRD ESR6, triggering no net loss requirements.
Producer Responsibility Organisation (PRO)	Licensed entity that organises collection and treatment to fulfil producers' EPR/PER obligations.
Project brochure	Summary document about Project characteristics, disclosed in multiple languages and formats during ESIA scoping and LRP consultations.
Project Footprint	The area occupied by Project infrastructure, such as turbines, access roads, substation, and cables.
Project-induced in-migration	Movement of workers or job-seekers into the project area, creating pressure on housing and services.
Provisioning services	Material outputs (e.g. crops, livestock, water, wind energy).
Public consultation meeting	Formal public session organised to discuss the ESIA scoping report (February 2025), disclose Project information, and capture feedback from communities and institutions.
Ramsar	Ramsar Convention on Wetlands
Raptor Survey (Territory Search)	Species-specific method for locating nests, territories and breeding evidence for raptors.
Real Estate Cadastre	National system for recording property rights, land classification and cadastral data.
Real-case scenario	Scenario applying quantified reductions for local conditions (e.g. cloud cover/sunshine hours, wind direction/orientation, realistic operation) to estimate annual exposure.
Receptor	A receptor is any environmental or social feature that may be affected—directly or indirectly—by project activities. Receptors are identified and assessed in each technical chapter of the ESIA to determine the potential significance of project impacts.
Recreational land use	Non-commercial community use of land for gatherings, celebrations, hunting, hiking or picnics.

Term	Definition
Replacement Cost	Valuation method ensuring compensation equals full cost to replace lost assets without depreciation, including transaction costs and transitional support.
Resettlement minimisation	Design approach to avoid or significantly reduce the need for land acquisition, displacement, or impact on private assets.
Residual effects	Impacts remaining after mitigation is applied.
Residual impact	Impact remaining after all feasible mitigation is applied, used to determine offset needs.
Ridgeline visibility	Visibility associated with project elements sited on or near skylines; often increases prominence within views.
Risk scoring matrix	Qualitative matrix combining exposure and vulnerability to derive overall risk levels (low, moderate, high, very high).
Rotor disk projection	Apparent area of the rotor “seen” from a receptor; varies with yaw and affects flicker intensity and duration.
Rotor-swept zone	Vertical zone between minimum and maximum blade tip height where collision may occur.
SCADA-based adaptation	Using SCADA to anticipate stress (thermal, vibration), manage curtailment, and trigger rapid inspections after events.
Scenic quality	The aesthetic appeal of a landscape arising from composition, features, views and sense of place.
Seasonal livelihood pattern	Predictable annual timing of planting, grazing, harvesting and other livelihood activities.
Secondary containment	Secondary containment is a safety measure designed to prevent hazardous materials from escaping into the environment in case of a primary container failure.
Second-degree protection area	Residential areas, educational buildings, playgrounds, public green spaces.
Seed dispersal	Movement of seeds by animals enabling regeneration of habitats.
Sense of place	The essential character and identity that makes a place distinctive.
Sensitive receptor	Building or location occupied by people vulnerable to noise impacts.
Sensitivity (landscape/visual)	Likelihood an ecosystem service will change with alterations to natural capital stocks.
Septic tanks / sanitary chemicals	On-site containment for sewage and chemicals; must be emptied by licensed contractors and never discharged untreated.
Severity (HRIA)	Measure of seriousness of a human rights impact, based on scale, scope and irremediability—not likelihood.
Shadow envelope	Geometrical extent within which rotor shadows can reach receptors given sun position, turbine geometry, and terrain.
Shadow flicker	Intermittent shadow patterns cast by rotating turbine blades onto nearby receptors.
Significance matrix	Tool combining magnitude and sensitivity to determine overall impact significance (negligible, minor, moderate, or major).
Soaring Bird Sensitivity Mapping Tool	BirdLife International tool used to pre-screen migration sensitivity and identify high-risk regions for large raptors and soaring species.
Social baseline survey	Structured gathering of demographic, livelihood and socioeconomic data from communities (conducted during Focus Group Discussions (FGDs) and Kii Informant Interviews (KIIs) to inform impact assessment and Livelihood Restoration Plan (LRP) preparation.
Social infrastructure	Public services and facilities such as schools, clinics, water networks and transport used by communities.
Sound power level	Total acoustic energy emitted by a source (LwA/LwZ).
Spill prevention and response plan	Preparedness and procedures (kits, training, reporting) to prevent, contain and remediate spills, which are elaborated in the response plan
Stakeholder engagement log	Continuous record of consultations, meetings, phone communications, disclosures, interviews and concerns raised; supports ESIA and LRP traceability.

Term	Definition
Stakeholder mapping	Systematic identification and categorisation of stakeholders based on interest, influence and potential Project impacts, updated throughout the ESIA.
Study area	The geographic boundary used for each aspect potentially influenced by the Project.
Substation	Facility that collects electricity generated by turbines and transforms voltage for grid transmission.
Supply chain communities	Communities living near mining, material processing or manufacturing sites supplying project components.
Survey Effort	Total hours of observation at each vantage point necessary to meet survey standards and ensure statistical reliability.
Susceptibility	The ability of a receptor to accommodate the specific type of change without undue adverse effects.
Sustainable Urban Drainage Systems (SUDS) / drainage capacity allowance	Designing drainage to accommodate extreme rainfall with climate-change allowances; minimising pooling/erosion at foundations.
ThinkHazard (Global Facility for Disaster Reduction and Recovery, GFDRR)	A screening tool developed by the Global Facility for Disaster Reduction and Recovery (GFDRR) that classifies local hazards for a given project area. The tool provides a summary of the likelihood and severity of hazards such as river or urban flooding, wildfire (e.g. “high” risk), or landslide (“low” risk), supporting project planning and risk management.
Third-degree protection area	Commercial/trade areas and agricultural zones.
Threatened Species (C1)	Species classified as Critically Endangered (CR), Endangered (EN), or sometimes Vulnerable (VU), assessed against global percentage thresholds and reproductive units according to International Union for Conservation of Nature (IUCN) Red List Criterion 1. Depending on lender criteria, the outcome of this assessment may result in the species or habitat being designated as Critical Habitat (CH) or Priority Biodiversity Feature (PBF).
Topographic shadow	Reduction or preclusion of flicker due to terrain or built/vegetation obstacles along the turbine–receptor sightline.
Tranquillity	A perceived state of calm/quiet often associated with low levels of visual and aural intrusion.
Type 1 / Type 2 sound level meter	Precision grade (IEC 61672-1) for environmental noise measurements.
Uncertainty Analysis	Model stage assessing limitations related to sampling, temporal variation, observer error and ecological variability.
Uncertainty and limitations	Acknowledgement of data gaps or methodological limitations affecting impact prediction, with recommendations on monitoring or mitigation.
Vantage Point viewshed	180° arc of 2 km radius surveyed from each vantage point.
Wind rose	Sectoral distribution of wind directions/frequencies used to estimate rotor orientation and operational sector hours.
Windographer	Software used to process wind datasets and generate wind roses.
WindPRO	Software used for shadow flicker calculations and wind project modelling.
Worst-case (astronomical) scenario	Pure geometrical/astronomical calculation assuming continuous turbine operation, full sun, and rotor disk perpendicular to the line-of-sight; provides conservative maxima.
Yaw / rotor orientation	Directional alignment of the rotor to prevailing wind; alters the apparent rotor disk projection toward the receptor and influences flicker occurrence.

List of abbreviations

Abbreviation	Definition
AEP	Alcazar Energy Partners
AGL	Above ground level
AIIB	Asian Infrastructure Investment Bank
AL	Assessment Location (noise receptor ID)
AoI	Area of Influence
BAP	Biodiversity Action Plan
BMEP	Biodiversity Monitoring & Evaluation Plan
BMP	Biodiversity Management Plan
BOP	Balance of Plant
BSA	Biodiversity Study Area
C1	Criterion 1 - International Union for Conservation of Nature (IUCN) Red List population reduction criterion)
CBD	Convention on Biological Diversity
CEDAW	Convention on the Elimination of All Forms of Discrimination Against Women
CH	Critical Habitat
CH	Critical Habitat
CHA	Critical Habitat Assessment
CICES	Common International Classification of Ecosystem Services
CLO	Community Liaison Officer
CO_2	Carbon dioxide
CR	Critically Endangered
CRA	Collision Risk Assessment
CRM	Collision Risk Model used to estimate bird collision likelihood with turbines and OHL
CRS	Coordinate Reference System
CRVA	Climate Resilience and Vulnerability Assessment
D_A	Areal Bird Density — number of birds in flight measured in seconds per m²
DE	German shadow flicker guidelines
DEM	Digital Elevation Model
DEMP	Decommissioning Environmental Management Plan
DFC	U.S. International Development Finance Corporation
E&S	Environment and Social
EAAA	Ecologically Appropriate Area of Analysis
EBRD	European Bank for Reconstruction and Development
ECHR	European Convention on Human Rights
ECMWF	European Centre for Medium-Range Weather Forecasts
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ELC	European Landscape Convention
EN	Endangered
EP4	Equator Principles 4

Abbreviation	Definition
EPR	Environmental Performance Review
EPR (EU)	Extended Producer Responsibility (EU framework)
EPSG:6204	Macedonian national coordinate system
ERA5	ECMWF global reanalysis dataset
ES	Environmental Statement
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plan
ESMP	Environmental and Social Management Plan (framework ESMP for construction and operation phases)
ESR	Environmental and Social Requirement (EBRD)
ESS	Ecosystem Services
ETSU-R-97	UK guidance for assessing wind turbine noise
EU	European Union
EU-DEM	Pan-European 25m digital elevation model used for ZVI/topographic shadow checks
EUNIS	European Nature Information System (habitats classification)
EWC / LoW	European Waste Catalogue / List of Waste codes
FGD	Focus Group Discussion
G	Ground absorption factor (ISO 9613-2)
GBVH	Gender-Based Violence and Harassment
GCF	Green Climate Fund
GDPR	General Data Protection Regulation (EU)
GHG	Greenhouse gas
GIIP	Good International Industry Practice
GIS	Geographic Information System
GLVIA3	Guidelines for Landscape and Visual Impact Assessment, 3rd Edition
GWh	Gigawatt hour
HRI	Human Rights Impact
HRIA	Human Rights Impact Assessment
IBA	Important Bird and Biodiversity Area
IBAT	Integrated Biodiversity Assessment Tool
ICCPR	International Covenant on Civil and Political Rights
ICESCR	International Covenant on Economic, Social and Cultural Rights
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IEMA	Institute of Environmental Management and Assessment
IFC	International Finance Corporation
IFI	International Financial Institutions
ILO	International Labour Organisation
IoA GPG	Institute of Acoustics Good Practice Guide
IPBES	Intergovernmental Science-Policy Platform on Biodiversity & Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area

Abbreviation	Definition
KII	Key Informant Interview (semi-structured interview with knowledgeable stakeholders)
KPIs	Key Performance Indicators
kV	Kilovolt
LA10	The A-weighted sound level which exceeded 10% of interval (traffic noise indicator)
LA90	The A-weighted sound level exceeded 90% of the measurement interval (background noise level)
LAeq	A-weighted equivalent continuous sound level
LAmax	A-weighted maximum sound level
LCA	Landscape Character Area
LD	Daytime noise indicator (07:00–19:00)
LDEN	Day-Evening-Night average noise level indicator
LDP	Law on Personal Data Protection (North Macedonia)
LE	Evening noise indicator (19:00–23:00)
LI	Landscape Institute
LN	Night-time noise indicator (23:00–07:00)
LRP	Livelihood Restoration Plan
LwA	Sound power level (A-weighted)
LwZ	Unweighted octave band sound power level
MAK-NEN	National Ecological Network of North Macedonia
MP	Noise Measurement Position
MSDS	Material Safety Data Sheet
MW	Megawatt
NbS	Nature-based Solutions
NBSAP	National Biodiversity Strategy and Action Plan
NCC / NDC	National Climate Commitment / Nationally Determined Contribution
NECP	National Energy and Climate Plan
NNL / NG	No Net Loss / Net Gain
NR	Nature Reserve
NTS	Non-Technical Summary
O&M	Operations and Maintenance
OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
OG RM	Official Gazette of the Republic of Macedonia
OHL	Overhead Line
PAPs	Project Affected People
PBF	Priority Biodiversity Feature
PBF	Priority Biodiversity Feature
PCH	Potential Collision Height (rotor swept zone: 29–211 m for this project)
PER (MK)	Producer Extended Responsibility (North Macedonia)
PPCA	Powering Past Coal Alliance
PRO	Producer Responsibility Organisation
PV	Photovoltaic (solar technology)
QHSE	Quality, Health, Safety and Environment
QHSSSE	Quality, Health, Safety, Security, Social and Environment
RD	Rotor diameter

Abbreviation	Definition
RM	Republic of Macedonia
RNM	Republic of North Macedonia
RPM	Rotations per minute of turbine blades
SAC	Special Area of Conservation
SCADA	Supervisory Control and Data Acquisition
SCI	Site of Community Importance
SDGs	Sustainable Development Goals
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SLM	Sound Level Meter
SPA	Special Protection Area
SPV	Special Purpose Vehicle
SS	Substation
SSP	Shared Socioeconomic Pathway
SUDS	Sustainable Urban Drainage Systems
TCFD	Task Force on Climate-Related Financial Disclosures
tCO2e	Tonnes of carbon dioxide equivalent
TFC	Total Final Consumption (energy consumed by end-users)
TS	Turbine Supplier
UDHR	Universal Declaration of Human Rights
UN SEEA	United Nations System of Environmental-Economic Accounting
UNEP-WCMC	United Nations Environment Programme – World Conservation Monitoring Centre (Global Critical Habitat screening layer)
UNGC	United Nations Global Compact
UNGPs	United Nations Guiding Principles on Business and Human Rights
UNHR	United Nations Human Rights
v10	Standardised wind speed at 10m height
VEC	Valued Ecological Component
VP	Vantage Point (bird observation survey point)
VU	Vulnerable
WBG	World Bank Group
WEEE	Waste Electrical and Electronic Equipment
WHS	World Heritage Site
WM	Weather Mast
WMMHP	Waste and Materials Management and Handling Plan
WTG	Wind Turbine Generator
ZTV	Zone of Theoretical Visibility
ZVI	Zone of visual influence (line-of-sight check)

1 Introduction

Issue and Revision Record

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1 Introduction

1.1 Overview

Mott MacDonald Limited has been appointed by Alcazar Energy Partners II HoldCo Limited (Holding Company), referred to as 'Alcazar Energy Partners' or 'AEP' to undertake an environmental and social impact assessment (ESIA) of the Stip Wind Farm in North Macedonia (the Project).

The Project is being developed by a Special Purpose Vehicle (SPV) incorporated in North Macedonia, fully owned by AEP and established for the purpose of developing, constructing and operating the Project, from now on referred to as the 'Project Proponent'.

1.2 Purpose of the ESIA

In order to proceed with the development of the Project, an ESIA has been developed to meet a suite of international standards and good international industry practice (GIIP). Ful details provided in Chapter 4.

The purpose of this ESIA, and the framework environmental and social management and monitoring plan (ESMMP) that accompanies it, is to assess the Project's potential environmental and social impacts, in order to satisfy the principles of the applicable national and international standards and guidelines and to define appropriate mitigation and management measures.

For the ESIA to be appropriate to the location and scale of the project, a scoping exercise was conducted to define key environmental and social aspects and potential impacts relevant to the Project. The scoping public consultation and hearing took place in early February 2025 based on the scoping report (dated 20 January 2025).

1.3 Brief Project overview

The Project is located in a rural area approximately 75km southeast of the capital, Skopje, near the city of Stip in North Macedonia. It lies predominantly within the municipalities of Stip and Radovic, with a smaller portion extending into Karbinci Municipality.

The Project consists of the development, construction, and operation of a wind farm comprising up to 54 wind turbine generators (WTGs), each with a nominal capacity of approximately 6-8MW, resulting in a total installed capacity of up to 396MW. The wind farm is expected to generate more than 1,340GWh of electricity annually.

The main Project components are:

- Up to 54 WTGs of 6-8MW power for a total of up to 396MW output
- A 35/400 kV substation
- Approximately 80km of 35kV buried cables connecting the WTGs to the substation
- Approximately 7km long 400kV overhead line (OHL)
- Approximately 68km of internal roads

The full Project description is included in Chapter 2 of this ESIA, and further details are provided in each individual assessment chapters.

1.3.1 Project participants

The main Project participants used throughout the ESIA are presented in the Table below.

Table 1.1: Main Project participant

Name	Description
Alcazar Energy Partners II HoldCo Limited (Holding Company)	''Alcazar Energy Partners'' or ''AEP''
Project Proponent/s	Any or all Special Purpose Vehicle (SPV) companies fully owned by Alcazar Energy Partners II HoldCo and established for the purpose of developing, constructing and operating all phases of the Project.
Balance of Plant (BOP) Contractor	The company(ies) responsible for delivering all supporting infrastructure and systems (civil works, electrical works, grid connection, etc.) required for the construction of the wind farm project.
Turbine Supplier (TS) Contractor (TS Contractor)	The company responsible for supplying the turbines and for their transportation, installation, and commissioning of the wind turbine generators

Source: Project Proponent

1.4 Structure of the overall ESIA package

This document is Volume II and presents the main ESIA. The overall ESIA package structure is presented in Table 1.2.

Table 1.2: Overall ESIA package structure

Volume	Chapter	Description
Volume I – non-technical summary (NTS)		Provides a high-level, accessible overview of the Project, summarising its scope and key characteristics for non-technical readers. It presents a concise yet comprehensive summary of the ESIA, highlighting the anticipated impacts and the proposed management and mitigation measures. The NTS serves as a key tool to support stakeholder consultation and information disclosure.
Volume II - Main ESIA report	1 - Introduction	This chapter - presents a brief overview of the Project, description of the Project and its participants, the purpose of the ESIA and outline of contents of the report.
	2 - Project description	Describes the Project, its main elements and activities for construction and operation. Describes the design of the wind farm and its purpose. Further Project details are to be found in each individual chapter as relevant to each discipline.
	3 - Project need and analysis of alternatives	Presents the purpose and rationale of the Project and summarises the different Project alternatives considered for energy supply, site selection and design, including the 'no-project' alternative.
	4 - Policy, legal and institutional framework	Defines key national policy, legislation and international lender guidelines applicable to the Project.
	5 - Information disclosure, consultation and participation	Provides an overview of the consultation processes and results.
	6 - ESIA process and assessment methodology	Sets out the stages of the ESIA process, key assumptions and overall assessment methodologies. The assessment methodologies and definitions may vary to tailor each individual assessment as required, if so, details of which will be specified in each assessment chapters.
	7 to16 - ESIA Chapters	Presents the baseline, impact assessment and mitigation measures for each of the following topics: ● 07 Socio-economic (HRI scan, cultural heritage, transportation) ● 08 Biodiversity (avifauna, terrestrial ecology, cumulative impacts)

Volume	Chapter	Description
		• 09 Collision risk assessment (CRA) • 10 Critical habitat assessment (CHA) • 11 Ecosystem services (ESS) • 12 Noise and vibration • 13 Shadow flicker • 14 Landscape and visual • 15 Waste and materials • 16 Climate Resilience and Vulnerability Assessment (CRVA)
Volume III Stakeholder engagement plan (SEP)		Guides stakeholder engagement (information disclosure and meaningful consultation) on the Project in line with national and international standards. Includes a grievance mechanism for stakeholders to use.
Volume IV – Framework environmental and social management plan (ESMMP)		Presents a construction and operation management and monitoring framework, to allow an effective approach by the Project Proponent/Contractors, for the implementation of the ESIA mitigation and enhancement measures.
Volume IV - Technical Appendices		Provides supplementary information such technical aspects, methodologies, field surveys, sources of data and information, list of associated reports or plans, among others.
Volume VI – Livelihood Restoration Plan (LRP)		Presents the full Livelihood Restoration Plan (LRP) undertaken for the Project

1.5 Project contact details

Table 1.3 presents the main contact details regarding the ESIA.

Table 1.3:ESIA contact details

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2 Project description

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2 Project description

2.1 Overview

Mott MacDonald Limited has been appointed by Alcazar Energy Partners II HoldCo Limited (Holding Company), referred as 'Alcazar Energy Partners' or 'AEP' to undertake an environmental and social impact assessment (ESIA) of the Stip Wind Farm in North Macedonia (the Project).

The Project is being developed by four Special Purpose Vehicles (SPV) incorporated in North Macedonia, fully owned by AEP and established for the purpose of developing, constructing and operating the Project, from now referred to as 'Project Proponent'.

This chapter presents the overall Project description, its components, location, an overview of the Project settings, surroundings and proposed activities that are to take place during the construction, operation and decommissioning. Further Project details (such as specific components, features, materials, socioeconomics, ecological, noise, construction methods, among others) are described in detail in each individual chapter of this ESIA as required and needed to the discipline and to the specific assessment of impacts. This ESIA has the level of Project detail required to undertake the impact assessment, however, is important to note that construction timelines, activities and techniques may vary once contractors are appointed and detailed construction method statements are developed.

2.1.1 Project categorisation

As part of their environmental and social due diligence processes, in line with IFC and EBRD policy requirements, the Lenders have categorised the Project as Category A. According to the Equator Principles 4 (July 2020), Category A projects are those "with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented".

2.2 Environmental consent

The Project was originally developed in 2009 when an environmental impact assessment (EIA) aligned to national requirements was undertaken and granted an environmental consent (EC, i.e.: a decision granting consent to the EIA.). Since 2009 the EC has been kept updated and is currently valid until 05 February 2028.

A Request for Opinion was submitted to the Ministry of Environment & Spatial Planning in 2024 noting the changes in Project design and technology. Based on the Opinion received, an Environmental Protection Elaborate was developed and submitted to the Ministry of Environment & Spatial Planning in November 2024 and approved in December 2024.

The overhead transmission line and the substation are being permitted under separate processes. A Letter of Intent was submitted to the Ministry of Environment & Spatial Planning in June 2025. An Opinion by Ministry was received in August 2025 requiring the development and submission of an Environmental Protection Elaborate. The Environmental Protection Elaborate was submitted to the Ministry in November 2025 and approved in January 2026. The international ESIA (this report) for the purposes of achieving international finance for the Project is being progressed as of January 2026.

2.3 Project description

The Project is located in a rural area, approximately 75km south-east from the capital city of Skopje near the city of Stip in North Macedonia predominantly within the municipalities of Stip and Radovic and to a minor extent in Karbinci Municipality.

The municipality of Stip is situated in the central eastern part of North Macedonia, comprising 556km², approximately 3.1% of the national territory. Stip Municipality lies in the middle of a watershed area of the Bregalnica River. The Project location is mainly hilly with elevation ranging between 500m and 900m above sea level. The wind farm borders the mountain Plackovica to the east, the valley of the Kriva Lakavica River to the west and the Derven Gorge to the south. On the northern side, the wind farm is open towards Ovce Pole and along the length of the Bregalnica River towards the valley of the Vardar River.

The Project consists of the development, construction, and operation of a wind farm comprising up to 54 wind turbine generators (WTGs), each of approximately 6-8MW nominal power, with a total installed capacity of up to 396MW. The expected annual production of electricity is over 1,340GWh.

The Project area is approximately 335ha (418.7ha including the WTG swept area of blades[1]) including a 35/400kV substation that will be built as part of the Project. The WTGs will be connected to the substation via approximately 80km of 35kV buried cables that will run along the internal roads and will be laid in trenches and covered with excavated subsoil and topsoil.

The Project substation will connect to an existing 400kV transmission line, through an approximately 7km long 400kV overhead line (OHL) that will be built as part of the Project.

As part of the Project, approximately 68km of internal roads will be constructed or reconditioned. Very limited new roads will need to be built, and these will mainly comprise short lengths of secondary roads from the existing roads to the actual WTG location/platforms.

In summary, the main Project components are:

- Up to 54 WTGs of up to 6-8MW power for a total of up to 396MW output
- A 35/400 kV substation
- Approximately 80km of 35kV buried cables connecting the WTGs to the substation
- Approximately 7km long 400kV OHL
- Approximately 68km of internal roads

It is envisaged that the main WTG components will be transported to site from the port of Thessaloniki, in Greece, approximately 180km south of the Project site.

The Project will be developed in three phases:

- Stip 1 – STP WIND WF comprised of WTGs 1–21, OHL, substation, and the internal roads and buried cables that will connect the Stip 1 WTGs
- Stip 2 – KARB WIND WF comprised of WTGs 22–38 and the internal roads and buried cables that will connect the Stip 2 WTGs
- Stip 3 – RADO WIND WF comprised of WTG 39–54 and the internal roads and buried cables that will connect the Stip 3 WTGs

[1] The total area covered by the rotating blades of all wind turbines, calculated as the sum of the circular areas described by each turbine's blades. This area is not physically occupied by infrastructure but is informed for transparency.

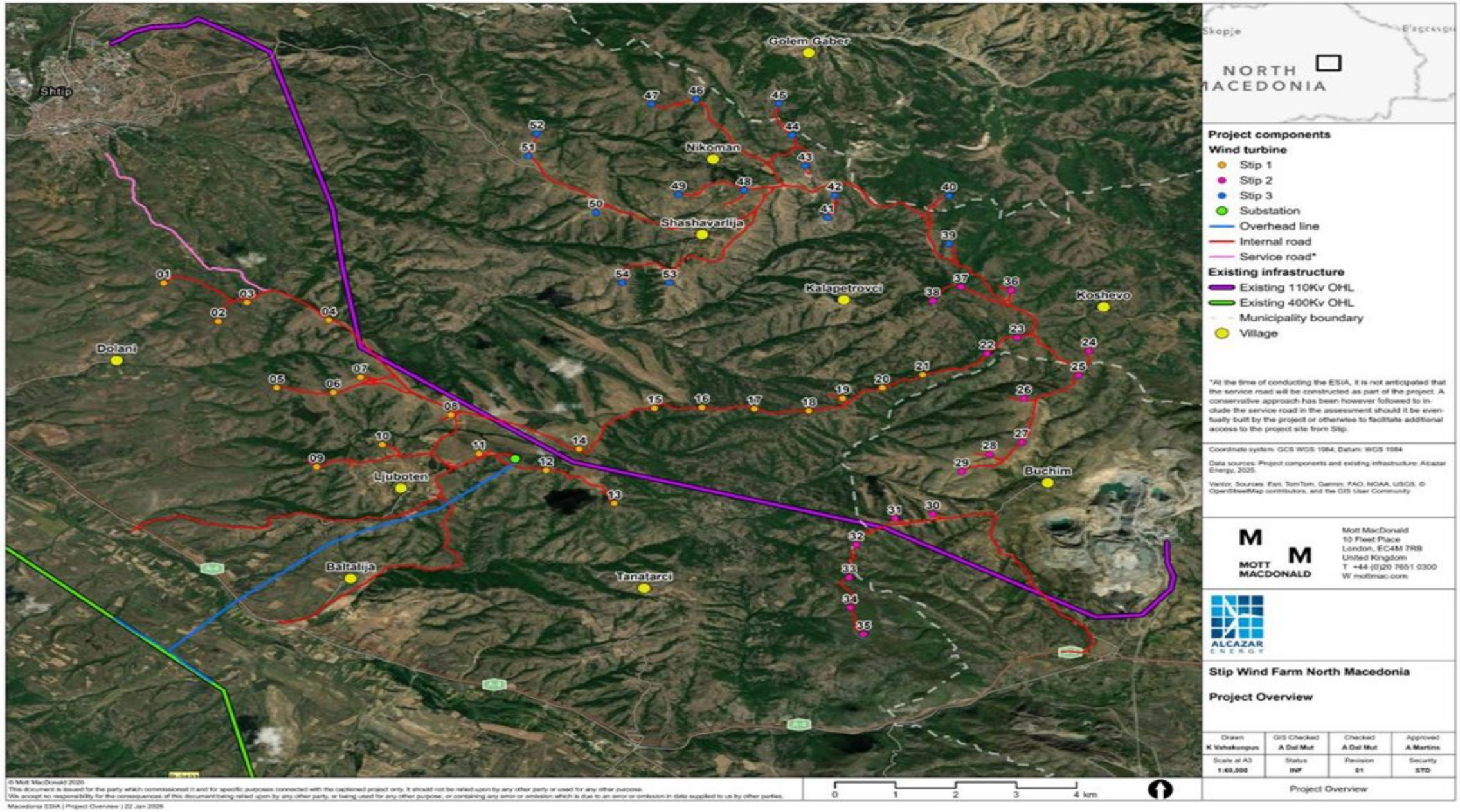
Construction of Stip 1 is expected to commence in Q2/2026 and last for approximately 24 months, with operations anticipated to begin in Q2/2028. Peak construction activity for Stip 1 is Projected between months seven and 15, although another peak period is expected later in the overall schedule. The construction of Stip 2 and Stip 3 is expected to follow, partly in parallel and partly afterwards, overlapping with Stip 1 at some point during the construction period. At this stage, Stip 1, Stip 2 and Stip 3 are expected to be operational by 2029. The Project is expected to remain operational for 25 to 30 years.

It is important to note that although the Project will be developed in three phases, this ESIA has been undertaken taking into consideration all three phases, therefore as one single Project, as per the definition given above. This allows for a more conservative approach when assessing impacts associated with full build-out (i.e. all 54 WTGs and facilities). In Chapter 8 (Biodiversity), to support a localised understanding of biodiversity-related risks and the critical habitat assessment (given the wide spatial distribution of WTGs and the locations of critical habitats) Stip 1- specific impacts are presented in detail.

Figure 2.1 below (also included in appendix A for a larger view) presents the layout of the main Project components. The WTGs are identified by their numbers. Internal roads, service roads[2], the Project OHL, the existing OHLs, and the substation location (between WTG 11 and 14) as well as the most populated towns and villages around the Project are depicted in the figure.

[2] At the time of conducting the ESIA, it is not anticipated that the service road will be constructed as part of the project. A conservative approach has been however followed to include the service road in the assessment should it be eventually built by the project or otherwise to facilitate additional access to the project site from Stip.

Figure 2.1: Project indicative layout



Source: Prepared by Mott MacDonald based on information provided by the Project proponent

There is an existing 110 kV OHL that connects the Buchim mine with the town of Stip that crosses the Project area, however this line does not affect nor is affected by the Project. The Buchim mine is an open pit mine with activities significantly reduced for decades however its facilities continues to process ore, extracted from materials extracted from the valley systems located west to the Project and transported to site by a covered conveyor system.

An EIA Notification letter was submitted in May 2025 to the public authorities from a private developer for the intention of developing a wind farm (near the village of Dolani – reflected in the map above), however due to its early stages of development and lack of any other public information (i.e. spatial planning approval, environmental permit or EIA, government authorisation, , etc), this potential development is no further considered in this ESIA.

2.3.1 Main Project features

2.3.1.1 Wind turbine generators

The planned WTGs to be installed for the Project are up to 6-8MW with approximately 120m hub height. The main components of the Project's WTG are:

- Blades: three blades made from high-strength composite materials like fiberglass or carbon fibre.
- Nacelle: houses the gearbox, generator, and control systems and other mechanical components necessary to convert mechanical energy into electrical energy.
- Gearbox/Direct Drive System: designed to step up the rotational speed of the turbine's rotor.
- Generator: converts mechanical energy from the WTG rotor into electricity.
- Yaw and Pitch Mechanisms: optimises alignment with the wind direction and adjust blade angle for maximum efficiency.
- Tower: is approximately 120m tall steel tower, providing a high elevation for better wind capture.

Figure 2.2 shows an example of a WTG.

Figure 2.2: Example of a WTG

Source: Project Proponent

The first stage of the WTG installation is the foundation excavations after which an anchor cage is placed in the foundations and concrete is poured covering it in its entirety (Figure 2.3). It is estimated that approximately 600m³ of concrete is required for each foundation, and this is challenging logistically, because the delivery of concrete needs to be coordinated carefully in order to ensure it's poured at the correct consistency and in a timely manner. At this stage the Project is not expected to have an onsite concrete batching plant, therefore all concrete will be outsourced and purchased from local concrete suppliers. A significant number of concrete trucks will be required for this purpose therefore; all roads need to be suitable to facilitate this process. The exact number of concrete trucks required during the construction phase is currently not known and will be estimated at a later stage.

Figure 2.4: Example of anchor caged and concrete pouring

Source: Mott MacDonald

Next to each WTGs a crane pad will need to be habilitated to accommodate cranes for the installation of the WTG and for maintenance during operation. The crane pads will be suitable to support loads required for the erection, assembly an operation and maintenance of the WTGs.

Each WTG will be equipped with a transformer that converts/steps up the output from the WTG to a higher voltage to meet a specific utility voltage distribution level that is appropriate for connection with the substation.

2.3.1.2 Substation, medium voltage (MV) collector system, control building and OHL

The 400kV substation that will be built for the Project will aggregate power from all the WTGs, regulate voltage, and provide protection systems. Figure 2.5 shows an example of a substation.

All the WTGs will be connected in circuits of three to four WTGs, and all the circuits of WTGs will be connected to the Project substation. The WTGs will be connected in 35kV, using MV cables buried in trenches running along the internal roads. There will be approximately 80 kilometres of cables across the site. Specialised machinery such as trenchers, will be used to dig the trenches in which the cables will be laid. It is preferrable to lay the cables next to the internal roads, as opposed to under the roads, for maintenance purposes.

Figure 2.5: Example of a substation

Source: Mott MacDonald

The Project will have a remote monitoring system to track key parameters such as wind speed, energy production, and system performance, with regular reports generated for maintenance and operational optimisation.

The approximately 7km long 400kV Project OHL will be constructed from the Project substation to the existing 400kV Stip-Negotino OHL, for the Project to connect to the national grid system. The right of way area will first be cleared and then the OHL tower foundations will be installed and finally cabled, connecting the towers from the Project substation to the existing 400kV Stip-Negotino OHL. Figure 2.6 shows an example of an OHL.

Figure 2.6: Example of an OHL

Source: Project Proponent

2.3.1.3 Access roads and internal roads

As part of the Project, the total internal road length is approximately 68km. Of this, around 50km (≈ 74%) will involve the upgrade or improvement of existing routes, while about 18km (≈ 26%) will comprise new roads in previously undisturbed areas. The new sections will predominantly consist of short lengths of secondary roads from the existing roads to the actual WTG location/platform. The roads will be wide enough to transport all the WTG parts, such as the blades which could be up to 90m long as well as the nacelles and power transformers for the substation. This will require removal and renewal of asphalt or gravel surfaces and road widening. Currently, it is anticipated that the internal roads will be approximately 5.5m in width with an additional 0.5m on each side to account for the slope footprint (i.e.: 6.5m in total). During construction, additional 1.75 m width, approximately, on each side will be required (i.e.: 10m in total).

The main access to the site will be from the south, using the A4 highway through local road R1204 and from there accessing to the site through the road to Ljuboten, but bypassing the village of Ljuboten in order not to affect it. An additional access road starting from the A4 highway is being considered for accessing WTG 30 to 35, close to Buchim village.

Once the roads are suitable, the WTG equipment can be transported to site, which will transported from the port of Thessaloniki in Greece by road. The WTG equipment will preferably enter the site through the access road at the south-west of the site, from the A4 national road, connecting R1204 local road and past the settlement of Ljuboten and on to the relevant locations. There is no plan to execute a new access from the north (coming from Stip), so all the equipment for the WTGs located in the north of the site will need to enter the site from the south and be transported through the site, past Ljuboten area, and on to the northern part of the site.

It is not expected that any large vehicles or trucks are required for the regular maintenance during the operations phase, however, in exceptional circumstances, such as major equipment failure (such as a gearbox failure, or in case of a blade replacement), then larger equipment (such as large cranes) may be required.

2.3.1.4 Operation and maintenance (O&M) control building and infrastructure

The main O&M offices will be located at the substation which will have all the normal office amenities and warehouses. The supervisory control and data acquisition (SCADA) system will be installed to monitor and control WTGs performance. This will allow real-time monitoring of power generation, operational status, and the detection of any faults or maintenance requirements. The O&M staff will operate from the control building at the substation, where the site offices will be located.

For the development phase of the Project, four meteorological masts (met masts) with an approximate height of 100m each have been installed across the Project area. These met masts will be decommissioned during the construction phase.

For the operation and maintenance phase, it is anticipated that one new permanent 120m met mast (corresponding to the WTG tower height) will be installed for each Project phase, taking into account potential requirements under the power purchase agreement (PPA). In addition, one or two temporary 120m met masts may be installed for each Project phase for the purposes of power performance testing. These temporary met masts would remain in place until testing is completed, which is expected to take approximately 12–24 months following the turbine supplier’s initial acceptance (handover).

2.3.1.5 Urban plan boundaries

In 2010, the Ministry of Transport and Communications approved the state urban plan for the Project, formally designating the Project area for construction and energy generation purposes. Based on recent technological improvements, which were incorporated into the Project design, a new urban plan was developed and approved in June 2025. As a result of this recently approved urban plan, the relevant land plots were reclassified from agricultural to construction use, providing the legal basis for the development of the wind farm and its main project features. This reclassification enabled the parcelisation of land and established the legal basis for subsequent land agreements, acquisition, and construction activities. The urban plan boundaries therefore underpin the Project components by ensuring that the necessary land use changes and permissions are in place for the Project's development. In December 2025, amendments and supplements to the Urban Plan were adopted to reflect Project developments and enable faster and more efficient implementation. The primary land use remains a wind park with its main features, while the changes include dividing the planning area into three units and expanding it to allow construction of a transmission line for grid connection.

2.3.1.6 Project land requirements

Table 2.1 below presents a summary of the expected land needs for the Project.

Table 2.1: Project land needs identified

Category	Project land needs[3]
Wind farm, substation and main roads	
Total number of land plots	1,068
Area of affected private plots (m²)	319,601 (11% of the total land area needed for the Project)
Area of affected public plots (m²)	2,717,752 (89% of the total land area needed for the Project)
Total area (m²)	3,037,353
OHL	
Total area impacted by permanent and easement land needs (m²)	221,380.42
Total number of land plots for permanent land needs	15
Total number of easements plots	149
Total number of public plots	95
Total number of private plots	69
Total permanent land needs area (m²)	2,933.75
Total easement area (m²)	218,446.67

Source: Project proponent (October 2025)

A detailed breakdown of the Project's land requirements by feature, highlighting the type of land agreement, the nature of land use restrictions, and whether the impact on land use is expected to be permanent or temporary refer to the associated Project Livelihood Restoration Plan (LRP).

[3] Subject to updates based on the ongoing parcelisation works.

2.3.1.7 Project activities

This section presents a general description of the main Project activities for pre-construction, site establishment, construction, operation and maintenance and decommissioning. As stated above the details of the site activities will be fully developed and known when the contractors are appointed.

General activities during site establishment and construction will include preparation of the area for construction and mobilization of equipment and the workforce. The preparations that are required on site for the workforce include, but are not limited to, site preparation, induction and training on E&S and occupational health and safety (OHS) aspects on a construction site, and awareness of emergency preparedness and response, among others.

Project activities during development and construction stages will generally include the following (non-exhaustive list):

- Development activities
  - Completion of all required studies for the Project development such as Technical feasibility studies (i.e., geotechnical, topographic, among others) and Project planning
  - Installation and maintenance of met masts
  - Obtaining required permits
  - Stakeholder engagement
  - Preparation of detailed design and layout requirements
  - Appointment of Balance of Plant (BOP) Contractor and Turbine Supplier (TS)
  - Securing all land requirements
- Construction activities
  - Mobilization of site team(s) and recruitment of workers
  - Establishment of temporary facilities such as site offices, workers' facilities, laydown areas among others.
  - Transportation of WTGs components to site from Thessaloniki port by road
  - WTG excavation and anchor cages preparation. Focused to relatively small individual footprints of the foundations to include excavations, land clearing, concrete works for anchor cages.
  - Erection of WTGs such as tower assembly, hub, rotor, and nacelle lift and rotor assembly through mobile cranes
  - Civil works required for the reconditioning of the required internal and access road network and civil works needed for new roads
  - Installation of SCADA and underground cables
  - Standard electrical tests for the electrical infrastructure as well as the WTG occurs at commissioning, as well as routine inspection of civil wors and engineering.
- Operations activities
  - Maintenance will also take place through a dedicated team. Preventive maintenance time for a modern wind turbine is approximately 40 hours per year. Non-routine or corrective maintenance may be of a similar order.
- Decommissioning activities
  - Dismantling of WTGs
  - Dismantling of met masts
  - Removal of all parts and equipment from the site
  - Dismantling and removal of underground cabling

- Demolition of buildings, foundations and platforms
- Restoring all affected surfaces
- Filling all holes and ducts
- Cleaning and levelling all Project sites.

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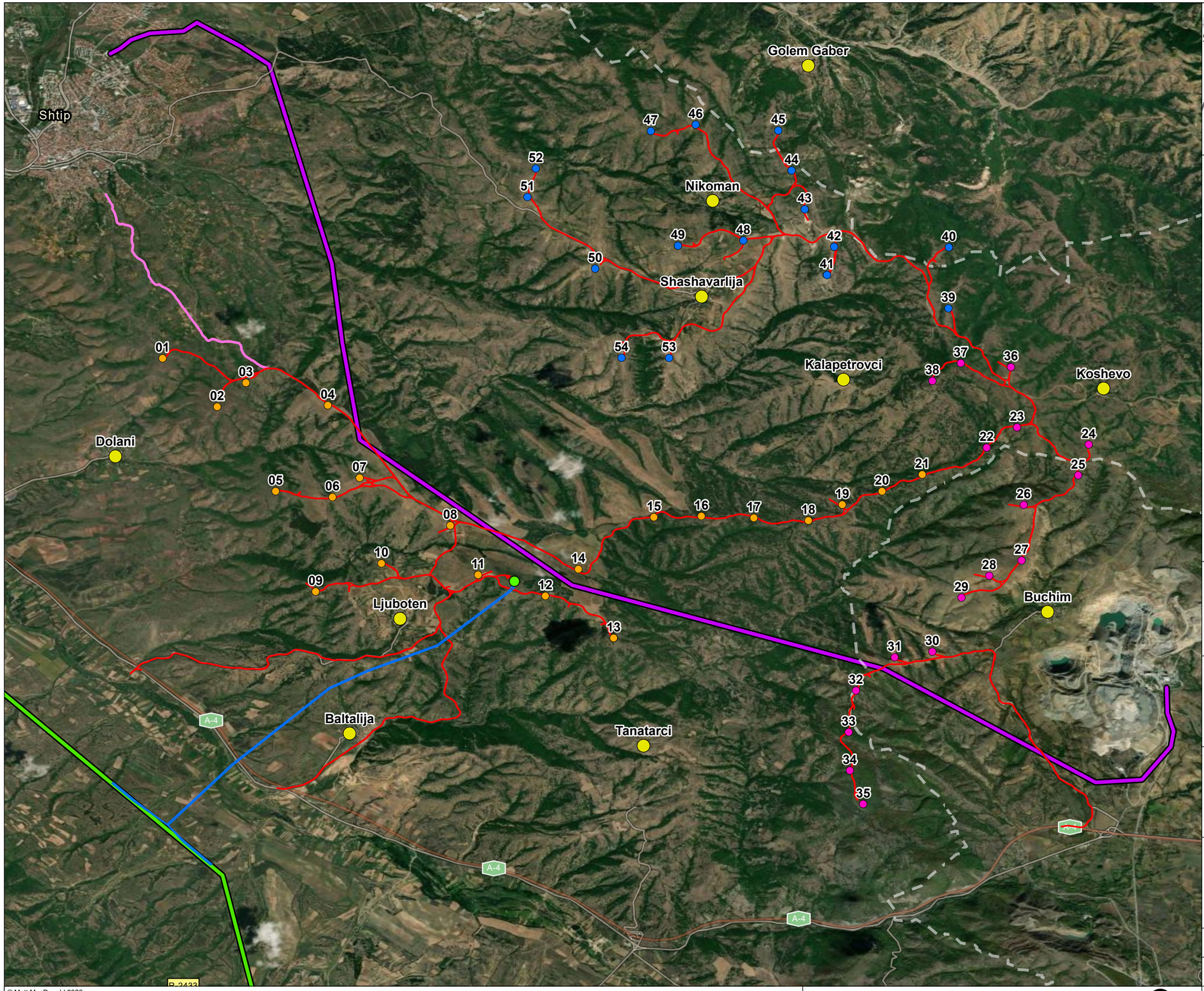
A. Project indicative layout



Project components

Wind turbine

- Stip 1
- Stip 2
- Stip 3
- Substation
- Overhead line
- Internal road
- Service road*

Existing infrastructure

- Existing 110Kv OHL
- Existing 400Kv OHL
- Municipality boundary
- Village

*At the time of conducting the ESIA, it is not anticipated that the service road will be constructed as part of the project. A conservative approach has been however followed to include the service road in the assessment should it be eventually built by the project or otherwise to facilitate additional access to the project site from Stip.

Coordinate system: GCS WGS 1984; Datum: WGS 1984

Data sources: Project components and existing infrastructure: Alcazar Energy, 2025.

Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

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ALCAZAR ENERGY

Stip Wind Farm North Macedonia

Project Overview

Drawn	GIS Checked	Checked	Approved
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Scale at A3	Status	Revision	Security
1:60,000	INF	01	STD

Project Overview

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3 Project need and analysis of alternatives

Issue and Revision Record

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A	28 January 2026	GB	ADM YC	AD	Draft
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3 Project need and analysis of alternatives

3.1 Overview

This chapter presents the Project need and analysis of alternatives. The assessment of alternative sites and technologies has taken into account various criteria including the Project requirements, geological features, existing infrastructure, land use planning, and the potential environmental and social impacts. The Project need has also been reviewed in the context of the North Macedonian energy transition objectives.

This chapter provides a summary of the design decisions made to date with reference to the above stated criteria.

3.2 Project need

Energy demand in North Macedonia is currently superior to the available installed generation capacity with a large portion of its energy needs being covered by imports from neighbouring countries. In addition, the carbon footprint from energy generation in the country is significant, due to the use of fossil fuels. According to the International Energy Agency[1] (IEA, 2023 data) North Macedonia has approximately 6,875MW of installed electricity generation capacity, with the majority of this energy coming from carbon-intensive sources (coal and coal products with 29.5%, oil and oil products with 43.9% and natural gas with 11.5%) with renewables and biofuels presenting the minority of its energy mix.

In recent times, North Macedonia has expanded rapidly its renewable energy sector, with approximately 1,663MW of renewable capacity installed by the end of 2024. This growth has been driven primarily by solar photovoltaics, in contrast, wind energy development remains limited. The country currently operates only three wind farms: Bogdanci (36.8 MW), Bogoslovec (36 MW), and the recently commissioned Dren Wind Farm (44 MW), bringing total installed wind capacity to approximately 117MW. This is modest compared to national renewable ambitions and highlights the need for significant expansion of wind generation.

To meet its 2030 National Energy and Climate Plan (NECP) targets, specifically a 42.5% renewable share in final energy consumption and 66% renewables in electricity generation, North Macedonia must substantially scale up wind capacity, which is expected to account for 12% of the future installed generation mix. Large-scale projects are therefore critical. The Project will alone almost fivefold the country's existing wind capacity. Such developments will also help reduce the country's reliance on electricity imports, which currently supply about 30% of national demand.

Within this context, the proposed Project represents a strategically important contribution to national renewable-energy goals, offering significant benefits in strengthening energy security, displacing fossil-fuel use, and supporting North Macedonia's transition toward a low-carbon electricity system.

The total final consumption (TFC) is the energy consumed by end users such as individuals and businesses to heat and cool buildings, to run lights, devices, and appliances, and to power vehicles, machines and factories. In North Macedonia, transport accounts for 44% of total

[1] North Macedonia Country Profile, available online at www.iea.org/countries/north-macedonia/electricity. Site accessed on 14 January 2026.

energy consumption, residential for 26%, industry 18%, while commercial and public services for 8.8% and the rest in agricultural and forestry.

The Stip wind farm Project is framed in the context of the National Energy and Climate Plan [2] (NECP) and the Powering Past Coal Alliance[3] (or PPCA). The PPCA is a coalition of national and subnational governments, businesses and organisations working to advance the transition from unabated coal power generation to clean energy. North Macedonia joined this alliance in 2021, with an aim to phase-out coal by 2027. Macedonian energy production is mainly based on only three energy resources, namely lignite (coal), biomass and hydroelectricity. The NECP acknowledges a risk of depletion of coal, posing security risks, lowering the diversification of the energy sources, and increasing the dependence on energy imports with no clear solution as to how these imports may be covered. NECP modelling indicates that by 2030, the installed capacity mix must shift to approximately 85% of renewables in total installed electricity capacity which will stem from hydropower plants (54%), solar PV plants (33%), windfarms (12%), and biogas and biomass power plants (1%). Harnessing this renewable resource is also in line with Millennium Development Goal number 7 of ensuring environmental sustainability while providing cheaper, cleaner energy.

Based on the above, from a national perspective, the Project will form an integral part to help North Macedonia achieve its 2030 goals by providing a total installed capacity of up to 396MW. Considering an average electricity consumption per household of 9,038 kWh/year, the estimated Project energy production would be equivalent to the annual energy consumption of ca. 90,000 Macedonian households

3.3 Analysis of alternatives

An analysis of alternatives has been prepared taking into consideration information and Project considerations provided by the Project proponent. Options explored comprise:

1. A “no project” alternative
2. Technology alternatives
3. Site selection criteria
- Alternative overhead line (OHL) route & substation (SS), and access road options

3.4 A ‘no project’ alternative

The no project option assumes that the proposed Project would not be developed, and the existing baseline situation would remain unchanged. Under this scenario, the national energy system would continue to rely on the existing electricity generation mix which is described in section 3.2 above. Furthermore, North Macedonia would remain a net electricity importer, sourcing part of its demand from abroad, underscoring the vulnerability of the current energy supply.

By not implementing the Project, North Macedonia would lose a significant opportunity to expand its renewable energy portfolio, particularly in wind, which currently represents a very small share of installed capacity (approximately 117 MW across three operational wind farms nationwide). This situation stands in contrast to the country’s 2030 National Energy and Climate Plan (NECP), which outlines ambitious targets requiring substantial increases in renewable

[2] National Energy and Climate Plan of the Republic of North Macedonia, Ministry of Economy, Republic of North Macedonia, 2020.

[3] Information website, Powering Past Coal Alliance, available online at poweringpastcoal.org. Accessed on 13 January 2026.

energy generation. In this context, the implementation of the project will fulfil more than 50% of the NECP modelling goals from wind farms, achieving 6.78 % out of the 12% target.

Given the currently limited wind capacity, achieving these targets necessitates the development of new, large-scale wind projects. The absence of the proposed Project would therefore widen the gap between existing capacity and the levels required by 2030, placing additional pressure on other renewable sectors, particularly hydropower and solar, which already face constraints related to climate variability, land availability, and grid integration. It would also diminish the diversification benefits that wind energy provides, reducing the resilience of the national energy mix.

Moreover, failure to develop the Project would undermine national efforts to reduce dependence on coal, which North Macedonia has committed to phase out by 2027 under international climate commitments. Without additional renewable capacity, especially from wind, the country may have to rely more heavily on electricity imports or extend the operation of fossil-fuel plants, both of which would delay progress toward decarbonisation and increase exposure to external market volatility.

In summary, the no project alternative would negatively affect North Macedonia's ability to meet its 2030 renewable energy targets, deepen dependence on fossil fuels and electricity imports, and slow the ongoing energy transition. The Project therefore represents a strategically important contribution to the country's renewable energy trajectory and its broader climate and energy security objectives.

3.5 Technology alternatives

This section provides a brief overview of alternative technology options that have been considered in the context of the objectives of the Project. It is noted that the North Macedonia NECP aims to promote and develop a diversified mix of national energy sources, including wind and solar energy.

Table 3.1: Comparison of alternative technologies

Technology	Advantages	Disadvantages
Geothermal power	• Typically, only a small area of land is needed for a large power output • Renewable technology • Continuous (baseload) power • High-capacity factors • Although North Macedonia has good geothermal potential, it currently has no power generated with this technology	• Challenge to mobilise private investment due to high upfront risk • High exploration and drilling mobilisation costs • Ecological and water impacts dependent upon project site selection
Thermal (gas, oil)	• Well-established technology • Continuous (baseload) power • High-capacity factors • Can create flexible plant able to respond rapidly to changes in demand-suitable for peaking power generation	• Fuel use has high GHG emissions and associated environmental impacts (for example air quality impacts) • Does not align with North Macedonia's energy policy goals • Does not reduce carbon emissions • Reliance on fossil fuels • Currently the majority of North Macedonia energy generation relies on coal/oil burning, and this should be reduced as per the NEPC. • Risk of exhausting lignite reserves in North Macedonia is considered a risk which would exacerbate reliance on foreign resources

Technology	Advantages	Disadvantages
Solar photovoltaic	• Typically, low maintenance • Renewable technology, with no CO_2 emissions from general operations • Can contribute to North Macedonia target for renewable energy generation • As per the North Macedonia Renewable Energy Siting cartography, several locations across the country are rich in solar resources and these resources will need to be harnessed • Small-scale solar already installed in several places in North Macedonia	• Relative inefficiency / square meter meaning a large amount of land is often needed • Power production is intermittent unless storage is included • Low-capacity factors
Hydropower	• In North Macedonia, hydro power generates approximately 23% of its energy. There are plans to build at least four major hydro power plants (the Vardar valley power plant; the Chebren pumped storage; the Vardar – Kozjak plant and the Veles and Gradec plant) as well as several other smaller hydro projects	• Depending on the facility design, can have significant negative impact on communities up and downstream • Can have significant impacts upon hydrological profile/ river ecology, ecosystems services and potential for physical and economic displacement
Waste to energy	• Non-recyclable materials that would go to landfill can be used to generate electricity	• Reliance on production of sufficient waste feedstock to supply a powerplant • GHG and air emissions from the process
Wind	• Renewable technology with CO_2 emissions only associated to its lifecycle assessment of equipment manufacture: no CO_2 emissions from general operations • Can contribute to North Macedonia renewable target and energy mix by almost five times the country's current wind installed capacity	• Typically needs large areas of land and open spaces for large power output • Terrain can constrain locations (transportation of parts and blades) • Turbines sometimes considered as visibly detrimental to surrounding landscapes • Environmental impacts in relation to birds and bats, some noise issues dependent upon project siting

Source: Mott MacDonald

Based on the above, wind technology is preferred over other energy generation technologies as it effectively meets the additional electricity needs while minimising environmental and social impacts. Wind energy is a proven and tested technology that produces clean energy compared to fossil fuel-based or thermal alternatives (gas). The Project will make productive use of wind energy, a renewable natural resource available at site, with a relatively small physical footprint that promotes continued current land uses. In comparison with other renewable alternatives, such as large-scale solar or hydropower of similar installed capacity (396MW), wind farms avoids extensive land take and potential permanent alteration of hydrological regimes.

3.6 Site selection criteria

As stated in Chapter 2 Project Description, the original Project was initially conceptually designed in 2009 when an environmental impact assessment (EIA) was undertaken and subsequently granted an environmental permit (EP). From its inception, the Project (despite significant changes to the wind turbine generators (WTGs) number and technology, total power output and micro siting) had undergone a thorough and iterative selection of potential locations across North Macedonia.

Several potential locations in the eastern part of the country were considered and investigated as alternatives and their adequacy assessed in terms of their meteorological conditions, wind

resource availability, avoidance of environmental and social impacts, access roads and connection to energy distribution networks among others. After careful consideration of all the parameters above, the current Project site had been deemed the most appropriate with the lesser environmental and social impacts and was selected based on the following criteria:

- Presence of a consistent and high wind resource, supported by energy yield assessments.
- Availability of a large, mostly uninhabited area suitable for wind farm development with very low population density, being able to maintain all required safety and setback distances from sensitive receptors (nearest sensitive receptor to a WTG is approximately 500m).
- Proximity to a high-voltage transmission line, enabling reliable interconnection and evacuation of power generated.
- Absence of constraints such as existing infrastructure, aviation restrictions, telecommunications signals or governmental land concessions.
- The Project prioritised areas where majority of the land was government-owned, with limited privately owned areas of low or no agricultural value (refer to the Livelihood Restoration Plan (LRP) which is part of this ESIA).
- Absence of protected areas, or nearby Key Biodiversity Areas, Zones of Ecological Attention, Natura 2000 sites including potential Natura 2000 site (approximately 10km from the site).
- Avoidance of forested areas or other environmentally or culturally sensitive sites as well as areas with protected visual and landscape designations.
- Good regional road network and connectivity as well as suitable connections with international ports for the transportation of larger equipment, such as the WTGs from the port of Thessaloniki, connected though the main route (A4) and located approximately 200km south of the Project site.
- Good quality of internal road network to minimise the construction of new internal roads and access roads, therefore minimising the impacts to land take, biodiversity and community impacts among others, and minimising the reengineering and reconditioning of existing internal roads network.

3.6.1 Design and layout alternatives

Following the acquisition of development rights in early 2024 and building on the original layout approved by the Ministry under the state urban plan, the Project undertook several design iterations. These were driven by alternative WTG models and capacity options, feedback from stakeholders and public authorities, constraints and planning processes. The overall objective was to reduce impacts on local communities, land use, and natural assets, while optimizing energy production. These included adjustments to the location of the wind turbines generators (WTGs), access roads and transmission line configuration. The initial configuration in 2009 consisted of 66 WTGs of 3MW each for a total of 198MW. The WTGs were to be connected via underground cables to two substations and connection to the grid via two OHL's. As the old layout was not adequate for the larger WTG rotors, the Project Proponent considered and evaluated several layout iterations before confirming the current Project layout and siting as the most appropriate.

The current Project design and final WTG micro siting, took into consideration opinions and requirements from public authorities, among others:

- Civil Aviation Agency with WTG lighting requirements and colour/marking.
- Public Roads Authority: opinion and requirements for the OHL connecting the substation to the existing line and its crossing over the A4 motorway.

- Environmental Authority and Water Consent Decision: indicating that although there are no permanent water bodies within the Project area, there may be seasonal watercourses during rainy seasons required to be left unobstructed.

In 2024, the Project went through its most significant changes. Several layout updates were developed following supplier/turbine model reviews and capacity optimisation and further refined based on land requirements and planning/yield considerations. Of significance four main changes occurred in 2024 as follows:

- April 2024 - first layout considering new WTG supplier
- April 2024 - updated based on land discussions, requirements (refer to LRP)
- May 2024 - updated to avoid potential impacts to a local private agricultural business
- June 2024 - updated based on yield and urban planning

Also of significance is the change from two substations to one as mentioned above. All the design changes and micro siting have been undertaken to:

- Respect buffer safety distances to seasonally used structures within the wind farm footprint
- Minimise noise and shadow flicker impacts
- Maintain appropriate safety buffer zones from nearby villages
- Consider information provided by affected and interested parties during ESIA and LRP consultations regarding the location of the WTGs
- Optimize energy production

Access roads were designed to follow all existing cadastral and municipal routes wherever feasible. Where new road sections were required to reach WTGs locations, their alignment has been optimised to minimise disruption, land take and livelihood impacts. The design and routing of the underground cables have been prioritised to follow internal Project and existing roads to minimise impacts.

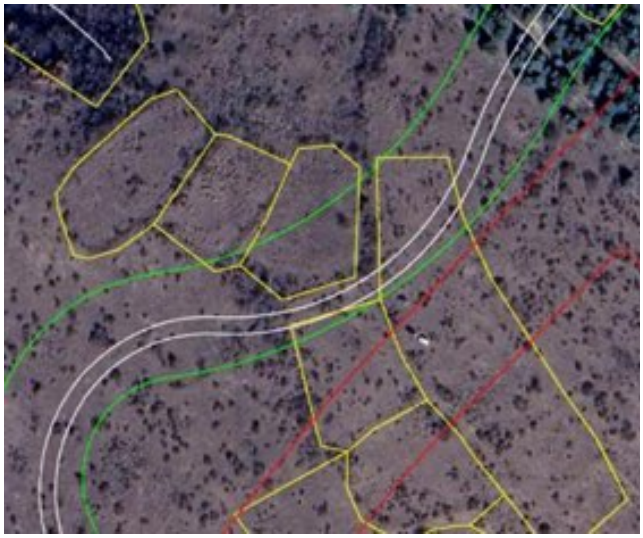
Specific design adjustments[4] have been undertaken in order to avoid social receptors such as privately owned lands, existing infrastructures, and placement of WTGs in proximity to populated areas. The Project considered a range of alternatives throughout the planning and design phases to minimise resettlement and other environmental and social impacts. These include both strategic site selection criteria and detailed engineering design modifications.

The figures below present a non-exhaustive sample of design changes[5] aimed at minimising resettlement and environmental impacts. The original design is shown in red, and the revised design in green. Figure 3.1 illustrates the revised road alignment, which reduced the number of affected private plots. While the road still crosses one private plot in this area, an impact that could not be avoided, it no longer affects any existing structures. Figure 3.2 shows the adjusted road design, which avoids an existing PV plant. Furthermore, WTG 7 has been relocated further north, and its hardstand rotated to minimise the impact on the privately owned square plot. The design changes presented here do not constitute an exhaustive list, they are a selection of examples illustrating the types of changes implemented to minimise resettlement, environmental impacts, and economic displacement.

[4] Specific examples included in the “Avoidance & Minimising land impacts.docx”, dated 25 September 2025

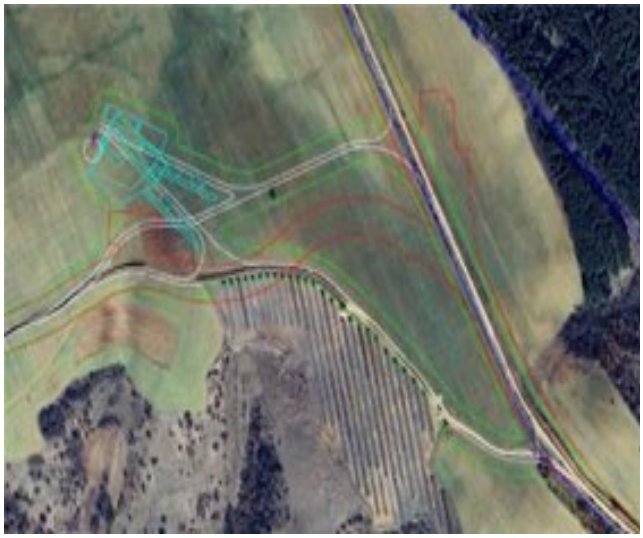
[5] Source: Project proponent. ‘Avoidance & Minimising land impacts.docx’. Dated 25 September 2025.

Figure 3.1: Road rerouted to limit private plot impact.



Source: Project Proponent

Figure 3.2: Design avoids PV plant; WTG-7 moved north



Source: Project Proponent

WTGs 28 and 29 were moved further from the settlements, thereby reducing potential environmental and social impacts (Figure 3.3). The laydown area previously overlapping with trees was eliminated to avoid environmental damage (Figure 3.4).

Figure 3.3: WTGs relocated to reduce proximity to town

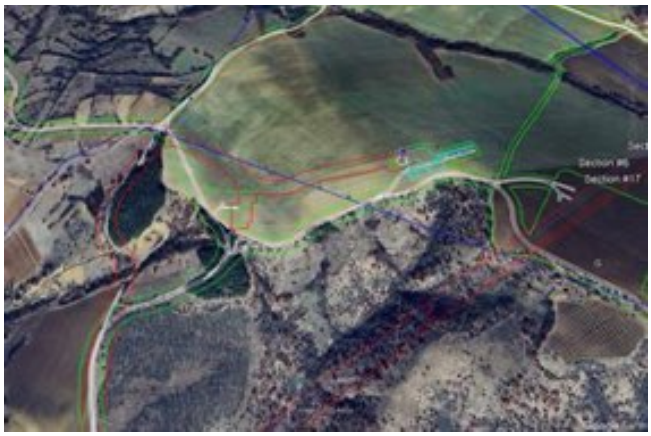
Source: Project Proponent

Figure 3.4: Laydown area removed to avoid tree impact

Source: Project Proponent

The alignment across the Bistren agricultural land was shifted toward the plot's edge to reduce impacts on cultivated areas while maintaining project objectives (**Error! Reference source not found.**).

Figure 3.5: Alignment shifted to plot edge



Source: Project proponent

Further details are included in Chapter 7 (Socio-Economic which includes cultural heritage and transportation) of this ESIA and the associated LRP.

3.6.2 Environmental considerations

One of the objectives of the NECP is to identify areas across the country with optimal conditions for the development of wind farms and solar plants. This objective has been achieved, and a dedicated cartography is now available, highlighting locations that maximises solar and wind energy production while avoiding key environmental sensitivities (i.e., important terrestrial features and avifauna). This is presented in the North Macedonia Renewable Energy Sitting cartography[6].

It should be noted that the Project is located in an area that maximises wind resource potential while remaining outside all designated Important Bird Areas, Natura 2000 areas (including potential Nature 2000 areas) and Important Plant Areas. The nearest Key Biodiversity Area, Ovche Pole, is located 8.5km from the Project site). The nearest sensitive ecological receptor to the Project's southern boundary is the northern portion of Lake Mantovo and the Lakavica River, which together form a Key Biodiversity Area and Important Bird and Biodiversity Area. There is, however, no ecological connectivity between the Project footprint and these designated areas. Additional information is presented in the biodiversity sections of this ESIA. This site is considered a Key Biodiversity Area and Important Bird and Biodiversity Area for two qualifying species – the Least Concern European roller (*Coracias garrulus*), formerly considered Near Threatened, and the Least Concern masked shrike (*Lanius nubicus*).

In addition, micro-siting of turbines and infrastructure has been considered to prevent loss of habitats listed on Annex I of the European Council Directive Council Directive 92/43/EEC[7]. Further details can be found in Chapter 8 (Biodiversity – terrestrial and avifauna), 10 (Critical Habitat Assessment) and 11 (Ecosystem Services) of this ESIA.

[6] North Macedonia Renewable Energy siting. Cartography available online at : https://tnc.maps.arcgis.com/apps/instant/media/index.html?appid=42942e8407c246cabcb43a0259ac54fb. Accessed on 14 January 2025.

[7] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora habitats . Available online at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A01992L0043-20130701. Accessed on 14 January 2025.

3.7 Conclusions

The Project offers a solution to minimising the dependence of North Macedonia on carbon-intensive sources such as coal and gas, minimising climate risks and potential future shortages as one of the main energy sources of the fossil fuels. A windfarm project is the most appropriate solution considering the location of the Project, and it is potentially compatible with other renewable energy facilities in the region (solar and hydro), and compatible with the NECP objectives. Multiple design alternatives were considered during the Project planning process, informed by technical feasibility as well as environmental and social considerations. Options were excluded where significant constraints were identified, including those related to biodiversity and livelihood restoration. The resulting preferred alternative, evaluated in this ESIA, incorporates design measures that substantially reduce potential impacts during both construction and operational phases.

4 Policy, legal and institutional framework

Issue and Revision Record

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A	21 January 2026	ADM	YC	AM	Draft
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4 Policy, legal and institutional framework

4.1 Overview

This chapter presents the relevant national and international requirements applicable to the ESIA and applicable local standards to livelihood restoration. These standards and guidelines provide international benchmarks for the identification and management of environmental and social risks and impacts. Often countries will incorporate the standards and guidelines into their own national policies or use international standards where they do not exist at the national level. Further details can be found in individual chapters.

Generally, where national standards are not as stringent as international requirements or vice versa, the Project will be required to defer to the most stringent requirement except in cases where national law or regulations have been explicitly identified as taking precedence for the Project.

4.2 National requirements

4.2.1 Overview of national environmental and social regulations and standards

Although the Project is in compliance with the national law and regulations, the main applicable national regulations and standards considered in this report are:

- Law on the Environment (Official Gazette of the Republic of North Macedonia No. 53/05, 81/05, 79/06, 101/06, 109/06, 24/07, 159/08, 83/09, 161/09, 01/10, 48/10, 124/10, 51/11, 123/12, 93/13, 187/13, 42/14, 44/15, 129/15, 192/15, 39/16, 28/18, 65/18, and Official Gazette of the Republic of North Macedonia No. 99/18, 176/21, 216/21, 89/22, 99/22, 171/22, 03/25, 124/25 and 191/25) and associated by-laws.
- Law on the Ambiental Air Quality (Official Gazette of the Republic of North Macedonia No. 67/04, 92/07, 35/10, 47/11, 59/11, 100/12,163/13, 10/15, 146/15 and Official Gazette of the Republic of North Macedonia No. 151/21 and 03/25) and associated by-laws.
- Law on Waters (Official Gazette of the Republic of North Macedonia No. 87/08, 6/09, 161/09, 83/10, 51/11, 44/12, 23/13, 163/13, 180/14, 146/15, 52/16 and Official Gazette of the Republic of North Macedonia No. 151/21, 99/22 and 03/25) and associated by-laws.
- Law on Waste Management (Official Gazette of the Republic of North Macedonia No. 216/21, 107/24 and 03/25) and associated by-laws.
- Law on Packaging and Packaging Waste Management (Official Gazette of the Republic of North Macedonia No. 215/21 and 03/25) and associated by-laws.
- Law on Management of Electrical and Electronic Equipment and Waste Electrical and Electronic Equipment (Official Gazette of the Republic of North Macedonia No. 176/21 and 73/24).
- Law on Batteries and Accumulators and Waste Batteries and Accumulators (Official Gazette of the Republic of North Macedonia No. 140/10, 47/11, 163/13 and 39/16) and associated by-laws.
- Law on Management of Additional Waste Streams (Official Gazette of the Republic of North Macedonia No. 216/21 and 195/22) and associated by-laws.
- Law on Extended Producer Responsibility for the Management of Specific Waste Streams (Official Gazette of the Republic of North Macedonia No. 215/21 and 73/24) and associated by-laws.
- Law on Noise Protection in the Environment (Official Gazette of the Republic of North Macedonia No. 79/07, 124/10, 47/11, 163/13, 146/15, and Official Gazette of the Republic of North Macedonia No. 151/21 and 03/25) and associated by-laws.
- Law on Nature Protection (Official Gazette of the Republic of North Macedonia No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 27/14, 41/14, 146/15, 39/16, 63/16 and Official Gazette of the Republic of North Macedonia No. 113/18, 151/21, 99/22 and 03/25).

- Law on Expropriation (Official Gazette of the Republic of North Macedonia No. 95/12, 131/12, 24/13, 27/14, 104/15, 192/15, 23/16, 178/16 and Official Gazette of the Republic of North Macedonia 122/21, 111/23, 208/24 and 258/25).
- Law on Labour (Official Gazette of the Republic of North Macedonia No.03/06, 44/06, 65/06, 16/07, 57/07, 77/07, 106/08, 161/08, 63/09, 114/09, 130/09, 149/09, 10/10, 50/10, 52/10, 58/10, 124/10, 132/10, 47/11, 11/12, 39/12, 13/13, 25/13, 170/13, 187/13, 106/14, 113/14, 20/15, 33/15, 72/15, 129/15, 27/16, 134/16, and Official Gazette of the Republic of North Macedonia No. 120/18, 110/19, 267/20, 151/21, 288/21, 111/23, 39/25, 74/25 and 124/25).
- Law on Safety and Health on Work (Official Gazette of the Republic of North Macedonia No.98/10, 93/11, 136/11, 60/12, 23/13, 25/13, 137/13, 164/13, 158/14, 15/15, 129/15, 192/15, 30/16 and Official Gazette of the Republic of North Macedonia No. 27/18, 231/18, 18/20 and 74/25).
- Law on Social Protection (Official Gazette of the Republic of North Macedonia No. 104/19, 146/19, 275/19, 302/20, 311/20, 163/21, 294/21, 99/22, 273/22, 236/22, 65/23 and 192/25).
- Law on Energy (Official Gazette of the Republic of North Macedonia No.101/25).
- Law on the Local Self-Government (Official Gazette of the Republic of North Macedonia No. 05/02 and Official Gazette of the Republic of North Macedonia No. 202/24).
- Law on Urban Planning (Official Gazette of the Republic of North Macedonia No.32/20, 111/23, 73/24, 171/24, 224/24, 40/25, 101/25, 101/25 and 127/25).
- Law on Construction (Official Gazette of the Republic of North Macedonia No.124/10, 18/11, 18/11, 36/11, 49/11, 54/11, 13/12, 144/12, 25/13, 79/13, 137/13, 163/13, 27/14, 28/14, 42/14, 115/14, 149/14, 187/14, 44/15, 129/15, 129/15, 217/15, 226/15, 30/16, 31/16, 39/16, 71/16, 103/16, 132/16 and Official Gazette of the Republic of North Macedonia No. 35/18, 64/18, 168/18, 244/19, 18/20, 279/20, 96/21, 227/22, 111/23, 115/23, 224/24, 224/24, 255/24, 03/25, 17/25, 87/25, 101/25, 250/25 and 269/25).
- Law on Protection of Cultural Heritage (Official Gazette of the Republic of North Macedonia No. 20/04, 71/04, 115/07, 18/11, 148/11, 23/13, 137/13, 164/13, 38/14, 44/14, 199/14, 18/15, 104/15, 154/15, 192/15 and 39/16; and Official Gazette of the Republic of North Macedonia No. 11/18, 20/19, 03/25 and 160/25).
- Law on Forests (Official Gazette of the Republic of North Macedonia No. 64/09, 24/11, 53/11, 25/13, 79/13, 147/13, 43/14, 160/14, 33/15, 44/15, 147/15, 7/16, 39/16, 147/17, and Official Gazette of the Republic of North Macedonia No. 274/22, 255/24 and 59/25).

The main regulations governing worker rights in the Republic of North Macedonia include the Law on Labour, Law on Public Enterprises and the Collective Bargaining Agreement and the Law on Administrative Servants. All labour laws are in line with ILO Conventions and the Constitution of Republic of North Macedonia (Official Gazette of the Republic of North Macedonia No. 52/91, 1/92, 31/98, 91/01, 84/03, 107/05, 03/09, 13/09, 49/11, 6/19 and 36/19).

4.2.2 Other conventions ratified by North Macedonia

- Nature Convention on Biological Diversity, Law on Ratification ("Official Gazette of the Republic of Macedonia" 54/97)
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity, Law on Ratification (Official Gazette of the Republic of Macedonia No. 40/2005)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn), Law on Ratification ("Official Gazette of the Republic of Macedonia" 38/99)
- Memorandum of Understanding for the Conservation and Management of the Central European Population of the Great Bustard (Otis tarda), The Republic of Macedonia has signed the Memorandum on 07.10.2000 in Amman, Jordan
- Convention on the Conservation of European Wild Fauna and Flora and their Natural Habitats (Bern), Ratification Act, ("Official Gazette of the Republic of Macedonia" 49/97)

- Convention on the Protection of the World Cultural and Natural Heritage, Official Gazette of the SFRY" 56/74). The Convention was ratified by an act of succession from the SFRY in 1977.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington), Ratification Act ("Official Gazette of the Republic of Macedonia" No. 82/99)
- Treaty on the Conservation of Bats in Europe (London, 1991), Ratification Act ("Official Gazette of the Republic of Macedonia" No. 38/99)
- Amendment to the Treaty on the Conservation of Bats in Europe, Ratification Act ("Official Gazette of the Republic of Macedonia" No. 13/2002)
- Convention on the Conservation of African-Eurasian Migratory Waterbirds (The Hague), Law on Ratification ("Official Gazette of the Republic of Macedonia" No. 32/99)

4.2.3 North Macedonian human rights laws

This sub-section outlines the key laws and provisions for protection of human rights in North Macedonia. When considered alongside the international treaties and conventions ratified by North Macedonia, the key rights which may be impacted by the Project (see section 7.4.6 – human rights scoping assessment) are enshrined in the North Macedonian legal framework and commitments.

The Constitution of North Macedonia establishes most of the fundamental legal principles and human rights protections in the country[1] which are outlined in Table 4.1. Additionally, as a member of the Council of Europe, North Macedonia is bound by the European Convention on Human Rights (ECHR). The ECHR is an international human rights treaty, that protects the rights of everyone within the 46 states that belong to the Council of Europe. The Convention for the Protection of Human Rights and Fundamental Freedoms (1950) offers many provisions that explain how fundamental human rights and freedoms are protected. Aligned with the UN conventions, it secures the human rights that are relevant to the Project[2].

Table 4.1: Relevant human rights included in North Macedonia's Constitution

Rights group	Rights
Civil and political rights	Right to life, liberty, and security Freedom of thought, conscience, and religion Freedom of expression and media Freedom of assembly and association Right to vote and participate in public affairs Protection from torture, inhuman or degrading treatment Right to a fair trial and legal protection Freedom of movement Right to privacy
Equality and non-discrimination	All citizens are equal before the law. Discrimination based on ethnicity, gender, religion, or political belief is prohibited. Special provisions protect the rights of ethnic communities, including language use and cultural expression.
Economic, social, and cultural	Right to work, fair wages, paid leave and social protection Right of workers to form unions Right to own property Right to education Right to health care Right to participate in cultural life Protection of cultural and historical heritage Rights of children

[1] North Macedonia (Republic of) 1991 (rev. 2011) Constitution - Constitute, accessed July 2025

[2] Home | European Union Agency for Fundamental Rights, accessed July 2025

Rights group	Rights
Minority and community rights	The Constitution recognises the multiethnic character of the state. Communities have rights to: ● Use their language and alphabet ● Establish educational and cultural institutions ● Be represented in public life and governance

Source: Constitution of North Macedonia

4.2.3.1 Labour rights protection

The Criminal Code provides the legal basis for prosecuting crimes related to forced labour and human trafficking. North Macedonia's Labour Law (2005, as amended[3]) regulates employment relationships and the rights and obligations of both employers and employees[4]. Key relevant provisions of the labour laws include:

- Children under the age of 15 may not be employed[5] (also listed in the Constitution)
- Limiting the hours or activities of construction workers in hot weather
- Right to bargain collectively
- The legal maximum duration of full-time work is 40 hours a week, over five days
- The legal maximum duration of overtime work is no more than eight hours per week up to a total of 190 hours annually[6]
- Should a worker complete 140 hours of overtime in a year, they are entitled to a bonus of one month's salary[7]
- The legal maximum of hours per day is 12 and per week is 55
- The minimum hours of daily rest are 12 per day and weekly rest is 24 hours per week
- The minimum duration of annual leave is 20 days
- Overtime rates are paid at 35% during the day or night 35%, work in three shifts 5% and work on Sunday 50% on top of the normal rate of pay
- Equal pay for equal work, regardless of gender
- Maternity leave, which can be shared between the mother and father, is provided for a duration of nine months.

The Law on Occupational Safety and Health regulates:

- The obligations of the employer and the rights and obligations of workers in the area of occupational safety and health
- Preventive measures against risks
- Information sharing, the consultations and the trainings of the workers and their representatives

[3] The Labour Law was adopted in 2005 and there have been amendments were adopted in 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2017, 2018, 2019, 2021, 2023 - North Macedonia Fact Sheet - Decent Work Balkans, access July 2025

[4] Helsinki Committee for Human Rights of the Republic of Macedonia, Overview of the Macedonian Labour Legislation, 2019, accessed July 2025

[5] The Labour Law states that children under 15 or those who have not completed compulsory education are prohibited from employment, except for legally permitted activities, which are limited to two hours daily and 12 hours weekly during school terms, and six hours daily and 30 hours weekly during school holidays.

[6] There is an exception to this for works that due to the specific process of work cannot be interrupted or for which there are no conditions and opportunities to organise shift work. In this case overtime in a period of three months cannot at average exceed more than eight hours per week.

[7] NORTH MACEDONIA 2023 HUMAN RIGHTS REPORT, accessed July 2025

The Law on Protection against Harassment at Work regulates the rights, obligations and responsibilities of employers and workers in relation to preventing psychological and sexual harassment in the workplace, measures and procedural protections, and support mechanisms for reporting and redress.

North Macedonia has ratified several key international treaties that reinforce its commitment to combating forced labour, modern slavery, and protecting human rights, including those listed in Table 4.4, ECHR and the UN Palermo Protocol (Trafficking in Persons). However, whilst the freedom to choose work is outlined in the Constitution, the prohibition of forced labour or slavery are not explicitly stated.

Other laws regulating employment and social protection which are of relevance to the Project include:

- Law on Employment and Insurance in Cases of Unemployment
- Law on Labour Inspection
- Law on Labour Relations
- Law on Employment of Disabled Persons
- Law on Peaceful Resolution of Labour Disputes
- Law on Salaries and the Law on Minimal Salary
- Law on Private Employment Agencies
- Law on Work Engagement of Persons

The minimum wage in North Macedonia is currently (as of July 2025) 22,567 Macedonian denars (€365 approximately) per month net. The living wage is significantly higher, at 52,235 MKD (€849) for 2021, however this figure is out of date due to rising inflation (more up to date information is not available at present – July 2025)[8].

The Law on Employment and Work of Foreigners outlines conditions and procedures for the employment of foreigners and some other provisions for the protection of migrant workers. However, whilst North Macedonia has been part of the 1949 ILO Migration for Employment Convention and the 1975 Migrant Workers Convention (both since 1991) the country has not ratified the 1990 UN International Convention on the Protection of the Rights of all Migrants Workers and Members of their Families.

4.2.3.2 Other human rights legal protections

The Law on Personal Data Protection (LDP) came into force in North Macedonia in February 2020. It mirrors many of the EU's General Data Protection Regulation principles, including: definitions of personal and sensitive data; obligations for data controllers and processors; requirements for consent, data security, and breach notification; rights of data subjects (e.g. access, correction, deletion).

The right to access effective remedies is covered by the ECHR and some aspects of the Constitution, such as rights to appeal, rights to judicial protection of rights and the right to compensation for unlawful actions by state authorities. Although the right to an adequate standard of living is not explicitly stated in the Constitution, it is implied through other rights, such as the rights to healthcare, to social security and social protection, and the right to education.

The right of citizens of North Macedonia to a healthy environment is enshrined in the Constitution and the Law on Environment (2005 with amendments). The law's stated objectives include preservation, protection, restoration and improvement of the quality of the environment; protection of human life and health; protection of biological diversity; rational and sustainable natural resource use; and forecast, monitoring, prevention, limitation and elimination of the negative environmental impacts[9].

[8] North Macedonia Fact Sheet - Decent Work Balkans, accessed July 2025

[9] Law on Environment. | UNEP Law and Environment Assistance Platform, accessed July 2025

North Macedonia's Law on Personal Data Protection (Official Gazette of the Republic of North Macedonia, no. 42/20 and 294/21, effective 24 February 2020) which is similar to the EU's General Data Protection regulation (GDPR). It covers an individual's right to access their data, rectify inaccuracies, erase data (right to be forgotten), restrict or object to processing and avoid automated decision making[10].

4.2.4 Relevant applicable standards for livelihood restoration

This section describes the reference framework against which the Livelihood Restoration Plan (LRP) has been developed and will be implemented. The LRP is primarily aimed at complying with the Republic of North Macedonia national legislation while also aligning with good international industry practice (GIIP) as typified by the International Finance Corporation's Performance Standard (IFC PS) 5, European Bank for Reconstruction and Development's Environmental and Social Requirement (EBRD ESR) 5, and European Investment Bank (EIB) Standard 6 for land acquisition and involuntary resettlement. These are described in the below sections.

4.2.5 Macedonian legal framework for land acquisition

Several key laws and regulatory instruments have been used to carry out land acquisition and valuation activities for the Project, as outlined in Table 4.2 below.

Table 4.2: Key laws and regulations governing land acquisition, valuation and expropriation in North Macedonia

Legal instruments	Key provisions
Constitution of the Republic of North Macedonia	The Constitution guarantees legal protection of ownership rights under Article 30, protection of land and natural resources by the State. No person may be deprived of their property, or of the rights deriving from it, except in cases concerning public interest determined by law. If property is expropriated or restricted, rightful compensation not lower than its market value is guaranteed[11]. The Constitution ensures equality in property rights regardless of gender.
Law on Expropriation[12] (Official Gazette of the Republic of North Macedonia No. 95/12, 131/12, 24/13, 27/14, 104/15, 192/15, 23/16 and 178/16 and Official Gazette of the Republic of North Macedonia No. 122/21, 111/23, 208/24, and 258/25).	This law allows for the expropriation of the ownership and the rights that derive from them on land, buildings and other facilities ('real property') for the purpose of constructing buildings and performing other works that are of public interest. The law is used for establishing public interest and determining fair compensation for the expropriated real properties. Construction of power plants for production of electricity is covered under the law in Article 2. The law determines procedures for full expropriation (permanent acquisition), establishing an easement (incomplete expropriation) and temporarily occupying (leasing) land/assets. Compensation for the acquired land and assets is to be provided in replacement property or in cash. As provided for in the Constitution, cash compensation must at least match the market value of the affected properties. An authorised property valuer or surveyor must determine the market value of the property in accordance with the Law on Appraisal. Where another asset is offered as in-kind compensation for the expropriated asset, it must be of similar value to the lost asset.

[10] Data Protection Guide North Macedonia, accessed August 2025

[11] Assembly of the Republic of North Macedonia (2019). The Constitution of the Republic of North Macedonia. Available at: https://vlada.mk/sites/default/files/dokumenti/zakoni/the_constitution_of_the_republic_of_north_macedonia_containing_the_valid_constitutional_provisions_in_force_as_amended_by_constitutional_amendments_i-xxxvi.pdf (Accessed September 23, 2025)

[12] Law on Expropriation (Official Gazette of Republic of Macedonia No. 95/12, 131/12, 24/13, 27/14, 104/15, 192/15, 23/16 and 178/16). Available at: https://a.fanj.nl/english/thewto_e/acc_e/mkd_e/WTACCMKD15_LEG_15.pdf (Accessed 23 September 2025)

Legal instruments	Key provisions
Law on Appraisal (Official Gazette of the Republic of North Macedonia No. 154/23, 158/11, 185/11, 51/12, 64/12, 188/14, 104/15, 153/15, 192/15, 30/16 and 86/25).	This law regulates the areas, conditions and methods for performing appraisals and the contents of the appraisal. It also governs issues relating to becoming a valuer, obtaining a license to value land and assets, and the operation of the Chamber of Valuers as well as other issues related to appraisal.
Methodology on the valuation of real estate (Official Gazette of the Republic of North Macedonia No. 54/12, 17/13, 21/13 and 142/14).	This methodology outlines the procedure of estimating the market value of agricultural land and assets as part of the expropriation procedure.
Law on Obligations (Official Gazette of Republic of Macedonia No. 18/01, 78/01, 04/02, 59/02, 05/03, 84/08, 81/09, 161/09, 23/13 and 123/13 and Official Gazette of the Republic of North Macedonia No. 215/21, 154/23, 220/23 and 209/24).	This law stipulates that compensation must be provided in cash to formal legal owners of land and assets (or those whose rights are recognisable under national laws) for damages or losses incurred as a result of investors/contractors (or others) accessing land or preventing access to land and/or assets.
Law on Property and Other Real Property Rights (Official Gazette of the Republic of North Macedonia No. 18/01, 31/08, 92/08, 139/09 and 35/10).	This law regulates the right of ownership and other real rights (the right of easement, the right to a real burden).
Law on Real Estate Cadastre (Official Gazette of the Republic of North Macedonia No. 55/13, 41/14, 101/14, 115/14, 116/15, 153/15, 192/15, 61/16, 172/16, 64/18 and Official Gazette of the Republic of North Macedonia No. 124/19 and 155/24).	The establishment and maintenance of real estate cadastre (registration of ownership and other real estate rights, real estate data etc) are governed by this law. It stipulates principles of cadastral classification of land and has provisions on management of geodetic works, real property surveys performed in service of the real estate cadastre, property valuation, supervision over geodetic works performed by authorised valuers/surveyors.
Rulebook of the Method of Cadastral Classification and Determination and Registration of the Change of Cadastral Culture and Land Class (Official Gazette of the Republic of North Macedonia No. 144/13, 95/15, 149/17 and 273/23).	Methods for cadastral classification of land are defined and provisions on change of a cadastral culture, as well as change of a land class (for agricultural land only) are stated.
Law on Agricultural Land (Official Gazette of the Republic of North Macedonia No." 135/07, 17/08, 18/11, 42/11, 148/11, 95/12, 79/13, 106/13, 164/13, 39/14, 130/14, 166/14, 72/15, 98/15, 154/15, 215/15, 7/16, 39/16 and Official Gazette of the Republic of North Macedonia No. 161/19, 178/21, 91/23, 218/24 and 235/24).	This law regulates the use, disposal, protection, and conversion of agricultural land (i.e. a change of the cadastral culture and land class).
Law on Land for Construction (Official Gazette of the Republic of North Macedonia No. 15/15, 98/15), 193/15, 226/15, 31/16, 142/16, 190/16 and Official Gazette of the Republic of North Macedonia No. 275/19, 101/21, 153/23, 61/24, 224/24, 233/24 and 87/25).	This law regulates the rights and obligations related to land designated for construction of various types of infrastructure development per the spatial/urban planning or infrastructure design documentation. The law outlines the meaning of this land category, conditions for its use, provisions on land management, and other matters.
Law on Social Welfare (Official Gazette of Republic of North Macedonia No. 104/19, 146/19; 275/19, 302/20, 311/20, 163/21, 294/21, 99/22, 236/22, 273/22, 65/23 and 192/25).	This law outlines social welfare payments and services to vulnerable residents in varying situations.
Law on Administrative Disputes (Official Gazette of the Republic of North Macedonia No. 96/19 and 220/24).	In order to ensure judicial protection of the rights and legal interests of natural and legal persons and to ensure legality, the Administrative Court in administrative disputes decides on the legality of the acts of the state administration bodies, the Government, other state bodies, municipalities, and the City of Skopje, organizations established by law and of legal and other persons in the exercise of public powers (holders of public powers) when deciding on the rights and obligations in individual administrative matters, as well as on acts adopted in misdemeanour proceedings.
The Law on Non-Contentious Procedure (Official Gazette of the Republic of North Macedonia No. 9/08 and Official Gazette of the Republic of North Macedonia No. 77/18).	This law establishes the rules of procedure according to which courts act and decide on personal, family, property and other legal situations and relationships determined by this or another law.

Legal instruments	Key provisions
The Law on General Administrative Procedure (Official Gazette of the Republic of North Macedonia No. 124/15 and 65/18).	This law regulates the procedure for exercising the protection of the rights and legal interests of natural persons, legal persons and other parties, as well as the protection of the public interest, which is obliged to be acted upon by ministries, state administration bodies, organisations established by law, other state bodies, legal and natural persons entrusted by law to exercise public powers, as well as the bodies of the municipality, the City of Skopje and the municipalities in the City of Skopje, when, in the exercise of their legal competences, they act, decide and undertake other administrative actions in administrative matters.

Source: North Macedonia Official Gazette 2025

4.3 International requirements

4.3.1 Applicable standards

- International Finance Corporation (IFC) Performance Standards (PS) on Environmental and Social Sustainability, 2012
  - IFC PS6 Guidance Notes (2019)
  - IFC Environmental, Health, and Safety (EHS) Guidelines, 2007
  - IFC EHS Guidelines for Wind Energy, 2015
  - IFC EHS Guidelines for Electric Power Transmission and Distribution, 2007
- European Bank for Reconstruction and Development (EBRD) Performance Requirements (PRs), 2019 – and the 2024 version as applicable to the Project.
- IFC, EBRD and CDC Note on Addressing Gender-Based Violence and Harassment: Emerging Good Practice for the Private Sector, 2020
- Equator Principles Guidance note on Implementation of Human Rights Assessments under the Equator Principles, 2020
- EBRD Resettlement Guidance and Good Practice, 2016
- IFC Good Practice Handbook on Land Acquisition and Involuntary Resettlement, 2023
- European Investment Bank (EIB) Environmental and Social Standards, 2022
- Applicable EU Directives on Environment and Climate Change for Candidate and Potential Candidate Countries
- The Asian infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF), 2021 (2021 ESF)
- The U.S. International Development Finance Corporation's (DFC) environmental and Social Policy and Procedures, 2024
- Equator Principles 4, 2020 (EP4)
- United Nations (UN) Universal Declaration of Human Rights (UDRH) and UN Guiding Principles on Business and Human Rights (UNGPs)
- Principles underpinning the Sustainable Development Goals (SDGs) and the Ten Principles to the United Nations Global Compact (UNGC)
- International Labour Organisation (ILO) instruments including Conventions and Recommendations, Codes of Practice and Guidelines, specifically but not limited to ILO Fundamental Conventions and ILO Declaration on Fundamental Rights and Principles at Work
- Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises
- The following Good international industry practice (GIIP):

- EU Commission notice "Guidance document on wind energy developments and EU nature legislation" (C (2020) 7730)
- IUCN Guideline "Mitigating biodiversity impacts associated with solar and wind energy", 2021.
- Article 6(3) and (4) of the Habitats Directive 92/43/EEC, and the related methodological guideline, if the Project potentially has an effect on Natura 2000 or Candidate Emerald Sites
- Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets (IFC, 2007)

4.3.2 IFC Performance Standards 2012

The IFC is a member of the World Bank Group and is recognised as an international leader in environmental and social sustainability policy. As a part of the 'positive development outcomes' outlined in the IFC's Policy on Social and Environmental Sustainability, the corporation applies a comprehensive set of social and environmental Performance Standards (PS) in its Project review process. The IFC PS are an international benchmark for identifying and managing environmental and social risk. The revised IFC Policy and PS on Social and Environmental Sustainability came into force in January 2012. There are eight IFC PS which are outlined in Table 4.3.

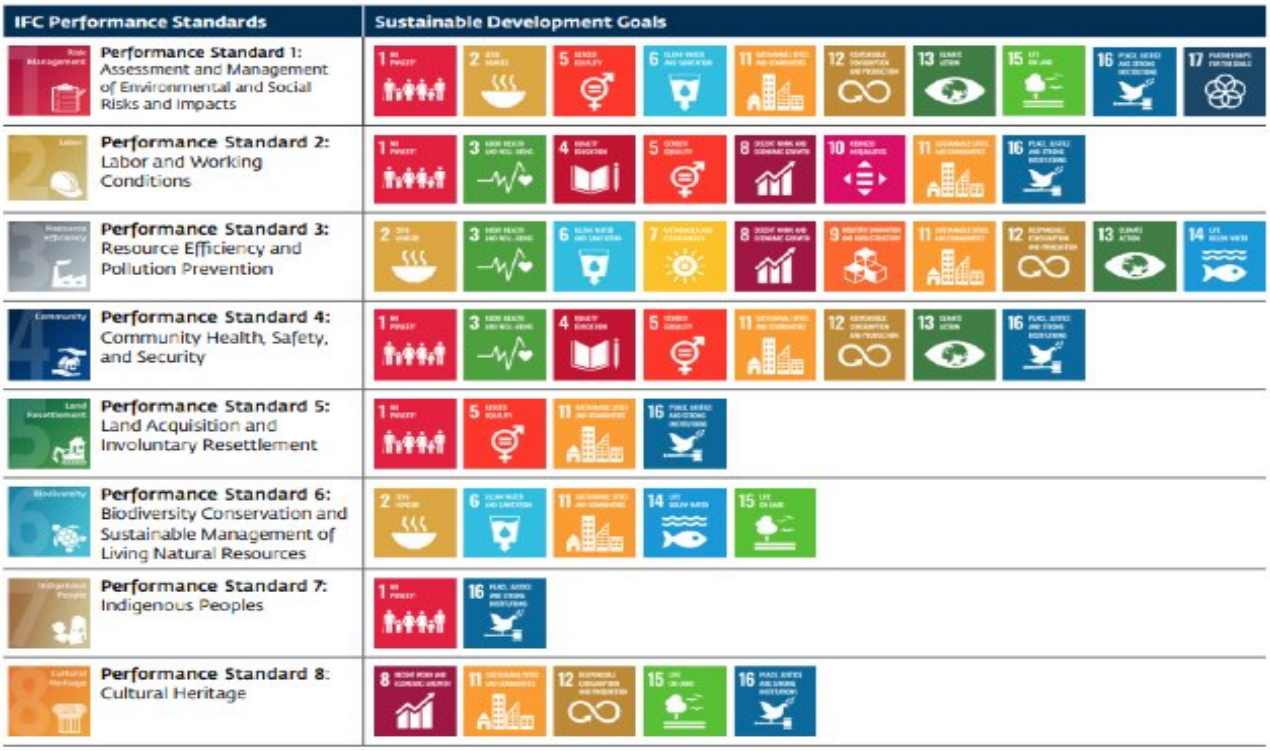
Table 4.3: IFC Performance Standards

Performance Standard	Description
PS1 – Assessment and Management of Environmental and Social Risks and Impacts	PS1 establishes the importance of: (i) integrated assessment to identify the environmental and social impacts, risks and opportunities of Projects (ii) effective community engagement through disclosure of Project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of social and environmental performance throughout the life of the Project.
PS2 – Labour and Working Conditions	PS2 recognises the need for economic development to be balanced with workers' rights. PS2 aims to: establish, maintain and improve the worker-management relationship; promote the equal opportunity of workers, and compliance with national labour and employment laws; protect the workforce by addressing child labour and forced labour; protect vulnerable workers; and, promote safe and healthy working conditions and the health of workers.
PS3 – Resource Efficiency and Pollution Prevention	PS3 recognises that economic activity and urbanisation often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. PS3 aims to: avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from Project activities; promote more sustainable use of resources including energy and water; and reduce Project-related emissions.
PS4 – Community Health, Safety and Security	PS4 recognises that Project activities, equipment, and infrastructure can increase community exposure to risks and impacts. PS4 aims to: anticipate and avoid adverse impacts on the health and safety of the affected community during the Project life cycle; and ensure that the safeguarding of personnel and property avoids or minimises risks to the community's safety and security.
PS5 – Land Acquisition and Involuntary Resettlement	PS5 recognises that Project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons who use this land. PS5 aims to: avoid or at least minimise involuntary resettlement wherever feasible by exploring alternative Project designs; mitigate adverse social and economic impacts from land acquisition by (i) providing compensation for loss of assets and (ii) ensuring that resettlement activities are implemented with appropriate consultation and disclosure; and improve or at least restore the livelihoods, standards of living and living conditions of displaced persons.
PS6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources	PS6 encourages sustainable development while recognising that the protection and conservation of biodiversity and sustainably managing living natural resources are fundamental to sustainable development. PS6 aims to: protect and conserve biodiversity; maintain the benefits from ecosystem services; and promote the

Performance Standard	Description
	sustainable management and use of natural resources through practices that integrate conservation and development.
PS7 – Indigenous Peoples	PS7 aims to: ensure that the development process fosters full respect for Indigenous Peoples; anticipate and avoid, minimise or compensate adverse impacts of Projects on Indigenous Peoples and provide opportunities for development benefits; establish and maintain an ongoing relationship with affected Indigenous Peoples throughout the life of the Project; ensure free, prior and informed consent of Indigenous Peoples; and respect and preserve their culture, knowledge and practices.
PS8 – Cultural Heritage	PS8 recognises the importance of cultural heritage for current and future generations. PS8 aims to: protect cultural heritage from the adverse impacts of Project activities; support its preservation; and promote equitable sharing of benefits from cultural heritage.

As shown by IFC in its guide 'Advancing UN Sustainable Development Goals through IFC's Environmental, Social, and Governance Standards' (IFC, 2023), the IFC PS can help a Project contribute to achieving the United Nations Sustainable Development Goals (SDGs). Figure 4.1 offers a mapping of IFC Ps against the SDGs.

Figure 4.1: IFC PS mapping to SDGS



4.3.3 The World Bank General Environmental, Health, and Safety (EHS) Guidelines

IFC Performance Standard 3 specifies the use of the World Bank Group Environmental, Health, and Safety Guidelines (known as the "EHS Guidelines").

The revised IFC/WB EHS Guidelines are a set of general and industry specific examples of international good practice. The EHS General Guidelines contain information on crosscutting issues applicable to Projects in all industry sectors. They provide guidance on performance levels and measurements considered to be achievable at reasonable cost by new or existing Projects with the use of existing technologies and practices.

Projects are expected to comply with the levels and measures identified in the EHS Guidelines where host country requirements are less stringent.

The EHS General Guidelines cover four areas of international good practice, these are:

- Environmental
- Occupational Health & Safety (OHS)
- Community Health & Safety (CHS); and
- Construction and Decommissioning

The general guidelines are supported by a series of sector specific guidelines. The EHS Guidelines for Wind Energy (August 7, 2015) and Electric Power Transmission and Distribution (April 30, 2007) are relevant to this Project and were considered when undertaking the ESIA.

4.3.4 EBRD Environmental and Social Policy (2024)

The following EBRD's Environmental and Social Requirements (ESRs) are applicable:

- ESR -1: Assessment and Management of Environmental and Social Risks and Impacts
- ESR -2: Labour and Working Conditions
- ESR -3: Resource Efficiency and Pollution Prevention and Control
- ESR -4: Health, Safety and Security
- ESR -5: Land Acquisition, Restriction on Land Use and Involuntary Resettlement
- ESR -6: Biodiversity Conservation and Sustainable Management of Living Natural Resource
- ESR -8: Cultural Heritage
- ESR -10: Stakeholder Engagement

Performance Requirement 7 Indigenous Peoples will not apply since based on the information available there are no indigenous peoples affected by the Project (The International Working Group on Indigenous Affairs does not identify any indigenous groups in North Macedonia[13] and as confirmed by the Project's EIA in 2009, the Project will not affect indigenous peoples).

PR9 Financial Intermediaries will not apply either as the sponsor is not a financial intermediary nor is the finance being directed through an intermediary lender.

4.3.5 International treaties, conventions and agreements

4.3.5.1 Aarhus convention

The United Nations Economic Commission for Europe (UNECE) Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention) was adopted on 25 June 1998 in the Danish city of Aarhus at the Fourth Ministerial Conference as part of the "Environment for Europe" process[14]. It entered into force on 30 October 2001. North Macedonia ratified the Convention in 1999[15].

The Aarhus Convention establishes a number of rights of the public (individuals and their associations) with regard to the environment. The Parties to the Convention are required to make the necessary provisions so that public authorities (at national, regional or local level) will contribute to these rights to become effective. The Convention provides for:

[13] Countries - IWGIA - International Work Group for Indigenous Affairs; The Indigenous World 2024

[14] Introduction | UNECE accessed July 2025

[15] Aarhus Convention – Aarhus Center – North Macedonia, accessed July 2025

- The right of everyone to receive environmental information that is held by public authorities ("access to environmental information"). This can include information on the state of the environment, but also on policies or measures taken, or on the state of human health and safety where this can be affected by the state of the environment. Applicants are entitled to obtain this information within one month of the request and without having to say why they require it. In addition, public authorities are obliged, under the Convention, to actively disseminate environmental information in their possession.
- The right to participate in environmental decision-making. Arrangements are to be made by public authorities to enable the public affected and environmental non-governmental organisations to comment on, for example, proposals for Projects affecting the environment, or plans and programmes relating to the environment, these comments to be taken into due account in decision-making, and information to be provided on the final decisions and the reasons for it ("public participation in environmental decision-making").
- The right to review procedures to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general ("access to justice").

4.3.6 Subject matter standards and guidelines

4.3.6.1 Human rights

Equator Principles 4[16]

Equator Principles 4 (EP4) specifies that human rights should be assessed by Projects as part of the environmental impact assessment and should refer to the United Nations Guiding Principles on Business and Human Rights (UNGPs), which are described in the more detail in section 0.

According to the Guidance Note on Implementation of Human Rights Assessments Under the Equator Principles[17], borrowers and Equator Principles Financial Institutions (EPFIs, otherwise known as lenders) should begin by carrying out an 'initial scan' of potential or actual Project-level adverse human rights impacts. The initial scan should use the UNGP methodology, noting which stakeholders could potentially be affected by which risks, if any.

If results of the initial scan point to 'lower risks' (those considered to be adequately mitigated by the Project and should not cause a significant impact to stakeholders), Projects can provide a high-level statement of risks or comments in a form acceptable to the EPFI for review.

If the results of the initial scan point to 'higher risks' (that may cause significant adverse human rights impacts to stakeholders and/or such impacts are not adequately mitigated by Projects plans), Projects should carry out additional in-depth (on the ground) assessment to understand risks and how they should be avoided, mitigated, and/or remediated.

Chapter 7 of Volume 2 of the ESIA describes the approach and findings of the HRIA Initial Scan.

United Nations Guiding Principles on Business and Human Rights[18]

The UNGPs are a set of guidelines for States and companies to prevent, address and remedy human rights abuses committed in business operations. They were devised by Professor John Ruggie (hence sometimes

[16] Equator Principles (2020): 'The Equator Principles, a financial industry benchmark' Available at: The-Equator-Principles-July-2020.pdf

[17] Available at: Guidance Note: On Implementation of Human Rights Assessments under the Equator Principles (equator-principles.com). Accessed in May 2025

[18] UN Human Rights (2011): 'Guiding principles on business and human rights' Available at: guidingprinciplesbusinesshr_en.pdf (ohchr.org)

known as the Ruggie Principles) and were endorsed by the United Nations (UN) Human Rights Council in June 2011.

International human rights treaties do not impose direct legal obligations on business enterprises. However, it is the duty of states such as the Republic of North Macedonia to translate their international human rights commitments into domestic law, and to enforce those laws. The Republic of North Macedonia has not produced a National Action Plan on Business and Human Rights to implement the UNGPs. Despite this, the UNGPs make clear that where national laws and commitments fall below the standard of internationally recognised human rights, companies should respect international standards. Where national laws conflict with international standards, companies should seek ways to honour the principles of those standards without contravening national law.

The UNGPs require businesses to respect human rights through a process of human rights due diligence, which identifies, prevents, mitigates and accounts for how they address human rights impacts with which they are involved. Human rights impact assessment is a key component of human rights due diligence.

The UNGPs state that when a business is assessing its human rights impacts it should:[19]

- Draw on internal and/or independent human rights expertise
- Undertake meaningful consultation with potentially affected rights-holders and other relevant parties
- Be gender-sensitive and pay particular attention to any human rights impacts on individuals from groups that may be at heightened risk of vulnerability or marginalisation
- Assess impacts from the perspective of risk to people rather than risk to business
- Repeat its risk and impact identification and assessment at regular intervals (ie before entering into a new activity, prior to significant decisions about changes in activities, and periodically throughout the Project-cycle).

According to the UNGPs, the minimum reference point for 'internationally recognised human rights' is made up of the International Bill of Human Rights and the eight core conventions of the International Labour Organisation (ILO). That is, those relating to freedom of association and the right to collective bargaining; the elimination of compulsory labour; the abolition of child labour; and the elimination of discrimination in respect of employment and occupation. In 2022, the ILO added health and safety to the core labour standards, so that there are now five (5) core labour standards and 10 core labour conventions.

In addition, the UNGPs state that depending on circumstances, business enterprises may need to consider additional standards, for example those safeguarding individuals belonging to specific groups or populations that require particular attention. Several UN core human rights treaties have elaborated further on the rights of indigenous peoples; women; national or ethnic, religious and linguistic minorities; children; persons with disabilities; and migrant workers and their families. These treaties are discussed further below in section 0**.**

International Bill of Human Rights[20]

The International Bill of Human Rights, which underscores all 30+ human rights and fundamental freedoms, is comprised of several international covenants and declarations. The term 'human rights' refers to all of the rights listed in this Bill and some are more applicable to the Project than others. The 'International Bill of Human Rights' is the informal name given to the UN main provisions on human rights and is comprised of the following:

- Universal Declaration of Human Rights (UDHR)
- International Covenant on Economic, Social and Cultural Rights (ICESR)

[19] As highlighted in HRIA guidance and toolbox, Danish Institute for Human Rights, 2016

[20] Office of the United Nations High Commissioner for Human Rights (1996): 'The International Bill of Human Rights' Available at: factsheet2rev.1en.pdf (ohchr.org)

- International Covenant on Civil and Political Rights (ICCPR)
- Optional Protocol to the International Covenant on Civil and Political Rights
- Second Optional Protocol to the International Covenant on Civil and Political Rights (focussed on the abolition of death penalty)

The UDHR contains 30 articles setting forth the human rights and fundamental freedoms to which all people are entitled without discrimination, all over the world. The first article sets out the declaration's philosophy, as follows:

'All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood.'

The second article sets out the principle of equality and non-discrimination as regards the enjoyment of human rights. Article three is a pre-requisite for enjoyment of other rights; it proclaims the right to life, liberty and security and introduces articles four to 21 which set out other civil and political rights such as freedom from slavery and the right to own property. Article 22 introduces articles 23 to 27 which identify economic, social and cultural rights such as the right to work, rest and leisure. The final articles, 28-30, recognise that everyone is entitled to social and international order in which their other human rights may be realised.

The ICESR and ICCPR provide for many of the same human rights as the UDHR, with a few key additions, including regarding the rights of minorities.

International Labour Organisation core labour standards[21]

As part of the UN, the ILO is a tripartite organisation of trade unions, governments and companies. Upon release of the Declaration on Fundamental Principles and Rights at Work in 1998, ILO member states agreed to respect, promote, and realise core labour standards –regardless of the level of economic development and regardless of whether or not the states have ratified the applicable conventions.

The Declaration outlines five "Fundamental Principles and Rights at Work" in ten "Fundamental" conventions (Table 4.4).

Table 4.4: ILO fundamental conventions

Fundamental Principles and Rights at Work	Fundamental conventions	Ratifications by North Macedonia[22]
Freedom of association and the effective recognition of the right to collective bargaining	ILO Convention 87 on Freedom of Association and Protection of the Right to Organise	In force since 17 Nov 1991
	ILO Convention 98 on the Right to Organise and Collective Bargaining	In force since 17 Nov 1991
Elimination of all forms of forced and compulsory labour	ILO Convention 29 on Forced Labour	In force since 17 Nov 1991
	ILO Convention 105 on Abolition of Forced Labour	In force since 15 Jul 2003
Effective abolition of child labour	ILO Convention 138 on Minimum Age (of Employment)	In force since 17 Nov 1991
	ILO Convention 182 on the Worst Forms of Child Labour	In force since 30 May 2002
Elimination of discrimination in respect of employment and occupation	ILO Convention 100 on Equal Remuneration	In force since 17 Nov 1991
	ILO Convention 111 on Discrimination (Employment and Occupation)	In force since 17 Nov 1991

[21] ILO (2019): 'Introduction to International Labour Standards: Conventions and Recommendations' Available at: Conventions and Recommendations (ilo.org)

[22] Ratifications of ILO conventions: Ratifications for North Macedonia, Accessed July 2025

Fundamental Principles and Rights at Work	Fundamental conventions	Ratifications by North Macedonia[22]
Safe and healthy working environment	ILO Convention 155 on Occupational Safety and Health	In force since 17 Nov 1991
	ILO Convention 187 on the Promotional Framework for Occupational Health and Safety	In force since 3 Oct 2012

Source: ILO Conventions, Protocols and Recommendations[23]

The ILO Declaration on Fundamental Principles and Rights at Work also makes particular mention of groups with special needs, including the unemployed and migrant workers. Additional ILO conventions relevant to HRIA, include the ILO Convention 19 on Equal Treatment for National and Foreign Workers in terms of Accident Insurance and Remuneration.

UN human rights treaties

In addition to the International Bill of Human Rights, there are a further set of human rights treaties which may be of relevance according to the UNGPs. For example, in certain circumstances where businesses are identified to have human rights impacts on individuals belonging to specific groups or populations, enterprises should respect the human rights of those individuals and groups. UN instruments have elaborated further on the rights of indigenous peoples; women; national or ethnic, religious and linguistic minorities; children; persons with disabilities; and migrant workers and their families. The specific conventions are:

- International Convention on the Elimination of All Forms of Racial Discrimination
- Convention on the Elimination of All Forms of Discrimination against Women
- Convention on the Rights of the Child
- International Convention on the Protection of the Right of All Migrant Workers and Members of their Families

Other relevant conventions and declarations, separate to the Core International Human Rights Treaties include:

- Convention on the Rights of Persons with Disabilities
- United Nations Declaration on the Rights of Indigenous Peoples
- Declaration on the Rights of Persons belonging to National or Ethnic, Religious and Linguistic Minorities

4.3.7 OECD Guidelines

The OECD Guideline for Multinational Enterprise stipulates the OECD's expectations on how international companies should act according to Responsible Business Conduct Matters. Chapter 4 (Human Rights) instructs that corporations and enterprises are responsible for respecting internationally recognised human rights. Chapter 5 (Employment and Industrial Relations) requires companies and their partners in the value and supply chains to respect workers' rights and avoid child labour and forced labour.

OECD Due Diligence Guidance for Responsible Mineral Supply Chains provides recommendations to help companies respect human rights and avoid complimenting conflict by purchasing minerals and materials from conflict-affected and high-risk areas[24]. It is important for the Project to follow this guideline to ensure that they are not engaged in human rights violations in their turbine supply chains. Also, the OECD guideline

[23] Available at: https://www.ilo.org/international-labour-standards/conventions-protocols-and-recommendations
Accessed in July 2025

[24] See: OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas - OECD

on Child Labou risks delineates the practical actions for companies to identify and mitigate the risks of child labour in the global supply chains[25].

4.3.8 Istanbul convention

The Istanbul Convention (2011) or the 'Council of Europe Convention on Preventing and Combating Violence Against Women and Domestic Violence' was ratified by North Macedonia in 2018. The Istanbul Convention has four main pillars: prevention, protection and support for victims, prosecution of offenders and integration of policies. It is the first legally binding instrument which claims to create a comprehensive legal framework and approach to combat violence against women.

4.3.9 International involuntary resettlement standards

4.3.9.1 IFC Performance Standard 5, 2012 (IFC PS5)

The Project is required to meet the IFC Performance Standards including PS5 on land acquisition and involuntary resettlement. Displacement is considered involuntary when affected individuals or communities do not have the right to refuse land acquisition, as is the case for some components of this Project. Key provisions of IFC PS5 include:

- Efforts must be made to avoid and minimise resettlement whenever possible, in particular physical displacement. When resettlement cannot be avoided, mitigation of potential negative impacts is required.
- Forced eviction must be avoided.
- Efforts must be made to improve, or at a minimum restore, the livelihoods and standards of living of displaced (physically[26] or economically[27]) persons to pre-Project levels. Projects are responsible for improving living conditions among displaced persons through provision of adequate housing with secure tenure.
- Displaced persons may include owners or non-owner residents, and people occupying land without formal, traditional, or recognisable usage rights.
- Resettlement activities must be implemented with disclosure of information, consultation, and the informed participation of PAPs.
- Special provisions must be made for individuals belonging to vulnerable groups.
- Resettlement should be seen as a development activity, and displaced persons should benefit from the Project where opportunities exist.

IFC PS5 defines a livelihood as 'the full range of means that individuals, families, and communities utilise to make a living, such as wage-based income, agriculture, fishing, foraging, other natural resource-based livelihoods, petty trade, and bartering'.

IFC PS5 is supported by the IFC's Good Practice Handbook on land acquisition and involuntary resettlement, 2023 which also guides land acquisition and resettlement management for the Project.

4.3.10 EBRD Environmental and Social Requirement 5, October 2024 (ESR5)

EBRD's ESR 5 on land acquisition, restrictions on land use, and involuntary resettlement addresses impacts of Project-related land acquisition[28], including restrictions on land use and access to assets and natural

[25] See: Child labour risks in global supply chains - OECD

[26] Relocation or loss of shelter.

[27] Loss of assets or access to assets that leads to loss of income sources or other means of livelihood.

[28] Land acquisition is used by EBRD to refer to all methods of obtaining lad for project purposes, including outright purchase, expropriation and acquisition of temporary or permanent access rights, rights of way, easements etc.

resources, which may cause physical displacement, and/or economic displacement[29]. The objectives of ESR5 align with those of IFC PS5, however there are some points on which ESR5 provides additional useful detail, as follows:

- The scope of application covers:
  - Restrictions that result in people experiencing loss of access to land, assets, natural resources or livelihoods, irrespective of whether such rights of restriction are acquired through negotiation, expropriation, compulsory purchase, or by means of government regulation
  - Displacement of people because of Project impacts that render their land or assets unusable or inaccessible
  - Voluntary land transactions may result in the displacement of persons other than the seller who occupy, use or claim rights to the land in question, such as informal tenants or other land users that have no right under national law.
- Negotiated settlements are encouraged to be pursued, regardless of whether the host government is prepared to expropriate land on the Project proponent's behalf. It is possible to achieve agreements by providing fair and appropriate compensation to affected persons or communities at full replacement cost[30] and any in-kind compensation must be at least at replacement value. Additional assistance and livelihood restoration measures must be provided by the Project as appropriate. It is important to manage and effectively mitigate the risks of asymmetry of information and the bargaining power of the parties involved in such transactions. EBRD may require specific monitoring of the negotiation process and as such documentation at every stage is critically important.
- Gender aspects are more clearly outlined in ESR5 and include the need to specifically understand the differential impacts of men and women, with suggested types of analysis, as well as details on compensation, entitlements, livelihood restoration and consultation.
- The need to observe data privacy laws and to obtain consent to hold and manage Project Affected Persons (PAPs) information.
- ESR5 sets out conditions for when land becomes uneconomic, unsafe or uninhabitable, requiring the Project to purchase the entire parcel in these cases.
- Disputes are to be resolved by a third-party valuer.
- The need for consistency in compensation values is clearly stated, and compensation values are to be disclosed and applied consistently. Where values are subject to negotiation, Projects are expected to adjust amounts upwards to ensure fairness. In all cases, a clear basis for the calculation of compensation will be documented and compensation distributed in accordance with transparent procedures.
- ESR5 provides some useful indications as to appropriate types of livelihood restoration measures according to various types of impact.

4.3.11 EIB Standard 6, 2022

EIB requires that:

- The promoter provides information on any expropriation of land and/or easement resulting in displacement and involuntary resettlement, likely related restrictions on access to land, shelter and/or livelihood and subsistence strategies and /or voluntary land acquisition to order to determine the need for an ESIA.
- Special attention to engagement with vulnerable, marginalize, and/or discriminated-against groups, Indigenous Peoples in the context of involuntary resettlement and/or economic displacement.

[29] Economic displacement is defined slightly differently by EBRD as loss of land, assets or restrictions on land use, assets and natural resources leading to loss of income sources or other means of livelihood.

[30] Full replacement cost is defined in ESR5 as a method of valuation yielding compensation sufficient to replace assets, plus necessary transaction costs associated with asset replacement.

EIB's objectives are very similar to the objectives of IFC PS5. However, one of EIB's Standard 6 objectives references more details about mitigating social and economic impacts from unavoidable involuntary resettlement by "(i) providing timely compensation for a loss of assets as the full replacement cost; (ii) ensuring that resettlement is designed, planned and implemented with the appropriate disclosure of information to those affected along with their consultation and informed participation; (iii) providing displaced persons with access to grievance mechanisms; and (iv) as a development opportunity enabling displaced persons to benefit directly from the Project, as the nature of the Project may warrant."

The application of the standard references a similar scope of application as IFC PS5. Some additional details include that the standard applies to any resettlement activities that are already underway or finalised before the promoter applies to the EIB for financing, if such activities are carried out in anticipation of or in preparation for the Project. EIB Standard 6 is more specific about not being applicable to resettlement resulting from voluntary land transactions, indicating that such transaction must be conducted with integrity, accountability, efficiency and transparency, and must be free of coercion, intimidation, fraud, and/or malfeasance.

EIB requires that, for Projects in Candidate and potential Candidate countries to the European Union such as North Macedonia, all the requirements in its resettlement standard must be followed. EIB also requires compliance with any obligations arising from the applicable national legislation and international human rights instruments.

EIB's standard requires that the resettlement census and surveys cover the same losses as IFC and EBRD and notes that access to natural or cultural resources or services should be investigated through the fieldwork. The census also needs to include seasonal resource users who are not present at the time of the census but who have a legitimate claim to the land. Data should be disaggregated and differential impacts on different members of the household need to be investigated and understood.

Where livelihoods are land based, land for land compensation is to be favoured by the Project and offered as an option. If it is not offered, justification will need to be provided to EIB. In cases where communal resources are lost, as with IFC and EBRD, EIB requires that continued access is provided to those resources, or that alternative resources of equivalent value are provided. Where this is not possible, EIB requires that justification is provided.

In relation to timing of compensation around taking over of land, EIB's standard clearly states that replacement land/housing/businesses or cash compensation will be provided prior to any displacement or access restrictions on land or natural resources. Where feasible, in-kind or cash compensation will be issued in the name of both the head of the household and his/her partner.

In cases where only part of the land or asset is acquired and the residual land is not residentially or economically viable, the Project is expected to offer the option to acquire the full plot. If there is a dispute in relation to the residential or economic viability of the remaining plot of land, a third-party valuator needs to be engaged to assess it.

If community facilities, utilities or public amenities are impacted, the Project must replace them to a similar or better standard. The replacement needs to be based on consultation with the Project-affected community and relevant government stakeholders. When possible, the Project, in cooperation with the relevant authority, will also improve social and public infrastructure with the aim of contributing to the sustainable and inclusive socioeconomic development of the affected and host communities.

On the topic of gender equality in resettlement, EIB has similar requirements to EBRD but additionally states that the Project will consider feasible measures for women to gain security of tenure and receive cash or in-kind compensation on equal terms as men.

Before the implementation of resettlement activities, the EIB, the Project and any other responsible entity involved in the resettlement activities will formally agree on the content of the resettlement planning documents. The approved resettlement planning documents must be made available to the public. Where

application for finance to EIB occurs after the resettlement planning document has been prepared and resettlement is underway, EIB may require a review of the process and corrective actions to bring the process in line with its standards.

Monitoring and evaluation requirements are similar to IFC and EBRD, although EIB requires that a completion audit is presented to the bank regardless of the scale of resettlement. Where resettlement impacts are significant, the audit will be prepared by an external party.

EIB's standard includes annexes that cover the contents expected in a resettlement policy framework and a RAP/LRP.

4.3.12 Gap analysis between Macedonian law and international resettlement standards

Table 4.5 below highlights the key gaps between Macedonian land and resettlement related laws and international standards referred to in section 4.3.9.

Table 4.5: Resettlement gap analysis - Macedonian legislation compared with international standards

Key issue	International standards (IFC PS5, EBRD ESR5, and EIB Standard 6)	Macedonian legal requirements	Gaps	Actions to bridge gaps identified
Avoidance or minimisation of displacement	The Project will consider feasible alternative Project designs and sites to avoid or minimise land acquisition or restrictions on land use, other assets and natural resources.	The law on spatial and urban planning states that planning should aim to improve living and working conditions for Macedonian citizens. The Constitution guarantees legal protection of ownership - the deprivation of the property rights and displacement is an exception in cases of public interest determined by law. The national legislation in the form of the EIA procedure requires consideration of alternatives including siting options. The proposed industrial facilities should be sited in a way to avoid or minimise impacts on 'valuable lands' (eg, on perennial croplands, forests) and to use state-owned land to minimise land acquisition from private landowners/leasers.	None	None
Avoidance of forced eviction	The Project will avoid forced eviction[31]. EBRD stipulates that the exercise of eminent domain, compulsory acquisition, or similar powers by a Project will not be considered to be forced eviction if it complies with the requirements of national law and the provisions of ESR5, and is conducted in a manner consistent with basic principles of due process (namely, it provides adequate advance notice and meaningful opportunities to lodge grievances and appeals; avoids the use of unnecessary, disproportionate or excessive force; does not result in homelessness; and ensures the provision of adequate compensation before the eviction takes place).	The terms 'involuntary resettlement' and 'forced eviction' are not referred to in the Law on Expropriation. Instead, the national law uses the term 'expropriation' for Government's power of eminent domain/land acquisition in the public interest. Refer to the next row for more details.	The Project will not acquire any land through forced evictions.	None

[31] Forced eviction in IFC PS5 refers to the permanent or temporary removal against the will of individuals, families, and/or communities from the homes and/or lands which they occupy without the provision of, and access to, appropriate forms of legal and other protection.

Key issue	International standards (IFC PS5, EBRD ESR5, and EIB Standard 6)	Macedonian legal requirements	Gaps	Actions to bridge gaps identified
Negotiated settlements	The Project will seek to acquire land rights through negotiated settlements even if it has the legal means to gain access to the land without the consent of the seller.	Land ownership/usage rights may be acquired or restricted through negotiated settlements with property owners and right-holders. Negotiated settlements are required by the Law on Expropriation as a first pass attempt to acquire land. The last instance in which they can be concluded is after the final expropriation decision[32] has been issued.	None – the Project is pursuing land acquisition through negotiated settlements however some use of the expropriation laws may be necessary[33].	None
Consideration of vulnerable groups	IFC requires that resettlement impacts be avoided with particular focus on the poor and vulnerable. Particular attention should also be paid to the needs of the poor and the vulnerable in planning for physical displacement. EBRD ESR5 clauses 17 and 18 require an assessment to address risks and impacts on vulnerable people throughout all of resettlement planning. Vulnerability analysis should be carried out and vulnerable people identified. Specific consultations should be carried out with vulnerable people and assistance measures should be tailored to the neds of the vulnerable people. EIB Standard 6 clause 6 requires special attention to engagement with vulnerable, marginalize, and/or discriminated-against groups, Indigenous Peoples in the context of involuntary resettlement and/or economic displacement.	There are social protection laws (e.g., Law on Social Welfare, 2009) that stipulate financial aid/state allowances for various categories of socially vulnerable people.	Gap: Macedonian laws do not call for specific consideration of vulnerable groups or provision of specific support to them during the land acquisition process.	As part of the LRP preparation, an analysis was carried out to understand categories of vulnerability and identify vulnerable PAPs. Bespoke entitlements are discussed and set out for vulnerable people. Separate consultations have been carried out with vulnerable people and groups as needed.
Consideration of gender aspects	EBRD ESR5 requires that gender dimensions are considered throughout the baseline surveys,	North Macedonia has adopted a set of legislative requirements regulating economic	Gap: Macedonian laws do not require specific consideration	For the LRP surveys, gender disaggregated

[32] Affected property owners are provided with the expropriation proposal, including the proposed amount of compensation and then individually invited to discuss a compensation proposal for the assets. The expropriation authorities are obliged to facilitate negotiations and to encourage the conclusion of a negotiated compensation agreement. Negotiations of land compensation rely on the asset valuation results and land prices determined by decisions of the Municipal Councils where the land to be acquired is located. Macedonian law requires that the expropriation documents (geodetic report and expropriation proposal) to be prepared which present inventories of affected properties and cover basic information (i.e. names, addresses, identity numbers) about registered owners of these properties so that they can be identified and compensated. Such studies do not cover informal users. The day of issuing the Expropriation Proposals to PAPs is considered the cut-off date. If a negotiated process has failed, compulsory expropriation is used as a last resort

[33] For instance, for case where people are absent, there are unresolved inheritance issues, and where negotiated settlement is unlikely to be reached.

Key issue	International standards (IFC PS5, EBRD ESR5, and EIB Standard 6)	Macedonian legal requirements	Gaps	Actions to bridge gaps identified
	impact assessment, mitigation implementation, and monitoring processes. Consultation needs to be undertaken with people of all genders. EIB Standard 6 states that where feasible, in-kind or cash compensation will be issued in the name of both the head of the household and his/her partner. EIB requires the Project to consider feasible measures for women to gain security of tenure and receive cash or in-kind compensation on equal terms as men.	and proprietary relations and housing, as well as ownership rights and entitlements for men and women equally, regardless of gender (e.g., the Constitution, the Family Law, the Law on Equal Opportunities, and others).	of gender issues during the national environmental impact assessment procedure or land acquisition processes.	data has been collected to understand the differential impacts that displacement will have on men and women. Livelihood restoration measures consider the needs and preferences of women. Compensation will be paid jointly to both spouses where appropriate, and both spouses will be informed of the livelihood restoration package. Consultation activities are encompassing separate meetings for women with women facilitators where appropriate. Women will receive compensation on equal terms as men.
Socio-economic surveys, census, inventory of affected assets and cut-off date	The Project will carry out socio-economic surveys to describe the baseline conditions of PAPs. The Project will carry out a census of PAPs and an inventory of affected assets, including land, structures, crops, communal amenities and natural resources. EIB also requires that access to natural and culture resources is also considered, including any seasonal resource users not present at the time of the surveys. The Project will establish a cut-off date for eligibility (the date after which assets are not eligible for compensation).	A socio-economic survey is not required as part of the land acquisition process.	Gap: Socio-economic studies are not required and land users who are not rights-holders are not required to be notified about the cut-off date.	As part of the LRP, socio-economic surveys and inventory of affected assets were carried out as per lender requirements. Cut-off-dates and its validity are being disclosed widely in the Project area of influence, not just to affected landowners.

Key issue	International standards (IFC PS5, EBRD ESR5, and EIB Standard 6)	Macedonian legal requirements	Gaps	Actions to bridge gaps identified
	EIB Standard 6 clause 23 indicates that the cut-off date will be valid: (i) for the period specified in national laws; or (ii) for the period specified in the resettlement planning documents; or (iii) for a reasonable time period from the census or inventory date. After this period the census, socioeconomic baseline and resulting valuation need to be updated.			
Valuation of affected lands and assets	The loss of land, property and assets will be valued using the replacement cost method.	The laws (for instance the Law on Expropriation) indicate that compensation for property (agricultural, pasture and forest land; residential land; residential and business structures) may not be less than the market value of the property. The market value is determined by a certified appraiser who is an authorised and licenced valuator - Bureau of Judicial Expertise - using methods established by the Law on Appraisal (based on European valuation standards). The Law on Obligation deals with incurred losses (income or profit) but this typically requires a court proceeding to establish validity.	Gap: The national valuation methodology for market value does not consider transaction costs.	The Project hired a certified land/asset valuator to determine the values of affected assets. The valuation methodology encompasses replacement cost which forms the basis of negotiations and compensation. Affected people are entitled to compensation for losses, as per the entitlements matrix and eligibility criteria aligned with international standards.
Eligibility	PAPs who are eligible for compensation include persons: (i) who have formal legal rights to the land; (ii) who do not have formal legal rights to land at the time of the census, but who have a claim to land that is recognised or recognisable under national laws; or (iii) who have no recognisable legal right or claim to the land they occupy (also called informal users). Compensation for crops, trees, structures and other fixed asset losses will be provided to landowners, share-crop/lease tenants, and	The laws do not distinguish between the categories of displaced persons. Owners of real estate (persons who have formal legal rights to the land) and the holders of other real estate property rights that are subject to expropriation. The law does not recognise people who have no legalisable legal right or claim to the land or assets they occupy or use. Only formal land users (landowners and leaseholders) are eligible for compensation of crop losses.	Gap: National law does not recognise persons who have no legalisable legal right or claim to the land or assets they occupy or use, whilst this is a fundamental requirement of the international standards.	The LRP preparation included surveys and interviews to understand use of affected land to gather a full picture of economic losses, including to informal users, employees, tenants, and users of natural resources.

Key issue	International standards (IFC PS5, EBRD ESR5, and EIB Standard 6)	Macedonian legal requirements	Gaps	Actions to bridge gaps identified
	informal users whether registered or not. As referenced above, EIB requires that seasonal users be identified.	Only those with formal legal rights are informed about the expropriation process and have the right to appeal; other categories of affected people are not informed or consulted.		All affected people, including seasonal users, are entitled to compensation for losses, as per the entitlement matrix.
Compensation and benefits for PAPs	The Project will offer all PAPs and communities assistance to restore, and potentially improve, their standards of living and/or livelihoods to pre-displacement levels. Land-for-land will be preferred in land-based economies. Cash compensation is acceptable if land-for-land is not feasible and if loss of land does not undermine the livelihoods of PAPs. Replacement land/housing/businesses or cash compensation will be provided prior to any displacement or access restrictions on land or natural resources. Where feasible, in-kind or cash compensation will be issued in the name of both the head of the household and his/her partner.	The laws (for instance the Law on Expropriation) contain provisions to compensate for land, crops, and other assets including unauthorised structures, as well as for economic losses of affected households. Compensation will be provided at market value or can be in the form of a replacement land/asset. The legislation does not include provisions to improve or restore standard of living and livelihoods of people affected by land acquisition. According to the laws (namely the Law on Expropriation and the Law on Construction), the construction contractor may receive permission to work on the acquired land prior to payment of compensation to the PAPs.	Gap: Macedonian law does not require livelihood restoration measures over and above paying compensation at market values. Furthermore, construction works on the affected land may begin prior to compensation being paid.	The LRP plans for supplementary livelihood restoration measures with the aim of restoring if not improving affected people's livelihoods. The Project is providing compensation for any given landowner prior to commencing works on the relevant land, noting that livelihood restoration support may continue after civil works have started.
Loss of community facilities, utilities and public amenities	Replacements will be provided for the loss of community facilities, utilities or public amenities, or access to them. EIB expects that community facilities, utilities or public amenities are replaced to a similar or better standard, based on consultation with the Project-affected community and relevant government stakeholders.	Macedonian law requires the construction contractor to preserve and restore the community facilities affected as a result of construction works.	None	Impacts on community facilities, utilities, public amenities have been assessed as part of the LRP and impacts avoided to the extent possible. Where not possible, appropriate mitigation will be developed based on a replacement approach that provides similar or better standards based on consultation with community and government stakeholders.

Key issue	International standards (IFC PS5, EBRD ESR5, and EIB Standard 6)	Macedonian legal requirements	Gaps	Actions to bridge gaps identified
Meaningful engagement	The Project must conduct meaningful and ongoing consultations with affected people and communities throughout resettlement planning and implementation in line with IFC PS1 and EBRD ESR10. Consultations will be supported by the disclosure of resettlement documentation, including valuation methodologies and the entitlements matrix. From the earliest stages and through all activities the Project will involve affected men and women, and vulnerable groups, conducting separate events where appropriate. All engagements will be documented.	Public hearings on the planned activities are carried out as part of the EIA process. There are no requirements regarding disclosure of the other land acquisition/resettlement documents. There is no requirement to identify and specifically engage with vulnerable persons or groups.	Gap: The public hearing for the EIA took place in 2009, and consultations for the Project will be conducted as part of the current ESIA process. Per local law, resettlement documents do not need to be disclosed, and vulnerable people or groups do not need to be consulted with special efforts.	The LRP has been produced with the undertaking of resettlement specific consultation in line with international standards. This entailed a combination of group and individual meetings, using iterative, two-way engagement. Separate consultations with women and vulnerable groups were conducted. Public consultation meetings on the ESIA scoping report have been completed. The Project proponent is conducting constructive stakeholder engagement since the earlier EIA process (2009) and documenting the results. Resettlement documentation including a non-technical summary (NTS) of the LRP will be disclosed to PAPs.
Grievance mechanism	A widely publicised grievance mechanism, which consists of both formal and informal channels, will be developed as per IFC PS1 and EBRD ESR10. The mechanism will be established as early as possible in the land acquisition and resettlement process, and at the latest prior to the census taking place in order to address specific concerns about compensation, resettlement or livelihood	Complaints related to land expropriation can be submitted after the infrastructure design has been approved. The decisions of the court are then followed. The affected parties can appeal to the relevant administrative court for protection of their rights.	Gap: A Project specific grievance mechanism is not required under national law.	The Project proponent has established a grievance mechanism that is used to handle grievances. The LRP includes specifics such as contact details for lodging grievances.

Key issue	International standards (IFC PS5, EBRD ESR5, and EIB Standard 6)	Macedonian legal requirements	Gaps	Actions to bridge gaps identified
	restoration measures raised by the PAPs or their representatives.			
Land acquisition and resettlement planning and implementation	The Project must prepare a resettlement and/or livelihood restoration plan proportionate to the risks and impacts associated with the Project for implementation. If the stage of Project development prevents the preparation of a full resettlement/livelihood restoration plan, a policy framework will be prepared as is prepared as a first step.	Article 26 of the Law on Expropriation requires a Geodetic Report and/or Expropriation Proposal must be prepared to substantiate the land/property expropriation for the Project. It must contain information such as number of cadastral parcels, title holder names, type and class of land, total area, area of land to be expropriated.	Gap: Macedonian law does not require a Project specific resettlement document addressing all types of loss to all types of PAP.	A LARPF outlining the general principles for managing resettlement and livelihood restoration has been prepared. Once the exact nature, magnitude and timing of the land acquisition or restrictions on land use became known, the LRP started being prepared addressing the international requirements.
Organisational capacity and commitment	The Project will designate specific personnel, including management representatives, with a clear allocation of responsibility and authority to plan and implement land acquisition and resettlement activities. The Project will prepare a budget proportionate to the required resettlement-related planning, mitigation, monitoring, evaluation and reporting activities. The Project will ensure the availability and timeliness of the required funds.	No requirement.	Gap: Macedonian law does not have specific requirements on organisational capacity or budgeting.	The LRP contains information about Project implementation resources, responsibilities and budgeting.

Key issue	International standards (IFC PS5, EBRD ESR5, and EIB Standard 6)	Macedonian legal requirements	Gaps	Actions to bridge gaps identified
Monitoring and evaluation	The Project will establish procedures to monitor and evaluate the implementation of the resettlement plan. Monitoring will involve the participation of key stakeholders, including affected communities. For Projects with significant displacement impacts the Project may decide to commission competent resettlement professionals to monitor the implementation of resettlement plans, design corrective actions, and produce periodic internal monitoring reports. For such Projects the Lenders may require periodic external compliance reviews. EIB requires a completion audit be presented regardless of the scale of resettlement. Where resettlement impacts are significant, the audit will be prepared by an external party.	Macedonian law does not include stipulations for monitoring and evaluation of the land expropriation process.	Gap: National law does not require monitoring of resettlement/expropriation activities for completion or effectiveness.	The monitoring activities and indicators are outlined in the LRP. A completion audit will be undertaken.

4.3.13 Land acquisition and livelihood restoration principles

The Project guiding LRP principles take account of national requirements and incorporate the guiding principles of the international standards to address the gap analysis discussed in the previous section. The Project Proponent is coordinating the synergies between the land acquisition and the LRP efforts and ensuring the following principles, organised into four thematic categories, are being followed.

4.3.14 Minimisation, avoidance and consultation

- Involuntary resettlement and land acquisition is being minimised or avoided where possible. Where acquisition of land use rights is unavoidable, management measures are being identified to minimise adverse impacts.
- Forced evictions are avoided.
- It is anticipated that normal land use (for instance crops or livestock grazing or activities that do not include vegetation growth above three to four metres at maturity) will continue in the area where the WTGs are.
- Negotiated settlements is the preferred Project approach.
- Affected persons, including untitled land users, are being meaningfully consulted to inform the process and obtain agreements through individual and group meetings. Engagement includes information disclosure (on land acquisition needs and process, and on LRP principles), data collection (on what and who is affected), consultation on entitlement options, presentation of valuation results and entitlement packages, and consultations leading to agreement signatures. Negotiations for the final agreement are being conducted in good faith.

4.3.15 Eligibility, compensation and entitlements

- Lack of formal title to use and benefit from land does not prevent eligibility for livelihood restoration support or certain types of compensation for loss of resource such as transitional support, cash compensation for assets or support to find alternative land. Affected persons without clear land or asset titles are entitled to assistance and compensation for the loss of non-land assets and land where appropriate[34].
- Compensation levels are sufficient and above market price to replace the permanently acquired assets (such as crops, trees and pastures) at full replacement cost[35] in local markets (using current market prices).
- All compensation for losses is being provided prior to land clearance impacts arising such as displacement or access restrictions on land or natural resources; payments in negotiated settlements such as leases are being made according to the signed schedules. Relating to allowances, where eligibility confirmation or assessment of transitional needs is still ongoing, some transitional allowances or support (eg, related to vulnerability aspects and coping, livelihood restoration, or rental assistance) may be provided after construction begins, in accordance with the LRP schedule for entitlements. Time lags are being kept to a minimum between impact and support to restore or improve living standards, livelihoods and living conditions.

[34] This is subject to confirmation with multiple stakeholders (eg, municipality, cadastral office, or neighbouring landowners) to avoid any opportunistic situations.

[35] The calculation of full replacement cost will be based on the following elements: (i) fair market value of the asset (with no depreciation); (ii) transaction costs; (iii) interest accrued, (iv) transitional and restoration costs; and (v) other applicable payments, if any.

- Should replacement agricultural land be identified as compensation, it must be at least equivalent in terms of productive potential, access and other locational advantages in relation to the old location.
- As part of the completion audit, the Project will explain whether and why land for land was offered.
- For temporary losses of land use, for instance during construction activities and land used for equipment and materials storage, cash compensation will be paid. No land for land will be offered because the land will be remediated to its original condition and continue to be used as previously.
- Although options will be offered and compensation in kind (land for land etc) is often preferred, payment of cash compensation for lost assets may be appropriate where livelihoods are not land-based.
- Payment of cash compensation may also be appropriate when the land taken for the Project is a small fraction of the affected asset, for instance 10 percent or less of the holding and the remaining area is economically viable.
- Cash compensation may also be paid where there are active markets for land use titles and labour, people actively use such markets, and there is sufficient supply of land, or the land is not being used by the owners.
- Affected people are being allowed to continue to plant and harvest crops on land after acquisition until informed by the Project, either within signed agreements or by notifications. The Project proponent will inform when the last harvest can be gathered after which no more planting is eligible for compensation. If the land is needed for Project use while standing crops remain, then the Project will compensate for them.
- Any damages to land and assets on the land caused by contractors during the construction activities will be addressed through cash compensation for lost productivity and by the provision of restoration measures (returning the land to its pre-Project condition, providing seeds for the next harvest). The principles of the LRP will guide the provision of compensation for such unforeseen damages caused advertently or inadvertently during construction and operation.

4.3.16 Livelihood restoration

- Livelihood restoration and mitigation measures will be managed as sustainable development activities. In line with GIIP, particular attention will be given to vulnerable displaced persons.
- When livelihoods are affected, affected persons will be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them to pre-Project levels or to levels prevailing prior to the beginning of Project implementation, whichever is higher.

4.3.17 Monitoring and grievances

- Conflict resolution and grievance redress mechanisms are established during the planning, implementation and monitoring phases.

Monitoring of adherence to land agreements, leases and the LRP will be undertaken.

5 Information disclosure, consultation and participation

Issue and Revision Record

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A	21 January 2026	HM	AM	MoB	Draft
B	19 February 2026	HM	AM	AM	Draft for consultation

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5 Information disclosure, consultation and participation

5.1 Overview

This chapter outlines the stakeholder engagement (consultation, participation and disclosure) process including activities that have been undertaken as part of the ESIA. A stakeholder engagement plan (SEP) has been developed as part of the ESIA process to serve as a 'live' management tool to guide stakeholder engagement for the Project lifecycle.

The SEP is appended in Volume III to this ESIA. The SEP outlines planned ongoing stakeholder engagement and implementation of the grievance mechanism throughout the construction, operation and decommissioning phases. After a summary of the guiding principles for engagement, this chapter describes the ESIA engagement activities.

5.2 Principles of stakeholder engagement

Stakeholder engagement in the ESIA phase has been conducted on the principles of respectful and meaningful dialogue outlined in the SEP (refer to Volume III). The consultation and disclosure activities used to inform affected communities about the Project and to inform the assessment in this ESIA have been underpinned by the principles that community engagement should be free from external manipulation, interference, coercion, and intimidation and conducted on the basis of timely, relevant, understandable and accessible information.

The ESIA phase engagement activities seek stakeholder opinions on impacts, mitigation and enhancement measures, which is highly important during an ESIA and throughout the life cycle of a Project. For the ESIA phase, emphasis has been placed on:

- Informing stakeholders about the proposed Project and discussing the ESIA
- Providing engagement opportunities to confirm that the benefits of the Project are maximised and that no potential major impacts have been overlooked
- Obtaining local knowledge to inform the ESIA process
- Reducing conflict through identifications of contentious issues and finding acceptable solutions
- Creating a sense of Project ownership or involvement in the minds of stakeholders
- Identifying issues of concern to stakeholders so these can be addressed appropriately within the ESIA process
- Managing expectations and misconceptions regarding the Project
- Verifying the significance of environmental, social and health impacts identified
- Informing the process of developing appropriate mitigation measures
- Providing an opportunity for those otherwise unrepresented to present their views and values, therefore allowing more sensitive consideration of mitigation measures and trade-offs

5.3 Stakeholder identification and analysis

Throughout the Project to date, a database of stakeholders has been revised to include additional organizations and individuals identified which have an interest in the Project or knowledge that would provide insight into Project issues. Key stakeholders were identified through a desktop and on-site stakeholder mapping exercise undertaken as part of the scoping

phase (2024-2025) and the ESIA phase (2025) and the associated scoping phase activities and public consultation events held in October-November 2024 and February 2025 respectively. The list of affected communities including the disadvantaged and vulnerable groups has been further validated and expanded during the focus group discussions (FGDs), key informant interviews (KII) and data gathering during the ESIA. Relevant interested and affected parties for consultation have also been identified through referrals.

5.4 Stakeholder engagement

The following is the stakeholder engagement process that has been carried out as part of the ESIA by AEP, Mott MacDonald and Maneko Solutions (Mott MacDonald's local partner).

5.4.1 Scoping phase disclosure and consultations

Introductory individual and group meetings were conducted by the Project proponent and its ESIA Consultants in October-November 2024, and two scoping phase public consultation events were organised in February 2025 (in Stip Municipality and Buchim village) to gather opinions on key issues and to confirm the terms of reference for the detailed ESIA and proposed assessment methodologies. During this phase the main stakeholders were governmental, NGO and local community members.

Table 5.1 below presents the meetings held with stakeholders during the ESIA scoping phase from October 2024 to February 2025, the Project information disclosed, and main topics discussed. Key documents and information disclosed to inform the scoping phase consultations have included:

- The Project brochure in English, Macedonian and Turkish, which was disclosed online from 13 January 2025 and in hard copy from 5 February 2025.
- The ESIA scoping report which was disclosed online from 21 January 2025 in English and Macedonian , prior to the meetings held in February 2025 to discuss its contents. The scoping report was also disclosed in hard copy on 5 February 2025.
- A presentation was delivered in Macedonian language during the scoping report public meetings held on 5 February 2025.

Table 5.1: Stakeholder engagement for the ESIA scoping phase

Date	Location	Description of meeting	Stakeholders met	Topics discussed
25 June 2024	Skopje	Official announcement and introduction of the Project at national level	Representatives of the Prime Minister, Ministry of Energy and Mayors of Stip and Radovic Municipalities.	• Project as a whole and renewable energy Projects
16 October 2024	Shashavarlija village, Stip Municipality	Ad hoc interview	Village representative	• General discussion about the Project, issues related to their way of life in the village, infrastructure needs, problems, and aspirations. Contacts shared and communication channels opened.
16 October 2024	Buchim, Radovic Municipality	Ad hoc interviews/ discussions	Group of residents in the village square and village representatives	
17 October 2024	Stip municipality building	Meeting to introduce Project, the teams, and discuss the scope of activities	Mayor of Stip Municipality	• Explanation of the various stages of the Project starting from the scoping phase, its purpose, activities to be undertaken, eventual public disclosure and upcoming activities as part of the ESIA.

Date	Location	Description of meeting	Stakeholders met	Topics discussed
				• Contact information was exchanged, and lines of communication were opened. • Mayor had prior knowledge of the Project but not in detail, had no immediate comments nor feedback about the Project and did not express any concerns and extended his support and assistance during the ESIA process.
17 October 2024	Ljuboten village	Ad hoc meeting whilst carrying out site walkover	Two local residents and a local homeowner	• General discussion about the Project, issues related to their way of life in the village, infrastructure needs, problems, and aspirations. Contacts shared and communication channels opened.
18 October 2024	Ministry of Transport , Skopje	Meeting to introduce Project, the teams, and discuss the scope of activities	Ministry of Transport	• Explanation of the various stages of the Project starting from the scoping phase, its purpose, activities to be undertaken, eventual public disclosure and upcoming activities as part of the ESIA. • Contact information was exchanged, and lines of communication were opened. • Discussion was held in regards of urban planning requirements and potential new set of updates to the urban planning applications – which is standard every ten years. • The MT has been previously contacted in relation to the Project, however the MT staff we engaged appeared not to have previous knowledge of the Project. The MT had no specific feedback nor expressed any concerns and extended their cooperation in the process.
27 Nov-ember 2024	City of Radovic	Meeting to introduce Project, the teams, and discuss the scope of activities	Municipality of Radovic	• Meeting with representatives from the municipality (head of urban planning department and the secretary of the municipality). • This meeting intended to familiarize the representatives of the municipality about the progress of the Project development process and to establish stronger relationship with his administration for the Project needs in relation to information disclosure channels, processes and assistance, as well as cooperation during permitting process and later construction and operation of the planned Project.
27 Nov-ember 2024	Village of Karbinci	Meeting to introduce Project, the teams, and discuss the scope of activities	Municipality of Karbinci	• Meeting with the Mayor of the municipality and head of urban planning department. • This meeting intended to familiarize the mayor of the municipality of Karbinci about the progress of the Project development process and to establish stronger relationship with his administration for the Project needs in relation to information disclosure channels, processes and assistance, as well as cooperation during permitting process and later construction and operation of the planned Project.
5 February 2025	Village of Buchim	**ESIA scoping phase public consultation meeting** Discussion following	Directly affected communities	• AEP and its consultants provided an overview of the Project and its objectives, explained the ESIA process and key findings of the scoping report.

Date	Location	Description of meeting	Stakeholders met	Topics discussed
		disclosure of scoping report in January 2025 to gather stakeholder feedback and address concerns on contents of ESIA scoping report		• Stakeholders asked about positive and negative effects of the turbines, specific locations and numbers of turbines in relation to Buchim. • Stakeholders asked if construction permits have been issued yet. • Some stakeholders raised concerns about the potential environmental impact, including biodiversity, noise, and land use. • There were requests for support to obtain potable water, sports facilities and electricity supply • Questions were raised regarding the Project's impact on local communities, particularly related to health, safety, livelihoods, land acquisition and employment opportunities. Stakeholders welcomed the information provided about the importance of fair compensation and transparent communication and emphasised the need for continued dialogue to ensure these concerns are properly addressed. • The grievance mechanism was outlined as the way for stakeholders to voice concerns or provide input. While stakeholders appreciated the introduction of a grievance mechanism, they requested additional clarity on how complaints would be addressed and how their concerns would be tracked.
5 February 2025	City of Stip	**ESIA scoping phase public consultation meeting** Discussion following disclosure of scoping report in January 2025 to gather stakeholder feedback and address concerns on contents of ESIA scoping report	Local institutions from Stip, Radovic and Karbinci NGOs Government bodies Business Sector	• AEP and its consultants provided an overview of the Project and its objectives, explained the ESIA process and key findings of the scoping report. • Stakeholders asked about land acquisition and whether it has started yet, as well as potential for conflicts with mineral extraction. • There was a question about the status of the national EIA and international ESIA process. • A stakeholder asked whether the Municipality of Stip was an investor in the Project. • Biodiversity and presence of black vultures was raised, and potential for collision of birds with WTGs was highlighted with a question about whether the WTGs can anticipate and prevent such collisions. • Distance of WTGs to villages/houses and length of cables necessary were discussed.

Source: ESIA scoping report, Mott MacDonald, January 2025, and AEP

Table 5.2 below outlines key issues raised during the scoping phase public consultation meetings. All topics were responded to live during the meetings, with the exception of bird monitoring which was responded to by email afterwards. Table 5.2 indicates where issues raised have been addressed in the ESIA. There were no further written comments provided by stakeholders at the end of the meetings.

Table 5.2: Summary of issues raised during the scoping phase public consultation meetings, and how issues raised have been addressed in the ESIA

Topics of the issues raised	Issues raised during scoping phase consultations	Relevant meeting where issue was raised	How issues have been addressed in the ESIA and supporting documentation
Effects of the wind turbines	Stakeholders were interested in learning more about positive and negative effects of the wind turbines.	Buchim, 5 February 2025	The NTS presents the ESIA findings in a simple manner to help the general public to understand the Project. The public consultation on the draft ESIA explained the findings of the ESIA in detail and gave opportunities to gain a deeper understanding of impacts and share local knowledge to improve mitigation measures.
Location of the turbines and associated facilities	Desire to know exact locations of the turbines. Confirmation of the distance from the wind turbines to the nearest settlements was requested. Questions were asked about the length of cables necessary for the Project.	Buchim and Stip, 5 February 2025	Chapter 2 of the ESIA contains mapping showing locations of the WTGs.
Land resettlement/ land acquisition	Questions around what will happen to the families who are displaced due to the turbines. Whether the land acquisition has taken place and the compensation process for private land owners.	Buchim and Stip, 5 February 2025	During the scoping phase meetings it was explained that there will not be physical displacement. The LRP provides considerable detail on entitlements for people affected by land acquisition
Community health and safety	Questions around any health impacts and dangers to people due to lightning. There was a request for the Project to help obtain potable drinking water in the village of Buchim.	Buchim, 5 February 2025	The social impact assessment discusses community health and safety issues, see Chapter 7 of the ESIA. Social Development and Investment Plan will be developed AEP but the contents of this is yet to be established.
Employment opportunities	There was interest in whether the Project would have employment opportunities.	Buchim, 5 February 2025	The social impact assessment discusses employment and Contractors are required to hire locally where possible, see Chapter 7 of the ESIA.
Biodiversity (birds)	Concerns were raised over biodiversity, specifically black vultures which are in the Project area. Concerns were raised over whether the wind turbines will have a system installed to anticipate collision with birds.	Stip, 5 February 2025	Following the scoping consultation a question was asked by an interested party in relation to why avifauna monitoring is planned for 12 months instead of 24. AEP and Mott MacDonald replied to the query providing a justification regarding the planned survey durations. The full reply is shown in Appendix C[1].
Source of Project funding	Questions around any investment from the municipality of Stip were raised and the Project conveyed that it was independent and is	Stip, 5 February 2025	Project finance is still being arranged (as of January 2026) but announcements will be made regarding lenders' decision to finance in due course (as per the programme in Section 6 of this SEP).

[1] AEP also arranged a follow-up meeting with Macedonian Ecological Society on 7 October 2025, to hear their expert opinion and insights regarding the project. A brief project update was also provided.

Topics of the issues raised	Issues raised during scoping phase consultations	Relevant meeting where issue was raised	How issues have been addressed in the ESIA and supporting documentation
	supported by international funding.		
Project grievance mechanism	The grievance mechanism was outlined as the way for stakeholders to voice concerns or provide input. While stakeholders appreciated the introduction of a grievance mechanism, they requested additional clarity on how complaints would be addressed and how their concerns would be tracked.	Buchim, 5 February 2025	The SEP provides detail on the grievance mechanism in use for the Project.
Noise	Some stakeholders raised concerns about the potential noise impacts. They requested further details on mitigation measures.	Buchim, 5 February 2025	Chapter 10 of the ESIA addresses the issues of noise and vibration.

Source: Minutes of scoping phase public meetings

5.4.2 Stakeholder engagement for preparation of the ESIA

This subsection provides a summary of key engagement activities carried out to aid the preparation of the ESIA. Focus groups discussions (FGDs) and key informant interviews (KIIs) were carried out to gather information about the social baseline and impacts, as well as to give participants the opportunity to voice their concerns and hopes for the Project.

The Project stakeholder engagement log shows key communications and engagements undertaken by the Project since November 2024.

ESIA FGDs and KIIs

During the ESIA preparation phase, key informant interviews (KII) and FGDs were conducted by Maneko Solutions (Mott MacDonald's subconsultant) with people from affected communities, these are summarised in Table 5.3. The meetings were used to inform attendees about the Project and to gather information for the social baseline.

Table 5.3: ESIA FGDs and KIIs

Date (2025)	Location	Activity	Stakeholders	Number of attendees
12-13 April	Buchim, Radovic	FGD	Female residents	9
12-13 April	Buchim, Radovic	FGD	Male farmers	10
13 April	Shashavarlija, Stip	FGD	Local residents, male and female	11 men, 2 women, 13 total
12 May	Golem Gaber, Karbinci	KII	Local resident	1 man
12 May	Ljuboten and Baltalija, Stip	KII	Local resident	4 men
12 May	Nikoman and Shashavarlija Stip	KII	Local resident	1 man
12 May	Dolani, Stip	KII	Local resident	3 men

Date (2025)	Location	Activity	Stakeholders	Number of attendees
12 May	Buchim, Radovic	KII	Religious representative (Imam)	1 man

Source: Maneko Solutions

During the FGDs conducted for the ESIA, respondents were keenly interested in the Project and asked questions about the following topics:

- Vicinity of WTGs to their property and whether their property will be affected
- Compensation for the property losses
- Possibility for fencing of swathes of Project land to inhibit access
- Fencing of construction sites for safety of children
- The Project scope of works and turbine locations
- Whether there will be jobs for residents of the villages, and how local jobseekers can get hired when the Project starts
- Road access and further degradation of the road surface by construction traffic
- Traffic safety and limiting the speed of Project vehicles through the area
- Access to drinking water
- Noise and dust

This list of concerns will help to frame the information presented to interested and affected parties during the draft ESIA consultation events.

Stakeholder engagement for the LRP

To ensure transparent and inclusive consultation and disclosure engagement during the preparation of the LRP, a series of consultation and disclosure activities were conducted. All activities are documented in the stakeholder engagement log and described in detail in the LRP, section 10 and the discussions considered in the LRP and ESIA socioeconomic baseline. Disclosure to affected landowners, land users, municipal authorities, and other relevant institutions was primarily carried out through formal letters, e-mails, text messages, or phone calls. The LRP team was provided with a frequently asked questions (FAQs) document and an LRP brochure to support communication with landowners and land users during the surveys. All disclosure materials included clear contact information for the Project's environmental and social specialists, so that stakeholders could seek further information or arrange meetings as needed. All materials were translated to Macedonian and, when required by stakeholders, to Turkish.

The LRP team conducted a comprehensive socioeconomic census survey targeting 139 affected landowners between 30 July and 12 December 2025. This survey with landowners was primarily conducted in person and achieved a strong participation rate. Out of the 118 landowners targeted, 96 completed the survey, representing 81% participation among those eligible.

Additionally, the LRP team conducted 13 KIIs and eight FGDs. The data collected during these surveys provided valuable insight into the existing livelihood activities, challenges, and opportunities within the Project area, and have established a basis for ongoing collaboration and engagement with stakeholders as the LRP process moves forward.

Disclosure of Project information

As mentioned above, the scoping report and a presentation during scoping phase public consultation meetings have been disclosed as well as the Project brochure during January-February 2025.

The land acquisition and resettlement policy framework was shared online in English from 28 July 2025 onwards. An LRP-specific brochure was disclosed online and in hard copy in Macedonian, Turkish and English during LRP census surveys between July 2025 and December 2025, as well as during KIIs and FGDs for the LRP from September to October 2025.

Further efforts to disclose the Project brochure to affected communities were undertaken in December 2025, when the villages of Shashavarlija, Ljuboten, Baltalija, Buchim and Damjan were visited in person to distribute hard copies.

Cultural heritage related engagement during ESIA

AEP has conducted an in-person meeting in May 2025 with the Institute for the Protection of Cultural Monuments and the Museum of Stip regarding potential sites of cultural heritage in the AoI. Following this engagement, the Project has agreed specific mitigations which are detailed in the ESIA.

Consultation between AEP and affected communities is ongoing and Project staff visited Buchim in October 2025 to discuss and consider options to address community concerns and mitigate any impacts associated with WTG 28. An open discussion addressed stakeholder concerns, including their traditional celebrations near the WTG location, and explored possible mitigation measures during construction and operational activities on the significant date. The Project footprint does not impact the specific location of the fountain and festivities, measures will be implemented during construction to ensure no impact, and WTG 28 will be curtailed on the 6 May annually.

ESIA public consultation events

Four public meetings to be held – one in Stip municipality building, one in Radovis municipality building, one in the Project AoI in Shashavarlija village in Macedonian language and one in Buchim village (Radovic Municipality) in Turkish language.

These locations are strategically located and evenly spaced to include as many people as possible and to hold a meeting in Turkish language for Turkish speakers of Buchim. Minibuses will be arranged to enable all those who wish to attend to do so (including vulnerable and non-vulnerable people from affected villages outside of Shashavarlija and Buchim where the meetings will be held). People will be informed as to the transport arrangements.

People from Shashavarlija, Nikoman, Kalapetrovci and Koshevo are likely to attend the Shashavarlija meeting. Buchim residents will attend the meeting in Buchim. And people from the remaining affected villages will attend the meetings in their respective municipality buildings.

Municipality buildings will be used for the meetings since they have large rooms, toilets, Projector facilities and are accessible for people with disabilities. In the village meetings, ground floor schoolrooms will be used where there are toilets, access for people with disabilities, Projector facilities and the largest rooms available within the villages.

The following will be presented during the meetings, at minimum:

- Presentation on the methodology and findings of the ESIA, impacts and where no/negligible impact has been identified[2]

[2] Specifically to respond to previous stakeholder concerns such as potential for impacts to bees and livestock

- Mitigation and management measures committed to by AEP, for consideration and comment by stakeholders.
- Key issues identified by affected communities.
- Time for questions and answers.

6 ESIA process and assessment criteria

Issue and Revision Record

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6 ESIA process and assessment criteria

6.1 Overview

This chapter outlines the overall process adopted to undertake the Environmental and Social Impact Assessment (ESIA) and describes the general assessment criteria used to identify, predict, evaluate, and manage the potential environmental and social impacts associated with the Project across its lifecycle, including construction, operation, and, where relevant, decommissioning.

Details of data collection, baselines, surveys, assumptions and limitation, assessment methodology for impact evaluation are described in detail in each individual chapter. The methodology for impact evaluation described in this chapter has been developed in accordance with applicable standards as presented in Chapter 4 and is further described and tailored in each individual chapter to align with the specific requirement of the assessment.

This Environmental and Social Impact Assessment package is comprised of the following volumes:

- Volume I: Non-technical summary (NTS)
- Volume II: ESIA main report (this volume)
- Volume III: Stakeholder Engagement Plan (SEP)
- Volume IV: Framework E&S management plan (ESMP)
- Volume V: Technical appendices
- Volume VI: Livelihood Restoration Plan (LRP)

6.2 ESIA structure and approach

6.2.1 Volume I: Non-technical summary (NTS) / executive summary

An NTS / executive summary has been produced and will be used for consultation purposes and translated into Macedonian and Turkish (as per Scoping consultation activities). It provides a high-level overview for lay readers identifying the scope and nature of the project, predicted E&S impacts and the proposed management and mitigation measures. The NTS will be used as a tool to aid consultation and information disclosure.

6.2.2 Volume II: ESIA main report

The assessment of effects and identification of residual significance will take account of any incorporated mitigation measures adopted by the project and will be largely dependent on the extent and duration of change, the number of people or size of the resource affected and their sensitivity to the change.

The criteria for determining significance are specific to each environmental and social aspect but generally for each impact the magnitude is defined (quantitatively where possible) and the sensitivity of the receptor is defined. Generic criteria for defining magnitude and sensitivity are summarised below, however depending on each individual chapter these criteria may be modified to assess the specificity of the impacts and magnitudes of each area.

6.2.3 Assessment criteria

This section presents summaries of the indicative assessment criteria implemented during the ESIA phase, however further details and refinements of these criteria are found in each individual chapter.

Magnitude

The assessment of magnitude is undertaken in two steps. Firstly, the magnitude of potential impacts associated with the Project have been categorised as beneficial or adverse.

Secondly, the beneficial or adverse impacts have been categorised as major, moderate, minor or negligible based on consideration of the parameters such as:

- Duration of the impact ‐ ranging from beyond decommissioning to temporary with no detectable impact
- Spatial extent of the impact ‐ for instance, within the site, boundary to regional, national, and international
- Reversibility ‐ ranging from permanent requiring significant intervention to return to baseline to no change.
- Likelihood ‐ ranging from occurring regularly under typical conditions to unlikely to occur.
- Compliance with legal standards and established professional criteria ‐ ranging from substantially exceeds national standards and limits / international guidance to meets or exceeds minimum standards or international guidance.

Table 6.1 provides an example of generic criteria applied for determining magnitude.

Table 6.1: Criteria for determining magnitude

Magnitude (Beneficial or Adverse)	Description
Major	Fundamental change to the specific conditions assessed resulting in long term or permanent change, typically widespread in nature, and requiring significant intervention to return to baseline; exceeds national standards and limits.
Moderate	Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change.
Minor	Detectable but minor change to the specific condition assessed.
Negligible	No perceptible change to the specific condition assessed.

Sensitivity

Sensitivity is generally site specific and relevant criteria have been developed from the baseline information gathered. The sensitivity of a receptor is determined based on the review of the population (including proximity / numbers / vulnerability), presence of biological features of the site and the surrounding area, soil, agricultural suitability, environmental features or any archaeological features etc. Generic criteria for determining sensitivity of receptors are outlined in Table 6.2.

Each detailed assessment will define sensitivity in relation to their topic.

Table 6.2: Criteria for determining sensitivity

Sensitivity	Definition (considers duration of the impact, spatial extent, reversibility and ability of comply with legislation)
High	Vulnerable receptor with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.

Sensitivity	Definition (considers duration of the impact, spatial extent, reversibility and ability of comply with legislation)
Medium	Vulnerable receptor with little or no capacity to absorb proposed changes or limited opportunities for mitigation.
Low	Vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation
Negligible	Vulnerable receptor with good capacity to absorb proposed changes or and good opportunities for mitigation

Impact evaluation and determination of significance

Impacts will be identified, and significance will be attributed taking into account the interaction between magnitude criteria and sensitivity criteria as presented in the significance matrix in Figure 6.1.

Figure 6.1: Determining significance matrix

Sensitivity	Magnitude							
		Adverse			Negligible	*Beneficial*		
		Major	Moderate	Minor		Minor	Moderate	Major
	High	Major	Major	Moderate	Negligible	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Negligible	Minor	Moderate	Major
	Low	Moderate	Minor	Negligible	Negligible	Negligible	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

6.2.3.1 Mitigation and enhancement measures

Where feasible the following hierarchy of mitigation measures will be applied:

- Avoid and reduce through design and engineering solutions (embedded mitigation).
- Abate impacts at source or at receptor.
- Repair, restore or reinstate to address temporary construction impacts.
- Compensation for loss or damage, such as replacement planting elsewhere.

In addition to the above, community engagement and disclosure activities play a key role in managing the extent of impacts and consideration shall be given to identification of enhancement measures. Enhancement measures are actions and processes that:

- Create new positive impacts or benefits.
- Increase the reach or number of positive impacts or benefits.
- Distribute positive impacts or benefits more equitably.

6.2.3.2 Residual impacts

Residual impacts are those impacts that remain after the application of mitigation and enhancement measures. For each aspect, the significance of impacts will be discussed before and after mitigation (i.e. residual impact). Impacts that have been evaluated as being ‘Moderate’ or ‘Major’ are classified as significant effects. Consequently, impacts that are ‘Minor’ or ‘Negligible’ are not significant.

Following the identification of mitigation, the significance of an impact is reviewed using the appropriate sensitivity and magnitude criteria (which may have altered as a result of the mitigation being applied) to determine the residual significance. Where appropriate, monitoring

will be implemented to evaluate if further mitigation will be required, and appropriate corrective actions implemented.

6.2.3.3 Uncertainties and limitations

Any uncertainties associated with impact prediction or the sensitivity of receptors due to the absence of data or other limitations is explicitly stated in each individual chapter. Where applicable, the ESIA will recommend measures, including monitoring or environmental and social management plans, to address and manage uncertainties.

6.2.4 Volume III: Stakeholder Engagement Plan (SEP)

The SEP outlines the disclosure and meaningful consultation activities to be carried out by the Project with affected and interested parties throughout the construction, operations and decommissioning phases of the Project. The SEP is developed as part of the ESIA for the Project, based on the Project Proponent procedure and principles and on the international standards to which the Project is aligned.

The SEP will be implemented as part of an Environmental and Social Management Plan (ESMP) that acts to mitigate and manage environmental and social risks and impacts throughout the construction and operation phases of the Project. The SEP is to be used as a live document and updated at key points in the Project lifecycle to ensure planned engagement is appropriate to the Project phase and to reflect any changes in the contextual conditions.

The structure of this SEP is as follows:

- Chapter 1: Introduction
- Chapter 2: Project description
- Chapter 3: National regulatory and international requirements for stakeholder engagement
- Chapter 4: Stakeholder identification and analysis
- Chapter 5: Summary of previous stakeholder engagement
- Chapter 6: Stakeholder engagement programme and responsibilities
- Chapter 7: Community grievance mechanism
- Chapter 8: Monitoring and reporting
- Chapter 9: Company contacts and information

6.2.5 Volume IV: Framework environmental and social management and plan (ESMPs) for construction and operation phases

The framework ESMPs is produced based on the findings of the ESIA which collates the mitigation and management requirements identified through the ESIA process.

The primary aim of formulating and implementing the ESMPs (for construction and operation) is to safeguard the environment, site staff and the local population against site activity which may cause harm or nuisance. The ESMP forms the basis of environmental and social protection provided to support delivery of environment, health and safety (EHS) performance in accordance with international standards and best practice. The ESMPs guides the main BOP Contractor’s production of more detailed management plans based on their specific scopes of work. For example, the contractor will typically be required to develop subplans such as an occupational health and safety plan, waste management plan, and traffic management plan.

For the purposes of the framework ESMP, “management” will be the control or mitigation measures and procedures required in managing key environmental and social effects, impacts and risks, and “monitoring” will be defined as monitoring, measurement, site inspection and

audits frequencies. The framework ESMP has been produced in accordance with international standards.

The framework ESMP will:

- Contain a description of proposed mitigation measures identified in the ESIA, including their estimated resources, timing and implementation arrangement.
- Define of responsibilities of parties in implementing the proposed mitigation measures and monitoring and evaluation. This includes identifying the site-specific management plans which will need to be developed by the BOP Contractor prior to construction and also those required during operation.
- Describe the standards, guidelines and legal requirements that should be adopted during the construction and operational phases.

The ESMPs will include appropriate management measures to protect labour rights and ensure safe working conditions, for instance, safeguard measures and recommendations related to recruitment, terms and conditions, code of conduct, occupational health and safety and labour among others.

6.2.6 Volume V: Technical appendices

Supporting documents, baseline information, and previous assessments used to support the ESIA are presented in Volume V of the ESIA.

6.2.7 Volume VI: Livelihood restoration plan

As part of the ESIA, a Livelihood Restoration Plan has been prepared and is part of the ESIA. The main objective of the LRP is to restore Project affected people (PAPs) standard of living to the pre-project levels and preferably improve their socioeconomic conditions. The scope of the LRP covers the following PAPs:

- Private landowners of plots affected by economic displacement during Stip 1.
- Tenants with recognised rights (through written or oral agreements with landowners) who occupy private land plots affected by Stip 1.
- Informal land users across the privately owned land plots affected by Stip 1.
- Concession holders of government-owned plots affected by Stip 1, 2 and 3.
- Informal land users of government-owned land plots affected by affected by Stip 1, 2 and 3.

The LRP should be considered a living document, subject to updates and refinements throughout the development and implementation of the resettlement process. The LRP is structured as follows:

- Part A LRP requirements and scope: details the purpose of the document, describes the Project and its components, presents the national and international regulations and standards that are applicable to the Project that this LRP is designed to meet, and the methodology for the LRP preparation.
- Part B Livelihood baseline: presents the findings of the socioeconomic surveys undertaken as part of the LRP preparation process. The surveys was used to provide a socioeconomic baseline profile of the affected people and communities.
- Part C Livelihood policy and entitlements: details the Project’s livelihood policy commitments and entitlements that will be provided to PAPs. The approach to implementation is described including institutional arrangements, consultation activities, monitoring, timeline and budget.

7 Socio-economic and cultural

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7 Socio-economic and cultural

7.1 Overview

This chapter presents the potential socio-economic and cultural heritage impacts associated with each phase of the Project. It is informed by outcomes of meetings and data gathering activities as detailed in section 7.2.6.4. It is based on current understanding of the socioeconomic and cultural baseline of the Project which is presented in section 7.3. Corresponding management, mitigation and benefit enhancement measures have been designed to reduce the significance of residual impacts to minor or negligible levels, and to maximise the benefits of the Project to the neighbouring and directly affected communities. The mitigation measures have been integrated into the environmental and social management plan (ESMP), which is contained within Volume 3 of this ESIA.

7.1.1 Study area and area of influence (AoI)

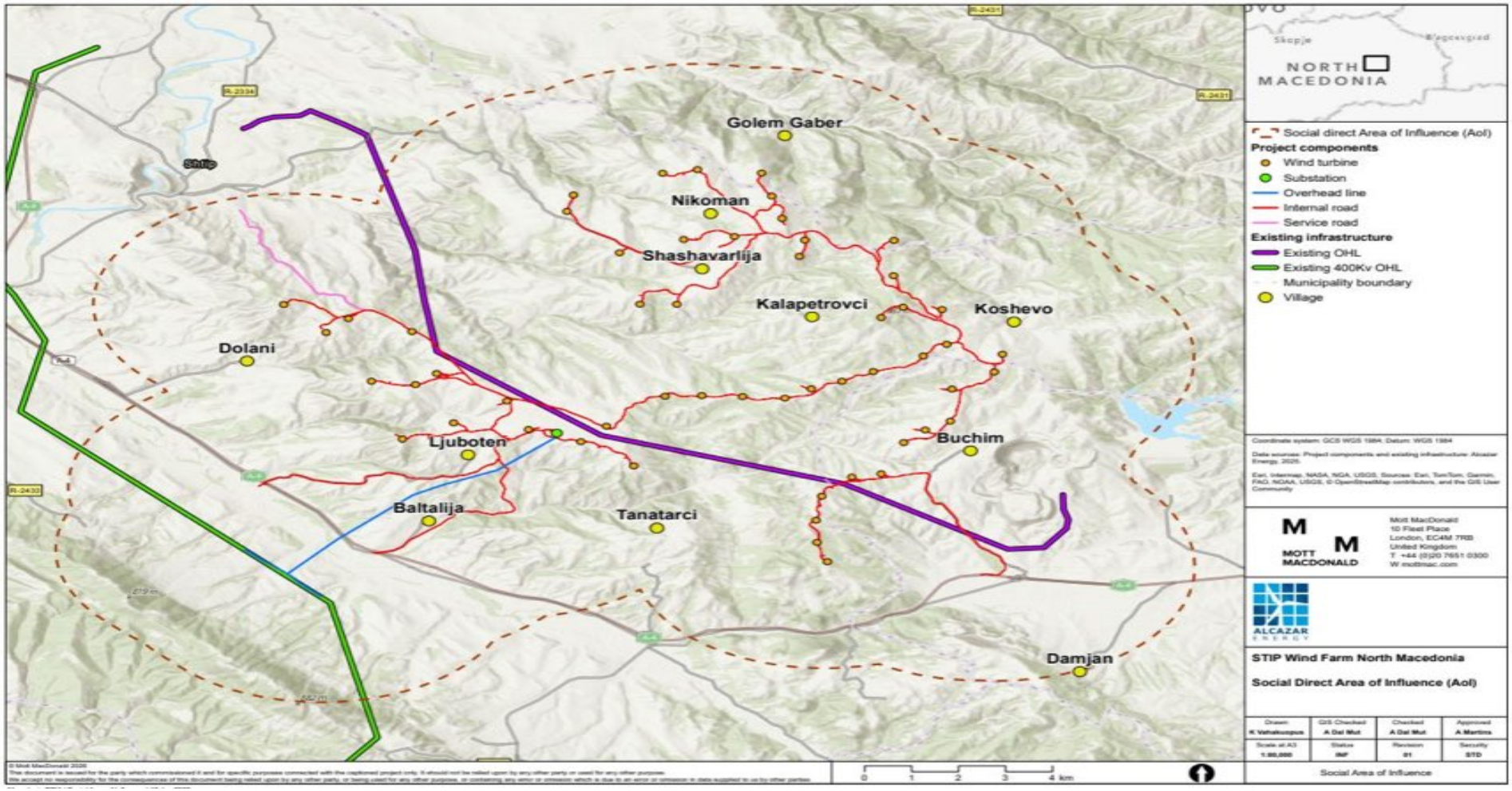
The direct AoI includes the Project footprint and within a 3km radius of all Project features, the villages where landowners and users predominantly live, and where the Project workers will be housed.

Eleven villages[1] have been identified within 3km of the key Project components (WTGs, the meteorological mast towers, internal roads, substation and OHL), within the municipality of Stip – Baltalija, Nikoman, Shashavarlija, Dolani, Ljuboten, Kalapetrovci, Koshevo, Tanatarci; within the municipality of Karbinci - Golem Gaber; within the municipality of Radovic - Buchim and Damjan. Buchim and Damjan are the largest two villages with populations of 260 and 585 respectively.

The closest villages to the Project components are Ljuboten, Shashavarlija, Buchim, Baltalija and Nikoman.

[1] Chflik village in Stip Muncipality was identified as one of twelve villages in the Scoping Report's definition of the AoI, but it has since been identified as being abandoned, as so is no longer listed as an AoI village. The villages of Lipov Dol and Shopur are also abandoned villages within 3km of the Project features but excluded from the AoI as no-one lives there.

Figure 7.1: Map of the social direct AoI and affected villages



Source: Mott MacDonald, using Free GIS Maps of North Macedonia - Resources | Simplemaps.com

The communities in and around the Project's AoI can be separated into those that will be directly affected and those indirectly affected. People who will be directly affected include:

- Formal landowners, formal users and informal users of land plots required for Project infrastructure.
- People living, working and farming within proximity to WTGs and users of public infrastructure potentially affected by noise, shadow flicker, blade/ice throw, electromagnetic interference or visual impacts.
- Residents of villages and road users where Project transportation will need to pass, including pedestrians and cyclists.
- Project workers (contracted and sub-contracted, construction and operation), and prospective workers, male and female.
- Residents living in neighbourhoods where non-local workers are staying.
- People continuing to use land adjacent to Project features.
- Local goods and service providers.
- Recreational land users.

Those who may be indirectly affected include residents of the wider municipalities where the Project is located (Radovic, Stip and Karbinci) and the country as a whole, and some who may gain indirect or supply chain employment during construction and/or operations. When considering human rights, wider supply chain workers and affected communities may also be located within the continent of Europe or globally. Other affected people and stakeholders have been identified during detailed ESIA baseline studies and will continue to be identified during ongoing Project consultation.

7.1.2 Assessment timeframe and Project duration

The construction of Stip 1 is expected to last for approximately 24 months. The construction of Stip 2 and Stip 3 will follow, partly in parallel and partly afterwards, overlapping with Stip 1 at some point during the construction period. For full details regarding the Project timeframes, see section 2.3 of the ESIA. The Project is expected to remain operational for 25 to 30 years.

7.2 Methodology

7.2.1 Baseline data collection

Primary and secondary data were collected for the direct and indirect AoI during the scoping and main ESIA phases.

Primary data used for the socio-economic baseline were collected mainly through the following activities:

- ESIA scoping site visit with walkover, observations, ad hoc interviews and stakeholder meetings with key governmental and community representatives in October 2024
- Outcomes from the ESIA scoping public hearings held in February 2025
- Three focus groups discussions (FGDs) with affected communities in the direct AoI covering men, women and farmers
- Five key informant interviews (KIIs) with village representatives (May 2025)
- Eight FGDs with affected communities about land use and affected livelihoods on publicly owned land needed for the Project as part of the livelihood restoration plan (LRP) fieldwork
- Thirteen KIIs with service providers and local authorities about livelihood restoration activities as part of the LRP fieldwork

- Site walkover of Project affected land as part of the LRP fieldwork: a comprehensive seven-day walkover was conducted across the Project area between 9 and 19 September 2025. The walkover covered most of the area designated for Project components and extended over approximately 57 km. The purpose of the walkover was to identify land use patterns and land users.

7.2.1.1 Focus group discussions

Due to the limited number of people living in the settlements in the direct AoI, FGDs were held in two of the largest villages: Buchim and Shasharvalija (400 and 79 residents respectively, as shown in Table 7.7). Damjan with a population of 175 people is also among the three villages with the largest populations, however it is at the outskirts of the Project AoI (2km away from Project features).

The process of organising meetings and interviews with stakeholders was complex and directly involved nine individuals at Maneko Solutions. Contact details of the required participants were obtained in direct communication with their colleagues, friends or relatives. Once the contact details were obtained, direct invitation for participation to the meeting was communicated with the requested people. In addition, the FGD (and KII – see section 7.2.1.2 below) specialists were experienced professionals, and they additionally engaged in identifying FGD/KII participants for each sequential event in cooperation with the core Consultant's team. Once the potential FGD participants were identified and their contact data were obtained, they were invited to take part directly by phone. It is estimated that half of the communicated stakeholders accepted taking part in the FGDs.

Specific efforts were made to organise the FGD with women of Turkish ethnic origin living in village of Buchim. Housewives, single mothers, farmers and employed women participated in the women's FGD. Vulnerable groups were partially involved since very elderly people were not willing to participate and the poorer farmers were generally focused on the livelihood provision activities.

The FGDs included an introduction to the Project and gaining of participants' consent to take part. It was explained to participants that their names would not be disclosed in reporting and that they should not repeat the views of others outside of the meeting room. The FGDs were conducted by a female surveyor and in Buchim, where most of the residents are Turkish, FGDs were supported by a Turkish/Macedonian translator. FGDs were held in local schools so that accommodations could be made for persons with disabilities.

Topic areas for discussion during the FGDs included:

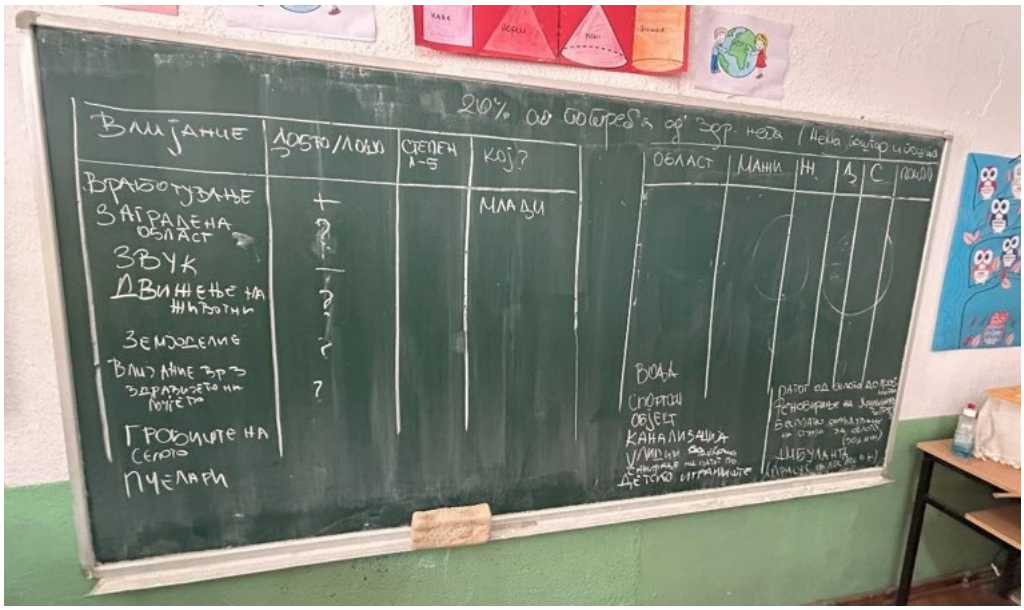
- Expected impacts of the Project and whether women or other groups might be affected differently
- Typical economic activities and any anticipated changes to livelihoods
- Ideas to maximise benefits
- Responsibilities for various household members
- Vulnerable groups
- Opportunities/barriers to income or resources
- Cultural norms

Figure 7.2 and Figure 7.3 show participants in the women's focus group in Buchim and the outcome of one of the discussion topics about anticipated impacts.

Figure 7.2: FGD with women in Buchim village, 12 April 2025

Source: Maneko Solutions

Figure 7.3: Outcomes of FGDs written for particpants to view and discuss



Source: Maneko Solutions

During the SIA FGD meetings (but also in the LRP surveys), moderators were given significant number of hard copies of the Project brochure in Macedonian, Turkish and English language, so each participant could choose what language version to take. Digital version was also an option that was voiced at the meetings, but due to the presence of hard copies, there was insignificant interest for obtaining a digital example. Just one of the participants asked for a digital version of the brochure in Macedonian language to be delivered to his email address.

The social baseline reports on the views of FGD (and KII) participants about the Project as well as their concerns and hopes. During the meetings participants were informed that all concerns, comments, and requests raised will be documented as part of the consultation process. It was explained that inputs will be incorporated into the ESIA and the issues raised are identified in the social baseline. Requests related to the community development needs (such as improvements to water supply, electricity, roads or other local infrastructure) were acknowledged and recorded. Stakeholders were informed that while such requests may be outside the scope of the Project, they are assessed in terms of potential linkages, impacts, and opportunities for mitigation measures or enhancement actions where relevant.

It was clarified to the stakeholders that the ESIA serves as the primary instrument for identifying, assessing, and addressing stakeholder concerns, and that outcomes of that assessment will guide the ESMP and the future engagement activities. In addition, stakeholders were made aware that documenting the event with their requests does not automatically guarantee they will get what they expect, but that all options and necessities must be properly examined prior to taking actions to meet these requests. Thus, it was emphasised that the representatives of the local communities (villages and the respective municipality administration) must work closely with the investor in order to create shared benefit.

During ongoing communication with stakeholders, especially residents of settlements within the AoI, care was taken to avoid creating unrealistic expectations or false hopes about the Project. The Project stakeholder engagement plan (SEP) highlights the concerns and hopes raised and suggests that they are addressed to stakeholders during the ESIA disclosure process.

All formal meetings produced written trails in form of reports or minutes of meetings, where the stakeholders' concerns, comments and requests were recorded, along with the attendance sheets.

7.2.1.2 Key informant interviews

KIIs were held with representatives of local villages located near the proposed turbine sites and in the direct AoI with people from Golem Gaber, Ljuboten, Baltalija, Nikoman, Shashavarlija, Dolani and Buchim. These interviews formed an essential component of the information gathering strategy and aimed to ensure that the voices of those most directly affected by the Project are heard and considered from the early planning stages.

Key informants were selected from the nearest villages for interview based on their roles within the community and their familiarity with local issues. These included representatives of village council members, community leaders, heads of local associations, and other individuals recognized for their active involvement in village affairs. Selection criteria also took into account the geographic distribution of villages relative to the planned turbine sites to ensure a balanced representation across the Project area.

Once the potential KII participants were identified and their contact data were obtained, they were invited to take part directly by phone. Only two people rejected participation in KII interviews.

Five KIIs were conducted on 12 May 2025 in the respective villages. In the interview with representatives from Ljuboten and Baltalija village, which was held in the village of Ljuboten, additional residents from these villages arrived and also gave contributions to the discussion.

The purpose of the KIIs was to gather qualitative, community-level insights on perceived impacts or concerns that may not emerge through public consultations. By engaging directly with village leaders, community elders, and locally active individuals, the Project team aimed to capture a nuanced understanding of community dynamics, expectations, and concerns, and to identify key priorities for further engagement and planning.

The contact with people for KIIs was established by phone. Contact information with the representatives of villages was received by the Stip Mayor's office representative or through visiting the village in question in the case of Golen Gaber where we were unable to contact either of the two household heads. KIIs were conducted in accessible locations and in the appropriate language for the interviewees. All interviews were conducted in person to encourage open dialogue and allow interviewers to observe non-verbal cues. A semi-structured interview guide was used to maintain consistency while allowing flexibility to explore specific topics raised by informants. Key areas of inquiry included land use and ownership, socio-economic concerns, understanding concerns and perceptions of impacts that might occur with the Project, and expectations for community benefits.

The following questions were addressed to the interviewees:

- Community context: Can you describe the main sources of livelihood and economic activities in your village?
- Awareness and perception: What have you heard so far about the proposed wind farm Project?
- Potential impacts: What concerns, if any, do people in your village have about the wind turbines being located nearby?
- Historical and social dynamics: Are there any local issues or dynamics that the Project team should understand better before moving forward?
- Cultural dynamics: Are there any cultural events and/or sacred sites in the area that the Project should be aware of?
- Expectations and opportunities: Are there specific improvements the village would prioritize if support from the Project were available?

Each interview lasted between 25 and 45 minutes. Interviews were not audio-recorded due to the insecurity of the people for the purpose of the interview but supplemented with handwritten notes to ensure accuracy and completeness of information. All informants were informed of the purpose of the interview, how the information would be used, and their right to decline to answer any questions or withdraw at any time. Guarantee of anonymity and confidentiality was expressed and discussed with all interviewees. Interviews were conducted in Macedonian language by trained field researcher's familiar with the cultural context and Project details.

The locations and number of attendees for the FGDs and KIIs are summarised in Table 7.1 below.

Table 7.1: FGDs and KIIs undertaken to gather social information for the ESIA

Date	Location	Activity	Stakeholders	Number of attendees
12 April	Buchim	FGD	Female residents	9 women
12 April	Buchim	FGD	Male farmers	10 men
13 April	Shashavarlija	FGD	Local residents	11 men, 2 women, 13 total
12 May	Golem Gaber	KII	Local resident, also a shepherd	1 man
12 May	Ljuboten and Baltalija	KII	Local residents	4 men
12 May	Nikoman and Shashavarlija	KII	Local resident	1 man
12 May	Dolani	KII	Local residents	3 men
12 May	Buchim	KII	Religious representative (Imam)	1 man

Source: Maneko Solutions

7.2.1.3 Secondary data

Secondary data for the direct AoI and the indirect AoI, as well as comparative national data were obtained and analysed. Secondary baseline data was collected from a range of published sources including websites and reports from government departments and organisations, civil society organisations, non-governmental organisations (NGOs) and local media. Examples of data sources include but are not limited to Project documentation, most recent census reports, government socio-economic policies and legislation, and civil society and business organisation reports. National and local level information has been drawn from a number of published sources from the Institute for Public Health of the Republic of North Macedonia, the Spatial Planning Agency, Federation of Trade Unions of North Macedonia, State Statistical office of the Republic of North Macedonia, and from international organisations such as the US Department of State Human Rights Report, World Bank Group (WBG), The Global Slavery Index, World Health Organization (WHO), United Nations Children's Fund (UNICEF) among others.

7.2.2 Sensitivity of social groups and resources

Sensitivity of social groups – namely communities, workers and businesses – has been determined by consideration of their vulnerability to impacts. This is measured by their capacity to cope with impacts that affect their access to, or control over additional or alternative social resources of a similar nature to baseline conditions, ultimately affecting their wellbeing. Sensitive or vulnerable people are generally considered to have less means to absorb and deal with adverse changes than less sensitive or less vulnerable people. Similarly, they may not be able to maximise and build on beneficial changes to their resource bases.

When considering sensitivity to social impacts the type of resources in question varies between different types of receptors. For example, a community's vulnerability has generally been measured in terms of its resilience to loss of community facilities, whereas an individual or household's vulnerability has been considered in relation to their resilience to deprivation and loss of livelihood assets or opportunities (such as jobs, productive land or natural resources). Impacts that increase impoverishment risks contribute to vulnerability. Impoverishment risks include landlessness, joblessness, homelessness, marginalisation, increased morbidity and mortality, food insecurity, loss of access to common property resources and social disarticulation. Other vulnerabilities have generally been measured in terms of community resilience to traffic nuisance and in-migration impacts, for example. Table 7.2 below presents the criteria that have been used to categorise the sensitivity of social groups.

Table 7.2: Criteria for determining receptor sensitivity

Social group sensitivity	Definition
High	An already vulnerable social group (such as individuals, households, community, settlement, business) with little or no capacity and means to absorb proposed changes and/or very little access to alternative similar sites, services or resources, and/or minimal opportunities for mitigation.
Medium	An already vulnerable social group with limited capacity and means to absorb proposed changes, with limited access to alternative similar sites, services or resources, or and/or limited opportunities for mitigation.
Low	A non-vulnerable social group with some capacity and means to absorb proposed changes, with some access to alternative similar sites, services or resources, and/or reasonable opportunities for mitigation.
Negligible	Social group with good capacity and means to absorb proposed changes and with good access to alternative similar sites, services or resources, and/or good opportunities for mitigation.

Source: Mott MacDonald, 2025

7.2.3 Magnitude of change

The magnitude of social impacts has been determined by consideration of the extent to which social groups gain or lose access to/or control over socio-economic or cultural resources, resulting in a beneficial or adverse effect on their individual and collective wellbeing. Wellbeing is considered as the financial, physical and emotional conditions and quality of life of people and communities.

For beneficial impacts, the extent to which local wellbeing is likely to be enhanced has been considered. This is in accordance with international trends in social impact assessment (SIA) practice towards an increased focus on enhancing long-term development benefits for a local community's sustainability, as opposed to only considering mitigation of adverse impacts. As such, the magnitude criteria include consideration of the extent to which benefits are shared with or realised by local people and communities.

The assessment of magnitude has been undertaken in three steps using professional judgment, wherein:

- Project related impacts have been identified
- The nature of the impact has been considered as to whether it is beneficial or adverse, direct or indirect, cumulative or any combination of the above
- Magnitude of impacts has been categorised as major, moderate, minor or negligible, based on consideration of parameters including likelihood, duration, number of people or groups affected, and spatial extent along with professional judgement.

Table 7.3 below presents the guideline criteria that have been used to categorise the magnitude of social impacts.

Table 7.3: Criteria for determining magnitude

Categorisation	Definition
Major	A highly likely impact that would have implications beyond the Project life, affecting the wellbeing of many people across a broad cross-section of the population and affecting various elements of the local communities', households' or workers', resilience
Moderate	A likely impact that continues over a number of years throughout the Project life and affects the wellbeing of specific groups of people and affecting specific elements of the local communities', households' or workers', resilience.
Minor	A potential impact that occurs periodically or over the short term affecting the wellbeing of a small number of people and with little effect on the local communities', households' or workers', resilience.
Negligible	A potential impact that is very short lived so that the socio-economic baseline remains largely consistent and there is no detectable effect on the wellbeing of people or the local communities', households' or workers', resilience.

Source: Prepared by Mott MacDonald

7.2.4 Significance determination overview

Each impact assessed will be classified into either adverse or beneficial, and characterised using two key impact assessment criteria: impact magnitude and sensitivity as outlined in the sections above. Significance attribution has used the matrix presented in Chapter 4 and is the result of considering both magnitude and sensitivity together.

7.2.5 Limitations and uncertainties

The socio and human rights baseline has been characterised using secondary and primary data sources. The LRP walkover survey was conducted in September 2025. Although certain land uses were not observed, this does not necessarily indicate that the Project area is not utilised for such purposes. Land use can be seasonal or may occur at times of day that did not coincide

with the presence of the survey team. To counter this limitation, the LRP socioeconomic baseline was developed using a range of tools and information sources. Therefore, the lack of direct observation during the walkover survey has not been treated as proof that such land uses are absent. Moreover, the LRP baseline includes annual livelihood calendars for the Project footprint area, along with seasonal patterns affecting income streams. These provide valuable insights into the timing and seasonality of livelihood activities.

Some secondary data currently available is more than four years old and therefore caution is required when identifying recent trends from this information. However, we do not consider the outdated data have a major impact on our analysis. Our analysis is also based on experience of similar Projects and knowledge of the likely impacts. Professional judgement has been used to reduce the level of subjectivity within any assumptions as far as possible and explanation for assumptions provided as appropriate.

7.2.6 Human rights impact assessment

The main guidance document for the development of this HRIA Initial Scan is the Guidance Note on Implementation of Human Rights Assessments Under the Equator Principles, which sets out that an HRIA Initial Scan is a quick and broad desk-based review that should determine initial risk levels and mitigation measures. If high risk levels are identified during the HRIA Initial Scan, additional and on-the-ground research driven by stakeholder engagement is required.

Additionally, in accordance with the Guide to Human Rights Impact Assessment and Management (HRIAM, 2010[2]), the scope of this HRIA Initial Scan considers:

- The key human rights risks associated with the country of operation
- The human rights risks and impacts relating to the business activity itself
- The human rights risks of key business relationships and third-party organisations[3]
- The range of stakeholders (potential and actual) who are directly or indirectly affected by the Project
- The nature and level of the risks and impacts, at different key stages of the Project's lifecycle
- The measures and actions which will be in place to mitigate identified human rights risks and Impacts

This HRIA Initial Scan was undertaken from July 2025 to August 2025. The Sponsor was consulted during this timeframe to better understand the Project. In line with the Equator Principles Guidance Note's advice for an 'Initial Scan', interviews with external stakeholders were not undertaken specifically for the HRIA Initial Scan.

7.2.6.1 Human rights scoping assessment

A scoping of potentially applicable human rights is presented in Table 7.4 below and is used to identify those rights that: (a) are of concern due to evidence of recent or current violations in the Project country or supply chain countries and / or (b) could be impacted by the Project because the nature of its activities. The rights listed are those rights defined in the UDHR, the ICCPR, the ICESCR, other United Nations human rights instruments, and the ILO Fundamental Conventions that were considered relevant according to the human rights context of the Project.

[2] A Guide by the International Business Leaders Forum (IBLF) and the International Finance Corporation (IFC), in association with the UN Global Compact. Available at: https://d306pr3pise04h.cloudfront.net/docs/issues_doc%2Fhuman_rights%2FGuidetoHRIAM.pdf Accessed July 2025

[3] Noting that most direct business relationships for the Project are not known at this stage.

A brief explanation is included for the rationale of scoping in or out human rights for their assessment. The impacts to those rights that are scoped in as being applicable are then assessed in Table 7.4.

Table 7.4: Scoping of human rights issues

Human Right [Applicable article or convention]	Scoped IN or OUT	Rationale for Scoping
Right of peoples to self-determination [ICCPR Art 1, ICESCR Art1]	OUT	The Project will not affect the right of people to freely determine their political status and freely pursue their economic, social and cultural development.
Labour rights: Right to work [UDHR Art 23, ICESCR Art 6] Right to enjoy just and favourable conditions of work [ICESCR Art 7] Right to social security, including social insurance [UDHR Art 22, ICESCR Art 9] Right to health [ICESCR Art 12] Right to education [UDHR Art 26, ICESCR Art 13 and 14] Right to freedom of association and the right to form trade unions and join a trade union and the right to strike [UDHR Art 20, ICCPR Art 22, ICESCR Art 8, ILO Freedom of Association and Protection of the Right to Organise convention; Right to Organise and Collective Bargaining Convention] Rights of migrant workers [International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families]	IN [1]	The Project could potentially fail to respect labour rights in line with the national legal framework and international requirements, especially within the contracted workforce or Project supply chains. Construction workers are one of the most vulnerable groups as their labour contracts may exclude correct safeguards in line with law requirements. Also, they are prone not to receive correct training and information on their rights. Discrimination towards women was also found to be a risk.
Right to life [UDHR Art 3, ICCPR Art 6] and Right to health [UDHR 25; ICESCR 12]	IN [2]	The Project could present a threat to health or life due to hazards arising from construction and operation, both for Project workers and for communities surrounding the windfarm Project. Project workers involved in the construction and installation of wind turbines are amongst the most vulnerable right holders because of the risk associated to their daily tasks. Additionally, communities located nearby the Project are subject to immediate risks.
Right not to be subjected to torture, cruel, inhuman and/or degrading treatment or punishment [UDHR Art 5, ICCPR Art 7]	IN [3]	The Project may affect the treatment that is given to the supply chain workers in countries where parts and equipment for the Project are made. Considering that the context of human rights protection in countries materials are produced, the Project must ensure the establishment of safeguards to avoid degrading treatment to workers along the whole supply chain.
Rights to liberty and security of person [UDHR Art 3, ICCPR Art 9]	IN [4]	Freedom of movement, liberty or security of supply chain workers may be affected considering the human rights contexts where some parts and materials for wind turbines are produced. Modern slavery forms such as passport retention in countries where parts are produced are to be avoided through safeguards that guarantee that supply chain workers are able to work and move freely.
Right to an effective remedy [UDHR Art 8]	IN [5]	The Project must establish a grievance mechanism as the first available channel for stakeholders to raise any issues related with human rights impacts

Human Right [Applicable article or convention]	Scoped IN or OUT	Rationale for Scoping
		and not inhibit access to national tribunals in case its required.
Right of detained persons to humane treatment [ICCPR Art 10]	IN [6]	Treatment of detained persons is unlikely on the Project, but there is a chance that a privately hired security company may detain individuals until public authorities can intervene.
Right not to be subjected to imprisonment for inability to fulfil a contract [ICCPR Art 11]	OUT	No relation or possible impact from the Project and this right was identified.
Right of aliens to due process when facing expulsion [ICCPR Art 13]	OUT	No relation or possible impact from the Project and this right was identified.
Right to a fair trial [ICCPR Art 14]	OUT	No relation or possible impact from the Project and this right was identified.
Right to be free from retroactive criminal law [ICCPR Art 15]	OUT	No relation or possible impact from the Project and this right was identified.
Right to recognition as a person before the law [UDHR Art 6, ICCPR Art 16]	OUT	No relation or possible impact from the Project and this right was identified.
Right to privacy [ICCPR Art 17]	IN [7]	The Project will keep personal information of rightsholders such as workers, local communities, landowners and land users which needs to be adequately managed to avoid any impacts to the right of privacy of all stakeholders. Care will need to be taken in recording and storing personal information for the development of the stakeholder engagement plan, LRP and workers' records to avoid data/privacy breaches.
Rights to freedom of thought, conscience and religion [UDHR Art 18, ICCPR Art 18]	IN [8]	Some Project stakeholders could face discrimination on religious or opinion grounds given local multiculturality and the potential requirement of migrant labour force. Regulation and enforcement of the laws can be uneven, and migrants are particularly vulnerable to discrimination.
Rights to freedom from war propaganda, and freedom from incitement to racial, religious, or national hatred [ICCPR Art 20]	OUT	No relation or possible impact from the Project and this right was identified.
Right to freedom of movement [UDHR Art 13, ICCPR Art 12] Right not to be subjected to slavery, servitude or forced labour [UDHR Art 4, ICCPR Art 8, Forced Labour Convention, Abolition of Forced Labour Convention]	IN [9]	Forced labour in the supply chain and through contractors/subcontractors is a potential risk for Projects of this nature. Unlawful recruitment and identity document retention are some of the risks that supply chain workers face in contexts where human rights are more vulnerable. Additionally, these activities may potentially result in child labour. Workers involved in the extraction of raw materials and minerals such as aluminium, copper, iron, and manganese, and the production of balsa wood, among others, are prone to suffer those impacts.
Right to freedom of assembly [ICCPR Art 21] Rights to freedom of opinion and expression [UDHR Art 19, ICCPR Art 19]	IN [10]	Rights to freedom of assembly can be breached through improper engagement planning and excluding or leaving people out of Project consultation processes.
Rights of protection of the family and the right to marry [ICCPR Art 23] and the right to a family life [ICESCR Art 10]	IN [11]	The Project could impact this right if stakeholders such as Project workers are prevented from having a healthy work-life balance, affecting their quality of family life.
Rights of protection for the child [ICCPR Art 24, ILO Minimum Age Convention, Worst	IN [12]	The Project could affect rights of children as the Project could purchase parts and materials from suppliers in locations where children are part of the

Human Right [Applicable article or convention]	Scoped IN or OUT	Rationale for Scoping
Forms of Child Labour Convention, Convention on the Rights of the Child]		labour force that is involved in the activities of mineral extraction for example.
Right to equality before the law, equal protection of the law, and rights of non-discrimination [UDHR Art 7, ICCPR Art 26, ILO Equal Remuneration Convention, Discrimination (Employment and Occupation) Convention]	IN [13]	The Project could impact this right if there were any discriminatory practices or treatment among its stakeholders, especially Project workers, prospective workers and Project-affected people either on gender grounds, cultural differences, etc.
Right to participate in public life [ICCPR Art 25]	OUT	This right relates to the right to participate in political affairs and public administration of the State, the right vote and be elected. No relation or possible impact from the Project and this right was identified.
Right to seek asylum from persecution in other countries [UDHR 14]	OUT	No relation or possible impact from the Project and this right was identified.
Right to have a nationality [UDHR 15]	OUT	No relation or possible impact from the Project and this right was identified.
Right to an adequate standard of living [UDHR Art 25, ICESCR Art 11]	IN [14]	The right to an adequate standard of living is a fundamental human right that ensures every individual has access to the basic necessities for a dignified life. This includes adequate food (access to sufficient and nutritious food to maintain health and well-being); clean water (availability of safe drinking water for personal and domestic use); housing (secure and adequate housing that provides safety and privacy); healthcare: access to necessary medical care and services. Rights-holders whose rights could be affected by the Project in this regard include Project workers in terms of accommodation provision and adequate pay, and communities whose livelihoods or access to services may be interrupted by the Project.
Rights to take part in cultural life and to benefit from scientific progress [UDHR Art 27, ICESCR Art 15]	IN [15]	This right includes the ability to access and enjoy cultural heritage. It is possible that the Project may affected cultural heritage.
Right to property ownership [UDHR Art 17]	IN [16]	The Project could affect these rights as a result of acquiring farmland for the construction of the wind turbines and other Project features.
Right to education [UDHR 26; ICESCR 13 and 14]	OUT	No relation or possible impact from the Project and this right was identified. The Project will not impact children's access to education and equal opportunity and access to training provided by the Project will be covered under non-discrimination above [13].
Right to a clean, healthy and sustainable environment [resolution adopted by the General Assembly July 2022]	IN [17]	The installation of wind turbines, transmission line, substation, roads and acquisition of land could create impacts on the right a clean, healthy and sustainable environment that the communities enjoy. Additionally, noise impacts during the construction phase, the potential for traffic incidents, dust, spills or contamination of water sources must be addressed.
Convention on the elimination of all forms of discrimination against women [CEDAW]	IN [18]	The socio-economic baseline conditions indicate that women in the direct AoI have fewer opportunities than male counterparts, due to less education, unpaid domestic and caring work and limited property rights. There is the potential for discrimination against women if their needs are not considered during consultation, recruitment,

Human Right [Applicable article or convention]	Scoped IN or OUT	Rationale for Scoping
		workforce planning/cultural relations, land acquisition and livelihood restoration.
Rights of minorities [ICCPR Art 27]	IN [19]	The Project could affect this right by lack of safeguards towards discrimination against Project stakeholders, especially minority workers and Project-affected people.
Rights of people with disabilities [Convention on the Rights of Persons with Disabilities]	IN [20]	The Project could affect rights of persons with disabilities as they could be excluded from the recruitment process or not given equal opportunities to work in the Project.
Rights of Indigenous People [ILO Indigenous and Tribal Peoples Convention, 1989 (No. 169)]	OUT	The Project is not anticipated to impact the rights of Indigenous Peoples, as defined in the ILO Indigenous and Tribal Peoples Convention, 1989.

Source: Mott MacDonald

7.2.6.2 Key information reviewed

A review of AEP's supplier management policies and procedures has been undertaken to help inform the assessment, including the following documents:

- Code of conduct for business partners
- Responsible investment policy
- Sustainability statement
- A pre-qualification (screening) questionnaire for prospective bidders prior to invitation to tender
- Quality, health, safety and environment (QHSE) tender questionnaire for bidders
- Employer quality, health, safety, security, social and environmental (QHSSSE) requirements and detailed list for wind Projects

7.2.6.3 Area of influence

The human rights AoI includes:

- Social AoI (section7.1.1).
- Workers including contracted workers
- Workers from main supply chain companies

7.2.6.4 Assigning severity to human rights impacts

The assessment involved establishing a baseline understanding of the nature of the Project context, as well as an assessment of impacts based on primary and secondary data collected and our technical experience on similar Projects. Actual and potential human rights impacts expected to arise as a result of Project activities have been identified and their severity assessed. The methodology for assigning impact severity for the HRIA initial scan is different from the methodology described in section 7.2 and used on the SIA and is discussed below.

Assigning severity

In accordance with the UNGPs, Principle 14, human rights impacts have been assessed according to their severity which is determined by considering the scale, scope and irremediability of the impact.

Identifying severity helps to define the priority in which human rights impacts and risks should be addressed. The key difference between severity and significance – the concept used in

environmental and social impact assessment – is that severity does not consider probability, rather it focuses on the potential severity of the consequences of the impact on human rights. This HRIA addresses all human rights impacts, both actual and potential. Actual impacts must be remedied as a matter of urgency and potential impacts must be mitigated.

According to the UNGPs:

- All human rights impacts need to be addressed.
- Where it is not possible to address all impacts simultaneously, the impacts should be addressed in order of their severity.
- Severity is determined by the scope (number of people affected), scale (seriousness of the impact[4]) and irremediability (any limits to restore the individual impacted to at least the same as, or equivalent to, her or his situation before the adverse impact occurred).
- While it is not necessary for an impact to have more than one of these characteristics to be considered 'severe', it is often the case that the greater the scale or the scope of an impact, the less it is 'remediable'.

Table 7.5 shows the parameters for evaluating human rights impacts used in this HRIA initial scan.

Table 7.5: Parameters for evaluating actual and potential impact severity

Factor		Description	Score
Vulnerability of affected people		Very limited capacity to absorb change	High
		Limited capacity to absorb change	Medium
		Some capacity to absorb change	Low
Severity of impact	Scale	Life- or long-term health threatening	A
		Non-life or health threatening, but tangible infringement of access to basic life necessities or freedoms including education, livelihood, etc	B
		All other impacts	C
	Scope	>50% of identifiable group	A
		11-50% of identifiable group	B
		<10% of identifiable group	C
	Irremediability	Complex technical requirements, little acceptance of remediation by the identified group, low capacity of implementation partner, no viable replacement for loss caused by impacts	A
		Simpler technical requirements, acceptance by the identified group, implementation partner can deliver with some capacity development	B
		Simple technical requirements, acceptance by the identified group, implementation partner has capacity to deliver	C

Source: Danish Institute of Human Rights and Community Insights Group, based on UN Guiding Principles

In addition to the above, the likelihood of the impact occurring has also been considered. According to the Guidance Note on Implementation of Human Rights Assessment Under the Equator Principles, this likelihood can be understood as a combination of different elements, including:

[4] The scale element also includes consideration of vulnerability of the rights holders because a person or group's circumstances including their capacity to absorb or respond to change may influence how serious the impact may be for them

- Inherent risks related to the business model in general or a particular high-risk operating context that are difficult to mitigate, even for experienced companies
- Evidence that the specific client has faced similar risks that it has failed to properly mitigate, leading to impacts.

Hence, likelihood is assessed in this HRIA Initial Scan using the following qualitative definitions:

- Likely – it is more likely than not that the impact will occur.
- Possible – it is not likely that the impact will occur but there is some possibility of occurrence.
- Unlikely – the impact is not expected to occur, though cannot be entirely discounted.

For the human rights that are within scope, the initial scan presented in Table 7.19 in section 7.4.6 includes a description of whether the Project will *cause* or *contribute to* the human rights impact. The initial scan presents the severity of the impact without mitigation according to the severity classification criteria in Table 7.7 below.

Impacts will be scored A-C for scale, scope and irremediability as identified in Table 7.5 above. An impact that scores mostly A for scale, scope and irremediability which affects individuals or groups with a high level of vulnerability will be given an overall severity assessment score of 5, for 'high severity', as shown in Table 7.6 below. Impacts scoring mostly Cs for scale, scope and irremediability affecting individuals or groups which are not vulnerable will receive a severity score of 1, for 'not severe'. Professional judgement is also used when considering and determining overall assessment ratings.

Table 7.6: Overall impact severity classification criteria

	Scale, scope and irremediability scores		
Vulnerability	**Mostly As**	**Mostly Bs**	**Mostly Cs**
High	5 - high	4 - moderate to high	3 - moderate
Medium	4 - moderate to high	3 - moderate	2 - low
Low	3 - moderate	2 - low	1 - not severe

Source: Adapted from the Danish Institute for Human Rights (2016) Human Rights Impact Assessment: Guidance and Toolbox

After stating the mitigation measures that the Project is committed to implement, the initial scan assessment in Table 7.19 states the residual severity considering the application of mitigation measures, on the assumption that the measures are implemented in full and monitoring is undertaken to verify that the implementation has been successful[5]. Professional judgement has been used when considering and determining overall severity assessment ratings.

For the residual impact rating, each actual or potential impact has either been assigned as higher, lower or negligible, in accordance with the requirements for an initial scan, applying the following criteria:

- Higher: Where ineffective or no mitigation measures are planned. The actual or potential impact involves long-term or permanent damage to the rights-holders. Mitigation measures are not possible, limited and/or difficult to implement. The Project will find it challenging to address or mitigate the impacts to this aspect and as such, there will be delays, reputational risk, or breach of national or lender requirements for the Project. Further assessment and an in-depth analysis are required.
- Lower: Where the Project is committed to mitigation measures to appropriately manage the actual or potential impacts. The Project is demonstrating is a good understanding of the human rights issues and risks it is seeking to manage them based on the information

[5] Noting the requirement in the UNGPs to mitigate all identified human rights impacts.

gathered and taking into account the vulnerability of the rights-holders. Can be addressed within the proposed Project plans or schedule. Where additional mitigation measures are required, these are likely to be easily implemented.

- Negligible: Where there is no foreseeable impact to rights-holders and if there is any, it will not be of more than inconvenience that should be fully addressed by the proposed mitigation measures.

Assigning priority

Where it is challenging to address all identified human rights impacts at once, the most severe, the most likely and the most imminent impacts must be prioritised and addressed first. As the Project is new, planning to prevent human rights impacts can occur simultaneously and therefore priority has not been assigned to individual mitigation measures.

7.2.6.5 Approach to assessing contractors and supply chain risks

The turbine supplier (TS), balance of plant (BOP) contractor / s OEM contractor (original equipment manufacturer, i.e. turbine supplier) and BoP contractor (balance of plant) have not yet been appointed, as of December 2025.

AEP has commissioned a labour and working conditions due diligence (LWC DD) on its preferred TS contractor which was not available for review due to constraints related to ensuring the confidentiality of the assessment owners. The LWC DD includes a review of the relevant management systems and onsite audits of selected manufacturing facilities in China.

7.3 Baseline

7.3.1 Administrative divisions

The Project is situated mainly in two municipalities, Stip and Radovic, with a small amount of the Project in the municipality of Karbinci. The municipalities of Stip and Karbinci are part of the Eastern Planning Region, while Radovic is part of the Southeastern Planning Region. The Municipality of Stip is the largest, consisting of 31 settlements, whilst the other two municipalities are smaller, with 23 settlements. Most of the settlements are rural, with only one urban settlement in Stip and one in Radovic.

7.3.2 Demographics

The population of North Macedonia has generally been in decline since the late 1980s, now standing at 1.83 million from a peak of over two million. Population decline has in part been caused by a steadily declining birth rate[6]. There has also been emigration to EU countries in recent years, however net migration is currently positive at 0.4 migrants per 1,000 population coming into the country, rather than leaving[7]. North Macedonia has a relatively low population density of 72 people per square km[8]. The Project AoI has a low population density. Women in North Macedonia are living longer than men, with a life expectancy of 79.6 years compared to 75.3 years[7].

According to data from the Census of Population, Households and Dwellings[9] conducted in 2021, the village of Buchim is the largest village in the AoI with 400 inhabitants, of whom 215 are men and 185 women. Based on the age distribution of the population within the census

[6] State Statistical Office of the Republic of North Macedonia, accessed November 2024

[7] North Macedonia - The World Factbook

[8] North Macedonia Population (2024) - Worldometer

[9] Available at: www.stat.gov.mk

results, it can be concluded that unlike many villages in the country, this village has a relatively high percentage of young people; half of the population is under 30 years of age.

The population of the village of Shashavarlija, which is the largest affected village in the Municipality of Stip, has been in continuous decline over the past 70 years, and according to the census, it has 79 inhabitants, of whom 41 are men and 38 are women. The village has 25 households and 44 dwellings. Nearly half of the village's residents are under the age of 30.

Table 7.7 gives an overview of the population in the Project affected settlements, according to the census of 2021, as well as the approximate distance to Project features to the nearest households within each settlement. The average number of inhabitants per household in Buchim village is 3.8 members, which is the second highest average number of inhabitants in the affected settlements. The village of Golem Gaber has a higher number of inhabitants per household than Buchim with five members per household. Shashavarlija has 3.2 members per household. The other villages have a notably lower average number of inhabitants per household, which indicates that these villages are inhabited mostly by elderly and/or single/unmarried people.

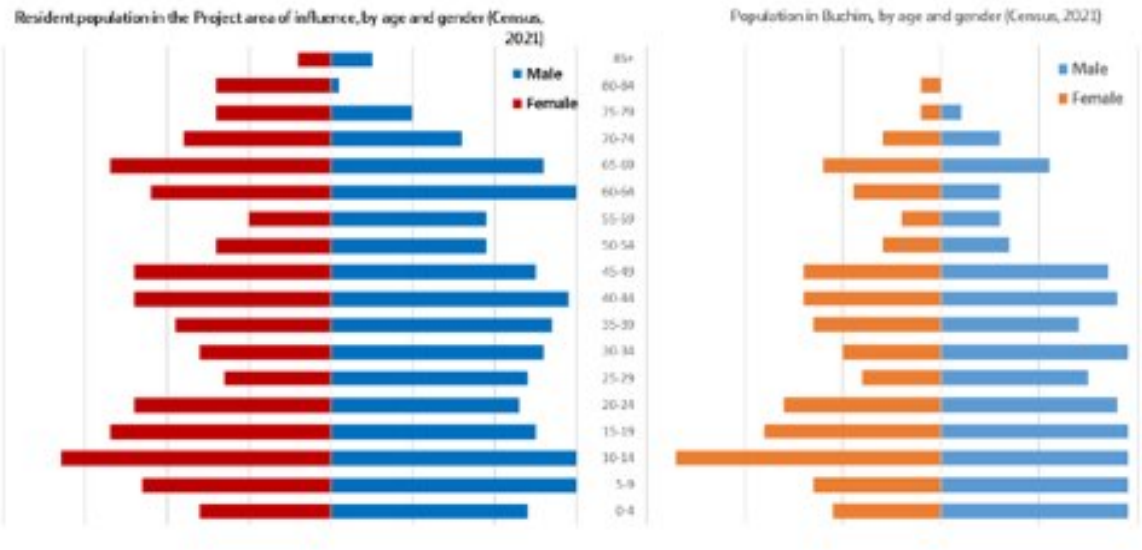
Table 7.7: Population of villages in the AoI and proximity to Project features

Affected settlements Population	Pop-ulation	No. of women	% women	No. of h/h	Average h/h size	No. of dwellings	Distance of Project elements to the nearest houses (m)
Baltalija village	7	3	43%	4	1.8	17	1,200
Nikoman village	2	0	0%	1	2.0	11	750
Shashavarlija village	79	38	48%	25	3.2	44	700
Dolani village	18	9	50%	13	1.4	153	1,250
Ljuboten village	24	10	42%	12	2.0	36	700
Kalapetrovci village	1	0	0%	1	1.0	13	1,000
Koshevo village	4	2	50%	2	2.0	18	950
Tanatarci village	1	0	0%	1	1.0	4	1,700
Municipality of Stip AoI total	**136**	**62**	**46%**	**59**	**2.3**	**296**	**-**
Damjan village	175	85	49%	78	2.2	129	2,000
Buchim village	400	185	46%	104	3.8	128	550
Municipality of Radovic AoI total	**575**	**270**	**47%**	**182**	**3.2**	**257**	**-**
Golem Gaber village	20	10	50%	4	5.0	7	1,100
Municipality of Karbinci AoI total	**20**	**10**	**50%**	**4**	**5.0**	**7**	**-**
TOTAL	**731**	**342**	47%	**245**	3.0	**560**	**-**

Source: Census of Population, Households and Dwellings 2021, available at: www.stat.gov.mk (h/h = household)

Figure 7.4 shows the demographic structure of the settlements in the AoI by age and gender.

Figure 7.4: Population pyramids for all villages in the AoI compared with Buchim

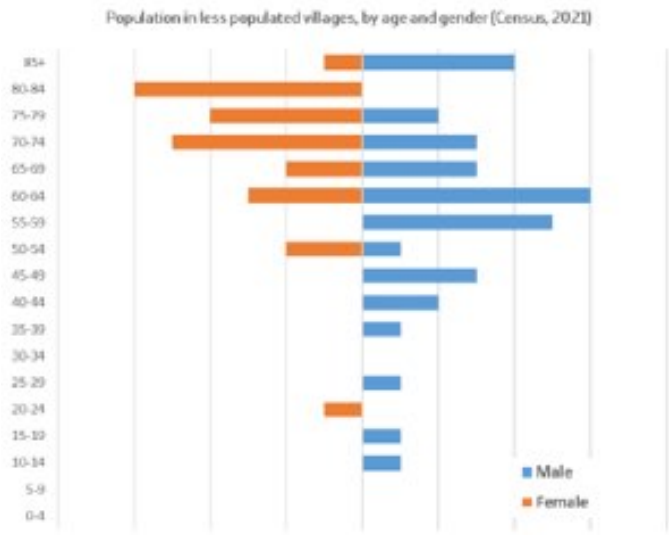


Source: Census of Population, Households and Dwellings 2021, available at: www.stat.gov.mk

The left-side pyramid reveals a broad-based age distribution, typical of rural and semi-urban regions. Children (0–14 years) and working-age adults (15–64) form the bulk of the population, with a noticeable tapering among seniors over 65. Female representation generally exceeds male in older age cohorts which is a common trend due to longer female life expectancies. The right-side pyramid is population structure in Buchim, which comprises 72% of the population in the AoI. There is a slight skew toward working-age males. The 0–14 age group is notably smaller in percentage than for the overall population of the AoI, indicating lower birth rates and limited young population in the village of Buchim.

If Shashavarlija, Golem Gaber and Buchim (Turkish language speaking villages) are extracted from the population structure, the population pyramid for the remaining seven villages shows significant elderly populations (above 60 years of age)). This is a typical image of villages that are in population decline.

Figure 7.5: Population pyramid for less populated villages[10] in AoI



Source: Census of Population, Households and Dwellings 2021, available at: www.stat.gov.mk

The KIIs conducted during the ESIA stage of the Project revealed that some dwellings in the affected villages are not resided in permanently. Some people travel daily or at the weekends from the City of Stip to the villages to tend their farms or businesses. Table 7.8 gives overview of the number of people living in the affected settlements where KIIs were conducted, according to the interviewee's responses.

Table 7.8: Estimated additional occupancy of selected villages in the AoI at the weekend

Village	Active h/h	No. of people living permanently in the village	Additional no. of houses populated during weekend	% of households occupied intermittently
Baltalija (Stip Muncipality)	2	3	2	50%
Nikoman	1	2	2	67%
Shashavarlija	20	70	5	20%
Dolani (Stip Muncipality)	10	14	60	86%
Ljuboten (Stip Muncipality)	10	20	20	67%
Kalapetrovci	1	2	1	50%
Koshevo	2	4	1	33%
Tanatarci	1	1	1	50%
Buchim (Radovic Municipality)	100	400	0	0%
Damjan	50[a]	100	0	0%
Golem Gaber (Karbinci Municpality)	2	10	0	0%

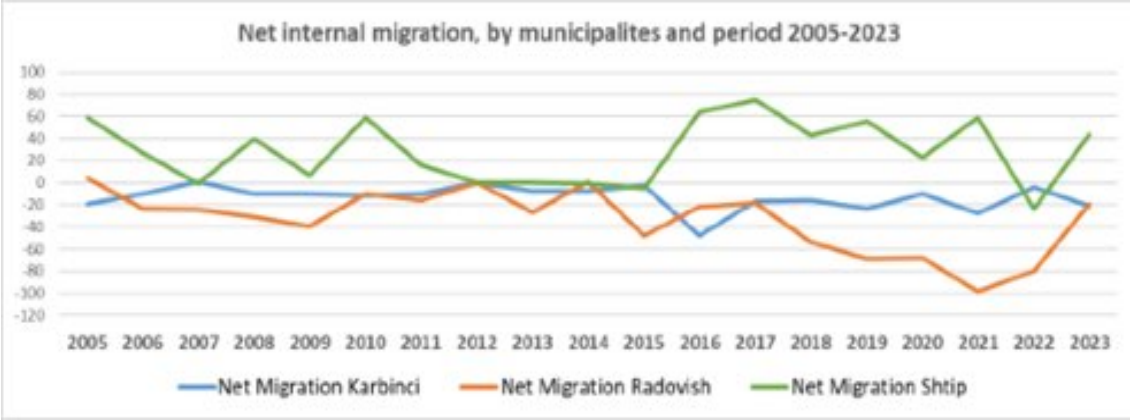
Source: KIIs in listed villages, Maneko Solutions a – this number represents the newest part of the settlement that is close to the Project AoI

[10] Includes Baltalija, Nikoman, Dolani, Ljuboten, Chflik, Kalapetrovci, Koshevo, Tanatarci, Damjan and excludes the larger, Turkish speaking village of Shashavarlija, Golem Gaber and Buchim

7.3.3 Migration

Migration is a significant factor shaping the population dynamics of North Macedonia as a whole, and its impact is particularly felt in smaller municipalities and rural areas, including Stip, Karbinci, and Radovic. The country has historically been, and continues to be, primarily a source of emigration, leading to a negative net migration balance. The following image gives an overview of the internal migration figures in all three municipalities for period of two decades.

Figure 7.6: Net internal migration in affected municipalities, 2005-2023



Source: Net migration, by municipalities and period 2005-2023, MakStat database

The municipalities of Karbinci, Radovic, and Stip display distinct internal migration patterns over the examined period, reflecting regional disparities in economic opportunity, service access, and demographic stability. Karbinci stands out as a relatively stable locality, with net migration values consistently close to zero. This steadiness suggests limited population inflow or outflow, potentially due to a combination of rural livelihood retention and low mobility. The absence of strong fluctuations implies that while Karbinci may lack dynamic growth drivers, it manages to retain its population more effectively than surrounding areas.

The Municpality of Radovic, by contrast, has experienced a gradual decline in net migration, with more pronounced negative trends between 2015 and 2020. This downward movement points to a sustained outmigration, likely reflecting economic stagnation or the departure of younger residents seeking employment and education opportunities elsewhere. The modest rebound observed in 2023 may indicate the early stages of demographic recovery, possibly supported by local development efforts or shifts in mobility patterns. Nevertheless, the municipality remains vulnerable to long-term depopulation.

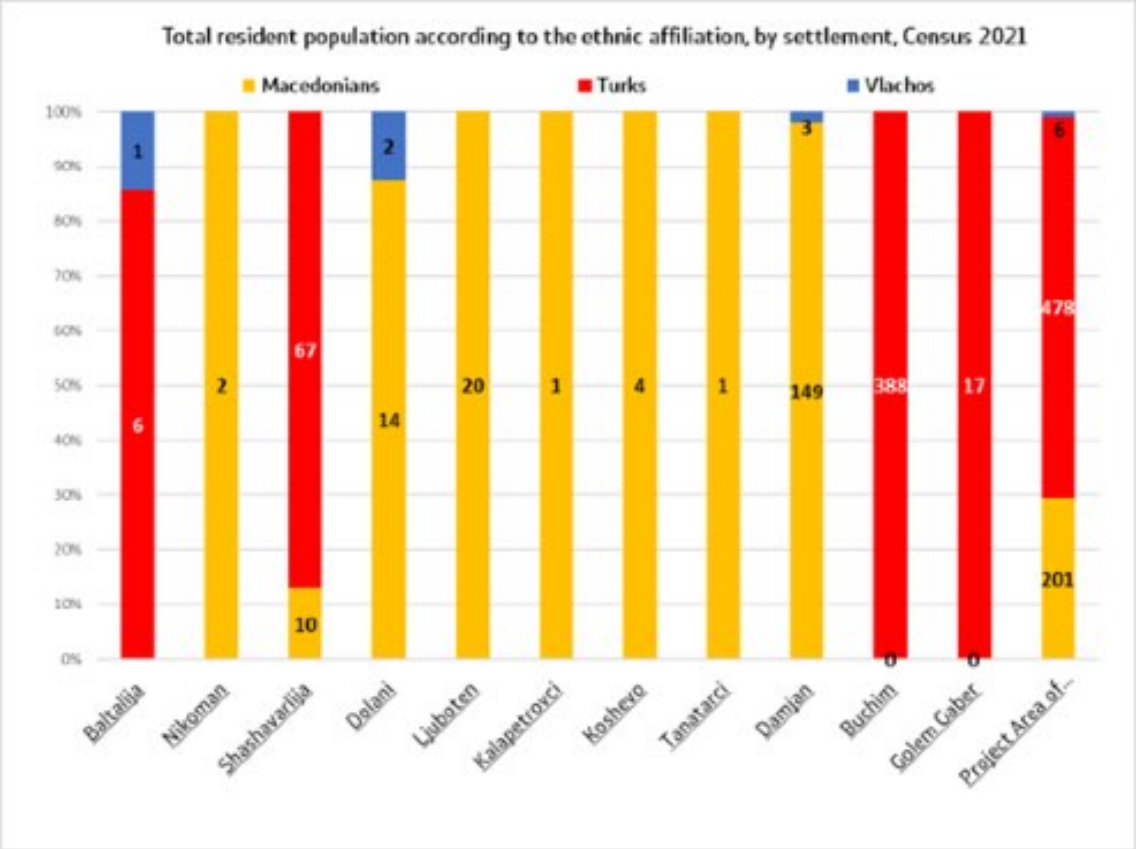
Stip Municipality emerges as a regional migration hub, characterised by strong fluctuations across the timeline. Peaks in net positive migration during 2005, 2009, and most recently in 2023 suggest that Stip has periodically attracted internal migrants, likely due to its urban amenities, educational institutions, and labour market appeal. These dynamics position Stip as both a destination for surrounding rural populations and a barometer of regional development. Its 2023 upswing could correlate with renewed investment or improved connectivity, underscoring its strategic importance in future population planning initiatives.

7.3.4 Ethnicity, religion and language

Most people in North Macedonia are Macedonian (58.4%) and nearly a quarter are Albanian (24.3%). Smaller groups include Turkish (3.9%), Roma (2.5%)[11], Serb (1.3%) and others including Bosnians, Vlachs and those for whom there was no information available[7]. There have been political challenges between ethnic groups in North Macedonia. The official language is Macedonian and Albanian is co-official. Turkish, Roma and other languages are also spoken. People of the Roma ethnic group report widespread societal discrimination: Roma are underrepresented in public institutions and employers often deny Romani applicants job opportunities. Some Roma report difficulty in finding jobs in the formal economy and lack of access to public services and benefits[12].

Within the settlements likely to be most affected by the Project, the majority of the population is of Turkish Yoruk ethnic origin, around 9% are Macedonian and there are also people of Vlach, Albanian and unknown origin, however all stakeholders engaged during the scoping site visit spoke Macedonian. The International Working Group on Indigenous Affairs does not identify any indigenous groups in North Macedonia[13] and as confirmed by the Project's EIA in 2009, the Project will not affect indigenous peoples.

Figure 7.7: Total resident population of the AoI village, according to the ethnicity



Source: Census of Population, Households and Dwellings 2021, available at: www.stat.gov.mk

[11] Data represent total resident population; Romani populations are usually underestimated in official statistics and may represent 6.5–13% of North Macedonia's population.

[12] NORTH MACEDONIA 2023 HUMAN RIGHTS REPORT, accessed July 2025

[13] Countries - IWGIA - International Work Group for Indigenous Affairs; The Indigenous World 2024

According to data from the Census of Population, Households and Dwellings[14] conducted in 2021, the village of Buchim is predominantly inhabited by people of Turkish ethnic origin—388 (97%) respondents identified themselves as Turks[15]. Golem Gaber village is also Turkish and the ethnic composition of Shashavarlija, the largest village in the AoI in the Municipality of Stip, is mixed with 67 Turks, 10 Macedonians and two 'others'[16]. The main religion in the settlements within the AoI is Muslim, primarily due to the presence of ethnic Turks and the residents of Buchim belong largely to Suni Islam. Meanwhile, Macedonians, which comprise the other main ethnic group are generally affiliated with the Orthodox Christian faith.

Participants in the Shashavarlija FGD conducted on 13 April 2025 mentioned tensions with residents of the settlement through which people from Shashavarlija pass to reach the town of Stip[17]. Specifically, at the entrance to the town, there is a Roma settlement, and participants noted that there has often been tension between the two communities in the past. Some villagers shared that conflicts have especially occurred regarding livestock theft and illegal logging happening in and around the village of Shashavarlija and expressed disappointment that their appeals to authorities on this issue have not resolved the issues.

7.3.5 Economy, employment and livelihoods

The largest portion of the North Macedonian economy is centred on services (58.2%), followed by industry (21.4%) and then agriculture (7%)[7]. Important agricultural products include milk, grapes, chillies/peppers, wheat, potatoes, apples, tomatoes, cabbages, maize, barley, whilst main industries are food processing, beverages, textiles, chemicals, iron, steel, cement, energy, pharmaceuticals, automotive parts.

On average across North Macedonia, one-third of household expenditure goes on food which is higher than neighbouring Serbia (23%) and Bulgaria (19%). Almost one-third of children in North Macedonia live below the national poverty line, increasing from 28% in 2015[18] in part due to a lack of social protection measures for children.

According to the KIIs conducted for the ESIA, agriculture is a common livelihood activity in the area, particularly for those villages that have children (and therefore people of working age). Livelihoods for households with elderly members are supported by pensions. In all five villages where interviews were conducted, the livelihood provision strategies on a household level consist of combination of livestock keeping, farming and salary or pension. Most of the Project features (WTGs and other elements) are located in mountainous and hilly territory where presence of agricultural and livestock activities is noted. Irrigation is barely present in the Project area due to the lack of water and therefore the farmers cultivate crops that give a good yield without requiring significant water resources.

In addition to the fact that livestock is mostly kept for their own needs, in villages with more inhabitants such as Shashavarlija, Golem Gaber, and Buchim, there are also livestock breeders who consider livestock as the main means of livelihood for their own households, so they sell milk to companies that purchase and produce dairy products, while selling part of the livestock to slaughterhouses or butcher shops.

People living in Baltalija village generally derive their livelihoods just from keeping livestock, while in Buchim and Golem Gaber villages, residents combine livestock farming with growing

[14] Available at: www.stat.gov.mk

[15] The rest of the residents were enumerated using administrative sources; therefore their ethnic affiliation has not been registered.

[16] One person identified as Albanian, and one person's ethnicity was not identified, Census 2021

[17] Precise location unknown.

[18] Every third child in the country lives in poverty, UNICEF report 17 October 2024, accessed July 2025

tobacco and some cereals used for own purposes. Residents of Ljuboten and Dolani villages combine livestock breeding with growing cereals and some receive pensions. In Ljuboten village, people also grow grape vines and orchards. Beekeeping for own and commercial purposes is present in Ljuboten, Dolani and Buchim villages. Green vegetable gardens are present in each village, but due to the scarce availability of water, green gardening is solely for private purposes.

Tobacco, as well as milk from sheep, cows and goats is gathered daily and sold for commercial purposes. There is an organised commercial activity for daily collection of milk from all villages in the area, conducted by local diary companies.

The village of Buchim is located in close proximity to the copper and gold mine of the same name which processes over 4.5 million tonnes of ore annually and employs 650 people[19], however as reported during the FGD with men in the village, only around 20 people from the village are employed there. Focus group participants indicated (at least perceived) historical employment discrimination and inadequate wages as primary reasons for low participation in employment at the mine[20]. The villagers perceive the mine's proximity as having minimal economic benefit and, overall, as being more detrimental than beneficial in terms of impact on local quality of life.

Of the nine women present at the FGD in Buchim, only one was employed, working as a shop assistant in the local store. The rest of the women at the FGD were key participants in their family's agricultural work, with their roles including maintaining home gardens with crops for household consumption to working in tobacco fields. The women in the Buchim FGD stated that most household income comes from agriculture, mainly from tobacco cultivation. Other crops are less represented and are mostly grown for personal use. A small number of households have a member working at the Buchim mine, however in most families, members who are able to work together on the fields. In terms of receiving material assistance, from the participants' statements it can be concluded that only a small number of families have members abroad, and remittances are not a common source of support for families in the village of Buchim.

Male participants of the FGD in Buchim confirmed that the local economy is predominantly agricultural, with tobacco as the primary crop, complemented by wheat and other cereals on a smaller scale. All members of the household are engaged in tobacco production (preparation, planting, growing, processing) and while adults are busy with the tobacco, the livestock is kept by the children and usually taken to graze in nearby hills or fields. Farmers registered as tobacco growers are subsidised by the government. The male villagers reported that the critical obstacle for agricultural development is the absence of adequate water infrastructure. Livestock farming occurs on a limited scale, also significantly constrained by poor water access. Another barrier to agricultural development is the low fertility of local soils, limiting agricultural productivity and potential growth. Unemployment is currently high among the younger population in Buchim village. Some villagers engage in other small scale economic activities such as herb gathering and beekeeping.

Most of the residents in Shashavarlija village secure their livelihoods through agriculture and livestock farming. Participants stated that due to the low fertility of the soil, tobacco is the dominant crop cultivated. Livestock farming plays an equally important, if not greater, economic role in this village. The proximity of the town of Stip (10.6km away by road) is attractive for younger people, who increasingly choose to work in Stip or move away entirely in search of better living conditions. There are two beekeepers in the village.

[19] About Us – Bucim, accessed July 2025

[20] These statements reflect the views of FGD participants which have not been independently verified.

An overview of the declared number of livestock and bees kept by the interviewed villages is presented in Table 7.9 below.

Table 7.9: Livestock and bees kept in selected AoI villages[21]

	AoI village name					
Livestock per village	**Ljuboten**	**Baltalija**	**Golem Gaber**	**Dolani**	**Buchim**	**Approx. total**
Livestock						
Sheep	180	100	100	600	600	1580
Cattle	-	-	-	25	35	60
Pig	-	-	-	30	-	30
Goat	-	-	-	20	20	40
Chicken	-	-	-	100	400	500
Households with livestock						
Sheep	2	1	2	3	3	11
Cattle	-	-	-	2	-	2
Pig	-	-	-	1	-	1
Goat	-	-	-	1	1	2
Chicken	-	-	-	1	10	11
Bees						
Number of beehives	300	-	-	500	300	1100
Beekeepers	5	-	-	8	9	22

Source: KIIs in selected AoI villages, Maneko Solutions

According to LRP FGD participants, income generation across the livelihood activities is characterised by a strong reliance on pooled household resources, significant seasonal fluctuations[22], and the strategic use of family labour. Land and livestock farmers, small business owners, and herb gatherers emphasised that large families are widely valued because they reduce the need to hire external workers and help sustain both domestic and economic activities. Households that can complement these efforts with at least one member earning a salary outside of the land-based livelihood (whether through employment in local institutions, private sector jobs, or in the Buchim mine) have more financial stability, though often insufficient on its own. Farmers engaged in livestock or crop production noted that external salaries alleviate financial pressure and allow farming to function as an auxiliary income stream. Most of the LRP FGDs highlighted additional coping strategies, such as community support during low-income periods. Remittances from abroad are rare.

Participants of the FGD with men in Buchim and those in Shashvarlija expressed concerns that noise from the WTGs may negatively affect livestock, that livestock's movement around grazing areas might be inhibited, that people's ability to gather herbs might be inhibited, and that beekeeping might be affected. These concerns are discussed further in sections 7.4.4.1.

[21] Estimates on livestock and bees have been made based on information gathered during the social investigation exercise conducted in ESIA stage, where local people who were met and interviewed were asked, in a nonformal conversation, to provide estimations of livestock in the villages per each household. Interviewed people (unstructured interviews) were willing to cooperate and were making estimation of the type and number of livestock (and beehives) their fellow villagers have. The figures are provisional and not quite accurate since each participant did not have contact with all villages. Firm data is no longer provided by the institutional stakeholders on a level of settlement, but on a higher level above municipality (statistical region) which is not quite applicable to the settlements from the AoI.

[22] Section 5 of the LRP presents seasonal livelihoods and income calendars for important natural resource-based livelihoods in the direct AoI.

7.3.5.1 Unemployment

The unemployment rate is reducing from 15.8% in 2021 to 13.08% in 2023, however youth unemployment (ages 15-24) is high at 28.6%[7]. Unemployment in the Project AoI does exist but in general, does not cause significant issues from the socio-economic perspective. Some individuals are registered as unemployed, but that does not necessarily mean that the household's livelihood lives in poverty. In the rural areas, these individuals are usually part of the agricultural workforce, which is often informal and registering and tracking individuals is challenging.

During the census in 2021 in Municipality of Karbinci, there were 1,270 employed individuals (523 female), which represents 94.3% of the total workforce. Only 5.7% of the available workforce was unemployed, and 48.4% of the working age population was registered as inactive. In Municipality of Radovic, there were 7258 employed individuals (2964 female), which represents 80.5% of the total available workforce. Some 19.5% of the available workforce was unemployed, and 50.1% of the working age population was considered as inactive. Furthermore, in Municipality of Stip during the Census in 2021, there were 18,134 employed individuals (8,865 female), which represents 91.1% of the total available workforce. Some 19.5% of the available workforce was unemployed, and 44.0% of the working age population was considered as inactive[23]. The total number of working age population in Municipality of Karbinci was 2,799 people, in Municipality of Radovic it was 19,948 people, while in Municipality of Stip it was 38,062 people. Table 7.10 below summarises this data.

Table 7.10: Employment data for affected municipalities, 2021

Location	Karbinci Total	Karbinci Female	Radovic Total	Radovic Female	Stip Total	Stip Female
Working age population - total (labour force + inactive + unknown)	2,799	1,351	19,948	9,901	38,062	19,369
Labour force total (employed + unemployed)	1,347	568	9,016	3,826	19,911	9,639
Employed	1,270	523	7,258	2,964	18,134	8,865
Unemployed	77	45	1,758	862	1,777	774
Total inactive population	1,354	738	9,987	5,574	16,756	90,89
Unknown	98	45	945	501	1,395	641
% of labour force employed	94.3%	92.1%	80.5%	77.5%	91.1%	92.0%
% of labour force unemployed	5.7%	7.9%	19.5%	22.5%	8.9%	8.0%
% of people of working age who are inactive - not in or looking for work	48.40%	54.6%	50.1%	56.3%	44.0%	46.9%

Source: State Statistical Office's MakStat online database, and Employment Agency online available statistics

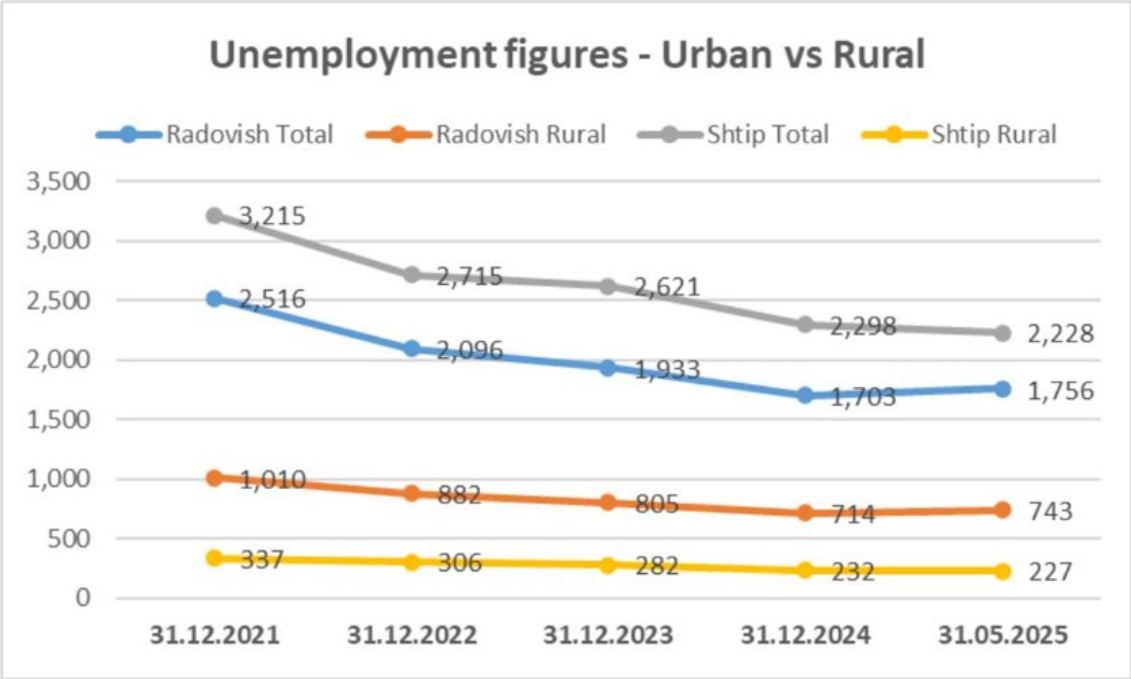
The National Employment agency records unemployment data via various employment agencies. The Radovic and Stip employment agencies collect data for Municipalities of Radovic and Konche (the latter is outside of the Project scope); and Municipalities of Karbinci and Stip respectively [24]. Figure 7.8 below illustrates unemployment trends with a distinction between total municipal unemployment and rural unemployment, from December 2021 to May 2025. In Radovic and Konche, the share of rural unemployment in the total unemployment figures in 2021 was 40.1%, in May 2025 this share increases (42.3%) but the overall unemployment decreases. In Stip and Karbinci, the rural share of unemployment was 10.5% at the end of 2021, and in May 2025 this share decreased slightly to 10.2%. The City of Stip offers significant

[23] This could represent people working in the informal economy, those working in subsistence farming or other similar groups

[24] https://av.gov.mk/pregled-na-evidentirani-nevraboteni-lica.nspx, accessed June 2025

employment opportunities, and its overall unemployment rate is lower than the one of the rural or smaller municipalities.

Figure 7.8: Unemployment and rural unemployment in Radovic and Stip Municipalities



Source: National Employment agency, Stip and Radovic offices, 2025

Regarding completed education, those without education and completed up to primary school education from Radovic represent 79% (78% for female) of the total number of registered unemployed individual jobseekers, while this figure in Stip is 56% (55% for female). In addition, opposite trend is noticed with the unemployed who have completed high school. In Stip 27% of the total number of registered unemployed jobseekers have completed high school education, while this share in Radovic is 15%.

Table 7.11 gives an overview of the ethnic structure of registered unemployed individuals, divided by gender and ethnic structure.

Table 7.11: Unemployment in affected municipalities, by gender and ethnicity

Unemployed jobseekers, May 2025	Total	Macedonians	Turks	Roma	Others
Radovic (+ Konche) total	**1756**	**662**	**1024**	**62**	**70**
No. women	893	323	532	33	38
Women % share	50.9%	48.8%	52.0%	53.2%	54.3%
Total % share		37.7%	58.3%	3.5%	10.6%
Women % share in total	50.9%	18.4%	30.3%	1.9%	5.7%
Stip (+Karbinci) total	**2228**	**1323**	**130**	**724**	**51**
No. women	1100	665	62	345	28
Women % share	49.4%	50.3%	47.7%	47.7%	54.9%
Total % share		59.4%	5.8%	32.5%	3.9%

Unemployed jobseekers, May 2025	Total	Macedonians	Turks	Roma	Others
Women % share in total	49.4%	29.8%	2.8%	15.5%	2.1%

Source: National Employment agency Stip and Radovic offices, 2025

Data presented in Table 7.11 show strong ethnic disfavor of employment traits in Radovic, where Turks, although represented by 16.6% of the population during the Census in 2021, amount to 58.3% of all registered unemployed jobseekers across the Municipalities of Radovic and Konche. If data for Konche are removed, 22.4% of Turkish ethnicity members of Radovic Municipality are unemployed, compared to 3.4% unemployment among Macedonian women in the same municipality.

Around 39% of the female population at working age (age 15-64) in the Municipality of Radovic are unemployed and regularly seek employment (i.e. they are registered at the Employment Agency as a job seeker). If this data is cross-referenced and generalised at the settlement level, that means that from 112 female residents of working age in Buchim, some 35 women could be approximated as being frequent unemployed job seekers. KII respondents indicated a likely keen interest from local people in accessing job opportunities on the Project, which was supported in the response to the FGD in Shashavarlija, where residents expressed hopes for employment especially for young people. There is concern that the jobs will likely only be available during the construction phase, with no long-term options. Participants emphasised that employing local residents must be a priority, not only during the construction but also in the operational phase. One participant said: “we don’t want to just watch other people come here to work while our own people are left without a chance.”

However, the LRP surveys found according to the Employment Agency of Radovic, the Project area is characterised by a high proportion of individuals with limited formal education and little historical interest in employment programmes, meaning that supporting them into formal employment has tended to be challenging. Many choose to work on informal activities, most commonly agricultural labour paid in cash which is a practice particularly prevalent in the region. Although legislation requires individuals to register as independent farmers to operate formally, many remain outside the system, and therefore are not eligible for agricultural subsidies. Some registered farmers, listed through the Pension and Disability Insurance Fund (PIOM) have access to related subsidies and benefits, but also continue informal work in parallel.

7.3.6 Land use

Utilisation of agricultural land in Stip Municipality, according to data in 2023 was: pastures (75.8%), gardens and arable land (24.1%), vineyards (5.5%), orchards (2.1%). Table 7.12 shows the utilised land in all three municipalities by type of land, in hectares, in 2023.

Table 7.12: Utilised agricultural land by use, in 2023 (hectares)

Municipality	Agricultural land	Utilized agricultural land, total	Arable land, gardens and kitchen gardens	Orchards	Vineyards	Meadows	Pastures
Karbinci	6,859	6,279	5,757	76	346	100	580
Radovic	32,637	10,689	9,188	479	607	415	21,948
Stip	30,880	7,430	6,780	155	412	83	23,399

Source: Makstat, SSO

Farmers in all three Project affected municipalities, along with farming businesses grow the following plants and crops: wheat, rye, barley, oats, maize, rice, sunflower, tobacco, potatoes,

onions, garlic, beans-single maincrop, peas-grain, cabbage, tomatoes, peppers, cucumbers, melons and watermelons, clover, alfalfa, vetches-hay, fodder peas-hay, fodder maize, fodder beet. Barley is the most sown area in the Municipalities of Karbinci (50%) and Stip (39%), while the wheat holds second place in both municipalities (23% and 27%). In the municipality of Radovic the most present plant sown on the fields is wheat (36%), followed by tobacco (35%).

Within the Project AoI, there are many uncultivated and abandoned land parcels, because the population in rural areas migrates to the cities of Stip, Skopje for work. The Project affected part of the Municipality of Radovic is predominantly rural and properties are mainly individual houses with sufficient plots of land for farming. Agricultural land dominates the municipality, with many properties dedicated to tobacco, vineyards, and other crops. In the Project affected part of the Municipality of Stip, the affected villages are characterised by traditional houses with agricultural land nearby. While in parts there are large areas of agricultural land near potentially affected settlements used for crop production, the residents do not generally depend on this land. Instead, they cultivate their own parcels, growing different commercial crops that differ from those on the larger agricultural lands within the Project area. This is particularly true for the Municipality of Stip.

During the FGD in Shashavarlija, residents raised the potential for impacts of the Project on the community's agricultural crops on land that will be within the construction area and whether compensation would be payable for damaged or destroyed crops. Specifically, the queries relate not to cases where the land is privately owned, but cases where State-owned land has been used for agriculture by residents. Some of the participants shared that they did not know certain land was State-owned, as their families had possessed and used it for generations, and only after the Project was announced did they learn that they had been using land that was not legally theirs. This situation has arisen through the process of land reform after World War II whereby privately owned land was declared State-owned land by the government as part of a plan to redistribute it for agricultural or other exploitation. In reality, where land was not redistributed, the former owners continued to use it, as did their children after them. The question was raised by FGD participants as to whether they are entitled to any compensation for any crops lost and future losses they will incur due to no longer being able to farm the land.

During the LRP FGDs, some community members of Shashavarlija expressed concerns about child safety during construction of the Project, referencing past experiences with other Projects in the region where construction zones were not secured. Such experiences have shaped a perception that this issue may happen again with this Project. The Project proponent will address these concerns by implementing robust safety measures and maintaining open communication with affected communities.

Concerns were also expressed in the ESIA FGD in Shashavarlija about the possibility of accessing land that they do own or may continue to use, but which they must reach by passing through land where Project features will be built. An example was mentioned when, a few years ago, a businessman bought a large plot of land near Shashavarlija which he fenced and made sure that none of the villagers could pass through his land to reach their own properties. Villagers who sold part of their land stated that they feel deceived because they only had short-term benefits, but in the long run, they can no longer access their properties and pastures, and some sold their livestock as a result. It should be noted that this concern does not relate to the Stip Wind Farm Project and these concerns will not be realised in relation to the Project because large swathes of land will not be fenced as a result of the Project.

7.3.7 Land tenure and Project land needs

In 2010, the Ministry of Energy, Mining and Mineral Resources approved the state urban plan for the Project, formally designating the Project area for construction and energy generation purposes. Based on recent technological improvements, which were incorporated into the

Project design, a new urban plan was developed and approved in June 2025. As a result of this recently approved urban plan, the relevant land plots were reclassified from agricultural to construction use, providing the legal basis for the development of the wind farm and associated infrastructure. This reclassification enabled the parcelisation of land and established the legal basis for subsequent land agreements, acquisition, and construction activities. The urban plan boundaries therefore underpin the Project components by ensuring that the necessary land use changes and permissions are in place for the Project's development.

Much of the land (around 90%) needed for the Project is government-owned. Some of the government owned land is used informally for agricultural purposes, some of it has agricultural and pasture concessions on it, and some of it is unused. Privately owned land is also needed and some of this is also used for agriculture. The Project does not expect to affect any buildings used as residences or businesses. Existing roads will be used where possible. The expected land needs for the Project are identified in the LRP Project description (chapter 2 of the LRP). Land use and livelihoods are described in the LRP baseline (chapter 5 of the LRP). .

7.3.8 Ecosystem services

Information from the FGDs and KIIs suggests that the current uses of ecosystem provisioning services in the direct AoI include agricultural land used for grazing, beekeeping cultivating crops and productive trees, collection of forest products and herbs. Community members raised concerns during LRP fieldwork regarding the potential loss of access to government land, especially for activities such as beekeeping, grazing, and forest product collection, which are highly location specific. Participants of the FGD in Shashavarlija also expressed concerns that the Project may negatively impact hunting due to impact from noise of the turbines. Chapter 11 of the ESIA will address Project impacts to ecosystem services used by people in the direct AoI of the Project.

7.3.9 Social infrastructure and services

7.3.9.1 Education

The literacy rate amongst North Macedonian citizens over the age of 15 is high at 98.4%, and there is little disparity between men and women (1.5% difference in favour of males). North Macedonia has successfully improved access to primary education over the last decade or so, but despite this, multiple international student assessment surveys and reports indicate significant learning deficiencies for students in North Macedonia. There are issues in delivery of quality education in rural areas and evidence of disparities based on ethnicity, socio-economic status, gender and other variables[25].

The education system in North Macedonia is decentralised, with municipalities primarily responsible for the management of primary and secondary schools, receiving financial resources from the state as block grants. Primary education (ages 6-15) and secondary education (ages 15-19) are both compulsory. Since primary and secondary schools are mandatory, municipalities are obliged to provide transport for school children whose school building is more than 2km (primary school) and 4km (secondary school) from their home.

For the villages in the AoI, education facilities are typically structured with a central primary school in a larger village or the municipal centre, with smaller, satellite schools (often up to the fifth grade) in surrounding, less populated villages. For higher education (secondary school and university), students from these rural areas usually commute to larger towns like Stip or Radovic. There are two small schools in the AoI, one in Buchim and another one in

[25] World Bank Document 'North Macedonia Special Focus Note: Primary Education – seize the opportunity to build back better.

Shashavarlija. The primary school 'Goce Delchev' in Stip has satellite premises in Shashavarlija that hosts students up to their fifth grade. A total of nine students are studying, from grades I-V, six students in a combined class, and three students in the preparatory group. Classes in this village are held in Turkish language. The older classes are held at the main school building in Stip City.

The primary school building in Buchim, 'Nikola Karev' is part of the school with the same name located in in Radovic Town. The school offers classes from first to fifth grade and classes are taught solely in Turkish in two classrooms. The school is located in the central part of the village, near the mosque. There are approximately 60 children in this school. Children living in Golem Gaber attend school in the village of Radanje. This municipal primary school 'Strasho Pindzhur' from Radanje, is satellite of the main school in the village of Karbinci. The children attend the classes in their mother tongue, Macedonian or Turkish language. For secondary education, students from Karbinci would commute to Stip, as Karbinci Municipality does not have its own secondary school.

Stip, as the largest city in the area, serves as an educational hub for surrounding rural areas, offering several high schools that cater to different academic and vocational tracks. It offers a comprehensive range of high school (secondary) education options, which are compulsory for students aged 15-19. These schools prepare students for higher education at universities or for direct entry into the workforce. There are six public high schools in Stip and one private. Stip also has a student dormitory and a boarding school for high school students.

In Radovic Municipality, there is only one high school, 'Kosta Susinov' and it offers two branches: general (social and humanistic conducted in Macedonian and Turkish language, natural sciences, and language and art) and vocational (construction and geophysics, mechanics, electricity and mining and metallurgy).

Table 7.13 gives an overview of the number of pre-school, primary and secondary school students in all three Project affected municipalities.

Table 7.13: Enrolled children by municipality, gender and school level

Municipalities (2023)	Kindergarten		Primary school		Secondary school	
	Total	Female	Total	Female	Total	Female
Karbinci	42	24 (57.1%)	417	202 (48.4%)	-[a]	-
Radovic	466	239 (51.3%)	2,275	1,157 (50.9%)	470	223 (47.4%)
Stip	1,089	493 (45.3%)	3,771	1,804 (47.8%)	2,149	1,060 (49.3%)

Source: MakStat Database a- There is no secondary school in Karbinci. Due to the vicinity of Stip, all high school students attend classes in the Stip schools. They commute on a daily basis, and Karbinci municipality pays for the travel costs

The opening of the University 'Goce Delchev' in Stip in 2007, gave young people from the city and the region the opportunity to acquire a university education locally. The university has 15 faculties and offer more than 70 study programs.

Women participating in the FGD in Buchim stated that once they are too old for primary school, children and young people from the village travel to schools in Radovic using transportation organised by the municipality. In the past, for many girls from Buchim village, the village school was the only education they received. Most of the participants in the discussion had completed only the fourth grade (equivalent to today's fifth grade). When asked about the current opportunities for girls in the village, most of the women stated that today, girls in the village complete primary education and graduate from secondary school, and it is increasingly common for them to continue their studies at universities. When asked whether there are opportunities to learn something new (a skill, knowledge on how to do something) in the village, the participants

agreed that there is no organised way for informal education in the village, and if they want to learn something, they do so by learning from each other.

Secondary education, which is mandatory in North Macedonia, and higher education have become increasingly common among younger residents of Buchim according to male FGD participants. However, some adults locally, especially women, have limited educational attainment. Male FGD participants expressed needs to renovate the school building and to provide playground equipment. In Shashavarlija, the village's primary school is the only public institution in the village. Up to 20 children can attend classes there up to the fifth grade, after which they continue their education in the town of Stip. Participants shared that the school building is new, built with financial support from TİKA[26].

7.3.9.2 Health, health services and medical facilities

Health expenditure in North Macedonia is approximately 8.5% of GDP and has decreased from a peak of 9% in 2003[27]. People in rural areas face several barriers to accessing healthcare which include insufficient health workers, inadequate availability of medicines and equipment and lack of modern medical technologies, as well as geographical/transport barriers particularly for the elderly in rural areas and those with chronic health conditions[28]. Of the rural population, just under 2% of people do not have access to improved sanitation and 1% do not have access to improved drinking water. Major causes of mortality in 2021 included COVID-19 (409/100,000 population), stroke, heart disease and inflammation, and diabetes[29].

The healthcare system in North Macedonia consists of three segments: primary, secondary and tertiary healthcare. The primary healthcare is based on a network of private and public health facilities: clinics and health centres. The system of primary protection includes preventive, promotional and curative services through different profiles of health workers and affiliate professionals: doctors, general medicine specialist, dentists, paediatricians, school medicine specialists, gynaecologists and labour medicine specialists. The secondary health provision is practiced throughout a system of specialist advice services, general and special hospital and institutes. The tertiary health care is practiced in clinical hospitals and the University clinical centre in Skopje.

The healthcare system is mostly financed through a mandatory healthcare insurance, which gives an option for all citizens to be healthcare insured. The mandatory healthcare insurance is financed by salary allocated amounts, intended for healthcare insurance. Furthermore, North Macedonia's state budget delivers funds for covering the health insurance expenses for citizens who do not fall under health insurance by any basis, including groups such as: underage children under 18 years of age (26 if they are students), pregnant women, nursing mothers, and people above 65 years. Public health is constantly monitored by the Institute of Public Health (IPH), and the latest data and healthcare analyses are included in the Health Map of the Republic of North Macedonia 2023[30]. Table 7.14 below gives an overview of the basic vital indicators for both considered health regions: Radovic and Stip.

[26] The Turkish Cooperation and Coordination Agency (TİKA) supported North Macedonians by carrying out about hundreds of Projects in different fields, primarily education and health, in North Macedonia between 2015-2021, from 500 Projects by TİKA in North Macedonia in 6 Years - TİKA, accessed July 2025

[27] Current health expenditure (% of GDP) - North Macedonia | Data

[28] Towards health equity, cohesion and resilience in inner North Macedonia Findings from an assessment of barriers to health services

[29] World Health Organisation - North Macedonia

[30] IPH - Institute for Public Health of the Republic of North Macedonia, accessed June 2025

Table 7.14: Vital indicators in the Health Regions Stip and Radovic, 2023

Vital indicators	Per 1,000 residents	
	Health region Radovic	Health region Stip
Birth rate	6.5	7.5
Mortality	12.1	13
Rate of natural increase	-5.5	-5.4
Perinatal mortality	5.7	8.2

Source: Health map of the Republic of North Macedonia in 2023 (Institute for Public Health, 2025) Note: data for Stip covers Karbinci and data for Radovic includes Konche

In the country in 2023, in accordance with the established ambulant-polyclinic morbidity groups, most common are diseases of the circulatory system (43.8%), followed by neoplasms (18.6%), symptom, signs and unspecified conditions (13.9%), injuries and intoxications (8.2%), endocrine, nutritional and metabolic disease (7.2%) and disease of respiratory system (4.7%). Compared to 2017, in some groups the morbidity rate has increase especially in signs symptom an unexpected conditions and certain consequences caused by external reasons[31].

The Project AoI belongs to two health regions: Radovic and Stip. The health region Stip, consists of 870 km² with 73 populated settlements and 47,878 inhabitants (49.6% female). The average number of inhabitants per square kilometre (km²) is 55.0 people. The health region Radovic, consists of 743 km² with 50 populated settlements and 26,541 inhabitants (50.6% female). Average number of inhabitants per square kilometre (km²) is 35.7 people. Table 7.15 below gives overview of the medical and dental care provision in both health regions in the AoI alongside the country's figures. In each case, the Stip health region has the best provision, with the fewest residents per doctor, dentist and pharmacist compared with Radovic health region and North Macedonia as a whole.

Table 7.15: Number of residents per selected healthcare professional type

2023	Stip	Radovic	North Macedonia
Number of residents per doctor	195.4	482.6	293.6
Number of residents per dentist	870.5	1,327.1	1,039.1
Number of residents per pharmacist	938.8	1,658.8	1,652.6

Source: Health map of the Republic of North Macedonia in 2023 (Institute for Public Health, 2025)

Health region Stip consists of one health centre, a clinical hospital, and a local office of the Institute for Public Health (the office covers three health regions Stip, Radovic and ProbiStip[32]). All three institutions are in the city of Stip. There are 370 patient beds in the clinical hospital and additional seven beds in a special gynaecological hospital.

The network of medical organisational units – locations in primary and preventive health care in health region Stip in 2023 consist of 23 units providing general practice, six units providing healthcare service for children aged 0-6 years, one unit providing health care services for school children and youth, and five units providing healthcare service for women. The mortality of Stip health region in 2023 was 13.2/1000 residents.

Health region Radovic consists of one health centre and an outpatient stationery, both located in the City of Radovic. The network of medical organisational units – locations in primary and preventive health care in health region Radovic in 2023 consists of 16 units providing general practice, two units providing healthcare services for children aged 0-6 years, one unit providing

[31] IPH, Population Health Report of the Republic of North Macedonia in 2023, accessed July 2025

[32] Probistip is a city in the northeastern part of North Macedonia.

healthcare services for school children and youth, and two units providing healthcare services for women. The mortality of Radovic health region in 2023 was less than Stip, at 12.2/1000 residents.

For needs related to health services, medications, social services, and access to banks, residents of Buchim village rely on the town of Radovic, which must be reached by some form of vehicular transportation, making it a challenge for some residents without private cars who cannot easily afford taxis. The village of Shashavarlija has no shop, clinic, bank, cash machine, or any other service, apart from the branch school. For all needs and public services, villagers rely on the town of Stip, which is not connected by public transport; they travel by their own vehicles if they have them, or by taxi, which they mentioned is expensive. In emergencies, residents of rural areas must rely on ambulances from Stip or Radovic.

Women in the FGD in Buchim as well as residents in Shashavarlija shared concerns that the WTGs may have negative health impacts related to noise. Noise impacts are covered in Chapter 10. The disclosure and consultation on the Draft ESIA will allow residents to better understand the relevant impacts. Men in Buchim identified the need to improve access to certain public services, such as healthcare and suggested this could be done through a doctor visiting the village several times a week and easier access to medication. Residents in Shashavarlija expressed concerns around air quality, which is addressed in Chapter 11. Residents in Shashavarlija also expressed concerns about water quality which was scoped out during the scoping phase.

The FGDs and KIIs undertaken for the LRP revealed concerns locally about wildfires in the Project AoI. People spoke of their concerns relating to safety and livelihoods and requested support in handling fires.

7.3.9.3 Water and sewerage facilities

Water supply for communal and industrial needs in the Municipality of Stip is provided through a public water supply system which supplies the city and in four rural settlements of which only Dolani village is part of the AoI. Shashavarlija village often faces water shortages, especially in the summer months. In such situations, the village can be left without access to drinking water for several months, which represents a significant problem both for the people and their livestock. Ljuboten village in recent years has also faced water scarcity, although the municipality has provided a new water source, but has not brought the water to the village. Residents use the water from the local wells or catchments, on an individual basis. Residents and weekend visitors bring drinking water in bottles and containers, bought from the shops in Stip. Residnets of Shashavarlija expressed concerns that the Project would affect water resources available for public use, however, as mentioned in the scoping report, the Project will not use groundwater, so this impact has been scoped out.

The rural population in 43 settlements in Stip Municipality is supplied with drinking water and communal needs from natural sources in most cases. The remaining settlements solve the problem of water supply through public taps (from captured local sources) and individual or public wells. People living in Golem Gaber in the municipality of Karbinci, use local catchments for supplying water to their homes.

Buchim village lacks both a public water supply and sewerage system, with water quality being compromised by proximity to the Buchim mine, affecting well-water used for drinking, agriculture, and livestock use. Wastewater in all the AoI settlements is regulated individually with households mostly relying on individual septic tanks or pit latrines.

Women in Buchim village identified the lack of a water supply, sewerage system and stable electricity supply as the biggest problems they deal with. According to the male villagers who took part in the FGD in Buchim, the critical obstacle for agricultural development is the absence

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of adequate water infrastructure. Participants reported that at present, residents of Buchim purchase drinking water from the town of Radovic or at significantly higher prices from the local store in Buchim. There is no publicly provided regular and free access (e.g., via water tanks) to drinking water. Men in the FGD emphasised the need to meet basic living necessities through a water supply network to provide access to potable water, construction of a sewerage system, and establishment of a waste collection and transportation system. Similarly, KII respondents indicated that they would highly appreciate assistance from the Project to provide access to potable water[33].

7.3.9.4 Energy infrastructure

All villages are connected to the electric grid, and all have access to internet. However, in communication with the residents of the villages it was notified that there are problems with reliability of supply with electricity and that such state causes break in operability of some home appliances prone to electric shocks. The fluctuation of power in the electric grid was communicated many times with the provider (EVN) who didn't solve the problem to this date. This applies to small villages in the Project area, as well.

Women in the Buchim FGD identified that the existing electricity infrastructure is inadequate for the Buchim village's needs, with unstable voltage and frequent power outages which often cause household appliances to break down, generally making life difficult in terms of food preparation, hygiene, maintenance, and more. These outages and the generally poor quality of the electricity supply cause frequent appliance breakdowns and reduce the lifespan of household equipment, which not only increases household expenses but also severely impacts the quality of life in the village. Both the men and the women in Buchim FGDs expressed a hope (or even an expectation) that the Project might improve the village's electricity distribution infrastructure, resolve long-standing problems with electricity supply and provide subsidised electricity for affected villagers (a 50% discount was mentioned).

7.3.9.5 Traffic and road transportation

Transportation in the East Region and the Municipality of Stip consists mainly of road and railway networks. There are no national or international airports in the vicinity of the Project, the nearest airport is in Skopje.

In regard to the basic road corridors in the country, relevant to the Project location are the following:

- East - West: M-5 - (BG - Delchevo - Kochani - Stip - Veles - Prilep - Bitola - Resen - Ohrid - Trebenishta - M-4; branch: Bitola - Mexitlija - border with Greece).
- North - South: M-6 - (BG - Novo Selo - Strumica - Radovic - Stip - M-5; leg: Strumica - M-1).

Regional roads are connected to the highway and main road network, which together with the local roads make up the road network of North Macedonia. Regional roads near the Project location are:

- R-526: Connection with M-5 Novo Selo - Stip - Kadrifakovo - connection with M-5 - Kriva Krusha - connection with M-5 - Veles - Izvor - Prilep - connection with R-106.
- R-601: connection with R-526 - Plackovica.

[33] The demand for drinking water supply networks in the villages of Buchim and Topolnica (Topolnica is outside of the Project's AoI) has been a longstanding community concern. Although this falls under municipal responsibility, in 2021 the Buchim mine supplied water to these villages via cisterns to meet basic needs. Additionally, the mine financed a 50,000 EUR hydrogeological survey. However, the municipality of Radovic reports that, while it has developed a water supply Project, it lacks the funds to begin construction. Furthermore, the inhabitants of Buchim suspect that the mine is responsible for the shortage and pollution of their water supply.

The road infrastructure across the municipalities of Stip, Radovic, and Karbinci is generally well-developed, with all key villages accessible via the regional and local road networks. These roads serve as vital lifelines, connecting rural settlements to municipal centres, essential services, and economic opportunities. All villages are connected to the broader road network via a mix of regional and local roads.

Baltalija, Nikoman, Shashavarlija, Dolani, and Ljuboten villages, situated within the Stip municipality, are all accessible through local asphalted roads branching from the Stip–Radovic regional road (R2431 and R2432). These villages are located relatively close to Stip town, with well-maintained connections suitable for daily commuting. Shashavarlija and Dolani, for example, benefit from a direct link through a paved road that connects to the eastern bypass of Stip. Although the roads are narrow in some segments, they are functional and regularly used by local traffic, school transport, and agricultural vehicles. Kalapetrovci, Koshevo, and Tanatarci villages, also in Stip Municipality, are connected to the R2432 regional road and further link to Stip and Radovic. The section that goes from the main local road toward Kalapetrovci villages is unpaved.

Buchim village, part of the Radovic Municipality is connected via a local asphalt road to the town of Radovic which is approximately 15km away. The road infrastructure there is relatively better maintained due to the needs of industrial transport, with regular traffic mining equipment and materials traffic. Public transport lines also serve the village, enabling access to healthcare, education, and administrative services in Radovic.

Golem Gaber village is accessible through a local dirt road that connects it to the village of Radanje, a part of Municipality of Karbinci. Though the road is narrower and less busy, it remains usable year-round and connects residents to regional services. Table 7.16 shows the key transport routes and their condition from the affected villages to their main urban hub.

Table 7.16: Connecting roads from AoI villages to the nearest urban hub/municipality

Village	Road type and connection	Nearest hub
Baltalija	Connected via regional road R1204 and A4	Stip
Nikoman	Asphalted municipal road passing through Shashavarlija	Stip
Shashavarlija	Asphalted municipal road	Stip
Dolani	Connected via regional road R1204 and A4	Stip
Ljuboten	Connected via regional road R1204 and A4 and asphalted municipal road	Stip
Kalapetrovci	Asphalted and dirt municipal road passing through Shashavarlija	Radovic
Koshevo	Asphalted and dirt municipal road passing through Shashavarlija	Stip
Tanatarci	Asphalted and dirt municipal road connected to A4, through Gorachino	Stip and Radovic
Buchim	Asphalted municipal road connected to A4	Radovic
Golem Gaber	Dirt municipal road connected to Radanje and asphalted road	Karbinci
Damjan	Connected via regional road R1204 and A4	Radovic

Source: Maneko Solutions observations, 2025

The current state of roads in all three municipalities is presented in Table 7.17. Transportation of people is largely conducted by private vehicles, due to the lack of organised public transport to and from the nearest city by municipalities. There is no public transport in Buchim village, except for school transport for the students. The only way to reach the town of Radovic is by car or taxi, the latter of which according to the participants of the women's FGD in Buchim, is too expensive for their financial means. For all needs and public services, villagers of Shashavarlija rely on the town of Stip, which is also not connected by public transport; they travel by their own

vehicles if they have them, or by taxi, which they mentioned is expensive. The only road to the village was also reconstructed with financial support from TİKA.

Some participants of the FGD with residents of Shashavarlija shared information about the existence of an alternative unpaved road, which is longer but has more passable terrain and could potentially be paved and used as an alternative route to the town. Participants stated that they have often faced barriers to freely using the road to Stip when passing through the Roma settlement at the entrance of the town as part of the need to build an alternative road to the village.

Table 7.17: Road type in the affected municipalities

Road type	Karbinci (km)	Radovic (km)	Stip (km)
Asphalt and cobbled street	44	82	62
Macadam[34]	1	-	-
Earth	33	56	6
Designed roads	31	7	83
Total	109	145	151

Source: MakStat database

FGD participants in Buchim indicated concerns around damage to local roads from Project machinery and the potential for the Project's vehicles to hinder free movement of farmers by taking up the available road space. In Shashavarlijia, residents expressed similar concerns about damage to roads and ability to move freely, as well as hopes for investment in public infrastructure, with some noting that Projects like this should be part of a broader rural development plan, not just an isolated investment. KII respondents indicated that they would highly appreciate assistance from the Project to resolve issues with poor local road infrastructure.

7.3.10 Recreation

All three Project affected municipalities are rich in history and offer many opportunities for tourism and recreation. However, the Project AoI is not generally recognised as an area for tourism or recreation. Residents use the area recreationally for gatherings as described in section 7.3.11 below as well as for recreational hunting, hiking and cycling mentioned above in section 7.3.8. Male FGD participants in Buchim highlighted the need for indoor sports facilities for especially for winter activities and a children's playground.

7.3.11 Cultural heritage and sites of local importance

There are two World Heritage Sites in North Macedonia, one at Ohrid[35] (130+km away from the Project site) and one at Mavrovo and Rostuša[36] (120km away). Four places are on the tentative World Heritage list:

- Church St. George (Sv Gjorgji) Kurbinovo (115+km away from the Project site)
- Archaeo-astronomical Site Kokino (60+km away)
- Cave Slatinski Izvor (230+km away)
- Markovi Kuli (65km away)

The municipality of Radovic is rich in cultural and historical landmarks. The town is home to the Church of St. Troica, a well-preserved Orthodox church that serves as a key religious and

[34] Crushed stone layers bound by bitumen or cement.

[35] Natural and Cultural Heritage of the Ohrid region

[36] Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe

cultural site. The nearby Konče Monastery, located in the surrounding hills, is a significant pilgrimage site and cultural resource. The region hosts several local festivals celebrating agricultural traditions and religious holidays, preserving the strong cultural identity of the municipality. The municipality of Radovic is a quiet but culturally rich area that maintains deep ties to its historical roots and rural traditions.

The municipality of Stip also has a rich cultural heritage, with landmarks such as the Isar Fortress, which dates back to ancient times, and the Church of St. Archangel Michael, a medieval church that reflects the city's historical significance. The city of Stip is also known for its vibrant cultural events, including the Stip Carnival and the annual Pastrmajlija Festival, celebrating a traditional North Macedonian dish. The city is a hub for traditional music and folklore, preserving local customs and arts that have been passed down through generations. Most of the above festivities are generally during summer and autumn seasons. There is also the Bargala archaeological site (approximately 8km from the Project) in the municipality of Karbinci.

In 2009[37] when the EIA to obtain permitting was carried out, the Spatial Planning Agency issued 'Conditions for Planning the Space for the preparation of the State Urban Planning Documentation for the construction of the Stip Wind Farm'. An inventory was prepared which contains a list of registered and recorded immovable cultural assets. According to the Law on Spatial and Urban Planning, in the spatial and urban plans, based on the documentation for the immovable cultural heritage planning, measures for the protection of cultural monuments as well as guidelines for determining the mode of their protection must be determined.

During the scoping phase (as of November 2024), existing registers of protected and unprotected cultural heritage were checked, and 28 archaeological sites were identified as being registered in the wider area of the following villages, which are located within the Project's direct AoI: Buchim (6), Naselba Damjan (which is part of Damjan village but not Damjan itself) (11), Golem Gaber (2), Baltalija (1), Dolani (8), Shashavarlija (1).

According to the notification received from the UZKN (Cultural Heritage Protection Office) at the Ministry of Culture (no.17-3473/2 of 18.11.2024), there are several archaeological sites and monuments of culture at the Project location. As such, the Project was directed to contact the Institute for the Protection of Cultural Monuments and the Museum of Stip as the competent institution to inspect the boundaries of the planning scope and to provide an expert opinion.

To ensure full transparency and effective collaboration, AEP proactively engaged with the Institute for the Protection of Cultural Monuments via an in person meeting. During this meeting, AEP presented the Project's detailed design and provided comprehensive explanations to facilitate their understanding of the planned activities and the potentially affected area. Following this engagement, the Project received additional archaeological maps and coordinates identifying archaeological sites located within the wind farm boundaries.

According to the expert opinion received from the Institute for the Protection of Cultural Monuments and the Museum of Stip (no. 08-2414 of 30 January 2025) for the wind farm, it was concluded that in the area of the urban plan in question there is recorded cultural heritage in the Municipality of Radovic[38]. The recorded cultural heritage is the archaeological site Gramada – 4-822-003/37 END in the village of Buchim, Municipality of Radovic. The Gramada site is listed in the Archaeological Map of the Republic of North Macedonia Volume II from 1996 as an Iron Age necropolis. Gramad is 1km west of the village, on the right side of the road to the village of

[37] Spatial Planning Agency, Technical Number: 11609, September 2009, Skopje

[38] Urban plan for areas of national importance for the construction of a wind farm (for the production of electricity from renewable sources with a capacity of over 10 MW) in the municipality of Stip, the municipality of Radoviš and the municipality of Karbinci, planning period 2025 - 2035, Kvadar DOO Skopje, 2025.

Shopur, there is a higher, level plateau on which there is a tumulus[39] with a diameter at the base of 10m and a height of 2m. Based on the coordinates provided by the Institute, the site is located within a private land plot near WTG 30, but it does not appear to be within the footprint of any Project feature. Despite this site being part of the national cultural heritage register, there was no mention to the use of this cultural heritage site by people during consultations for the LRP or the SIA, nor do the opinion letters provide information on this.

In relation to the 400kV transmission line in cadastral municipalities Ljuboten, Puhče, and Lakavica, Municipality of Stip, registered under No. 08-272/1 dated 23 September 2025, a professional team from the Institute for the Protection of Cultural Monuments and the Museum of Stip, carried out a field inspection which determined that within the area of the proposed urban plan, i.e., the planning scope for the OHL, there is no recorded cultural heritage.

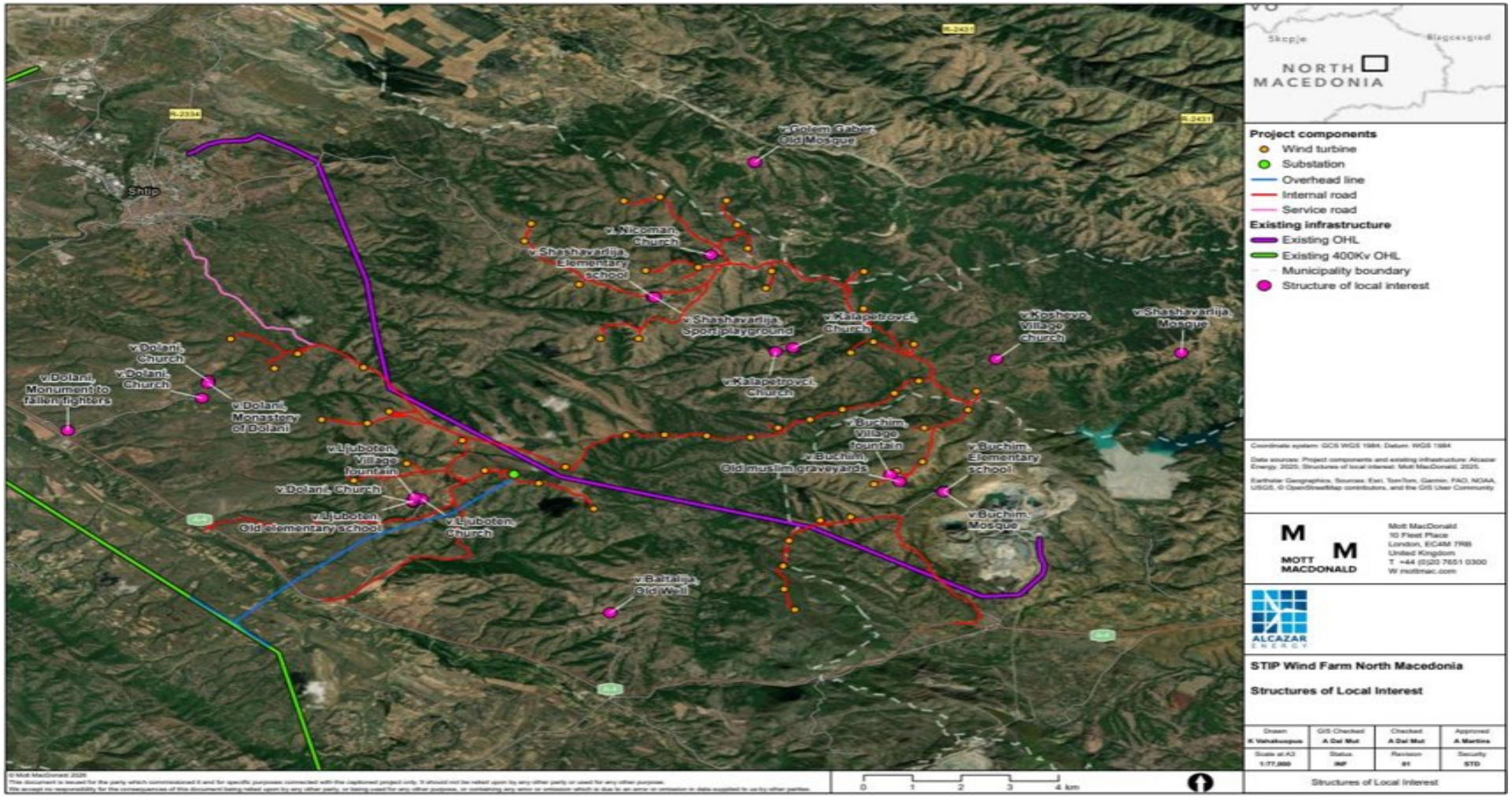
Further, in relation to an access road in cadastral municipalities Ljuboten and Lakavica, Municipality of Stip, registered under No. 08-148/1 dated 24 April 2025, a professional team from the Institute for the Protection of Cultural Monuments and the Museum of Stip, carried out a field inspection which determined that there is cultural heritage in Baltalija village. The recorded cultural heritage is the archaeological site Star Bunar – 4-832-002/55 END in village Baltalija, Municipality of Stip. The coordinates of the site are not provided in the letter from the Institute. The site Star Bunar is listed in the Archaeological Map of the Republic of North Macedonia, Volume II (1996), as an early Christian basilica located below the village on the right side of the riverbed, where foundations of walls forming the base of a structure with dimensions of 18 x 10m oriented east were detected. The dimensions, orientation, and parts of an architrave beam suggest the existence of remains of a basilical structure.

The three decisions described in the three paragraphs above constitute the total of the decisions provided to date (January 2026) on the Project by the relevant authorities. Should any further decisions be sought or provided in future, the outcomes will be incorporated into the Project ESMPs, including the archaeology and cultural heritage management plan.

From the perspective of important cultural sites for the villagers within the direct AoI, it was noted by male FGD participants in Buchim that adjacent to the planned WTG number 28 there is a location (shown in Figure 7.9 as v. Buchim, village fountain) which is used by the young people of the village for festivities on Gjurgjovden (St George's Day) on 6 May each year in a tradition dating back hundreds of years. Women contributors to the FGD in Buchim also highlighted the importance of this location, that they might not go there anymore but that they wished for their children still to be able to visit there. There is a livestock fountain/water trough (about 700m north-east from the village) in the same area around which people gather to make a grill. The water trough is located approximately 90m from WTG 28 and 20m from the closest Project boundary, although it is a large parcel of land and most of it does not overlap with the Project components. The village's residents invite relatives to join them at the celebration. A village representative, along with an Imam, accompanied Maneko Solutions to the location in May 2025 to stress the importance of it to local people. Actions taken by AEP to consult on and resolve this potential issue are discussed in section 7.4.3.3 and the issue is tracked via the grievance log.

[39] An ancient burial mound

Figure 7.9: Structures of local interest



Source: Mott MacDonald and Maneko Solutions, based on ESIA fieldwork discussions

In addition to this, and in a nearby location there is an unmarked old Muslim grave site located close to the planned road widening area to access WTG 28, shown on Figure 7.9 as v. Buchim, old Muslim graveyards, about 500m north-east of the village. It is an unmarked location of about 500-1,000m², it is not fenced, and used as pasture with several individual trees around and multiple large stones which are markers of old graves. Concerns have been raised about access during and after construction. The old Muslim grave site was observed in May 2025 at approximately 280m from WTG 28 and 30m from an internal road to be used during construction. However, a representative of the village of Buchim informed in September 2025 that they understand the graveyard extends and overlaps with the planned road widening area to access WTG 28. The precise location of the graves in relation to the planned road widening area is under review by AEP in order to avoid impacting them.

Although the residents of Buchim belong to Suni Islam confession, in favour of social cohesion, they also celebrate on the annual Yoruks Festival on 25 August. The Yoruks Festival is organized in different parts of the country where people of Yoruk origin live and is a significant event for the people of Yoruk origin. Traditional Muslim festivals such as Eid al-Fitr are also celebrated.

Figure 7.10: Livestock fountain located at red circle A (

)

Source: Maneko Solutions

Figure 7.11: Muslim graveyard located at yellow oval B (

)

Source: Maneko Solutions

The LRP survey with landowners indicated the most visited spiritual sites are Church St. Petka (Ljuboten village), Church St. Jovan (Ljuboten village), Church St. Gjorgji (Puhce village), Church St. Nedela (Chiflik village), Church Sv. Ilija and Church Sv. Petar i Pavle. There is also a mosque (Shasavarlija village). No other religious sites or temples, mosques, synagogues were mentioned. Most responses referenced visiting them between one and three times a year (52, 80%)[40] and that ceremonies take place annually (46, 71.9%) or more than once a year (18, 28.1%)..

Figure 7.12: Example of a church in Ljuboten village

Source: Maneko Solutions

During the KIIs village representatives reported that in Ljuboten there are two festivity dates which support community cohesion. Both festivities are conducted in summer, on 8 August (St.

[40] 52 respondents, 80% of whom answered between one and three visits per year

Petka) and 11 September (St. Jovan). There is a similar case in Dolani, where the festivities are conducted on 2 August (St. Ilija) and 13 September (St. Simeon). People originating from the respective villages gather in their village on both dates and celebrate saints to which both churches in the villages, respectively, are dedicated to.

7.3.12 Human rights context and baseline

This section of the baseline contains key human rights related information additional to the social baseline contained within this section which is relevant to the predicted potential and actual human rights impacts. It provides a description of the human rights issues and risks in the Project locality in North Macedonia, the wind energy sector and the Project supply chains. It also discusses the extent to which local laws are aligned with international human rights governance and good practice. Potentially affected rights-holders are identified as per the key rights scoped into our assessment (see Section 7.2.6.1) and levels of vulnerability to human rights impacts are identified in section 7.3.14. Gender issues are discussed in section 7.3.13 and minority issues are discussed in section 7.3.4.

As North Macedonia is a candidate country to the European Union, it has certain human rights obligations to fulfil under the Chapter 23 of the EU accession process. In its 2024 annual report[41], the European Commission noted that North Macedonia's legal framework on the protection of fundamental rights is largely in line with European standards and that North Macedonia has ratified most international human rights instruments (also see section 4 of this ESIA).

7.3.12.1 Labour rights risks in North Macedonia

In the construction sector generally and in wind power global supply chains which can span across the world, labour rights are among the key human rights risks faced by Projects such as this one. Although the North Macedonian laws related to labour are mostly in line with international and EU standards, in-country implementation shows deviations.

With regards to occupational health and safety issues in North Macedonia, the number of workplace fatalities 2023 was 15 workers[42] whilst in 2024 it increased slightly to 17 workers[43]. In 2023, 93 accidents were noted in the workplace, however there may be underreporting on workplace health and safety statistics and there is a limited number of labour inspectors (1.36 per 10,000 workers).

The State labour inspectorate reports especially risky work activities include those in the construction industry, energy supply industry, in mining and quarrying, and in the transportation industry, all of which form elements of the Project.

Another particularly relevant issue for the Project occurs during summer when the temperatures are high and labour inspections issue warnings recommending construction workers should refrain from work or limited work activities on hot days. However, in practice the results of inspections showed that employers do not respect inspection warnings and keep workers working under dangerous conditions.

In North Macedonia, the minimum wage set by law is below the poverty income level in all sectors[12]. According to data from the Federation of Trade Unions of North Macedonia, 2.62 minimum wages are needed to meet a family's needs[44]. Unpaid overtime work is a notable

[41] Commission Staff Working Document, North Macedonia 2024, accessed July 2025

[42] IZVESTAJ-NESRECI-PRI-RABOTA-2023.pdf, accessed July 2025

[43] Last year, 17 people lost their lives at work in North Macedonia • KosovaPress accessed July 2025

[44] North Macedonia Families Struggle as Monthly Costs Soar Past €1,000 – Wages Cover Only a Fraction – BalkanView, retrieved January 2026

issue and there are many cases of unpaid overtime work in the private sector, especially in construction[12] and security companies[45] which is of relevance to the Project. This issue is exacerbated due to the ongoing lack of labour inspectors working in the field, lack of training and equipment. There are issues with government enforcement of the minimum wage, hours of work, and occupational health and safety standards, particularly in the construction sector. The construction sector is noted as one of the riskiest areas for labour rights in North Macedonia and includes a large number of informal workers[12].

North Macedonian law provides for the right of workers to form and join unions, bargain collectively, and conduct legal strikes. The law prohibits discrimination against unions and their members and provides for reinstatement of workers fired for union activity. There is no official data of the rate of unionisation of workers in North Macedonia[45], however information on the website of the Federation of Trade Unions of North Macedonia shows that they have around 70,000 members organised in 19 branch unions, and that they have youth and women's sections. The Federation of Trade Unions includes the trade union of industry, energy and mining of North Macedonia[46], the autonomous trade union of the workers in energy industry of North Macedonia[47], the trade union of the workers in catering, tourism, communal and housing economy, handicraft and protecting associations of North Macedonia and others which may be relevant to Project workers[48]. There is also a Confederation of free labour unions of North Macedonia which includes 11 branch labour unions as members. Collective agreements are regulated within the North Macedonian labour law but are not present in all economic sectors. Trade unions appear to be closely linked to political parties in North Macedonia and come under pressure from government to lower their demands in support of business community interests[45].

The prevalence of forced labour in North Macedonia is 12.6 people per 1,000 according to the Global Slavery Index[49], making it comparable to neighbouring Albania but higher than other neighbours Kosovo, Bulgaria and Greece and relatively high risk for the region. Since there is a labour shortage in the construction sector in North Macedonia[50], it seems likely that the Project may need to hire migrant workers to make the shortfall. However, the lack of regulation on importing workers, in terms of providing accommodation, healthcare and other key services presents a risk to the welfare of migrant workers.

7.3.12.2 Rights of people with disabilities in North Macedonia

Despite the Constitution and supporting laws in North Macedonia aimed at protecting the rights of persons with disabilities (including physical, sensory, intellectual, and mental disabilities), there was unequal access to provision of education, health services, public buildings, and transportation. As such, some fundamental human rights of people with disabilities to education, health, right to take part in public life and freedom of movement were not upheld. Positively, there are laws which govern employment of persons with disabilities which provide for financial incentives to companies and vocational training for people with disabilities. However, government requirements that people with disabilities obtain medical confirmation to serve in

[45] North Macedonia Fact Sheet - Decent Work Balkans, accessed July 2025

[46] Which appears to represent renewable energy workers, as discussed in industriAll Europe | NEWS | Just Transition in North Macedonia, retrieved January 2026

[47] Which represents workers from all aspects of the energy sector.

[48] Federation of Trade Unions of North Macedonia |, accessed July 2025 – other potentially relevant unions include: Trade Union for Civil Engineering, Industry and Planning of North Macedonia (SGIP), Trade Union of Workers in Transport and Communications of the Republic of Macedonia (SRSVM)

[49] World | The Global Slavery Index, accessed July 2025

[50] North Macedonia, low wages and labour shortage / North Macedonia / Areas / Homepage - Osservatorio Balcani e Caucaso Transeuropa, accessed July 2025

supervisory positions in the private or public sector violate the right to equal treatment based on merit[12].

7.3.12.3 Supply chain human rights issues

Many mining companies which supply minerals to produce wind turbines are known to have caused human rights impacts on local communities, predominantly in low and middle-income countries in Africa (Democratic Republic of Congo (DRC), Gabon and South Africa), Latin America (Mexico, Peru and Chile), and Asia-Pacific (China, Indonesia, Russia, India, the Philippines and Malaysia), where minerals were sourced.

An example of these types of human rights issues in the wind energy raw materials supply chains include mining of copper and cobalt – copper is a key element used in coil windings, cable conductors and transformer coils of wind energy technologies and cobalt is used for the large batteries storing wind energy. Both copper and cobalt mines are commonly located in countries where there is conflict and challenging human rights contexts[51]. Cobalt mining in the DRC, which is home to over half the world's reserves, is associated with forced eviction of communities, child labour[52], fatal workplace accidents and violent clashes between artisanal miners and security personnel of large mining companies[53]. Artisanal miners lack basic workplace protections such as tools and protective clothing, whilst in larger mines labour rights issues such as payment of a living wage are not observed. The mines are also associated with environmental damage and in Peru, community challenges and opposition to poorly planned mines have resulted in the deaths of human rights defenders.

Balsa wood is a key material used in wind turbine blade as it is lightweight. One of the largest exporters of Balsa wood is Ecuador, where increased deforestation of the natural forest for balsa wood plantations has taken land from indigenous communities exposing them to risk to their right to self-determination and environmental impacts which threaten their survival and dignity[51].

The batteries for wind energy systems use lithium, most of which comes from Chile, Argentina and Bolivia. Lithium mining uses a lot of water and affects fresh water supplies for nearby indigenous communities as well as water used for crops and livestock. Not only does this affect their livelihoods and right to an adequate standard of living, it threatens their physical and cultural survival as an indigenous group (right to self-determination).

Many of the key suppliers for the Project are not yet known, however, as mentioned above AEP has commissioned a standalone labour and working conditions due diligence (LWC DD) for its preferred WTG supplier.

7.3.13 Gender

Within the wind energy sector globally, women represent only 21% of the workforce, compared to 32% in renewables overall and 22% in traditional energy industries like oil and gas[54]. Perceptions of gender roles and cultural-social norms form a major barrier to gender equality in the sector.

In North Macedonia, there is a significant gender gap in the presence of women in governance, decision-making and public life[55]. This is particularly poor at the local level, with only two women elected mayors out of 81 at the last elections. Women are also disadvantaged in the labour

[51] IHRB - What are the rights implications of wind energy?, accessed July 2025
[52] TVPRA; 2024 List of Goods Produced by Child Labor or Forced Labor, accessed July 2025
[53] Forced evictions at industrial cobalt and copper mines in the DRC, accessed July 2025
[54] Wind energy A gender perspective, accessed July 2025
[55] Country gender equality profile of North Macedonia

market, with an activity rate of 44.9% compared with 67.2% for men, whilst employment in 2021 was 38.3% for women and 56.2% for men. Employment types are starkly gendered, more women being employed in the 'care sectors' which are typically paid less. Women are also paid less in comparable positions than men[12]. In rural areas there is a lack of early childhood education/pre-school which increases the care burden for women who typically look after children and the elderly. Women's household duties take them three times as long as men's (3.38 hours compared to 1.11 hours). Intersectional issues such as living in rural areas or being of Roma or Yoruk origin increase economic participation issues for women.

Only around 12% of women in North Macedonia are owners of land and half of those are not active in decision-making around their land. In rural areas, only 5% of women hold property rights, typically due to widowhood. Women in North Macedonia also have limitations on their decision making around their own sexual and reproductive health, with only 59% in the general population and 69% in the Roma population feeling able to do this. Although there is a solid legal framework to protect women against gender-based violence and harassment (GBVH), reported crimes of domestic violence are on the increase (1,117 in 2022, 1,056 in 2021 and 992 in 2020).

Workplace sexual harassment is an issue affecting women, particularly those from vulnerable groups such as ethnic minorities and those with disabilities in North Macedonia[56]. GBVH against women continues to be a significant and increasing problem in North Macedonia[12], including psychological, physical, economic, and domestic violence; sexual harassment; or sexual assault. Although North Macedonia improved its legislative response to violence against women through ratifying and enshrining the Istanbul Convention into national law (updates to the penal code were implemented in September 2024), issues including inadequate implementation and limited access to victim services remain[57]. Violence and sexual harassment against LGBTQI+ persons are also a problem[12].

Gender dynamics in the Municipality of Stip, particularly in the rural villages of Shashavarlija, Dolani, and Ljuboten, reflect traditional patriarchal norms that influence women's roles in both private and public life. Women in these communities often face limited access to economic opportunities, education, and decision-making processes compared to their male counterparts.

In agriculture, women contribute significantly to farm labour but have less control over land ownership and income. Inheritance customs often favour male heirs, reinforcing economic dependency of women on men. Additionally, rural women bear the burden of unpaid domestic work, limiting their participation in community leadership or employment outside the home. Educational attainment among women in the villages of the AoI is generally lower than in urban Stip, with early marriages and childcare responsibilities further restricting opportunities. While younger generations have slightly improved access to education, traditional expectations still discourage women from pursuing careers beyond the household.

Local government in Stip has made some efforts to promote gender equality, such as awareness campaigns and women's associations, but rural areas lag behind. Village councils remain male-dominated, with few women in leadership roles. Social norms discourage female political participation, with traditional family obligations acting as a barrier.

The village of Buchim in Radovic Municipality exhibits deeply rooted gender inequalities, shaped by traditional values and economic challenges. Women in Buchim are primarily responsible for household duties, childcare, support for elderly relatives and agricultural work, yet they have minimal influence over financial decisions or community leadership. Economic opportunities for

[56] (PDF) MOBBING AND SEXUAL HARASSMENT IN THE WORKPLACE IN THE REPUBLIC OF NORTH MACEDONIA, accessed July 2025

[57] https://www.theadvocatesforhumanrights.org/Res/North%20Macedonia%20UPR%20Information%20Gender-based%20Violence.pdf, accessed July 2025

women are limited, with few formal employment options outside subsistence farming. Men typically control property and income, leaving women economically vulnerable. While some women engage in small-scale trade or handicrafts, lack of access to credit and markets limits their earning potential. Education levels among women in Buchim are improving, but early dropouts due to marriage or family obligations remain common. Young women show interest in education, yet societal pressures often steer them toward domestic roles rather than professional careers. Local governance in Radovic has introduced gender equality measures, but Buchim's village structures remain male-dominated. Women's participation in public meetings is low, partly due to cultural norms discouraging female visibility in leadership.

All three municipalities, but Stip particularly, support activities for improvement of women's status in society. In 2024, the municipality of Stip supported activities related to Roma women entrepreneurs (jobseeker and self-employment workshops), support for women and girls being victims of any kind of violence, and support for city's girls' football club.

Women taking part in the FGD in Buchim mostly answered negatively when asked whether they have income from their agricultural work that they can spend independently, stating that the income from their work goes into the household's shared budget. Household chores and childcare are predominantly the responsibility of women in Buchim. Participants did not mention receiving help from third parties and they noted that living in extended households (families living with elderly parents) is not common in the village, so elderly parents only occasionally help with the children (if they themselves are not engaged in farming). Regarding care for elderly parents who need assistance, this is mainly the responsibility of women, although there were cases mentioned where men also sometimes participate in caring for their elderly parents.

Almost unanimously, participants of the FGD in Shashavarlija stated that household chores, childcare, and caring for the elderly are primarily women's responsibilities, although help is sometimes available. In addition, women work alongside men in agricultural and livestock activities and contribute to the household income. Recently, villagers shared that they encourage their daughters to continue their education and pursue career paths, proudly mentioning examples of girls from the village who are studying or have gone abroad to build careers after graduation.

7.3.14 Poverty and vulnerable groups

The Laeken Poverty Indicators 2022 report, published by the State Statistical Office[58] , provides key insights into poverty, income inequality, and social exclusion in the country. The data is based on EU-standardized measurements, including the at-risk-of-poverty rate, material deprivation, and low work intensity. With regards to the at-risk-of-poverty rate, the percentage of people living below the national poverty threshold (60% of median income) was 21.8% in 2022, showing slight fluctuations compared to previous years. Around 14.5% of the population faced severe material deprivation, meaning they could not afford basic needs such as heating, nutrition, or unexpected expenses. Households with very low employment participation (below 20% of potential work hours) accounted for 8.3%, reflecting challenges in labour market access.

Analysed by household types, the at-risk-of-poverty rate in households of two adults with two dependent children in 2022 was 27.2%. According to the most frequent activity status, the at-risk-of-poverty rate for employed persons was 8.9%, while for pensioners it was 9.9%. The Gini coefficient (measure of income distribution inequality) was 29.8%[59].

[58] https://www.stat.gov.mk/pdf/2025/4.1.25.29_mk.pdf, accessed July 2025

[59] If a nation were to have absolute income equality, with every person earning the same amount, its Gini score would be 0%. On the other hand, if one person earned all the income in a nation and the rest earned zero, the Gini coefficient would be 1 (100%). The least equal nation in the world is South Africa (63%) and the most equal is Slovakia (24.1%), Gini Coefficient by Country 2025, accessed July 2025.

Poverty rates varied across regions of North Macedonia, with rural areas and certain municipalities experiencing higher deprivation levels compared to urban centres like Skopje. Children, elderly individuals, and single-parent households were disproportionately affected by poverty and material deprivation. None of the three Project affected municipalities have an active social inclusion strategy. Stip and Radovic Municipalities had some strategy in 2011, but this has since expired. Radovic Municipality has an active Strategy for Local economic development, but it does not treat social vulnerabilities, just economic aspects. The Municipalities of Stip and Karbinici do not have active strategies for local economic development.

The UN Sustainable Development Cooperation Framework[60] identifies several groups being at risk of being 'left behind' or excluded from North Macedonian society due to vulnerabilities and marginalisation. These include:

- Youth who are not in education, employment or training
- Vulnerable women and girls (through non-participation in the labour force, under-representation in politics and GBV)
- Roma communities (through poverty, lack of education, lack of documentation and poor living conditions)
- Children (through overlapping vulnerabilities such as poverty, ethnicity, large households); persons with disabilities (through access issues, social attitudes, and discrimination)
- Refugees, asylum seekers and internally displaced people
- LGBTI[61] people
- Older people (i.e. over 60) especially those with overlapping vulnerabilities including gender and ethnicity.
- People, especially women, living in rural areas and small farmers (through geographic isolation and rural poverty and through lack of property ownership for women). Smallholders are identified as being the most vulnerable group in the agricultural sector in terms of falling onto poverty. This is largely because of unfavourable assets and structures, as well as low productivity and international competition.

The North Macedonian law on social protection identifies being over the age of 65 as an indicator of vulnerability. It is important to consider that this age is not definitive but would need to be accompanied by other indicators such as poverty, landlessness, or disability to result in vulnerability, or decreased resilience to change.

The Law on Dwelling identifies vulnerable groups as children without parents or parental care, beneficiaries of social and permanent assistance, persons affected by natural disasters, people with disabilities and persons in need of care of another person, socially vulnerable persons from the Roma community, single parents with minor children.

During the scoping site visit, elderly people who live in villages affected by the Project were identified as potentially vulnerable due to their limited capacity to absorb changes brought about by the Project related to lack of mobility from their village and limited means of income.

FGD participants in both Buchim and Shashavarlija stated that the did not know of people with disabilities in their villages, however there are people who struggle to, or cannot, take care of themselves independently. Male farmers in Buchim estimated that around 20% of Buchim residents require regular health services in Radovic due to age, illness, or inability to independently manage daily tasks. Those with means currently manage this independently, using personal vehicles and investing time and effort, which reduces their participation in

[60] MKD final CCA Report 2020_20201120.pdf

[61] Lesbian, gay, bisexual, transgender, and intersex

economic activities (primarily agriculture). Individuals without such support remain without adequate care. Elderly and frail people in Shashavarlija encounter problems because they need to use the road to access health services and care. For those who are immobile, this is already very difficult, and in medical emergencies, they have to wait for an ambulance from Stip.

Potentially vulnerable groups in the Project area include elderly persons, persons with disabilities, persons with chronic illness, households under poverty line, single-headed households, Roma or Yoruk or people in other marginalised ethnic groups, children, and those using land without formal land rights[62]. People who experience more than one form of vulnerability, or intersectionality of issues, are considered to be the most vulnerable to Project impacts. Women in the context of rural North Macedonia and in the direct AoI are considered to be vulnerable in that they may be less likely to be able to participate in Project benefits such as employment and they have less control over land and resources, hence they tend to have an economic dependency on men. For further analysis of gender norms and inequality, see section 7.3.13. The ESIA considers vulnerabilities and identifies groups which may be disproportionately affected by Project impacts.

7.4 Assessment of impacts

This section presents the identification and assessment of the following anticipated beneficial and adverse significant social impacts of the Project in the planning, construction, operational and decommissioning phases:

- Economic displacement
- Employment generation and economic development
- Nuisance from increased traffic
- Cultural heritage and sites of local importance
- Project induced in-migration
- Community development

These impacts are discussed in this section. In addition the nature of typical health, safety and security risks for both workers and communities in the direct AoI are discussed. An HRIA initial scan is provided in section 7.4.6. Section 7.5 provides outline mitigation measures and section 7.6 describes monitoring requirements. Section 7.7 identifies any residual impacts with mitigation applied and assumed to be implemented effectively.

7.4.1 Identification of social groups and resources, and analysis of sensitivity

Table 7.18 below summarises the sensitivity/vulnerability of potentially impacted groups and resources to social and human rights impacts as determined through consideration of their resilience to impacts or infringements on their rights. Vulnerability is a term used in HRIA and sensitivity is used in SIA. Both terms mean the broadly the same[63], which is: the capacity of affected people (also termed rights-holders in HRIA) to absorb change. Each affected group or resource has been assigned ‘high, medium or low’ sensitivity or vulnerability to Project impacts and these ratings are used in the HRIA initial scan and SIA. Not all individuals in the groups described in Table 7.18 below will have the same level of vulnerability; within the rights-holders/potentially affected groups there will be individuals who are more vulnerable than others

[62] The LRP definitions of vulnerability are based on the census survey of landowners and focus on impacts related to economic displacement. The vulnerability described here is relevant to all social and community impacts including road traffic increases, employment, Project-induced in-migration.

[63] And are defined above in sections 7.2.2 and 7.2.6.4.

because of personal characteristics such as gender, ethnicity, age, status, as discussed in section 7.3.14 above.

Table 7.18: Group sensitivity/vulnerability analysis for rights-holders/affected groups or resources

Rightsholders /potentially affected group or resource	Brief analysis of vulnerability/sensitivity	Group sensitivity/ vulnerability
Local communities	Households living in the Project's AoI will face some temporary health and safety risks associated with the installation of wind turbines in construction. Given the reliance on informal types of employment as well as farming in the AoI, it is likely that people from the local communities will be interested in participating in employment opportunities on the Project. Vulnerability is considered to be high as members' of local communities' pre-existing knowledge about and qualifications to work on large scale infrastructure and construction Projects is expected to be limited. Vulnerability of children walking to school or other locations along village roads used by Project traffic is also considered to be high.	High
Formal landowners and formal users	People who own or have the legal right to use agricultural and other land where the Project will be located either permanently or temporarily are considered to be of medium vulnerability. While they may be reliant on their land and/or farming as a means of livelihood they have legitimately recognised rights to compensation under North Macedonian law. Educational attainment and gender inequality in the Project AoI may prove to be a barrier for women in accessing livelihood restoration initiatives and so women affected by economic displacement are considered of higher vulnerability than their male counterparts.	Medium
Informal land users	Informal occupants of land needed for the Project are considered to be of high sensitivity as they are likely to rely on farming activities as part of their household incomes and their rights are not recorded in the cadastre, so they cannot be compensated for lost land. Given the high reliance on the land, limited transport options and relatively low levels of education reported in the affected villages, farmers are considered less able to adjust household livelihoods or find alternatives. As per the above row, educational attainment and gender inequality in the Project AoI may prove to be a barrier for women in accessing livelihood restoration initiatives and so women affected by economic displacement are considered of higher vulnerability than their male counterparts.	High
Local road users	People travelling through the Project AoI, including pedestrians or hikers and cyclists are considered to be of high sensitivity to changes on the road network as existing volumes of road traffic are low and will increase during construction.	High
Archaeological sites/sites used for cultural purposes	Any damage to archaeological or culturally important sites is considered irreparable and therefore sensitivity is high.	High
Project workers	Workers can be vulnerable to labour rights infringements such as non-payment of overtime, a minimum wage which is low compared to living costs, unregulated hours of work, high numbers of informal workers and poor occupational health and safety standards, particularly in the construction sector. There are also higher rates of forced labour than neighbouring countries and poor observation of limits to work in hot weather. Low skilled construction workers and those in lower tiers of the contracting chain (whom are the primary subject of analysis in the ESIA due to their numbers and vulnerability) are generally at greater risk of poor labour conditions than semi-skilled or skilled white-collar workers. Vulnerability of Project workers is therefore considered to be high.	High

Rightsholders /potentially affected group or resource	Brief analysis of vulnerability/sensitivity	Group sensitivity/ vulnerability
Supply chain workers	The construction materials and raw materials for wind turbines and other key Project components will be sourced from different geographical locations and communities in low- and middle-income countries that have been associated with poorer labour standards and enforcement. This presents challenges in tracking and monitoring human rights issues, especially in the lowest tiers of the supply chain. Some of the risks for supply chain workers include poor occupational health and safety, child labour and forced labour. Gender discrimination in supply chain countries exacerbates vulnerability for women and girls.	High
Supply chain communities[64]	Communities in locations where raw materials are sourced may experience pressure on ecosystem services including high demand for water and damage to cropland and natural ecosystem products through mismanagement and lack of regulation of large- and small-scale mining. People living in areas impacted by mines are likely to have limited control over impacts and are therefore considered to be of high vulnerability.	High
Female workers	Women in North Macedonia and in the Project AoI experience inequalities in many realms of their lives. Women have limited control over resources and experience harassment and other forms of gender-based violence including in the workplace and intersectionality of issues including disability, age and ethnicity plays a part in increasing vulnerability for these groups. Lower levels of education for women and pervasive gender norms/roles in the Project AoI may prove to be a barrier to accessing Project employment for women.	High
Migrant workers	Like in many countries, migrant workers in the construction sector in North Macedonia are at risk of unfair labour practices and poor regulation in terms of provision of services for their basic needs. The minimum wage is low, there are labour rights risks in terms of underpayment of wages and overtime, working hours and occupational health and safety. Migrant workers are sometimes subject to unfair recruitment procedures which affect their rights. Low skilled migrant workers are considered to be of high vulnerability.	High
Minority workers and workers with disabilities	Minority ethnic groups and people with disabilities are more vulnerable than North Macedonians and those without disabilities to discrimination in, or lack of access to the workplace.	High

Source: Mott MacDonald

7.4.2 Analysis of development phase impacts

7.4.2.1 Economic displacement

Prior to commencement of construction (expected in Q2 2026), Project activities will primarily involve planning, negotiations, and securing access to land required for Project components. Based on data collected to date, no residential or business structures have been identified as affected by the construction of Project components; therefore, physical displacement is scoped out of further analysis. However, site preparation activities are expected to result in temporary and permanent economic displacement, which is addressed through a dedicated LRP. Ecosystem services impacts are assessed in Chapter 11.

The preparation of the LRP enabled the identification and differentiation of land and livelihood impacts between Stip 1 privately owned land and Stip 1, 2 and 3 government-owned land

[64] It is difficult for individual companies like AEP to affect these rights-holders because their suppliers provide products for so many companies. Impacts on this group have not been assessed in detail, rather at a screening level in relation to the HRIA initial scan. Appropriate mitigation such as supply chain due diligence has been assigned.

(covered under the LRP dated January 2026[65]). The following section discusses these impacts in detail, along with gender considerations, vulnerable groups affected by economic displacement, and the livelihood restoration support measures designed to mitigate these impacts.

Land and livelihood impacts in privately owned land (Stip 1)

The Project will affect privately owned land across 200 plots belonging to 139 landowners during Stip 1, resulting in economic displacement. The socio-economic census surveys were completed with 96 landowners (69%), representing 96 households and 276 household members, while 43 landowners were not surveyed due to inheritance processes, refusal to participate, or inability to locate them. In addition, it is estimated that 17 households represented by tenants with recognised rights occupy 33 plots, and approximately 26 households have been identified as potential[66] informal land users. Based on available data, the estimated number of PAPs is 362[67].

No landowners reported residential structures within the affected plots, and physical infrastructure improvements are minimal, limited mainly to fencing and occasional vineyard infrastructure. Most plots (92.7%) are unfenced, and 90% have no utilities or functional infrastructure[68], confirming that physical asset impacts are negligible. The entitlement analysis indicates that 57 formal landowners (41%) have crops on affected land, primarily vineyards, cereals and tobacco, with smaller proportions cultivating forage crops, vegetables, nuts and eggs. In addition, 13 tenants with recognised rights and one informal land user are expected to lose crops. Regarding trees, the analysis shows that 72 formal landowners (51.8%) have trees on their plots that may be affected by the Project, including oak, fruit and decorative species. Livestock farming is practised by five households, and one household reported beekeeping.

Temporary land needs include the urban plan boundaries[69]. Permanent land requirements cover the widening and construction of access and internal roads, the substation, WTG foundations, WTG laydown and construction areas[70], meteorological masts, OHL towers, operational buildings, and parking areas. The land above or beneath certain Project components, such as buried cables, the OHL line, and the swept area[71], may experience temporary or permanent restrictions depending on the intended use[72].

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[65] Privately owned land for Stip 2 and 3 will be part of a separate LRP.

[66] Informal land users were identified based on indications in land valuation reports, such as the presence of grazing animals, where landowners did not report owning animals. The term ‘potential’ is used because these observations do not confirm the existence of informal land users but highlight plots that may require further investigation.

[67] To make this estimate, the total number of household members among the surveyed landowners (n = 276) was considered. For the remaining groups of PAPs (landowners not surveyed, tenants with recognised rights, and informal land users), one PAP per case was assumed.

[68] Among the remaining responses, six respondents (6.6%) noted the existence of electricity poles, while irrigation systems, privately owned wells and internal access roads were mentioned by one landowner each (1.1%). No one recounted income from utilities.

[69] The Project requires an update to the urban plan, resulting in the subdivision of certain plots within the Project area and their reclassification from agricultural to construction use. This is considered a temporary impact, as restrictions apply only during the construction phase. Once construction is completed and the site has been remediated, surface use can resume.

[70] The Project proponent has permanently changed the planning designation for the land from agricultural to construction use and is currently securing the land for permanent use.

[71] The ‘swept area’ refers to the circular area covered by the rotating blades of a wind turbine; the area through which the rotor blades move as they spin.

[72] Some activities, like livestock grazing, beekeeping, or herb gathering, may still be permitted. However, others, such as planting deep-rooted crops or tall trees, constructing permanent structures, or hunting, could be prohibited, depending on the specific Project component.

Permanent land loss will affect 81 landowners, 11 tenants with recognised rights, and seven informal users, while temporary loss of access will impact 99 landowners, 11 tenants, and 20 informal users. Severe permanent impacts[73] are expected for 13 landowners, two tenants, and three informal users. Overall, the Project's impact on physical assets is minimal, with only 39 households expected to experience partial livelihood losses, primarily due to their reliance on agriculture or firewood harvesting for sales or personal consumption. No household is anticipated to lose its livelihood entirely as a result of the Project.

Land and livelihood impacts in government-owned land (Stip 1, 2 and 3)

The review of formal land use identified concession agreements covering approximately 62.26 million m²[74] of agricultural and pastureland as of December 2025. Around 76% of the total area has no active concession agreements, suggesting that a substantial proportion of land may be available for Project use, subject to government approval. The remaining 22% is under active concessions and may require engagement and, where necessary, negotiation with third parties.

Agricultural concessions are highly concentrated, with one concessionaire holding approximately four million m², which represents 91% of all concessioned agricultural land and 6.5% of the total government-owned land reviewed. The remaining agricultural concessions are distributed among 14 entities, only two of which hold more than 1% of the total area under agricultural concession. Pasture concessions show a similar pattern of concentration, with one concessionaire controlling approximately 6.78 million m², equivalent to 97% of concessioned pastureland and 11% of the total government-owned land reviewed. Most pasture concessions grant grazing rights across entire cadastral municipalities rather than specific plots. The anticipated land take for the Project is relatively small in the context of the total government-owned land reviewed, and concessionaires are expected to continue their activities within unaffected portions of impacted plots.

Informal land use was assessed through consultations undertaken during the preparation of the LRP and ESIA and a site walkover. The site walkover observations suggest that the Project area is predominantly non-urbanised, with land use characterised by a mosaic of natural and semi-natural habitats, limited and dispersed agricultural activity, and minimal residential or commercial presence. This exercise supports the institutional and stakeholder feedback: that the risk of displacement or significant livelihood impact is low for most of the area, though pockets of agricultural and pastoral use do exist and will require targeted mitigation.

While some land-based activities were mentioned during ESIA and LRP FGDs and KIIs, these references often reflect their broader cultural and economic importance rather than direct occurrence within the Project footprint. In the municipalities of Stip and Radovis, land use is central to local livelihoods, with agriculture, livestock farming, forestry, herb gathering and beekeeping being the most common activities. Agricultural production focuses on tobacco and cereals, while livestock farming (particularly cattle, sheep and goats) is widespread and unlikely to be significantly affected, as grazing can continue within the wind farm area. In Radovis, residents frequently cultivate nut and fruit trees on state-owned land, and beekeeping is a valued supplementary activity. Forested areas support the collection of non-timber products such as herbs, mushrooms and pinecones, which provide income and hold cultural significance, especially for older residents. Hunting and recreational uses such as hiking and cycling occur but are less prevalent. Livelihood strategies rely heavily on family labour, seasonal income fluctuations and community support, with external salaries providing additional stability.

[73] When more than 50% of a landowner's or land user's total landholding and land use is permanently affected by the Project.

[74] This is the total area for the land plots, not the area affected by the Project.

Seasonal patterns strongly influence agricultural and resource-based activities, with peak periods for planting, harvesting and sales concentrated in spring, summer and late winter.

Gender considerations

The LRP placed particular emphasis on gender dynamics throughout its preparation and implementation. During the preparation phase, data-gathering methodologies were designed to increase women's visibility in both private and public land contexts[75], and gender considerations were integrated into the social baseline. During implementation, special attention is given for women to be fully informed about entitlement packages and actively involved in decision-making processes[76].

Vulnerable groups affected by economic displacement

Vulnerable groups are identified and addressed through the LRP in line with GIIP. The vulnerability assessment was conducted at household level using socio-economic survey data, and a composite score was calculated to classify households into three categories: high, medium and low vulnerability. The methodology applied 14 criteria including gender, age, education, ethnicity, health status, economic conditions and dependence on natural resources for livelihoods, among others. Of the 139 private landowner households affected by Stip 1, vulnerability data was available for 94 (67.6%), with the majority classified as medium vulnerability (51 households), followed by low (23 households) and high (20 households). While the survey included questions on land users, landowners generally lacked detailed knowledge of individuals occupying their plots, meaning the ranking was applied only to formal title holders. However, the vulnerability assessment methodology was designed to be applicable to all PAPs, including those on privately and government-owned land, who will be identified as the Project progresses. Among the 39 households expected to experience partial impacts on their livelihoods, 28 are classified as medium or highly vulnerable.

The impact of economic displacement as assessed to date (January 2026), which relates to impacts on all government owned land needed and privately owned land needed for Stip 1, affects some people of **medium to high sensitivity** and some people of **low or negligible sensitivity**. The impact is certain to occur but only affects specific individuals' and households' livelihoods in a partial way, so it is considered to be **adverse and of moderate** magnitude. The magnitude may increase as more PAPs are identified when further studies are carried out on the remainder of the privately owned land needed, and as new informal land users are identified on affected land. Overall, the impact is assessed to be of **moderate significance** at present.

7.4.3 Analysis of construction phase impacts and risks

7.4.3.1 Employment generation and economic development

The construction for Stip 1 Wind Farm Project is expected to take 24 months. Given the overlapping schedules of all Projects (Stip 1, 2 and 3) , workforce numbers are likely to fluctuate between phases rather than peak at a single time.

In total, an estimated 100-300 workers at any one time are expected to be required during the construction phase for civil works, WTG installation, OHL installation, commissioning and testing

[75] For private land, the survey targeted landowners rather than self-identified 'heads of households', as cultural norms often lean to men being listed as heads even when women manage household affairs. For public land, specific FGDs were organised with women's groups and conducted in Turkish by a female facilitator to create a more comfortable environment for participants.

[76] For example, women are encouraged to sign legal documents where possible, and compensation payments are made jointly to both spouses to promote equitable benefit sharing. Additionally, LRP disclosure meetings will make a special effort to personally invite women and will include Turkish as a language option, recognising that some women in the AoI speak only Turkish.

and support services. Workforce numbers will be confirmed once TS and BOP contracts are agreed. The construction workforce is expected to consist of approximately 20% international (highly skilled) and 80% national workers from within North Macedonia.

AEP's 'employer's requirements' stipulate that the construction contractors shall apply necessary efforts and aim to meet a 30% target for local content during construction where possible, with local being defined 'as per the ESIA and generally the village/s or residential areas in closest proximity to the Project' – in this case, the villages of the direct AoI. Where labour resources from the direct AoI have been exhausted, the Project will seek workers from the indirect AoI, the Municipalities of Stip, Radovic, and Karbinci. Low to medium-skilled workers from outside of North Macedonia are not Projected to be required at this stage (as of October 2025), although highly-skilled workers and professionals will be required during the construction phase at least. Normal site working hours are unconfirmed at present. Low skilled roles include general labouring jobs such as site preparation, providing assistance to skilled trades, moving materials and equipment, as well as drivers, cleaners, security guards, caterers.

Indirect or induced employment generation will create new jobs in the Project supply chain and supporting industries in the wider AoI through sourcing of construction materials and equipment such as gravel/sand, cement, vehicles and personal protective equipment (PPE) as well as providing services to construction workers (e.g. groceries, restaurants, barbers, transportation).

The labour and working conditions of construction workers will be of interest to trade unions, workers and human rights advocates. The mismanagement of these working conditions could create conflict with the Project proponent and its contractors as well as the possibility to delay the construction schedule of the Project through workers slowdowns or strikes. Labour rights issues are discussed in the HRIA initial scan, Table 7.19.

Given existing cultural attitudes regarding what is considered to be appropriate work for women, it is less likely that women will apply for employment opportunities during construction and in particular for work considered to be manual labour. In addition to the potential for disparity in available employment opportunities for men and women on the Project, there is the potential for female workers to experience exclusion from or sexual harassment within the work environment, as detailed in the social baseline section 7.3.13. There is also the potential for discrimination within the cultural context against certain ethnic minority groups such as Roma or Yoruk in the local population so that they may be excluded from the potential benefit of employment or so that they are treated unequally to the mainstream workforce once employed[77].

Impact of local employment

It is expected that the Project's construction phase impact on local employment will be **beneficial** and of **minor to moderate magnitude**, because although jobs will be temporary, the local content targets specified in AEP's employer's requirements mean that there will be monitored efforts to include local people. Additionally, there is a limited labour supply in the villages surrounding the Project, which tend to have elderly populations of limited size. The Project has compiled a list of respondents from the LRP census survey who are interested in Project jobs. The list identifies the types of jobs they are interested in, their work experience, gender, contact details and includes 32 people: 29 men and three women. The majority expressed interest in positions such as labourer, security guard, and driver.

The sensitivity of local people who are looking for work on the Project is considered **high** given that most residents may lack skills and experience to capture skilled and higher paid employment opportunities. However, as on-the-job training will be provided for workers, it is

[77] Mitigation to prevent this, in the form of AEP's principles and guidelines, code of conduct and employer's requirements, is discussed in section 7.7.

possible that the skills and experience gained during construction phase will benefit future job prospects where workers develop new skills or enhance existing skills. The impact of local employment generation is considered to be **moderate** during construction.

Impact on local economy - opportunities for in-country procurement and local businesses service providers

The expected CAPEX for the Project is approximately USD 340 million. The proportion of the spend likely to occur in North Macedonia cannot be determined at this stage (October 2025), as the TS and BOP contracting processes are ongoing. The procurement opportunities available for businesses are unknown at present. Local community enterprises and start-ups are expected to face challenges in being able to compete with larger and more established professional providers to access the limited in-country higher value services and supplies. It is expected that the Project's impact on the local economy will be **beneficial** and of **minor magnitude**, due to limited contracts available and local businesses being limited in their ability to access higher value contracts. The **sensitivity** of the receptors (i.e. local communities and businesses) is considered as **high**. Combining the expected characteristics of the impact on local economy with the sensitivity of the receptor creates a **moderate impact**, which is considered to be potentially significant, depending on the outcome of main contract negotiations.

7.4.3.2 Nuisance from increased traffic

During the construction phase there will be an increase in road traffic, including large and slow-moving vehicles within the direct AoI. Road traffic will be generated from deliveries of plant, equipment and construction materials. At this stage (October 2025) workers' accommodation on site is not planned and instead construction workers will be transported by bus from local towns which will add to the vehicle movements. The scale of traffic increases (truck movements per day) are not known at this stage; more information will become available once the Project contractors are appointed.

In April 2024, a wind farm route survey was conducted for the Project by a company specialising in heavy lifting, heavy haulage, and superstructure works. The purpose of the survey was to assess the route conditions and propose solutions for transporting WTG components. Along the route, several critical points were identified where structural interferences could hinder successful transportation and road widening designs were based on this.

As the roads needed for distribution of Project materials will be upgraded and widened at the start of the construction phase by the Project proponent, wear and tear to existing roads is not expected. Road widening will need to take into account passing places so that local farm traffic and other traffic is not hindered by Project traffic movements and daily life can continue as normally as possible during construction. Despite this, it is likely that there will be some nuisance to road users of pre-existing local roads in the direct AoI during the construction phase. This may be particularly problematic for those with disabilities or health needs trying to access healthcare, for children accessing educational facilities and for people going about their livelihood activities. In addition, there may be night work during construction for specific work packages (e.g. concrete pouring, WTG installation, commissioning tests), which may occur sporadically with no fixed schedule. This may increase the nuisance factor from noise and potentially increase road safety issues in unlit areas (road safety is also addressed in section 7.4.3.5; noise is covered in Chapter 10). The sensitivity of the most vulnerable receptors to the **adverse impact** of traffic nuisance is **high** and the magnitude of the temporary impact is **minor**, resulting in an impact of **moderate significance**.

7.4.3.3 Cultural heritage and sites of local importance

All relevant information regarding cultural heritage in the direct AoI and important sites for residents of Buchim as described in the baseline section 7.3.11 has been passed from the fieldwork teams to the Project proponent so that impacts to known locations of importance can be avoided. Consultation between AEP and affected communities is ongoing and Project staff visited Buchim in October 2025 to discuss and consider options to address the concerns and mitigate any impacts associated with WTG 28. An open discussion addressed stakeholder concerns, including their traditional celebrations near the WTG location, and explored possible mitigation measures during construction and operational activities on the significant date. The Project footprint does not impact the specific location of the fountain and festivities, measures will be implemented during construction to ensure no impact, and WTG 28 will be curtailed on the 6 May annually.

Additionally, based on input regarding the potential presence of archaeological sites and cultural heritage within the Project, received from the Institute for the Protection of Cultural Monuments and Museum Stip, arrangements will be made for supervision of the identified sites in line with the communications received from the authorities. Potential **adverse impacts** to cultural heritage and sites of local importance will be avoided and therefore the although the **sensitivity of people will be medium to high,** the adverse impact will be of **minor magnitude** and **minor significance**.

7.4.3.4 Project induced in-migration

As noted in the social baseline (section 7.3.12.1) there is a labour shortage in the construction sector in North Macedonia. As such, it is possible that migrant workers will be employed on the construction phase of the Project. Project-induced in-migration may occur for the construction phase as the workforce may need to be sourced from both inside and outside of the direct and indirect AoI, although large numbers of workers from outside of the indirect AoI (i.e. outside of North Macedonia) are not envisaged currently (October 2025).

In-migration can increase Project risks and costs through the creation of new migrant stakeholder groups; unmet expectations of local participation, benefit and development; and deterioration in the socioeconomic context in which a Project is operating.

Adverse impacts of influx workforce may include increased demand and competition for:

a. local social and health services,
b. for local goods and services, which can lead to price hikes and crowding out of local consumers,
c. increased volume of traffic and higher risk of traffic accidents,
d. increased demands on the ecosystem and natural resources,
e. social conflicts within and between communities,
f. increased risk of spread of communicable diseases, and
g. increased rates of illicit behaviour and crime.

Such adverse impacts are usually amplified by local-level low capacity to manage and absorb the incoming labour force, and specifically when civil works are carried out in, or near, vulnerable communities and in other high-risk situations[78].

In this section, we discuss impacts a and b above. Nuisance from increased traffic (impact c) is discussed in section 7.4.3.2 above. Community, health and safety risks (impacts c, e, f and g

[78] ManagingRiskofAdverseimpactfromProjectlaborinflux.pdf, Accessed October 2025

above) are discussed below in section 7.4.3.5. Ecosystem services impacts (impact d) are discussed in Chapter 11.

Opportunistic migrants may be attracted to the area looking for employment opportunities on the Project. Accommodation will be provided for non-local workers in the form rented rooms from accommodation providers within Stip and the wider local and regional areas. A workers' accommodation camp is not envisaged at this stage (January 2026). A small increase in the non-local population is not expected to result in increased pressure on local services but could contribute to perceptions that people from the direct AoI are not sufficiently benefiting from employment opportunities and create conflict between the community in the direct AoI and workers from outside the direct AoI.

Potential new migrant stakeholder groups for may include returning family members, extended family members and former residents seeking employment; permanent labourers who move to be close to their place of employment; entrepreneurs who come to capture business opportunities associated with the Project as well as the increased demand for goods and services associated with the temporary higher levels of disposable income; and opportunistic migrants seeking direct or indirect employment.

Although public facilities and services are under resourced with limited capacity to accommodate the arrival of opportunistic migrants, the main medical services required by Project workers will be provided by the Project itself (such as first aid) and workers will be housed in municipal centres.

At the Project work sites, the demands on electricity, water supply and solid waste collection will not increase significantly as the Project is expected to purchase water privately, arrange for solid waste disposal and use generators for electricity.

The magnitude of the **adverse** Project induced in-migration impacts to the direct AoI residents and businesses is considered **minor** given the small number of workers from outside North Macedonia likely to be employed by the Project and the less likely scenario that opportunistic economic migrants will be attracted to the area. Any increase in population will be of short duration and the likelihood of the Project workforce to need to use local public services is low. The sensitivity of local residents is considered **high** given the levels of poverty and unemployment, the unsuitability of the local area to support additional population and limited public services. Local communities are unaccustomed to experiencing in-migration. The overall significance of Project-induced in migration is expected to be **minor**. Risk mitigation measures will be planned for in case the situation changes and migrant workers from outside of North Macedonia are required for the Project.

7.4.3.5 Health, safety, wellbeing and security risks (occupational and community)

This section identifies and discusses the occupational and community health, safety and security risks to which workers, site visitors and nearby residents may be exposed during the construction phase. Risks have been identified based on professional judgment and knowledge of similar Projects.

The items covered here are considered to be risks (that are generally typical of Projects of this nature and are not expected or considered likely to happen) as opposed to impacts (things that are expected or considered likely to happen and which can be positive as well as adverse). For this reason, significance has not been assessed, however appropriate management and mitigation measures are described in section 7.7. The control measures identified for the construction phase are also applicable to risks associated with the operational and decommissioning phase.

The main Project activities that represent risks to the health and safety of workers, local residents and the general public during construction are:

- Upgrading, widening and construction of internal roads
- Site clearance
- Construction activities (specialist excavation of WTG and OHL tower foundations, erection of WTGs and towers, stringing of power lines and commissioning of electric infrastructure general construction of buildings as well as)
- Transportation of workers, WTGs and associated equipment

Occupational health and safety (OHS) risks

Risks associated with OHS are based on assumptions of activities identified in Chapter 2 (Project Description) and which include some night working. The key OHS risks for the construction phase are outlined by component below:

Wind farm and general construction risks:

- Working at height will occur throughout construction and include hazards such as adverse weather conditions (high winds)
- Exposure to extreme heat
- Workers involved in vegetation clearance are at greater risk of snake bites
- Lifting operations will be a key component of the construction phase involving use of large, complex pieces of lifting equipment, resulting in exposure to physical hazards
- Rotating and moving equipment can cause injury or death from being trapped or struck by machinery parts
- Solid particles or liquid chemical sprays may cause eye injury or blindness
- Manual handling can result in ergonomic injuries
- Trip and fall hazards, objects falling from height
- Exposure to dust, noise and vibrations
- Exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery
- Working near live traffic

OHLs and substations:

- Workers may be exposed to hazards from contact with live power lines
- Working in proximity to power lines presents the risk of higher exposure to electric and magnetic fields (EMFs)
- Working at height
- Exposure to chemicals including pesticides used for right of way (RoW) clearance

Internal roads:

- There will be physical hazards including working in close proximity to moving vehicles, use of heavy machinery, exposure to adverse weather, potential for work in confined spaces such as trenches, falls from machinery and falling objects
- Chemical hazards will include exposure to dust, exhaust emissions, herbicide use and diesel fuel
- There is the potential for exposure to extremely high levels of noise from heavy equipment operation and proximity to traffic

Disease related risks which might arise during the construction phase of the Project include outbreaks and increase in the incidence of communicable diseases due to the presence of the

construction workforce living in a limited geographic area. The in-migration and housing of workers carries potential risks to worker and community health from communicable diseases, particularly respiratory infections (colds, flu, COVID-19), gastrointestinal infections such as food poisoning or norovirus, and skin infections such as staphylococcus arising from improper care of cuts and scrapes[79]. Additionally, there are increasing rates of Lyme disease globally due to changes in climate[80] which may be of relevance during the site clearance phase of works. Having to treat communicable diseases increases pressure on existing health services.

The arrival of workers during the construction phase could lead to an increase in communicable disease in local communities in accommodation centres where workers are housed. Ensuring good housing conditions and nutritional status of the workers are useful preventive measures.

The employment of local people who may be unfamiliar with working on a construction site of this nature increases risks of accidents and injuries since the local workforce may be unfamiliar with processes, materials, technology and the working culture. It should be assumed that the local workforce has no existing knowledge of hazards, protection, working with others, using specialist PPE and equipment such as harnesses, and duty of care.

Provided that the OHS risks within the construction phase are appropriately prevented, controlled and mitigated through management and mitigation measures described in section 7.5 they hold present a low risk to construction workers.

Community health, safety, and security risks

There are a number of activities in the construction phase that could cause risks to local communities. For example, Project truck and passenger vehicle movements will increase existing traffic volumes and may result in road safety risks, especially in areas where there are vulnerable road users such as non-motorised vehicles, pedestrians, cyclists and children on the road, and especially during periods of night work. Noise impacts are discussed in chapter 10.

There could be health and safety risks to the local community posed by the existence of construction sites if they are not secured, well managed and overseen. Access to construction sites by community members presents health and safety risks similar to those described for workers. There is a heightened risk for children and young people, whose ability to appreciate risk and act accordingly is lower than that of the general population.

Any accidents involving local community members will have serious effects on the individual or his/her household and could cause tensions between local communities and the Project. However, provided that all common prevention and mitigation measures are appropriately implemented, as described in section 7.7, the risk of injury for community members is assessed as low.

There may be an increased risk of workers' sexual abuse and exploitation of local people in the community. The Project workforce is considered to be of medium size with a relatively long overall construction phase duration, some workers who come from outside the direct and indirect AoI will be separated from families for long periods of time, all of which are factors that may increase the risk of GBVH and spread of sexually transmitted infections (STIs).

Any new migrant groups may result in social tension or possibly conflict between workers and local host communities due to competition for opportunities as well as cultural differences. Few, if any unskilled workers are expected (at this stage, October 2025) to be employed from outside North Macedonia and so this risk is considered to be low. Anti-social behaviour (behaviour not customarily accepted in society) can be instigated by increases in wages, for instance

[79] The Spread of Infectious Diseases on Construction Sites – Cairnmead, Accessed October 2025

[80] Lyme disease is becoming more common. But its symptoms aren't always easy to spot - BBC Future, Accessed October 2025

substance abuse that causes accidents and injuries, prostitution or domestic violence and so mitigation measures will be incorporated in the ESMP to take a precautionary approach.

The Project's existence may present security risks to local stakeholders/residents by the presence of security personnel and a risk of harm causes through use of inadequately trained security personnel or disproportional use of force by public law enforcement. Security will be the responsibility of the TS Contractor and the BOP Contractor, each within the scope of their respective works. The Project proponent may also engage an additional, separate security provider if deemed necessary. Erecting public warning signage and theft deterrents (such as fencing) for Project components, worksites and equipment will minimise risks of theft and trespass.

There is a risk that relations between local communities and the Project may be poor due to negative perceptions of the Project, leading to ill feeling and tension. The Project SEP will plan for continued engagement with communities including a community liaison officer aimed at maintaining cordial relations with communities and resolving grievances promptly.

7.4.3.6 Community relations and community development

During the data gathering for the SIA, the various hopes, desires and expectations of the Project from the affected communities have been shared. As is common with many power generation Projects, communities have expressed the hope that power distribution infrastructure will be improved to reduce power outages in their villages. An expectation for discounted electricity was also expressed by some FGD participants. Other expressed needs include for: long-term Project employment; waste infrastructure and services; medical provision in the form of doctors visiting the villages and access to medication; water and sewerage infrastructure; road repair and widening (some of which will occur through Project activities and resolving transportation challenges for Project vehicles); access to land; and support with managing wildfires.

AEP develops its own Social Development and Investment Plan for each asset . The Social Development and Investment Plan will take into account the needs expressed by affected communities during the SIA fieldwork and the Project will carry out further consultation with affected communities to understand how best to use community development budgets. As part of the community development plan, stakeholder engagement will be undertaken to:

- Explain the process and budget available for community development
- Agree on the most effective and most needed activities
- Discuss the needs and hopes which it will not be possible to act on in order to manage expectations and maintain good relations.
- Give clear information on timeframes, locations of development Projects, which groups of people will benefit
- Collaborate with public bodies to coordinate efforts where appropriate

Consideration will be given to any unintended consequences of community development such as inadvertent discrimination, exclusion of certain Project affected groups, creation of dependencies on the Project, and potential for conflict. The community development plan will aim to share Project benefits equitably between villages, ethnic groups, genders and age groups.

Provided that community development planning is managed in line with community needs and expectations of affected communities are handled respectfully (but also depending on the types of Projects undertaken and budgets provided) community development is expected to be a **beneficial impact of minor magnitude**. Although not all affected communities are of the same level of sensitivity, conservatively we consider them to be of **high sensitivity** due to the large

number of needs for basic service provision which are currently unfulfilled. The resulting impact is expected to be of **moderate significance**.

7.4.4 Analysis of operation phase impacts and risks

7.4.4.1 Livelihoods risks

Concerns were expressed during SIA data gathering that livestock such as bees and grazing animals (sheep, goats and cattle) may be negatively affected by the noise from WTGs. There are 15 households keeping grazing animals and 22 beekeepers in the direct AoI. A study conducted in 2023[81] concluded that there was an absence of impact from wind turbines on honey bee colonies. Similarly, a study[82] on the impact of WTG noise on terrestrial mammals concluded that there is a weak link between WTG noise and livestock. There are various anecdotal articles which claim effects are more adverse (some of which have been disproven[83]) but without evidence or a scientific approach. Close community liaison with farmers and monitoring of the grievance mechanism will be incorporated into the SEP/ESMP. The results of these studies will be communicated to affected communities via public consultation on the draft ESIA.

7.4.4.2 Employment generation and economic development

Impact of local employment

Operational activities are relatively limited and mainly include planned preventive maintenance, corrective maintenance, SCADA room and substation operations, and site security. A small workforce of approximately 50 personnel are expected during operation, including managers, engineers, technicians, support staff, and security personnel. Working hours are unconfirmed at this stage (October 2025) but are expected to generally follow standard office hours, except for on-call staff, weekend engineers, and those involved in urgent corrective maintenance activities. Night-time activities, if any, are expected to be very limited and specific.

AEP's 'Employer's Requirements' stipulate that the operational contractor shall apply necessary efforts and aim to meet a 70% target for local content during operations, with local being defined as per the ESIA and generally the village/s or residential areas in closest proximity to the Project – in this case, the villages of the direct AoI.

While the stability of long-term employment will have a significant **beneficial** effect on the lives of these individuals and their households, whose **sensitivity is high** if they are from the local (direct AoI) communities, the overall number of people to be employed is low making the **magnitude minor** and resulting in the significance of this impact being assessed as **moderate**.

National economy development

Over the life of the Project (Phases 1, 2 and 3), the Project is expected to generate approximately EUR 140 million in corporate income tax payments to the national government, which will contribute to the economy and development of North Macedonia in a small way over 25 to 30 years. Indirect employment may occur as a result of increased spending of those engaged in the project, however since this number is so low, this is also assessed as a

[81] Is it safe for honey bee colonies to locate apiaries near wind turbines? Fourrier et al, Entomologia Generalis, Volume 43 (2023), Issue 4, 799-809, Entomologia Generalis, Accessed October 2025

[82] The impacts of wind power on terrestrial mammals- A synthesis ISBN 978-91-620-6510-2, Olof Helldin et al, 2012, Accessed October 2025

[83] For example, the French Agency for Food, Environmental and Occupational Health and Safety disproved suspected links between WTGs and health issues in cattle - Disorders on two cattle farms highly unlikely to be due to wind turbines | Anses - Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Accessed October 2025

negligible beneficial impact. The procurement of local goods and services is also likely to be minimal and have a negligible impact on local economies. In both cases the receptors' sensitivity (local residents/communities) is considered **medium to high**, however the magnitude of the impact is **negligible to minor**, as they will benefit a very small number of people. As such, this impact is considered to be insignificant.

7.4.4.3 Impacts on internal and access roads

The water and electricity supplies will be secured locally for the substation and O&M building during operations. There will likely be a septic tank for wastewater disposal. Negative impacts are not expected on community infrastructure during operations.

The Project proponent will carry out regular maintenance of upgraded and constructed internal roads needed to access WTGs for repairs and maintenance and **magnitude is considered minor**. Significance is assessed as being **minor beneficial** for local owners' access to their plots of land, whose sensitivity is characterised as **high**.

7.4.4.4 Health, safety, wellbeing and security risks (occupational and community)

Occupational health, safety and security risks

Operational activities present similar OHS risks as the construction phase, including the key risks of working at height and electrical safety. Additional risks during operations are outlined below for each component of the Project.

Wind farm and general operational risks

- WTG collapse and blade shear or breakage potentially caused by poor maintenance, brake failure or extreme wind conditions
- Potential damage to blades and electrical equipment by lightning strikes leading to fire OHLs and substations
- Exposure to chemicals including pesticides used for RoW maintenance

Risk of WTG collapse or breakage is very low. The WTGs will be procured from a reputable manufacturer and will be compliant with several codes, standards and certifications applicable in the industry[84].

Provided that the OHS risks are appropriately prevented, controlled and mitigated through management and mitigation measures such as risk assessment and an OHS management plan they present a low risk to the operational workforce.

Community health, safety and security risks

Risks associated with community health, safety and security during operations include those associated with:

- Frosting and ice shed
- Blade shear or breakage
- WTG collapse
- Lightning strike and fire
- Issues associated with unauthorised access and vandalism

[84] These include but are not limited to: European Directives (93/68/EC. CE-marking Directive, 2006/42/EC. Machinery Directive, 2014/30/EU. EMC Directive, 2014/35/EU. Low voltage directive; EC-/EN 61400 series of standards, norms and guidelines (including. lightning protection); Applicable ISO Standards (ISO 12100:2011, EN ISO 13849-1:2015, ISO 13850:2015, EN 50308, EN 795:2012); IEC 61400-1 Wind Turbine Loads; Other EN, ISO and Eurocode Mechanical Standards, Norms, and Guidelines.

The risk of frosting and ice build-up leading to ice throw and potential injuries is considered to be low as the areas around WTGs are unlikely to be occupied during cold periods (e.g. for agriculture) and the closest residential dwelling is approximately 550m away from the WTG (WTG 28, near Buchim), which is further than the IFC recommended guidance (1.5 x WTG height, which is 211m = 317m). The WTGs will also have ice prevention systems. The risk of ice falling directly from the WTGs and causing injuries is also considered low, provided that the local population is made aware of this risk.

Occurrences of blade shear or breakage, WTG collapse and fire of WTGs are extremely rare and due to the distance to the nearest residential dwelling and the low likelihood of persons occupying areas near the WTGs in conditions that could cause such occurrences, the risk of injury is considered low. Further, the WTGs will have fire prevention systems. A risk of fire may be associated with the substation, however as will have a fire protection system, the risk of injury or spread to a wildfire from substation fire is considered low. Wind farms are not expected to adversely affect fire behaviour or create major ignition risks[85]. However, it is possible that, despite automatic shutdown and isolation installed within the WTGs, the turbine can malfunction and a fire may result.

Lightning strikes to WTGs are also possible, however it is expected that with the lightning protection system incorporated in the WTG design, including conductors and grounding systems, there is little potential for damage caused by lightning, which could further lead to injury. It is possible that WTGs may reduce the risk of wildfires caused by lightning, particularly if WTGs are sited on ridges. The risk to community members is considered low.

There will be no enclosing fence around the WTGs, however unauthorised access into the WTGs will not be possible, as the tower access doors will be locked. The substation and O&M building will be fenced and locked and there will be onsite security present. The risk of injury from unauthorised access is considered low.

Any accidents involving local community members will have serious effects on the individual or his/her household and could cause tensions between local communities and the Project. However, provided that all common prevention and mitigation measures are appropriately implemented, the risk of injury for community members is considered low.

There are risks to aircraft safety during wind farm operations. The Civil Aviation Agency (CAA) has been consulted and provided its consent for the Project on 22 April 2025, subject to conditions relating to markings on the WTGs and lighting colours and regimes. The Project proponent will continue its ongoing liaison with the CAA as the Project progresses.

7.4.5 Analysis of decommissioning phase impacts

7.4.5.1 Employment generation

The dismantling of WTGs, disposal of materials and reinstatement of land will generate some direct and indirect employment opportunities. Some of those opportunities will be available for local people. The sensitivity of individuals who are employed on the Project is expected to be **high** if baseline conditions remain similar in the intervening years, however the magnitude is **minor to negligible**, resulting in a **beneficial** impact of **minor significance**.

7.4.5.2 Nuisance from increased traffic

Similar to the construction phase, decommissioning activities will result in increased heavy and slow moving traffic, including abnormal loads, on local roads in the direct AoI as well as on

[85] Wind Farms and Bushfire Operations, 25 October 2018, Australasian Fire and Emergency Service Authorities Council Limited, 2018_10_AFAC_windfarmsbushfiresoperations.pdf, Accessed October 2025

roads to waste disposal and waste recycling facilities equipped to manage waste wind farm infrastructure. This **adverse impact** may affect people of **high** sensitivity as discussed in the section on construction phase impacts (7.4.3.2) who need to use local roads to access education and health facilities. The nuisance will be short-lived and affected a small number of people, so it is deemed to be of **minor magnitude** and result in an impact of **moderate significance**.

7.4.5.3 Health, safety, wellbeing and security risks (occupational and community)

OHS risks

Potential OHS risks posed by the closure and decommissioning phase of the Project are similar to those of the previous phases, refer to sections 7.4.3.5 and 7.4.4.4. Provided that the decommissioning phase OHS risks are appropriately prevented, controlled and mitigated through management and mitigation measures described in section 7.5 they present a low risk to the workforce decommissioning the Project components.

Community health, safety and security risks

As with the construction phase, the most common risks for community health, safety and security during decommissioning are injuries resulting from unauthorised access to construction sites, as well as traffic accidents (refer to sections 7.4.3.5 and 7.4.4.4). Any accidents involving local community members will have serious effects on the individual or his/her household and could cause tensions between local communities and the Project.

However, provided that all common prevention and mitigation measures are appropriately implemented, as described in section 7.5, the risk of injury for community members is considered low.

7.4.5.4 Cultural heritage

Decommissioning of the Project is not expected to have an impact upon the known cultural heritage resources because the activities associated with decommissioning will be confined to areas previously impacted during the construction phase of the Project. Consultation with affected communities will take place prior to works commencing to identify areas of local significance so that they can be avoided during decommissioning works.

7.4.6 Human rights initial scan

This section predicts human rights impacts which may occur as a result of the construction, operation and decommissioning phases of the Project. A separate baseline section has not been drawn up in relation to human rights, please refer instead to the socio-economic baseline in section 7.3 which contains all the relevant information, including a subsection on human rights. The methodology and AoI for the human rights impact assessment are described in section 7.2.6.

The human rights assessment has been undertaken in alignment with requirements of the United Nations Guiding Principles on Business and Human Rights (UNGPs), the International Bill of Human Rights, the core labour standards and other key conventions of the ILO, and other core UN human rights treaties. A general and high-level consideration of supply chain/supplier risks has been included in this assessment although many suppliers are not known at the time of writing (October 2025).

7.4.6.1 Identification of rights-holders

The key rights-holders[86] whose rights may be affected by the Project are:

- Project workers including contracted/sub-contracted workers
- Landowners and formal land users affected by land acquisition and loss of livelihoods
- Communities living in the Project's AoI who may be affected by movement of vehicles, presence of a construction workforce and temporary worker accommodation, emergencies
- Jobseekers and stakeholders who may be affected by discrimination with regard to employment, participation or access to remedy
- Supply chain workers and affected communities in the supply chain
- Users of archaeological/cultural sites

Within each of these groups, there may be people who are affected more severely than others including migrants, women, people with disabilities and children.

As many of the human rights impacts identified cross-over with other sections of the ESIA, this section has been presented in summary form in Table 7.19 below. The types of interactions of the Project with the scoped in human rights are identified in Table 7.4.

[86] Rights-holders are individuals (sometimes groups) are that can make legitimate claims that their rights have been contravened.

Table 7.19: Human rights initial scan

#	Impact (potential or actual) and right	Rights-holders	V	L	Severity elements			Severity without mitigation	Mitigation measures to be applied	Residual severity
					Sca	Sco	Irr.			
1	**Potential impacts** on labour rights such as non-payment of overtime, inadequate rest/breaks, lack of contracts, prevention of union activity, unequal treatment of women, monitories or migrant workers. **Potential** impact on the right to work (if contracts are terminated without warning or protections). *Contribute* to impact through indirect workforce (contracted, subcontracted and supply chain) *Cause* impact if direct workforce affected	Project workers (contracted, sub-contracted) Supply chain workers Female workers Ethnic minority workers Workers with disabilities	High	Poss.	B	C	C	3	● Project proponent to develop and implement a human rights policy to drive human rights compliance ● Project proponent to train managers and key staff in anticipated interactions between the Project and human rights issues to embed the Project's commitments on delivering on human rights policies and procedures ● TS and BOP contractors to assess occupational health and safety (OHS) and labour risks and draw up OHS plans, method statements, hazard prevention and protective measures. ● TS and BOP contractors to develop labour and working conditions management plans in line with the AEP's employer's requirements, establishing workers' rights protections and safeguards for vulnerable groups (women, ethnic minorities, migrant workers, workers with disabilities and measures to avoid any form of discrimination or harassment in the workplace. ● AEP to implement and monitor its supply chain management policies (supplier code of conduct, employer's requirements etc) and supply chain management plan regarding human rights protection in the supply chain. ● AEP to undertake a supply chain mapping, risk analysis and due diligence to understand and mitigate labour risks related to the source or manufacturing locations of any additional primary supplier components and materials not covered by previous LWC DD. ● Project proponent to implement actions arising from LWC DD. ● AEP to consider appointment of alternative suppliers if red flags are raised during DD on preferred suppliers/bidders. ● Project proponent to use legally binding contract clauses in agreements with contractors, passed down to subcontractors and supply chain providers regarding protection of labour and human rights in line with national law and international standards. ●	Lower

#	Impact (potential or actual) and right	Rights-holders	V	L	Severity elements			Severity without mitigation	Mitigation measures to be applied	Residual severity
					Sca	Sco	Irr.			
									• Project proponent and contractors to develop and disclose Human Resources (HR) policies, Project labour commitment, entitlements and labour procedures to workers, through clear and accessible communication materials and training (including toolbox talks) that consider language and literacy parameters. • TS contractor to use temporary contracts for all construction phase workers, no 'at the gate' hiring. • TS and BOP contractors to undertake demobilisation planning to include adequate notification of temporary workers regarding the end of employment. Provision of certificates of employment. • Project proponent to carry out labour monitoring of contractors' workforce including interviews with Project workers and inspections of Project provided workers' accommodation • TS and BOP contractors to carry out labour monitoring of subcontracted workforce including interviews with Project workers and inspections of Project provided workers' accommodation	
2	**Potential impact** to the rights to life and health through unsafe working conditions for workers, potential for GBVH, site access by passers-by, road safety issues, presence of security force and potential for environmental damage and spills. *Contribute* to impact through indirect workforce (contracted, subcontracted and supply chain) or construction related impacts *Cause* impact if direct workforce affected	Project workers Women in the workforce Local communities Supply chain workers Supply chain communities		Un.	A	B	A	4	• Project proponent to monitor and enforce Contractors' environmental health and safety (EHS) and security obligations (site fencing and management, OHS plan, community health and safety plan, security management plan (SMP), transport management plan (TMP) etc) and Emergency Preparedness and Response Plan (EPRP), which will provide measures for protecting Project workers and local communities. • Project proponent to develop and implement a Project specific GBVH risk assessment procedure in line with AEP's GBVH risk assessment procedure • TS and BOP contractors to develop a training management plan within the OHS plan or training management plans to make sure the workforce receives appropriate instruction to avoid health and safety risks. • Project proponent, TS and BOP contractors to provide workers with appropriately fitting PPE and restrict them from performing tasks for which they are unfit. • TS and BOP contractors to carry out OHS inspections and monitoring and enforce action on outcomes.	Lower

#	Impact (potential or actual) and right	Rights-holders	V	L	Severity elements			Severity without mitigation	Mitigation measures to be applied	Residual severity
					Sca	Sco	Irr.			
									• Supply chain management measures as per row 1 (this table)	
3	**Potential impact** to the right not to be subjected to torture, cruel, inhuman and/or degrading treatment or punishment through forced labour or other labour rights breaches in Project supply chains. *Contribute* to impact via procurement	Supply chain workers	High	Poss.	B	C	C	3	• Supply chain management measures as per row 1	Lower
4	**Potential impact** to the rights to liberty and security of person through forced labour in Project supply chains. *Contribute* to impact via procurement	Supply chain workers	High	Poss.	B	C	C	3	• Supply chain management measures as per row 1.	Lower
5	**Potential impact** to the right to an effective remedy. *Cause or contribute*	All rights-holders	High	Poss.	C	C	C	2	• Project proponent maintain grievance mechanisms for general use (outlined in the SEP) and for displaced people (outlined in the LRP). • Implementation of workers' grievance mechanism procedure framework for Project workers and oversight of contractors' management of worker grievances. . • TS and BOP contractors to ensure workers' grievance mechanisms are available to contracted and subcontracted workforce. • Project proponent, TS and BOP contractors to ensure grievance mechanisms are gender-sensitive and able to handle grievances from victims of GBVH. • Project proponent, TS and BOP contractors to provide GBVH training for people handling grievances. • Availability of AEP's whistle-blower facilities to all Project and supply chain workforces.	Lower

#	Impact (potential or actual) and right	Rights-holders	V	L	Severity elements			Severity without mitigation	Mitigation measures to be applied	Residual severity
					Sca	Sco	Irr.			
6	**Potential impact** to the right of detained persons to humane treatment through inappropriate treatment of trespassers or mishandling of site security issues. *Contribute* to impact via a security contractor	Project workers or local communities interacting with Project security personnel	High	Un.	B	C	C	2	• Project proponent to carry out security risk assessment. • TS and BOP contractors to develop security management plans in line with risk assessment. • TS and BOP contractors to carry out vetting and training for security personnel. • TS and BOP contractors to develop security management plan in collaboration with security contractor where applicable.	Lower
7	**Potential impact** to the right to privacy through potential personal data breaches. *Cause or contribute*	Project workers Local communities Formal landowners and formal land users	Med - high	Poss.	C	B	B	3	• Project proponent to develop a data protection policy with commitments and processes to protect workers and other right-holders' personal data and information. • Project proponent, TS and BOP contractors to implement data protection commitments and processes. • Contract clauses to require compliance with data protection policy from contractors, subcontractors and suppliers.	Lower
8	**Potential impact** to the rights to freedom of thought, conscience and religion; and to freedom from war propaganda and freedom from incitement to racial, religious, or national hatred through discrimination on religious or opinion grounds given local multiculturality and the potential requirement of migrant labour force. *Contribute* to impact through bringing together Project workforce.	Project workers Migrant workers Local communities	High	Poss.	C	C	C	3	• • Project proponent to include policy statements on anti-bullying and harassment as part of HR policies and Project labour commitment. • Project proponent to include in the environmental and social management plan (ESMP) and workers' code of conduct establishing that no discriminatory behaviour or harassment will be tolerated. Disclose to workers the channels to elevate any grievances related to this. • Project proponent to base SEP on inclusive principles and procedures to promote freedom of thought, conscience, opinion and expression by workers and Project affected communities.	Lower
9	**Potential impact** to the right to freedom of movement and the right not to be subjected to slavery, servitude or	Supply chain workers	High	Poss.	B	C	C	3	• Supply chain management measures as per row 1.	Lower

#	Impact (potential or actual) and right	Rights-holders	V	L	Severity elements			Severity without mitigation	Mitigation measures to be applied	Residual severity
					Sca	Sco	Irr.			
	forced labour through forced labour in the supply chain or lower tiers of contracting chain. *Contribute* to impact through indirect workforce (contracted, subcontracted and supply chain) or construction related impacts	Contracted/ subcontracted workers								
10	**Potential impact** to the rights to freedom of assembly and to freedom of opinion and expression through non-inclusive Project engagement. *Cause* impact through poor engagement planning and implementation	Project workers Local communities	High	Un.	C	C	C	2	• Project proponent to base SEP on inclusive principles and procedures to promote freedom of thought, conscience, opinion and expression by workers, Project affected communities and disadvantaged groups and individuals. • Project proponent to ensure consultation is non-discriminatory, enabling access for vulnerable groups through careful consideration of venues, timing and potential for environments intimidating certain stakeholders.	Lower
11	**Potential impact** to the rights of protection of the family, the right to marry and the right to a family life through prevention of workers from having a healthy work-life balance, affecting their quality of family life. *Contribute* to impact through indirect workforce (contracted, subcontracted and supply chain) or construction related impacts	Project workers Supply chain workers	High	Poss.	C	C	C	3	• TS and BOP contractors to establish working time, overtime pay levels and caps, roster, weekly rest, annual leave and parental leave policies according to the applicable national laws in labour contracts and human resource policies/Project labour commitment. • TS and BOP contractors to disclose working conditions at beginning of recruitment processes for candidates to have complete information. • Labour monitoring as per row 1.	Lower
12	**Potential impact** to the rights of protection for the child through child labour in Project supply chains.	Supply chain workers	High	Poss.	A	C	C	4	• Supply chain management measures as per row 1.	Lower

#	Impact (potential or actual) and right	Rights-holders	V	L	Severity elements			Severity without mitigation	Mitigation measures to be applied	Residual severity
					Sca	Sco	Irr.			
	Contribute to impact via procurement									
13 18 19 20	**Potential impact** on the right to equality before the law, equal protection of the law, and rights of non-discrimination *Cause* impact through improper stakeholder engagement planning and implementation *Contribute* to impact through indirect workforce mistreatment (contracted, subcontracted and supply chain) or construction related impacts	Women, migrant workers, people with disabilities, ethnic minorities, other vulnerable groups, people with more than one vulnerability within Project workforce and local communities	High	Poss.	C	C	C	3	● Project proponent, TS and BOP contractors to recognise groups most likely to suffer discrimination in Project hiring, selection of workers for training and promotion, stakeholder engagement and other Project activities ● Project proponent, TS and BOP contractors to establish non-discrimination and equal opportunity as fundamental to all HR policies, procedures and Project labour commitment. ● Project proponent to implement a gender mainstreaming component in Project related plans and programs, especially the SEP and LRP (see Table 7.20 below) – Develop SEP with vulnerable groups given special consideration. – Develop LRP with vulnerable groups given special consideration. ● Labour monitoring as per row 1.	Lower
14 a	**Potential impact** on the right to an adequate standard of living through labour rights issues in the Project workforce or supply chain. *Contribute* to impact through indirect workforce (contracted, subcontracted and supply chain) or construction related impacts	Project workers Supply chain workers	High	Poss.	B	A	C	4	● Human Resources (HR) policies, Project labour commitment, as per row 1 to include payment of a living wage for all Project workers. ● Labour monitoring as per row 1. ● Supply chain management measures as per row 1.	Lower
14 b	**Actual impact** on the right to an adequate standard of living *Cause* impact through Project purchase/lease of productive land	Landowners, users and tenants	Med	Likely	B	C	C	2	● Project proponent to develop land acquisition and LRP in line with national law and international standards, with prompt implementation of payment of entitlements and livelihood restoration.	Lower

#	Impact (potential or actual) and right	Rights-holders	V	L	Severity elements			Severity without mitigation	Mitigation measures to be applied	Residual severity
					Sca	Sco	Irr.			
15	**Potential impact** on the right to take part in cultural life if cultural heritage or sites of importance to people living in the AoI are affected *Cause* impact through Project purchase/lease of land	Local communities	High	Un.	C	C	A	3	• Project proponent to avoid cultural heritage features and sites of local interest by Project infrastructure. • Consultation with cultural heritage authorities where required.	Lower
16	**Actual impact** on the right to own property if the Project resorts to expropriation of land *Cause* impact through Project purchase/lease of land	Landowners	Med	Poss	C	C	C	2	• Project proponent to avoid expropriation of land and negotiate reasonable settlements with landowners. • Project proponent to develop land acquisition and LRP in line with national law and international standards.	Lower
17	**Potential impact** on the right to a clean, healthy and sustainable environment through the potential for environmental damage or spills *Contribute* to impact through actions or inactions of EPC or other contractors/subcontractors	Local communities Children	High	Poss.	C	B	C	3	• Project proponent to develop ESMP and sub-plans in line with national law and international standards to mitigate environmental impact and accidental/unforeseen damage.	Lower

Source: Mott MacDonald

7.5 Mitigation and enhancement

As mentioned in section 7.2.6.2, AEP has a series of policies and procedures designed to mitigate human rights risks within its supply chains. These provide mitigation for some of the key risks identified in relation to Project supply chains. Many of the mitigations identified for other chapters of the ESIA provide for human rights mitigations; additional specific mitigations arising from the HRIA initial scan are included in Table 7.19 above.

Table 7.20 below presents the mitigation measures that will be used to avoid, mitigate, manage and improve the potential socioeconomic and cultural heritage risks and impacts identified. As there is significant cross-over between social and human rights issues, some of the mitigation measures appear in both Tables.

In addition to the above, community engagement and disclosure activities can play a key role in managing the extent of impacts and consideration shall be given to identification of enhancement measures. Enhancement measures are actions and processes that:

- Create new positive impacts or benefits.
- Increase the reach or number of positive impacts or benefits.
- Distribute positive impacts or benefits more equitably.

7.5.1 Socio-economic, community and cultural heritage mitigation and enhancement measures

Table 7.20: Socio-economic, community and cultural heritage mitigation and enhancement measures

Impact topic	Details of mitigation/enhancement measure	Implementation timing	Implementation method	Responsibility
Land acquisition	LRP Special consideration of women and vulnerable land users in livelihood restoration packages Households of medium or high vulnerability will receive special support under the vulnerable household support programme. This includes financial allowances (either in cash or in kind) and tailored assistance throughout the livelihood restoration process. For formal landowners of private land affected by the Project, specific individual packages will be proposed based on an entitlement analysis. For the rest of PAPs from privately owned land and government-owned land (such as tenants with recognised rights, concession holders and informal land users), the LRP considers certain livelihood restoration programmes publicly accessible to help mitigate any loss of livelihood.	Planning during Project development, implementation during construction and operations until completion (subject to completion audit)	LRP	Project proponent
Livelihood risks	Veterinary support will be provided to economically displaced people via the LRP Close community liaison with farmers and monitoring of the grievance mechanisms for any livestock-related complaints	Implementation throughout construction phase.	LRP SEP	Project proponent
Employment of local people	TS and BOP contractors to develop and implement a Project-specific labour and working conditions management plan in line with AEP's employer's requirements TS and BOP contractors to establish roles and responsibilities for recruitment and staff development TS and BOP contractors to develop recruitment plans as per AEP's employer's requirements, to include: ● Establishing criteria for the selection process based on experience, skills, qualifications rather than personal traits ● Clear job descriptions for every position ● Emphasising non-discrimination and equal opportunity ● Recruitment personnel aware of Project requirements and standards	Planning prior to construction, implementation throughout.	Employer's requirements Labour and working conditions management plans Recruitment plans Social development plans SEP Training management plans Priority measures for PAPs – contract clauses for recruitment fairs with PAPs, record keeping on no. of PAPs employed	Project proponent

Impact topic	Details of mitigation/enhancement measure	Implementation timing	Implementation method	Responsibility
	Project proponent to develop Project-wide recruitment policy stating that all groups are invited to apply for work and providing clarity on local employment definitions and targets. TS and BOP to develop and implement a recruitment plan to cover recruitment approach accounting for AEP's local content targets and measures to promote diversity and inclusion with a focus on women's empowerment and to avoid discrimination on gender, ethnicity or other grounds. Recruitment approach to include disclosing required positions and skills/experience within local communities in advance through appropriate mechanisms (for instance CLO and community representatives) and prohibiting "at-the-gate" hiring Management of expectations through engagement on the recruitment policy, likely number of jobs for local people, the definition of local and duration of construction. BOP and TS contractors to include skills development and capacity building for local workers to be included in ' training management plans. TS/BOP contractors to give priority to be given to people affected by land acquisition (PAPs) who expressed interest in jobs on the Project. Contract clauses for TS and BOP contractors to develop and maintain an effective mechanism for recruitment within direct AoI and ensure they review the CVs of people affected by land acquisition for Project jobs. Priority to be given by Project proponent and O&M Contractor for employing local people from direct AoI during operations; training to be given to help access operational jobs; 70% target to be set out in recruitment policies and plans.	Planning prior to operations, implementation throughout.	Skills development training for local people to access operational jobs Operational labour and working conditions management plans	
Local procurement	Include maximising local procurement of goods and services in supply chain management plans in line with employer's requirements	Planning prior to construction, implementation throughout.	Supply chain management plans	Project proponent
Potential for influx	TS and BOP contractors to develop and implement worker codes of conduct to promote harmony between workers and affected communities, encourage respectful behaviour and prevent GBVH	Planning prior to construction, implementation throughout.	Worker code of conduct Workers' accommodation plan Employer's requirements	Project proponent

Impact topic	Details of mitigation/enhancement measure	Implementation timing	Implementation method	Responsibility
	TS and BOP contractors to develop and implement a workers' accommodation plan to outline where Project workers will stay and compliance with international accommodation standards[87] for Project provided accommodation Provision of medical and first aid care for workers at site as per employer's requirements		OHS Plan EPRP	
Emergencies such as fire or extreme weather	TS, BOP and O&M contractors to develop and implement coordinated emergency preparedness and response plans so that Project company, Project employers and their staff, and relevant third parties (local authorities and emergency services) are prepared to respond to accidental and emergency situations in a manner that prevents and mitigates harm to people and the environment. The EPRP will: ● Identify emergency situations and the communities and individuals that may potentially be impacted. ● Identify response procedures, provision of equipment and resources, designation of responsibilities, communication systems and channels and periodic response training. ● Install telecommunication systems with emergency personnel in place prior to civil works commencing and emergency communication protocol	Planning prior to construction, implementation throughout. Revision prior to operations, implementation throughout.	EPRP	Project proponent
Traffic nuisance	Road widening designs to include passing places to minimise disruption for affected communities. TS and BOP contractors to prepare coordinated TMPs to include: ● Early notification for communities of busy traffic/delivery periods or any road closures/partial road closures ● Consideration of road access needs during medical emergencies during traffic management planning ● Avoidance of key times of day for closures through consultation with affected road users (farmers, people accessing healthcare, parents of children accessing education)	Planning prior to construction, implementation throughout.	Road widening designs TMPs Periodic maintenance	Project proponent

[87] Workers' Accommodation: Processes and Standards, September 2009, IFC and EBRD

Impact topic	Details of mitigation/enhancement measure	Implementation timing	Implementation method	Responsibility
	Regular road maintenance during operations	Throughout operations		
OHS risks	TS and BOP contractors to conduct OHS risk assessments to identify potential hazards to workers, including physical, chemical, biological, meteorological[88], and radiological Provision of medical insurance for the workforce TS and BOP contractors to prepare method statements TS and BOP contractors to prepare and implement OHS plans and procedures to address: ● Hazard analysis, mitigation, and training ● PPE usage ● Roles and responsibilities ● First aid provisions, staff resources including first responder training for relevant personnel ● Pest and vector control, especially snakes and vector borne diseases associated with working in remote areas such as dengue fever ● Documenting and reporting occupational accidents, diseases, and incidents	Planning prior to construction and operations, implementation and periodic reviews throughout.	OHS risk assessments and method statements OHS plans	Project proponent
Community health and safety risks	TS and BOP contractors to conduct community health and safety risk assessment TS and BOP contractors to design, establish and regularly inspect theft deterrents and safety provisions including safety exclusion zones, fencing, signage, locks and CCTV at construction work sites and operational electrocution risk areas TS and BOP contractors to prepare and implement community health, safety and security management plan (CHSSP) Community safety awareness campaign, including for children living in the direct AoI, designed and implemented in consultation and participation with communities covering construction site, electrical safety, road safety	Planning prior to construction, implementation throughout.	Community health and safety risk assessment CHSSP SEP Security risk assessment, policy, guard's code of conduct and SMP Workers' code of conduct Training plan Disciplinary procedures EPRP	Project proponent

[88] Measures considering wind and heat (such as avoiding the hottest hour, regular breaks, shade and access to water)

Impact topic	Details of mitigation/enhancement measure	Implementation timing	Implementation method	Responsibility
	Project proponent to conduct security risk assessment, prepare and implement security policy covering appropriate use of force and other human rights topics TS and BOP contractors to prepare and implement security guard's code of conduct and SMP TS and BOP contractors to prepare and implement workers' code of conduct Liaison with CAA to be included in SEP TS to incorporate consideration of blade and ice throw in EPRP for operations	Prior to construction and throughout construction and commissioning Prior to operations		
Road safety risks	TS contractor to prepare TMP for delivery of abnormal loads and materials, considering possibility of vehicles moving in unlit areas at night BOP contractor to prepare TMP for movement of materials, equipment and workers, considering possibility of vehicles moving in unlit areas at night	Prior to construction and delivery of abnormal loads	TMPs	Project proponent
Cultural heritage	Project proponent to develop framework archaeology and cultural heritage management plan containing all stipulations and conditions from Institute for the Protection of Cultural Monuments and the Museum of Stip. TS and BOP contractors to finalise and implement archaeology and cultural heritage management plan. Project proponent to consult on and review road widening plans near WTG 28 to ensure that impacts to the graves in the old Muslim cemetery are avoided. Project proponent to continue consultation with residents of Buchim to ensure resolution to concerns around significant sites near WTG 28 remains satisfactory. Prior to construction, Project proponent notify the Institute for the Protection of Cultural Monuments and the Museum of Stip so that professional archaeological supervision of excavations can be arranged. Specifically for the access road, Project proponent to notify the Institute for the Protection of Cultural Monuments and the Museum of Stip so that professional archaeological supervision can be arranged	Prior to construction and implementation throughout	SEP and community liaison Method statement for ground clearance and excavations CFPs	Project proponent

Impact topic	Details of mitigation/enhancement measure	Implementation timing	Implementation method	Responsibility
	TS and BOP contractors to ensure presence of authorised archaeologist/conservator (in line with the requirements from Institute for the Protection of Cultural Monuments and the Museum of Stip), who will perform archaeological conservation supervision before and during ground clearance, vegetation clearance and excavations, especially at WTG 30. Contractors to prepare chance finds procedure (CFP) to include consultation with relevant authorities and inclusion of their presence and input as required. CFP to align with national law. If movable or immovable cultural heritage is discovered, the provisions of Article 65[89] of the Law on Cultural Heritage should be followed, i.e. the contractor is obliged to immediately stop the work activities and to notify the competent institution. Any finds will be demarked and protected via fencing/blocking off and the site manager and cultural heritage focal point will be contacted. The antiquities department will be informed and consulted to seek guidance and specialist advice for management of the find(s) and how best to proceed, given its nature and extent All finds will be recorded (including but not limited to): ● date, time, location of the discovery ● description of the estimated weight and dimensions with photo; description of temporary protection for implementation (if any).			
Community relations and development	Project proponent to develop and implement community development plan based on community needs and consultation with communities. Implement and regularly update the stakeholder engagement plan to manage stakeholder and community relations, expectations and grievances through consultation and disclosure mechanisms based on principles of respectful and meaningful dialogue, and including identified roles and responsibilities for	Prior to construction and implementation throughout	Community development plan SEP to include community grievance mechanism Dissemination of grievance mechanism contact details to affected communities	Project proponent

[89] Official Gazette of the Republic of North Macedonia No. 20/04 115/07, 18/11, 148/11, 23/13, 137/13, 164/13, 38/14, 44/14, 199/14, 104/15, 154/15, 192/15, 39/16, 11/18 and 20/19

Impact topic	Details of mitigation/enhancement measure	Implementation timing	Implementation method	Responsibility
	information disclosure, communication strategies, informed consultation and participation, and achieving broad community support. SEP to also include: ● Key points arising from SIA/HRIA (road safety campaign, access issues, community development, etc) ● Management of expectations around jobs and community development initiatives Implement community grievance mechanism as part of the SEP including recording and tracking of grievances received			
Update of plans, policies and procedures as appropriate for operations and decommissioning phases	TS/O&M contractor to update plans, policies and procedures as listed above and as required in the employer's requirements Project proponent to oversee and approve updates.	Plans drawn up and approved prior to commencement of operations	All plans, policies and procedures applicable in operations	Project proponent

7.6 Monitoring

Social monitoring requirements are presented in Table 7.21. Procedures for social monitoring will be described in Project specific plans and procedures related to labour and working conditions, livelihood restoration, stakeholder engagement, OHS, CHSS and traffic.

External monitoring of the LRP and evaluation of the return of economically displaced households to pre-existing or improved livelihood restoration will be required. A LRP closeout report verified by an independent third party will need to be produced. The LRP will include details on the requirements of a close out report.

Monitoring will be undertaken to determine the effectiveness of mitigation measures in terms of potential or actual human rights impacts. Many of the relevant monitoring measures are included under social monitoring, so only monitoring that is specific to the human rights impact assessment is outlined in Table 7.22.

7.6.1 Socio-economic, community and cultural heritage monitoring

Socio-economic, community and cultural heritage monitoring parameters are provided in Table 7.21 below. Each of the monitoring parameters has its own monitoring obligations, and the contractors are responsible for monitoring, recording, documenting, and reporting them to the Project proponent. The Project proponent will monitor the contractors' monitoring statistics and reports. Further detail will be provided in the ESMP.

Table 7.21: Social monitoring requirements

Monitoring topic	Responsibility	Monitoring parameters	Monitoring locations	Monitoring frequency	Monitoring timing / duration
OHS risks and incidents	Contractors Project proponent	• Worker hours • Fatality • Lost time incidents (LTI), number of days lost • Hours worked since last LTI • LTI frequency rate (LTIFR) • Medical treatment case • First aid cases • Environmental incident • Near misses • Near misses investigated and closed • Potential risk corrective actions • OHS staff/worker ratio • Emergency drills (inc. fire) conducted • HSE inspections and audits	All worksites	Daily during construction, statistics recorded monthly in contractors' monthly reports	During construction and operations
Emergency preparedness and response	Contractors Project proponent	• Training drills, including lessons learned • Emergency preparedness and response equipment (fire extinguishers, spill kits, medical emergency equipment, etc) and facilities • Community preparedness and response engagement activities (numbers and type) • Emergency service providers preparedness and response times (ie how fast incidents have been responded to)	All worksites	Quarterly for construction and bi-annual for operations	During construction and operations

Monitoring topic	Responsibility	Monitoring parameters	Monitoring locations	Monitoring frequency	Monitoring timing / duration
Worker accommodation	Project proponent Contractors	Pre-accommodation check based on guidelines to be developed but likely to include: ● Number of rooms and beds, workers accommodated ● Worker and community grievances ● Disease type / incident, lost time impacts ● Facility, including water and food quality and hygiene inspections ● Ablution facility ratios per user ● Waste segregation and appropriate disposal ● Ongoing monitoring: – Adherence to code of conduct for accommodated workers – Facility maintenance and upkeep via monitoring of WGM	Accommodation	Pre-accommodation check: One-off inspection Ongoing monitoring: Monthly	During construction and operations
Security	Project proponent	● Number of security guards ● Vetting of security guards ● Training of security guards ● Memorandum of understandings (MoUs) with public security forces – if relevant (one-off) ● Use of force or other security related grievances ● Incidents (onsite – threats, theft and robbery, roadblocks, manifestations, damage; off site – community conflicts, protests, other) ● Security engagement – meetings with public security entities, meetings about security with other stakeholders	Project worksites	Monthly	During construction and operations
Labour monitoring	Project proponent Contractors	● Adherence to Project labour commitment, worker code of conduct, labour and working conditions management plans, contract clauses related to labour rights and working conditions ● Worker profile (gender, origin, permanent/temporary, age) ● Worker contracts, working hours, overtime hours, timely and accurate worker payments ● Worker grievances – trends, type, prompt close out ● Notifications prior to termination of contracts, dismissals, disciplinary cases	Project worksites	Daily to quarterly	During construction and operations

Monitoring topic	Responsibility	Monitoring parameters	Monitoring locations	Monitoring frequency	Monitoring timing / duration
		• Provision of training (types, duration, certification, outcomes) and training records • Benefits, leave • Inspections for forced labour and child labour • Presence and activities of workers' organisations • Access to OHS provisions and appropriately fitting PPE • Local (direct AoI and indirect AoI) employment and content • PAP employment on the Project • Worker health prevention measures and incident rates			
Procurement	Contractors Project proponent	• Number of local businesses engaged in the indirect AoI and North Macedonia	Project offices	Monthly	During construction and operations
Gender management	Contractors Project proponent	• Women included in programs/initiatives through LRP and community development plan	Affected communities and Project workforce	Monthly	During all phases
Chance finds	Contractors	• Training records • Number and types of chance finds • Remedial activities	Project worksites	Monthly	Construction
Livelihood restoration	Project proponent	• LRP	Economically displaced households	Monthly	As per LRP
Community development	Project proponent	• Consultation on community development • Community investment initiative activities, beneficiaries, outcomes • Budget allocated • Budget spent	Affected communities	Monthly	During construction and operations
Stakeholder engagement	Project proponent	• Information disclosed • Meetings held (participant numbers, gender representation, topics covered, satisfaction with resolutions) • Grievances received • Grievances open • Grievances closed	All stakeholders	Monthly	During construction and operations

Monitoring topic	Responsibility	Monitoring parameters	Monitoring locations	Monitoring frequency	Monitoring timing / duration
		● Timeframe for closing grievances			
Community health and safety	Project proponent	● Health and safety risk awareness campaigns as needed – for example on road safety and construction site safety as detailed in SEP (participant numbers, gender and age representation, topics covered, outcomes) ● Workers code of conduct signed by workers ● GBVH complaints ● Accident records ● Reports/grievances related to road safety ● Anti-social behaviour incidence	Affected communities	Monthly	During construction and operations

Source: Mott MacDonald

7.6.2 Human rights monitoring

Table 7.22: Human rights monitoring requirements

Monitoring topic	Responsibility	Monitoring parameters	Monitoring area	Monitoring frequency	Monitoring timing / duration
Human rights policy	Project proponent	● Senior level commitment to human rights policy ● Contract clauses for contractors to adhere to human rights policy	Project managers on site	One-off	Once at the start of construction and once at the start of operations
Training	Project proponent Contractors	● Numbers of staff and contractor staff trained on human rights topics, dates of courses and refreshers ● Inclusion of human rights issues in site worker induction training ● Understanding of human rights topics (such as GBVH) among workers when interviewed	Project staff on site	Quarterly	Throughout Project lifecycle

Monitoring topic	Responsibility	Monitoring parameters	Monitoring area	Monitoring frequency	Monitoring timing / duration
Supply chain	Contractors	● Supply chain mapping and risk analysis reviews completed ● Findings incorporated into supplier selection ● Contract clauses on supplier code of conduct ● On site audit records for higher risk suppliers	Primary supply chain	Prior to notice to proceed	Prior to construction, annually thereafter
GBVH measures	Project proponent Contractors	● Numbers of signed workers' codes of conducts as a % of Project workers ● Review grievance mechanisms for GBVH complaints and satisfactory close-out	Project managers and staff on site	Quarterly	Throughout Project lifecycle
Public and workers' grievances	Project proponent Contractors	● Numbers of grievances ● Types of grievances and recurrency ● Number of grievances related to GBVH ● ● Appropriate close-out measures and actions to prevent recurrence ● Grievances closed out within timeframes	Affected communities Project workers	Quarterly	Throughout Project lifecycle
Data protection	Project proponent	● Senior level commitment to data protection policy ● Contract clauses for contractors to adhere to data protection policy and laws ● No complaints about data collection, handling and storage	Affected communities	Quarterly	Throughout Project lifecycle
Consultation and information disclosure	Project proponent	As included in the SEP: ● Accessibility of engagement activities for vulnerable groups including women and people with disabilities. ● Numbers of women and vulnerable individuals attending and contributing to engagement activities. ●	Affected communities	Quarterly	Throughout Project lifecycle

7.7 Residual impacts

Residual impacts are those impacts that remain after the application of mitigation and enhancement measures. For each aspect, the significance of impacts will be identified before and after mitigation (i.e. residual impact). Impacts that have been evaluated as being 'Moderate' or 'Major' are classified as significant effects. Consequently, impacts that are 'Minor' or 'Negligible' are not significant. Table 7.23 below shows the residual significance of impacts identified in section 7.6

The HRIA initial scan identified that with the application of mitigation measures, each of the potential and actual impacts identified was reduced to 'lower' severity and as such it is concluded that, provided the mitigations are applied and implemented effectively, an in-depth HRIA is not necessary for the Project.

Table 7.23: Residual social and human rights impacts

Impact	Initial significance	Residual significance	Significant or not significant
Development phase impacts			
Economic displacement	Moderate adverse	Moderate to minor	Significant
Construction and decommissioning impacts			
Local employment generation	Moderate beneficial (minor in decommissioning)	Moderate	Significant
Local procurement	Moderate beneficial	Moderate	Significant
Traffic nuisance	Moderate adverse	Minor	Not significant
Cultural heritage	Minor adverse	Negligible	Not significant
In-migration	Minor adverse	Minor	Not significant
Community development	Moderate beneficial	Moderate	Significant
Operational impacts			
Local employment generation	Moderate beneficial	Moderate	Significant
National economy development	Negligible to minor beneficial	Negligible to minor	Significant
Services and access roads	Minor beneficial	Minor	Not significant

Source: Mott MacDonald

8 Biodiversity

Issue and Revision Record

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8 Biodiversity

8.1 Introduction

8.1.1 Overview

This chapter presents the biodiversity assessment for the Project, conducted in accordance with the requirements of International Finance Corporation (IFC) Performance Standard 6 (IFC PS6): Biodiversity Conservation and Sustainable Management of Living Natural Resources (IFC, 2012; IFC, 2019), European Bank for Reconstruction and Development (EBRD) Environmental and Social Requirement 6 (ESR6): Biodiversity Conservation and Sustainable Management of Living Natural Resources Guidance Note (EBRD, 2025) and European Investment Bank (EIB) Environmental and Social Standards 4 (ESS4): Biodiversity and Ecosystems (EIB, 2022). These standards form the core of the Project's Environmental and Social Compliance Framework and therefore define the requirements for this chapter.

The assessment aims to identify and evaluate potential impacts on biodiversity, including habitats and species of conservation concern and to propose appropriate mitigation and management measures to ensure compliance with international and national standards.

The biodiversity assessment has been designed to:

- Establish a comprehensive baseline of ecological conditions within the Project area and its Area of Influence (AoI), including habitats, flora and fauna.
- Identify internationally recognised and legally protected areas, including potential overlaps with Natura 2000 sites, Important Bird and Biodiversity Areas (IBAs), and Key Biodiversity Areas (KBAs).
- Identify critical habitats and priority biodiversity features.
- Assess potential direct, indirect, and cumulative impacts of the wind farm on biodiversity, with particular attention to avian and bat species vulnerable to collision and displacement.
- Apply the mitigation hierarchy (avoidance, minimisation, restoration, and offsetting) to reduce adverse impacts and achieve no net loss or net gain of biodiversity where required.
- Set the recommendations for future Biodiversity Management Plan (BMP) and Monitoring Frameworks to guide implementation, adaptive management, and stakeholder engagement throughout the Project lifecycle.

The chapter integrates findings from desktop studies, field survey, stakeholder consultations, and expert input. It also considers the seasonal dynamics of biodiversity, including migratory patterns and breeding seasons, to ensure that the assessment reflects the full ecological context.

This biodiversity assessment supports informed decision-making and contributes to the Project's overall environmental and social performance, ensuring that biodiversity is protected and sustainably managed in line with the requirements of international financial institutions and national authorities.

8.1.2 Structure of this Chapter

This chapter is organised to provide a clear, systematic assessment of biodiversity-related risks and opportunities associated with the proposed wind farm Project

1. **Introduction:** Outlines the overview of the chapter.
2. **Legal and Policy Framework:** Summarises relevant national legislation, European Union (EU) directives, and international conventions applicable to biodiversity conservation in North Macedonia. It also outlines institutional responsibilities and the Project's requirements under IFC PS6, EBRD ESR6 and EIB ESS4 which are part of the Environmental, Social and Governance (ESG) Framework that the Project must align with.
3. **Methodology:** Describes the approach used to assess biodiversity, including:
   - **Desk Study**: Review of existing literature, databases, and previous studies.
   - **Field Surveys**: On-site ecological surveys conducted across seasons to capture species presence, habitat conditions, and ecological processes.
   - **GIS**: Mapping of habitats, species distributions, and ecological connectivity.
   - **Impact Assessment Approach**: Application of the mitigation hierarchy and significance evaluation methods.
4. **Baseline Biodiversity Conditions:** Presents the ecological characteristics of the Project area and its surroundings, including:
   - Habitat types and condition (natural/modified)
   - Flora and Fauna
5. **Impact Assessment:** Evaluates potential impacts on biodiversity during:
   - **Construction Phase:** Habitat clearance, noise, and disturbance
   - **Operation Phase:** Collision risk for birds and bats, habitat fragmentation
   - **Decommissioning Phase:** Site restoration and long-term ecological effects
6. **Mitigation and Enhancement Measures:** Identify proposed measures to avoid, minimise, restore, and offset biodiversity impacts. Includes species-specific mitigation options.
7. **Residual Impacts:** Assesses the significance of remaining impacts after mitigation, including potential for achieving **no net loss** or **net gain** of biodiversity.
8. **Monitoring and Adaptive Management:** Outlines a framework for biodiversity monitoring and adaptive management strategies to respond to unforeseen impacts or changing ecological conditions.
9. **Conclusions and Recommendations:** Summarises key findings and provides recommendations for Project design, implementation, and biodiversity safeguards.
10. **References:** Lists all sources used in the assessment, including scientific literature, documents, and survey reports.
11. **Appendices:** Provides supporting documentation, including:
    - Species lists and conservation status
    - Detailed field survey reports

8.1.3 Links to other ESIA chapters

This section links to assessments presented in other ESIA chapters, including:

- Chapter 7 Socio Economic and Cultural
- Chapter 12 Noise and Vibration
- Chapter 14 Landscape and Visual
- Chapter 15 Waste and Minerals Management

8.2 Legal and Policy Framework

8.2.1 Relevant Macedonian Environmental Legislation

The development of wind energy infrastructure in North Macedonia, including the Stip Stip Wind Farm, is governed by a comprehensive legal and policy framework designed to safeguard biodiversity and ensure sustainable land use. This framework integrates national laws, strategic plans, and international commitments, particularly those aligned with the European Union (EU) and the Convention on Biological Diversity (CBD).

Table 8.1 below summarizes the key pieces of legislation and strategic instruments that are directly relevant to biodiversity conservation and wind farm development. It highlights the scope of each law or policy, its relevance to environmental and biodiversity protection, and specific provisions that developers must consider during Project planning, permitting, construction, and operation.

Table 8.1: National legislation/ requirements

Legislation	Scope and Relevance	Key Provisions for Wind Farm Projects
Law on Nature Protection (Official Gazette No. 67/2004)	Governs biodiversity conservation, protected areas, and ecological networks.	Requires biodiversity assessments for Projects near sensitive areas. Mandates avoidance of critical habitats. Supports ecological connectivity and species protection. Lists protected species. Prohibits killing, capturing, disturbing, or destroying habitats of strictly protected species. Requires permits for any activity affecting protected species.
Law on Environment	Provides the framework for environmental protection and EIA processes.	Wind farms require full Environmental Impact Assessment (EIA). Biodiversity impacts must be assessed and mitigated. Public consultation is mandatory.
Energy Law (2025)	Regulates renewable energy development and permitting.	Wind farms must be included in the Annual Plan for Energy Facilities. Requires environmental approvals before construction. Mandates energy storage and bank guarantees for implementation.
NBSAP 2018–2023 (National Biodiversity Strategy and Action Plan)	Strategic biodiversity policy aligned with CBD and EU directives.	Encourages biodiversity mainstreaming in energy planning. Promotes avoidance of high biodiversity value areas. Supports monitoring and adaptive management. Refer to Section 8.2.1.1 below.
EU Birds and Habitats Directives (as part of EU accession alignment)	Guides protection of species and habitats across Europe.	Natura 2000 site considerations. Protection of migratory birds and bats. Strategic siting and mitigation hierarchy required. Refer to Section 8.2.1.2 below.

8.2.1.1 National Biodiversity Strategy and Action Plan (NBSAP)

North Macedonia's National Biodiversity Strategy and Action Plan (NBSAP) 2018–2023 provides the foundational policy framework for biodiversity conservation and sustainable development, aligning with the CBD and the EU Birds and Habitats Directives. The strategy emphasizes the integration of biodiversity into sectoral policies, including energy infrastructure, and is directly relevant to the planning and implementation of renewable energy Projects such as the STIP Wind Farm.

Key strategic goals/targets include:

- To overcome the main/underlying causes of biodiversity loss through its mainstreaming in the society through full implementation of EU nature conservation legislation
- Reduce direct and indirect pressures on ecosystems and biodiversity through established management practices
- To improve the status of biodiversity components aiming to increase the benefits of biodiversity and ecosystem services through restoring at least 15% of degraded ecosystems and establishing green infrastructure.
- To improve biodiversity knowledge and availability of all relevant information related to biodiversity through improving biodiversity monitoring and data systems, which supports evidence-based impact assessments and adaptive management.

The NBSAP identifies energy development as a sector with significant potential impacts on biodiversity, particularly through habitat fragmentation, collision risks for birds and bats, and disturbance during construction and operation. It calls for strategic siting of infrastructure to avoid ecologically sensitive areas, such as protected areas, critical habitats, and ecological corridors.

For the STIP Wind Farm, compliance with the NBSAP entails:

- Conducting robust biodiversity baseline studies and impact assessments.
- Avoiding or minimising impacts on species of conservation concern and key habitats.
- Aligning mitigation and monitoring measures with national conservation priorities
- Engaging stakeholders, including local communities and biodiversity experts, in Project planning and adaptive management.

The NBSAP also supports the expansion of the national protected areas network and the development of the National Ecological Network (MAK-NEN), which should be considered in the wind farm's site selection and design (MoEPP, 2018).

8.2.1.2 EU Directives

Wind farm development in North Macedonia must comply with the Law on Environment (2010) and the Law on Environmental Impact Assessment, which integrate key EU directive principles especially those of the Birds and Habitats directives. Although not yet an EU Member State, North Macedonia has held EU candidate status since 2005 which is why requirements of EU directives apply.

These directives require Member States and accession countries to ensure that Projects do not adversely affect the integrity of Natura 2000 sites, which include Special Protection Areas (SPAs) for birds and Special Areas of Conservation (SACs) for habitats. For wind energy developments within or in close proximity to these sites, a step-by-step assessment process is mandated, including screening, appropriate assessment, and, if necessary, derogation procedures under Article 6(4) of the Habitats Directive.

Developers must also implement species protection measures, particularly for birds and bats, and apply the mitigation hierarchy to avoid, minimise, and offset impacts. Strategic planning tools such as wildlife sensitivity mapping and cumulative impact assessments are recommended to guide siting decisions and reduce biodiversity risks. These requirements are

integrated into the Environmental Impact Assessment (EIA) process and are essential for ensuring compliance with EU legislation.

8.2.2 International Conventions and Agreements

North Macedonia is a signatory to several key international agreements and conventions that shape its approach to biodiversity conservation and environmental governance. These instruments provide the legal and policy foundation for integrating biodiversity considerations into national development strategies, including the planning and implementation of renewable energy Projects such as wind farms. By aligning with global frameworks, North Macedonia commits to safeguarding species, habitats, and ecological processes. These agreements also support the application of best practices in environmental impact assessment, strategic siting of infrastructure, and long-term biodiversity monitoring. Table 8.2 outlines the most relevant international instruments.

Table 8.2: Convention/ International agreements

Agreement/Convention Name	Scope and Objectives	Relevance to Wind Farm Projects
Convention on Biological Diversity (CBD) Rio de Janeiro, 1992	Global framework for biodiversity conservation and sustainable use.	Requires integration of biodiversity into national planning and impact assessments.
Convention on Migratory Species (CMS) Bonn, 1979	Conservation of migratory species across national boundaries.	Relevant for assessing impacts on migratory birds and bats.
EUROBATS Agreement 1991, under Bonn	Protection of all bat species in Europe, their roosts, and habitats.	Directly relevant to wind farm impacts, assessment and mitigation relating to bats.
Bern Convention Bern, 1979	Conservation of European wildlife and natural habitats.	Supports protection of habitats and species in Project areas.
World Heritage Convention Paris, 1972	Protection of cultural and natural heritage of outstanding value.	Ensures Projects do not impact designated heritage sites.
CITES Washington, 1972	Regulates international trade in endangered species.	Ensures compliance with species protection laws.
European Convention on Vertebrate Animals Used for Scientific Purposes Strasbourg, 1996	Regulates use of vertebrate animals in research.	Supports ethical standards in biodiversity research.
European Landscape Convention Florence, 2000	Promotes protection and management of landscapes.	Encourages integration of landscape values in Project design.
Agreement on the Conservation of Bats in Europe London, 1991	Conservation of bat populations and habitats.	Directly relevant to wind farm impacts on bats.
Agreement on the Conservation of African-Eurasian Migratory Waterbirds Hague, 1995	Conservation of migratory waterbirds and their habitats.	Supports assessment of impacts on migratory bird flyways.
Aarhus Convention Aarhus, 1998	Access to environmental information and public participation.	Mandates stakeholder engagement in environmental decision-making.
UN Framework Convention on Climate Change (UNFCCC) Rio de Janeiro, 1992	Global response to climate change.	Supports climate-resilient infrastructure and biodiversity adaptation.
UN Convention to Combat Desertification (UNCCD) Paris, 1994	Addresses land degradation and desertification.	Promotes sustainable land use in Project areas.

Source: MoEPP, 2018

8.2.3 IFC PS6 Requirements

The STIP Wind Farm is required to comply with IFC PS6, which sets out requirements for biodiversity conservation and sustainable management of natural resources. To comply with IFC PS6 a Project must:

1. **Identify Biodiversity Risks and Values**

- Undertake comprehensive baseline studies to identify habitats, species of conservation concern, and ecological connectivity
- Classify habitats as Modified, Natural and Critical Habitat in accordance with IFC PS6 definitions.

2. **Apply the Mitigation Hierarchy:**

- Avoid impacts where possible, such as sensitive areas for biodiversity.
- Minimise impacts that cannot be avoided, such as optimising turbine layout and construction methods to reduce biodiversity impacts.
- Restore disturbed areas and offset significant residual impacts where necessary to achieve no net loss or net gain

3. **Conduct a Critical Habitat Assessment**

Determine if the Project is located in Critical Habitat. Where Critical Habitat is identified, the Project must demonstrate:

- There are no viable alternatives in less sensitive areas.
- The Project will not lead to measurable adverse impacts on biodiversity values.
- Robust long-term mitigation, monitoring and management measures are in place to deliver net gain.

8.2.4 EBRD Requirements

The STIP Wind Farm is required to comply with EBRD Environmental and Social Policy (EBRD, 2024) and Environmental and Social Requirement 6 (ESR6): Biodiversity conservation and sustainable management of living natural resources Guidance note (EBRD, 2025). To comply with EBRD ESR6, a Project must:

1. **Identify Biodiversity Baseline and Risk**

Establish a detailed biodiversity surveys through appropriate field surveys and data collection to identify protected areas, habitats, species, ecological function and ecosystem services. Assess biodiversity risks and impacts, including cumulative effects as part of the ESIA.

2. **Mitigation Hierarchy and No Net Loss**

Apply the mitigation hierarchy (avoidance, minimisation, restoration, and offsetting) to reduce biodiversity impacts. Where impacts remain, the Project must commit to achieving no net loss of biodiversity.

3. **Critical Habitat and Priority Biodiversity Features (PBF)**

Identify Priority Biodiversity Features and Critical Habitats in accordance with ESR6 definitions. For any identified critical or priority biodiversity features, the Project must demonstrate:

- No viable alternatives in less sensitive areas.
- The Project will avoid significant adverse impacts on biodiversity values.
- Long-term, scientifically robust mitigation, monitoring, and management measures are implemented.

Where impacts remain, the Project commits to achieving a net gain for critical habitat features and no net loss of PBF.

4. **Alignment with EU Directives**

- Projects in the EU/ candidate and potential candidate countries must comply with EU legislation (e.g. Habitats and Birds Directives).

8.2.5 EIB Requirements

The STIP Wind Farm is required to comply with European Investment Bank Standard 4: Biodiversity and Ecosystems (EIB, 2022). To comply with EIB ESS4, a Project must:

1. **Identify and Assess Biodiversity Risks, Impacts, and Dependencies**

- Conduct robust baseline studies and biodiversity assessments to understand habitats, species, ecosystem functions, and ecosystem services.
- Assess direct, indirect, cumulative impacts on biodiversity and ecosystems.

2. **Apply the Mitigation Hierarchy and the Precautionary Approach**

- Avoid impacts wherever possible, then minimise, restore, and as a last resort compensate for residual effects.
- Apply the precautionary principle in situations of scientific uncertainty to prevent irreversible biodiversity loss.

3. **Achieve No Net Loss and Net Positive Impact Where Required**

- Ensure No Net Loss of biodiversity for all Projects.
- Achieve Net Positive Impact (NPI) in cases involving Critical Habitat or where required by Project location or risk

4. **Protect Critical Habitat and High-Value Biodiversity Areas**

Projects must identify and safeguard ecosystem services that local communities depend on, integrating a human-rights-based approach.

- Identify and safeguard Critical Habitat, legally protected areas, and internationally recognised sites.
- Projects affecting Critical Habitat must demonstrate:
    - No viable alternatives;
    - No measurable adverse impacts on the ecological integrity of the habitat;
    - Implementation of long-term, effective mitigation and monitoring to deliver net positive outcomes.

5. **Safeguard Ecosystem Services and Vulnerable Communities**

- Identify ecosystem services relied upon by communities, especially vulnerable or Indigenous groups. Avoid or mitigate impacts that could undermine livelihoods, cultural values, or human wellbeing.

6. Safeguard Ecosystem Services and Vulnerable Communities

- Identify ecosystem services relied upon by communities, especially vulnerable or Indigenous groups.
- Avoid or mitigate impacts that could undermine livelihoods, cultural values, or human wellbeing.

7. Ensure Compliance with National, EU and International Obligations

- Projects in the EU/ equivalent jurisdictions must comply with EU legislation (e.g. Habitats and Birds Directives).
- Projects outside the EU must align with national law and EIB biodiversity principles, aiming for no net loss and net-positive outcomes.

Comparison between IFC, EBRD and EIB requirements

IFC PS6, EBRD ESR6 and EIB ESS4 share core principles, including the use of the mitigation hierarchy, protection of critical habitats, and the goal of no net loss of biodiversity. However, ESR6 places greater emphasis on PBF, ecosystem services, while PS6 provides more detailed guidance on Critical Habitat and offset requirements. EIB also requires an overall “Net Positive Impact” in Critical Habitat. EIB includes an ecosystem-based approach to mitigation through integration of human rights around ecosystem services and precautionary principle application.

In practice, the STIP Wind Farm has adopted a harmonized approach to meet all standards. There is a requirement for Net Gain/ Net Positive Impact in Critical Habitats and No Net Loss for Natural Habitats and PBF.

8.2.6 Good International Industry Practice

In addition to the legal and policy frameworks set out in the sections above, this ESIA chapter also follows Good International Industry Practice (GIIP), including:

- Rodrigues et al. (2015). Guidelines for consideration of bats in wind farm Projects. EUROBATS Publication Series No. 6. UNEP/EUROBATS Secretariat, Bonn, Germany.
- Bennun et al. (2021). Mitigating biodiversity impacts associated with solar and wind energy development: Guidelines for Project developers. IUCN and The Biodiversity Consultancy, Gland, Switzerland and Cambridge, UK.
- IUCN & TBC (2024). Guidance on biodiversity cumulative impact assessment for wind and solar developments and associated infrastructure. IUCN and The Biodiversity Consultancy.
- EUKI Wind4Bio Framework (2023). Framework for mitigating the biodiversity risks of wind farms in Wind4Bio territories. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.
- The Biodiversity Consultancy (2019). Wind energy: managing biodiversity risks. Practical application of the mitigation hierarchy and biodiversity screening tools.
- Scottish National Heritage (2014) Recommended bird survey methods to inform impact assessment of onshore wind farms. May 2014. [pdf] Available at: <http://www.snh.gov.uk/docs/C278917.pdf>
- Hundt, L., 2012. Bat surveys: Good Practice Guidelines, 2ndEdition. Bat Conservation Trust, London.

- Band, W, Madders, M, & Whitfield, D.P., (2007). Developing field and analytical methods to assess avian collision risk at wind farms. In: Janss, G, de Lucas, M & Ferrer, M (eds.) Birds and Wind Farms. Quercus, Madrid. 259-275.
- Gullison, R.E., Hardner, J., Anstee, S. & Meyer, M. (2015) Good Practices for the Collection of Biodiversity Baseline Data. Prepared for the Multilateral Financing Institutions Biodiversity Working Group & Cross-Sector Biodiversity Initiative

8.3 Methodology

This section outlines the approach adopted to establish the ecological baseline and assess potential impacts associated with the proposed Project. The methodology integrates a comprehensive desk study and literature review to collate existing ecological data relevant to the Project. The study area is defined to encompass the proposed development footprint, while the field survey area includes habitats and ecological features within and adjacent to the site that may be directly or indirectly affected. The Areas of Influence (AoI) are also delineated to capture all receptors potentially impacted by construction and operational activities, including mobile species. Field surveys were conducted using standard ecological techniques appropriate to the target taxa and habitats and were timed to coincide with key seasonal windows. Geographic Information Systems (GIS) were employed to spatially analyse ecological data, support habitat mapping, and inform both the baseline characterisation and impact assessment.

8.3.1 Study Areas

For the purposes of this ESIA, three areas of interest to biodiversity are defined and are presented in Table 8.3 below. Areas of Influence (AoIs) were based on relevant GIIP sources (Nature Scot, 2024; Rodrigues et al., 2015; CIEEM, 2018), combined with site specific professional judgement. Factors including habitat continuity, terrain, and the realistic zones of behavioural or collision risk influence were considered when defining final buffers.

Habitats and Terrestrial Fauna

For habitats and terrestrial fauna, the 500m AoI is used as the study area. This reflects the spatial extent over which construction or operational activities may cause direct or indirect effects such as habitat loss, fragmentation, or disturbance. The selected distances account for the configuration and continuity of habitats, expected mammal ranging behaviour, and the potential for activities to influence species use of adjacent habitats. These distances follow GIIP while incorporating local topography and ecological context to define a precautionary but proportionate assessment area.

Bats

For bats, the 500m AoI is used as the study area. EUROBATS guidance (Rodrigues et al. 2015) recommends minimum turbine–habitat separation distances of approximately 200 m. However, the 500 m AoI is precautionary and appropriate because bat activity can extend beyond these minimum siting thresholds. While international good practice (e.g., EUROBATS) typically references larger distances of potential effect, the application of a 500 m AoI for bats represents a deliberate and proportionate departure from these standards, based on site-specific baseline conditions, including the absence of bat-related designations (e.g. Natura 2000) within the wider landscape, the absence of mature woodlands and roosts within 500 m, and the focus on understanding commuting and foraging behaviour. Further refinement to up to 1 km will be assessed through adaptive monitoring and mitigation measures outlined in the BMP.

Birds

For birds, the AoI is 2km and extends to 6km for breeding raptors. Birds exhibit collision and disturbance impacts at broader spatial scales, therefore the AoI captures displacement from

foraging or breeding habitat and barrier effects altering movement routes.Many non-raptor birds are most commonly displaced within approximately 500 m, but the AoI extends to 2km to account for variability among species and openness in landscape to include both disturbance and barrier effects. Raptors have large territories, high mobility, and heightened sensitivity to wind turbines due to collision risk and displacement from foraging ranges therefore the AoI is increased to 6km. This 6km AoI is appropriate given the topographical features, openness of the habitats and potential presence of nesting raptors.

Figure 8.1 below presents the AoIs detailed above within the context of the Project and its components.

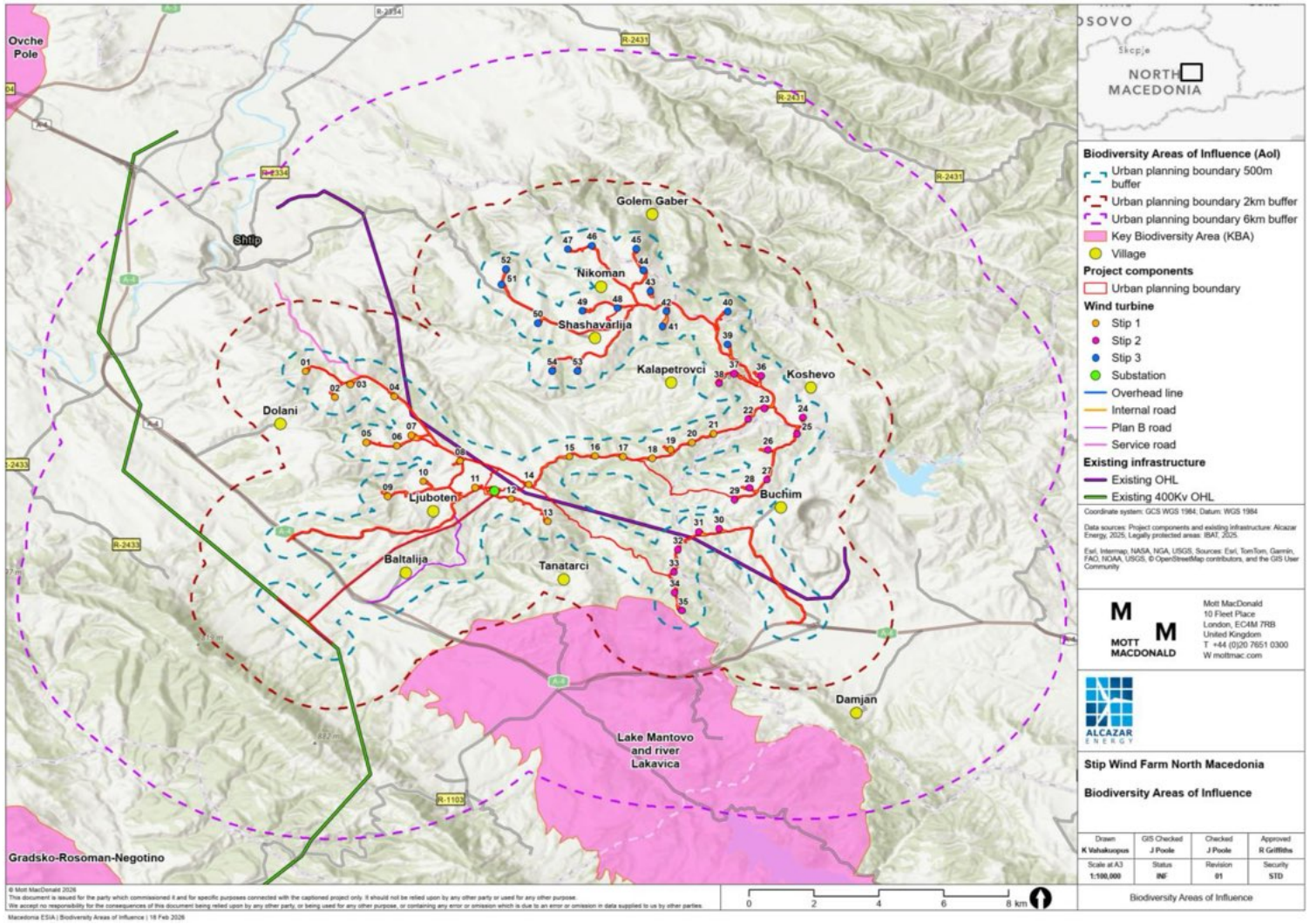
Table 8.3: Areas of interest to biodiversity

Study Element	Purpose/ Definition	Spatial extent	Taxa/ Features included
Biodiversity Study Area (BSA)	Desktop study area to identify internationally recognised and legally protected areas and compile a preliminary species list relevant to the Project.	50 km buffer around the Project for protected areas and IBAT species list	Protected area; Species list[1]
Field Survey Area	On-site area used for collecting biodiversity field data.	Transects and points within the Project site plus 500 m beyond the site boundary.	All biodiversity receptors surveyed per field methods (habitats, flora, mammals, bats, birds, herpetofauna)
Biodiversity Area of Influence (AoI)	Assessment area used to evaluate potential Project impacts on biodiversity receptors around each Project component.	500 m around each Project component for habitats, flora, mammals, herpetofauna; 2 km around each Project component for birds, extended to 6 km for breeding large raptors.	500m - habitats, flora, mammals, herpetofauna 2km – birds 6km – breeding raptors

Figure 8.3 to Figure 8.6, (presented in Chapter 4 below) present the 50km, 2km and 500m study areas. The field survey reports detailing the maps of surveyed areas are presented in Appendix B. The spatial scales selected for the BSA, Field Survey Area and AoI reflect IFC PS6, EBRD ESR6 and EIB ESS4 requirements for landscape-level species and align with GIIP for wind farms in steppe and montane environments.

[1] This list is drawn from the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (purchased from Integrated Biodiversity Assessment Tool (IBAT).

Figure 8.1: Biodiversity Areas of Influence



Source: Mott MacDonald, 2026.

8.3.2 Desk study and literature review

The assessment involved establishing a baseline understanding of habitats and associated biodiversity present within the study area. This was undertaken through a desk study of national and international secondary data sources which included:

- Critical Ecosystem Partnership Fund (CEPF, 2018)
- WWF Terrestrial Ecoregions of the World (Biomes) - ArcGIS Viewer (ESRI, 2022)
- IBAT (https://ibat-alliance.org/) – a list of threatened species and internationally recognised and legally protected areas under the IUCN Red List within a 50km buffer surrounding the site was purchased in November 2024.
- IUCN Red List of Threatened Species (http://www.iucnredlist.org) (IUCN, 2025)
- The National Red List of North Macedonia (https://redlist.moepp.gov.mk/species-summary-page/) – includes plants, mammals, reptiles, amphibians and fungi
- EUNIS, the European Nature Information System (https://eunis.eea.europa.eu/index.jsp)
- The Global Register of Introduced and Invasive Species (GRIIS) for North Macedonia (Global Register of Introduced and Invasive Species - North Macedonia)

IUCN Red List and National Red List

As part of this ESIA, the IUCN Red List of threatened species has been consulted following the purchase of IBAT data in 2024. In 2018, “National Red Lists for Species Conservation in North Macedonia” (IUCN ECARO, 2018) was produced in order to help set the framework for the national Red List assessments. The report provides background to the global IUCN Red List and the differences with National Red Lists and gives recommendations for structuring the North Macedonian Red List process. A number of species from plants, mammals, amphibians and reptiles have since been assessed at national level following IUCN criteria. These have been included in the assessment, were available. Birds have not been assessed according to a National Red List.

Information on the following nature conservation areas and other protected areas (existing or proposed) within the BSA has also been collected and reviewed:

- Ramsar sites
- Key Biodiversity Areas (KBA)
- Important Bird and Biodiversity Areas (IBA)
- World Heritage Sites (WHS)
- UNESCO Biosphere Reserves

8.3.3 Field survey

8.3.3.1 Survey Period

Table 8.4 below summarises the survey periods, frequency, and reporting outputs for each biodiversity receptor.

Table 8.4: Survey periods, frequency, and reporting outputs

Topic	Field Survey Months	Survey Frequency	Reporting Outputs
Habitats and Flora	May, June, and September 2025	Three survey campaigns (Spring/ Summer)	3 reports (May 2025; June 2025; September 2025)

Topic	Field Survey Months	Survey Frequency	Reporting Outputs
Mammals	May, June, and September 2025	Three survey campaigns (Spring/ Summer)	3 reports (May 2025; June 2025; September 2025)
Herpetofauna	May, June, and September 2025	Three survey campaigns (Spring/ Summer)	3 reports (May 2025; June 2025; September 2025)
Bats	Monthly Oct–Nov 2024; Feb – Oct 2025	Monthly (11 Months)	One final year report (October 2024 – October 2025) and additional supporting information
Birds	Monthly October 2024 – October 2025	Monthly (13 Months)	One final report (October 2024 – October 2025)

The surveys were conducted by Maneko and the survey methodologies are summarised below with details of each report provided in Appendix B.

8.3.3.2 Survey methodologies

Habitats and Flora

Field surveys were conducted in May, June, and September to identify habitat types, with a focus on priority habitats such as grasslands and woodlands. A desktop review informed the identification of data gaps, which were addressed through targeted fieldwork.

Habitat classification followed EU standards, using ecological, floristic, and physiognomic criteria. Key data, such as species presence, habitat condition, and GPS coordinates, were recorded and used to produce GIS-based habitat maps (refer to Section 8.3.4 for habitat mapping). Biodiversity value was assessed using IUCN Red Lists, EU directives, and national legislation. Identification of the habitats was performed based on phytocoenoses, dominant plant species and range-restricted species, accompanied by recognizing the characteristics of the geographical location, altitude, relief, substrate and soil. The coordinates, photography, observable species (characteristic, frequent, dominant, etc.), observations, representativeness, degree of conservation, and degree of preserved functions were recorded during surveys.

Mammals

During the field survey, data of the presence of mammals within the survey area was obtained using the method of sign (transect) surveys. Transects were carried out in different habitats and searched for footprints, scats, hairs and other signs of presence of mammal species. When found, all signs were photographed and data on identified species, date, location, habitat and type of data were recorded.

Bats

Manual and automated bat detector surveys on the ground were undertaken. Transects were driven with the vehicle headlight dipped and at a consistent speed of 15 mph (24 km/h). Echolocation calls were continually recorded by a detector mounted to point out of the window or sunroof at a 45-degree angle to the direction of travel.

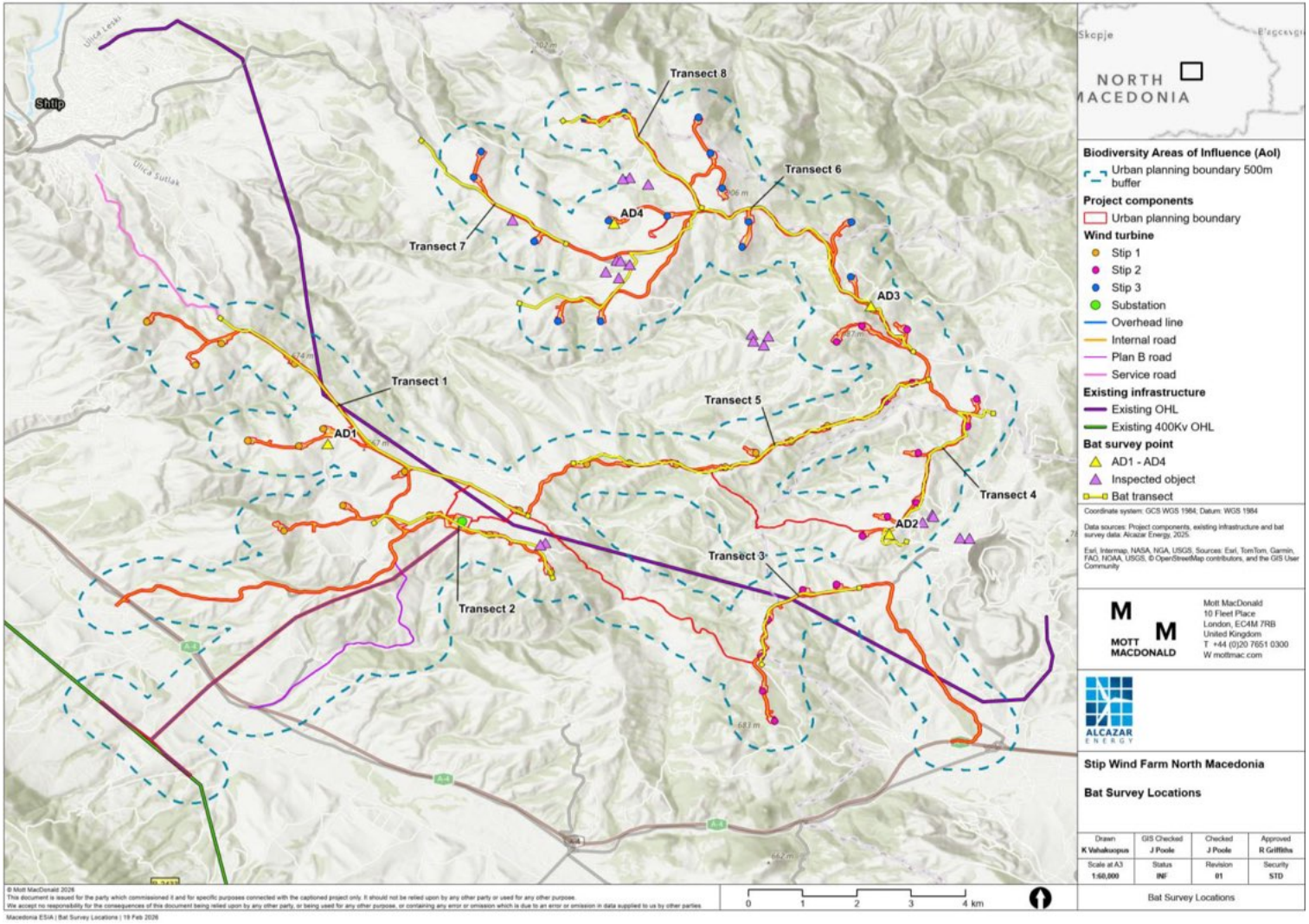
Manual survey effort (to determine a site-specific bat activity index (number of bat contacts per hour)) was as follows:

- One survey visit every 10 days, two whole nights in September/October 2024, first half of night from sunset for 4 hours
- One survey visit every 10 days (if weather conditions are appropriate), first half of night from half an hour before dusk for two hours (November-December 2024).
- One survey visit every 10 days, first half of the night from sunset for four hours (February-March 2025);
- One survey visit every 10 days, i.e. two times for the first half of the night (from sunset for four hours) and one whole night in May (March-May 2025); and

- One survey every second week, always a whole night (June-July 2025).

One automated bat detector was installed in each of the four wind park clusters. At least one night during each manual detector survey visit. The bat survey locations are presented in Figure 8.2 below and in Appendix B.

Figure 8.2: Bat survey locations



Source: Mott MacDonald, 2026.

Birds

Vantage point surveys

Vantage Point surveys were undertaken between October 2024- October 2025 across two seasons (six month each). A total of nine VP locations were used across the survey period, a summary of survey effort is shown in Table 8.5. Total observation hours consisted of 72 at each VP1-8 and 81 at VP9.

Table 8.5: VP survey effort

VP	Oct 24	Nov 24	Dec 24	Jan 25	Feb 25	Mar 25	Apr 25	May 25	Jun 25	Jul 25	Aug 25	Sept 25	Oct 25	Total hours
1	5	4	6	4	4	10	6	6	6	6	6	6	3	72
2	5	4	6	4	4	10	6	6	6	6	6	6	3	72
3	5	4	6	4	4	10	6	6	6	6	6	6	3	72
4	5	4	6	4	4	10	6	6	6	6	6	6	3	72
5	5	4	4	6	4	10	6	6	6	6	6	6	3	72
6	5	4	4	6	4	10	6	6	6	6	6	6	3	72
7	5	4	4	6	4	10	6	6	6	6	6	6	3	72
8	5	4	4	6	4	10	6	6	6	6	6	6	3	72
9	6	6	6	6	6	6	6	6	6	9	9	6	3	81

Source: Mott MacDonald (2025)

The surveys followed national guidance (Prakljačić, , Saveljić, Vujović, & Jovićević, 2011)) and international best practices (Nature Scot, 2024). Their main objective was to supply data for the Updated Collision Risk Model ((Band, 2012) (Elizabeth, 2015)), which estimates bird mortality due to turbine collisions. Vantage Point (VP) surveys were used to measure flight activity and its spatial distribution across the wind farm site. A total of nine VP watches were conducted within the Project area between October 2024-October 2025.

Based on NatureScot (2024) guidance, VP watches lasted 2–2.5 hours with at least 30-minute intervals between surveys, conducted across varied weather and times of day to capture representative bird activity. Each VP was surveyed for 33 hours (non-breeding season), and 39 hours (breeding season), totalling 72 hours annually. Observers recorded detailed data on target species identified as vulnerable to turbine collisions, including species, sex, flight direction, location, duration, and height every 15 seconds, categorizing flight heights as <30 m, 30–210 m, and >210 m for VP1-VP8 and <30 m, 30-50 m, 50-200 m and >200m. Flights were hand-mapped within the 2 km viewshed, focusing on the collision risk zone defined by turbine layout. Non-target species showing potential collision risk were also noted, with summaries compiled every 10 minutes.

Breeding bird surveys

Breeding bird surveys were undertaken once a month in April, May and June 2025. A total of 13 transects were walked, and surveys varied between 0.5 hours-2.5 hour depending on the transect length which varied from 774m to 4952m. These visits were spaced evenly to capture temporal variation. Each survey began at sunrise, and the starting point and direction of the transect varied to avoid bias in time-of-day observations. Surveys were only carried out in fair weather, excluding heavy rain, poor visibility, or strong winds. Observers recorded all birds identified by sight or sound, focusing on passerines and other small breeding species, and logged GPS coordinates for each individual.

Raptor searches

Raptor searches were undertaken twice a month between March and June 2025 inclusive. In accordance with SNH (2025) species-specific surveys were undertaken to identify breeding locations of raptors in the AoI. Two survey visits were undertaken to identify evidence of territory occupation (Visit 1) and location of active nests (Visit 2). In addition to census of widespread and numerous raptor species small raptor species survey area was around 2 km from Project component, and for larger species (e.g. Eastern imperial eagle *Aquila heliaca*) was a 6 km radius.

Nocturnal surveys

Two nocturnal surveys were conducted in October (for owl species) 2024. Two visits in April and two visits in May 2025 were undertaken for other target nocturnal species. Surveys undertaken in October were undertaken for 6 hours in duration and in April and May for 4 hours. These corresponded with the breeding and when territories are established which maximises detectability for target species (i.e. scops owl *Otus scops* and nightjar *Caprimulgus europaeus*)

To identify nocturnal species present within the AoI, playback surveys, i.e. the broadcast of recordings of target species calls using audio equipment to illicit a response from birds present in the AoI, were conducted at 24 locations within 500m of the turbine clusters (Prakljačić et al, 2011).

Herpetofauna

The specimens observed in the field were determined according to field guides. The methodologies used for undertaking the surveys included the search and seize (or catch and release) method and line transects, with surveys being undertaken in the morning when frequencies of occurrence are higher.

8.3.4 GIS, habitat mapping and calculations

The GIS and habitat outputs produced in this report have been created using the following data sources:

- Internationally recognised and legally protected areas (IBAT data purchase in November 2024)
- Study area/ AoI (created by developing a buffer using wind turbine locations provided by the Project Proponent)
- Habitat mapping was created by ground truthing satellite imagery using EUNIS habitat classification and the EU Habitats Directive Annex I habitat types within 500m of the Project components and WorldCover V2 2021 100m resolution data - WorldCover Viewer between 500 and 2km)

Habitats within the 500m and 2km AoIs and habitats under the direct footprint for each Project component were calculated. These calculations were made by overlaying the Project components in GIS with the habitat map created using the data sources mentioned above.

8.3.5 Stakeholder Engagement in Biodiversity Assessment

Stakeholder consultation is presented in Volume II, Chapter 5 and the Stakeholder Engagement Plan is presented in Volume V of this ESIA. Previous stakeholder engagement has been undertaken and details of this are presented in the ESIA Scoping Report.

8.3.6 Impact assessment methodology

The general methodology for the impact assessment for this ESIA is presented in Chapter 6. For Biodiversity, the methodology for determining biodiversity receptor sensitivity is summarised in the following section.

8.3.6.1 Criteria for determining biodiversity receptor sensitivity

The criteria used to determine the sensitivity of biodiversity receptors is defined in Table 8.6 below. Features of negligible sensitivity and features that are unlikely to be present within the AoI will not be included within the impact assessment and justifications will be provided in the baseline and impact assessment chapters.

Table 8.6: Criteria for determining biodiversity receptor sensitivity

Sensitivity	Detail	Species criteria	Habitat or site criteria
Very High	Very high conservation concern and rarity. International scale or national/ regional scale with limited potential for substitution.	Species that meet Critical Habitat thresholds in accordance with IFC PS6, EBRD ESR6 or EIB ESS4. Species listed under Annex II of the Habitats Directive as 'priority species'	All areas of potential Critical Habitat (IFC PS6/ EBRD definition). Internationally recognised areas (IFC PS6/ EBRD definition) and nationally designated sites in IUCN categories I and II. Species listed as Priority Habitats under Annex I of the Habitats Directive
High	High conservation concern and rarity. International scale or national/ regional scale with limited potential for substitution.	Species that meet Priority Biodiversity Features (PBF) in accordance with EBRD ESPR6. IUCN or nationally CR/EN species that do not meet Critical Habitat thresholds in accordance with IFC PS6. Species listed under Annex II of the Habitats Directive	Habitats of significant international ecological importance, Natural Habitats that are globally threatened and/or of international and/or national conservation concern and/or high biodiversity, with limited potential for substitution. Species listed under Annex I of the Habitats Directive
Medium	Medium conservation concern and rarity, regional scale with good potential for substitution.	Species not considered PBF but that are: Vulnerable species listed by IUCN Nationally protected or rare species Restricted-range species. Migratory species	Nationally designated sites in IUCN categories III-VI or with no equivalent IUCN category. Regionally important natural habitats. Natural habitats which do not qualify as Critical Habitat. Endemic Bird Areas (EBAs).
Low	Very low or low conservation concern and local scale.	IUCN Near Threatened /Least Concern (LC). IUCN Data Deficient (DD) species. Species of no national importance (threat and/or protection).	Sites designated at local level (no IUCN category). Undesignated sites and natural habitats of some local biodiversity and cultural heritage interest. Modified habitats with limited biodiversity value. Artificial and converted habitats (e.g., artificial water bodies, plantations, agricultural crops).
Negligible	Very limited ecological importance.	Invasive species. Species of no international or national value.	Highly modified habitats of no biodiversity value (e.g., hardstanding, bare ground and buildings).

Source: Mott MacDonald, 2025

8.3.6.2 Criteria for determining impact magnitude

The magnitude of impact is defined by taking into account the degree of change to the biodiversity baseline in terms of how permanent or reversible the impact is likely to be, its spatial scale (local, regional, national, international) and the ease with which mitigation measures can be put in place to return it to the baseline state.

The criteria used to determine the magnitude of the changes which will be created by the Project is defined in Table 8.7.

Table 8.7: Criteria for determining impact magnitude

Magnitude (positive or adverse)	Description (considers probability of impact occurring, duration of the impact, spatial extent, reversibility and ability to comply with legislation)
Major	Fundamental change to critical habitat (natural/ modified) and/or natural habitats and associated species, resulting in long term or permanent change, typically widespread in nature (regional, national and international). Would require significant intervention to return to baseline.
Moderate	Detectable change to the habitats and associated species, resulting in non-fundamental temporary or permanent change typically affecting the local area.
Minor	Detectable but minor change to habitats and associated species that is temporary in nature, with high capacity to return to the baseline conditions.
Negligible/No change	No perceptible change to habitats and associated fauna.

Source: Mott MacDonald, 2025

The magnitude of biodiversity impacts is, to an extent, subjective. The determination of the magnitude will therefore be based upon professional judgement taking into account the perceived sensitivity of the receiving environment.

8.3.6.3 Determination of significance

Significance takes into account the interaction between magnitude criteria and sensitivity criteria as presented in the significance matrix in Table 8.8. Impacts that are evaluated as being ‘Moderate’ or ‘Major’ are significant effects and identified as such. Consequently, impacts that are ‘Minor’ or ‘Negligible’ are not significant.

Table 8.8: Significance evaluation matrix

Magnitude of Impact	Sensitivity of Receptors			
	Low/ Negligible	Medium	High	Very High
No Change	Not significant	Not significant	Not significant	Not significant
Negligible	Not significant	Not significant	Not significant	Not significant
Minor	Not significant	Minor	Minor	Moderate
Moderate	Not significant	Minor	Moderate	Moderate
Major	Not significant	Minor	Moderate	Major

Source: Mott MacDonald, 2025

All impacts will be mitigated through following the mitigation hierarchy. Where impacts are still considered to be significant after mitigation (significant residual impacts), these will require further management (e.g. offsetting) and monitoring to achieve biodiversity targets as set out in this ESIA.

8.3.7 Limitations

The surveying team during the Flora and Habitat surveys encountered hard-to-reach terrain, overgrown bushes, difficulty to pass/walk through to reach surveying transects and some significant distances from accessible roads even with an off-road vehicle. Due to the inability to survey the entire site, twelve sampling points were selected to represent the variation in existing habitats. All twelve points were surveyed; however, restricted access to certain areas may have resulted in some species being overlooked. Nevertheless, the range of habitats surveyed is considered adequate to identify priority features. Therefore, this limitation is not regarded as significant in the context of the overall survey.
Seasonal challenges for herpetofauna were encountered during the September surveys. As summer progressed, the days began to shorten, and the nights became colder from late August. These conditions directly affected the amphibians and reptile presence, as their body temperature depends on the temperature of the external environment, leading to a lower activity frequency. These limitations were overcome through availability of desk-based data (IBAT and literature review) to understand potential species presence and likelihood of presence within the AoI.
Calculations of temporary and permanent habitat loss are based on GIS mapping. These calculations may provide an overestimation of loss due to the imperfections in boundaries of habitat types, mapped Project components and existing features (e.g. existing roads). Therefore, this ESIA presents a precautionary approach to habitat loss calculations.
For birds, during the non-breeding season, a total of 33 hours of VP survey effort was completed, which is slightly below the recommended best practice threshold of 36 hours. To supplement this, an additional three hours of survey effort were undertaken during the breeding season. Across both breeding and non-breeding seasons, a minimum of 72 hours of observation was conducted at each VP location. The shortfall in non-breeding season survey hours has been acknowledged and appropriately accounted for within the collision risk assessment, ensuring that the evaluation of potential impacts remains robust and precautionary.
Ornithological surveys were conducted over a single calendar year, which inherently limits the ability to account for inter-annual variation in bird populations and behaviour. Such variation can influence the accuracy of baseline data used to assess potential impacts, including habitat loss, displacement, and collision risk. To address this limitation, a comprehensive literature review was undertaken. This focused on species identified through the IBAT that were not recorded during field surveys, evaluating their potential presence within the AoI. Despite the temporal constraint, the surveys were designed to span all four seasons, incorporating both diurnal and nocturnal observations as well as breeding season coverage. This approach ensures a broad representation of species likely to be present and provides a robust foundation for assessing the potential ornithological impacts of the proposed development. Baseline This chapter presents the biodiversity baseline established to inform the ESIA. The baseline was developed through a combination of desk-based research, literature review, and targeted field surveys, in accordance with national legislation and international best practice. The assessment covers the Project site, 500m buffer from the Project site for habitats and flora, mammals and herpetofauna, 2km for birds, 6km for breeding raptors and 50km for internationally recognised and legally protected areas. The biodiversity baseline encompasses key ecological receptors including habitats, flora, mammals, bats, birds, herpetofauna, invertebrates, and fungi. Particular attention was given to species and habitats of conservation concern, including those that are globally/nationally threatened (Critically Endangered (CR), Endangered (EN), Vulnerable (VU)), nationally protected, restricted-range, and/or migratory. The presence of alien invasive species was also recorded where relevant.

Field surveys were conducted during optimal seasonal windows to maximise detection of target taxa, and included habitat mapping, species inventories, and acoustic and visual monitoring techniques. The results of this baseline provide a foundation for assessing potential impacts and informing appropriate mitigation and monitoring measures.

For a comprehensive list of species that could or have been confirmed with 50km of the Project and for the detailed field survey reports refer to Appendices A and B.

8.4 Biodiversity Baseline

8.4.1 Biodiversity Overview

North Macedonia lies partially within the Mediterranean Basin Biodiversity Hotspot (CEPF, 2025). The portion of North Macedonia that overlaps with the Mediterranean Basin hotspot includes areas with ecosystems, such as dry grasslands, oak woodlands, and karst landscapes. These habitats support a variety of restricted-range and threatened species, including migratory birds, endemic plants, and rare invertebrates.

North Macedonia overlaps with four ecoregions, according to WWF Terrestrial Ecoregions of the World map (ESRI, 2022). The main ecoregion which is also where the Project is located is Balkan mixed forests, these forests are a mix of deciduous and coniferous species and host a variety of endemic and threatened flora and fauna. Rodope montane mixed forest, Aegean and Western Turkey and Pindus Mountains mixed forests are also found in North Macedonia.

A total of 28 key ecosystem types have been identified, corresponding to 177 habitat types under the European Nature Information System (EUNIS) classification (EEA, 2025). Forests cover approximately 38.5% of the land area, predominantly deciduous and mixed types, while 44% is agricultural land, including high-quality pastures in mountainous regions. Grasslands are widespread, often forming secondary habitats due to forest degradation and farmland abandonment (CBD, 2025). In total, 40 nationally and internationally protected designations have been identified within a 50km buffer of the Project site (as shown in Figure 8.3 and Figure 8.4).

A summary of the baseline conditions identified from desktop studies and field survey information is presented below. Each group is assessed in further detail from Section 8.4.1.2 to Section 8.4.1.11. The full species list utilised for the baseline is presented in Appendix A and the survey reports detailing methodologies and results during surveys are available in Appendix B.

Habitats

The three main habitat types identified within the 500m AoI are; Eastern Quercus pubescens woods (25.65%), Arable land (21.03%) and Helleno-Balkanic [Satureja montana] steppes (19.37%). Natural habitats include Eastern white oak woods, Helleno-Balkanic steppes, grassland, tree cover, lines of trees; hedgerows, shrubland, temporary running waters and bare/sparse vegetation.

Flora

Based on IBAT data within the 50km buffer, two flora IUCN Endangered (EN) species and one VU species were identified, and three EN and one VU species were identified nationally. Twelve species were identified during the field survey undertaken. None of the flora species recorded on site were identified as protected or strictly protected in Macedonia.

Terrestrial mammals

Within 50km of the Project based on IBAT data, there are three globally threatened terrestrial mammal species. In addition, two nationally VU species are potentially present within this buffer. Six species were identified during the field survey undertaken, none of which are considered threatened under the IUCN Red List or nationally.

Bats

The IBAT data identified 21 species of bats within 50km of the Project. Of these, four are IUCN VU. Of the species identified, five species are migratory, 20 are listed on Annex IV of the Habitats Directive and eleven are listed under Annex II. Fifteen bat species were identified during the field survey undertaken between October 2024 and October 2025. Three of these are considered VU under the IUCN Red List and five are listed under both Annex II and Annex IV of the Habitats Directive. Field surveys found no natural bat shelters or roosts within human settlements in the study area. Only a limited number of buildings were available for inspection, as most are seasonally occupied. Bat activity analysis (including bat activity indexes) was undertaken for each species and month. The results show the majority of activity for each species is low across most months. However, species with a high risk of collision were recorded with medium and high activity in different periods of the year (for details refer to Section 4.1.5).

Birds

The IBAT data returned records of three IUCN EN and five VU species. One hundred and fifty-seven species were identified during the field surveys undertaken in 2024/25. Of these, two species are considered VU under the IUCN Red List.

Herpetofauna

Within the 50 km buffer of the Project area, IBAT data indicates that the global ranges of seven reptile and four amphibian species of conservation concern overlap with the site. Of these, the two reptile species listed as Vulnerable (VU) and three amphibian species also listed as VU on the IUCN Red List. The National Red List also considers one amphibian VU and one EN, and four reptiles VU and three EN. Eight amphibian species were identified during the field surveys, including one IUCN VU species, two IUCN VU reptiles species were also identified during field surveys, as well as one nationally VU species. In addition, the European ratsake *Zamenis situla* and four-lined snake *Elaphe quatuorlineata* are considered Annex II species under the Habitats Directive and are found in the AoI.

Invertebrates

A total of 68 species from the insecta class were identified through the IBAT data within 50km of the Project. Of these, twelve are considered globally threatened. Of the threatened species, six are IUCN EN and the six are IUCN VU. None of the species have been nationally assessed against IUCN criteria.

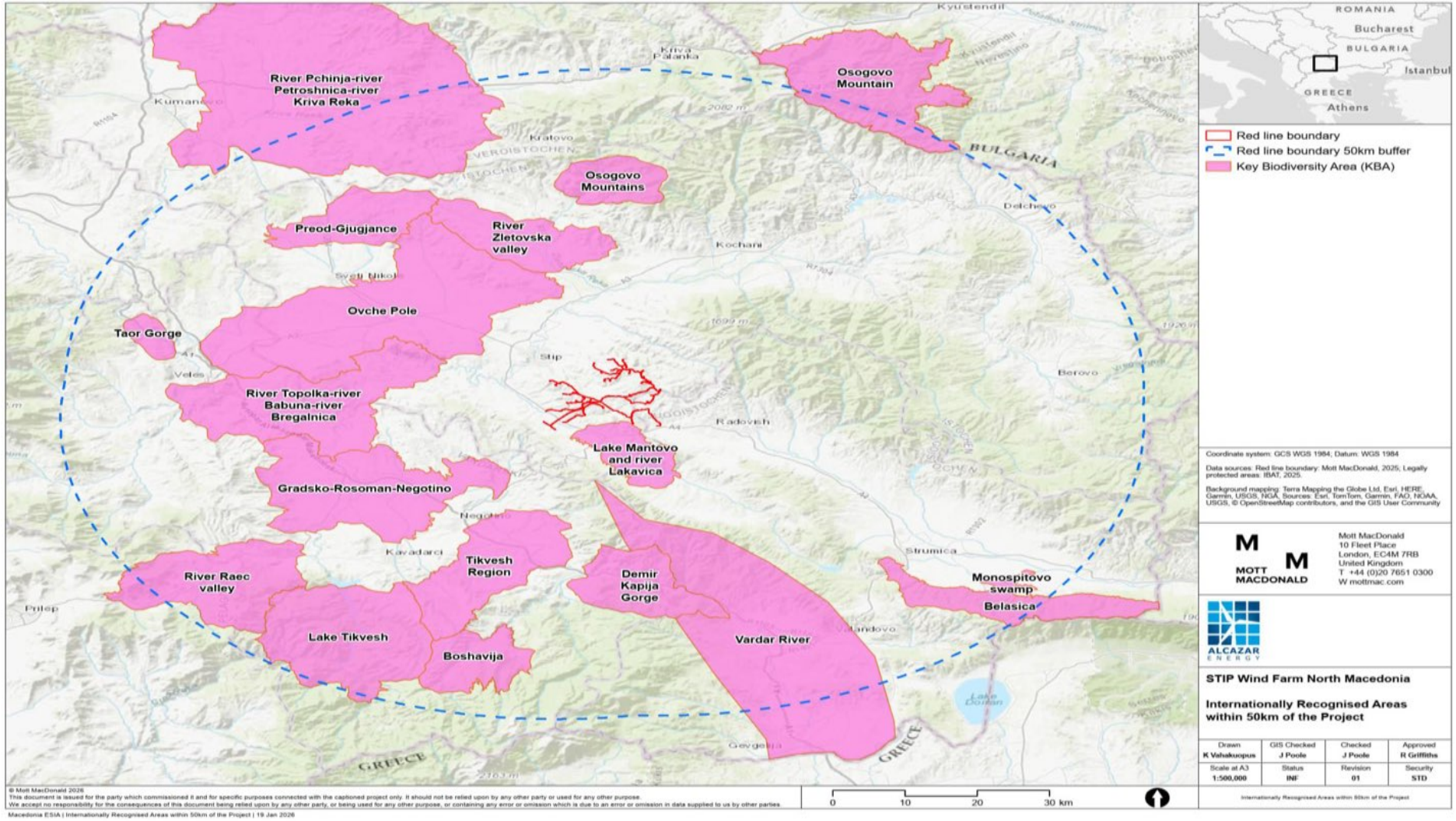
Freshwater species

The IBAT data includes freshwater fish, arthropods, molluscs and aquatic plants within 50km of the Project. These species have not been included in the assessment as there are no permanent waterbodies within the AoI.

Fungi

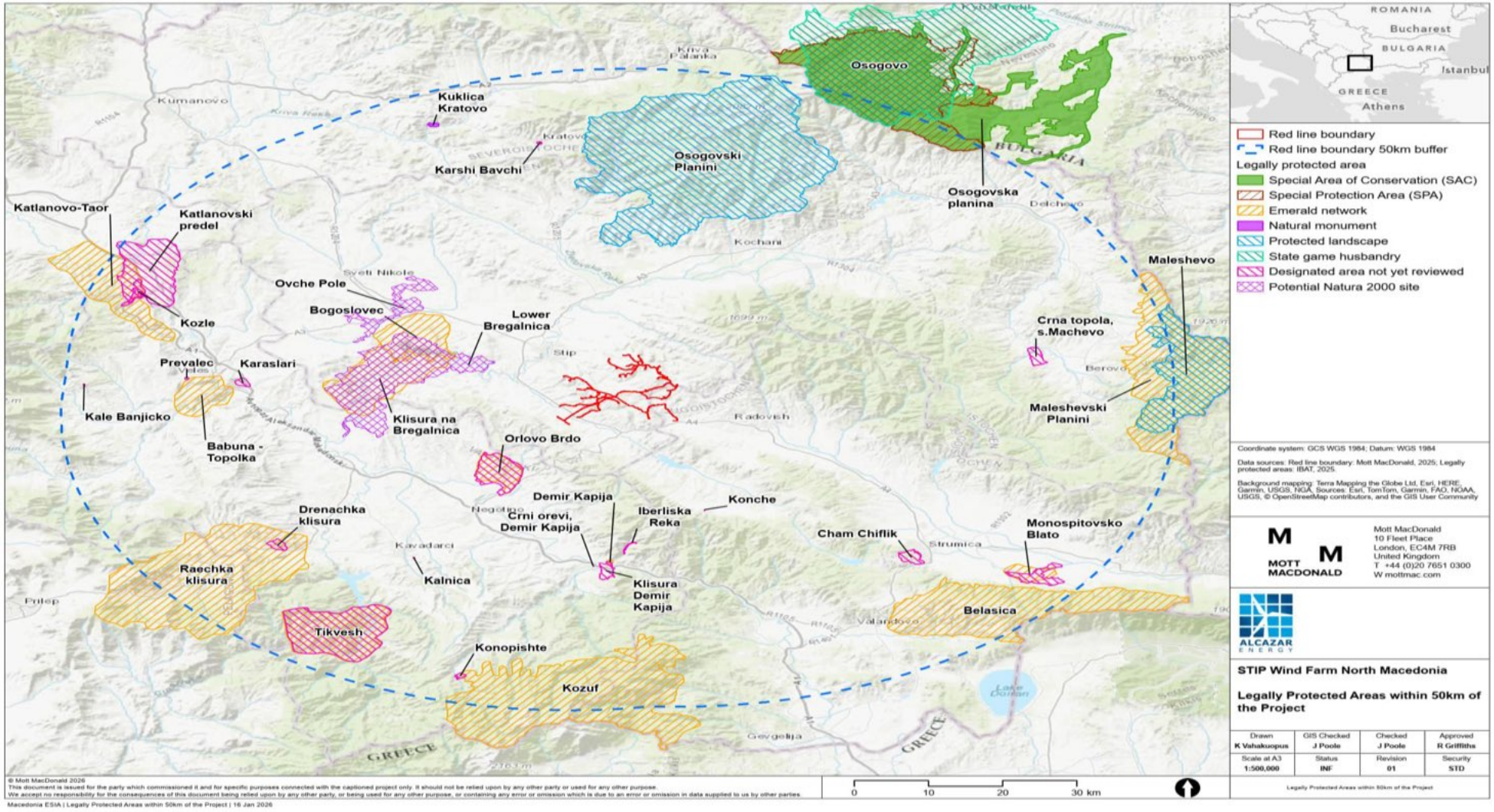
Ten globally threatened species of fungi were identified in the 2024 IBAT data as potentially being present within the 50km buffer. One is IUCN EN (*Hyphoderma etruriae*), while the remaining nine are VU. Nationally, two of the globally threatened VU species are considered CR and EN respectively, and a further two are VU. No fungi surveys were undertaken for this Project; however, habitat survey were undertaken in May, June and September 2025 within the AoI, highlighting that the habitat types are not suitable for significant fungal species.

Figure 8.3: Internationally recognised areas within a 50km buffer of the Project site.



Source: Mott MacDonald with IBAT data, 2025.

Figure 8.4: Legally protected areas within a 50km buffer of the Project site.



Source: Mott MacDonald with IBAT data, 2025.

8.4.1.1 Internationally recognised and legally protected areas

This section outlines the internationally recognised and legally protected areas within 50km of the proposed wind farm development. These areas include designations based on both global conservation criteria and national or EU legislation.

Internationally recognised sites comprise Important Bird and Biodiversity Areas (IBAs) and Key Biodiversity Areas (KBAs). Legally protected areas include Natura 2000 sites such as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) under the EU Habitats and Birds Directives, as well as nationally designated sites such as Natural Monuments, Protected Landscapes, Emerald Network designations and State Game Husbandries. The section also notes the presence of additional designated sites that have not yet been formally reviewed. These areas are assessed in terms of their ecological value, legal status, and relevance to the impact assessment and mitigation planning for the Project.

Within a 50km buffer of the Project, there are a total of 16 internationally recognised areas (presented in Table 8.9) and 36 EU/nationally protected areas (presented in Table 8.10).

Lake Mantovo and River Lakavica IBA/KBA is located approximately 160 m from WTG35 and 100 m from the construction boundary around WTG35. Although neither the turbine nor any associated temporary construction facilities are located within the IBA/KBA, the designated area falls within the Project's 500 m AoI. Of the two qualifying features, European roller (*Coracias garrulus*) were not recorded in the AoI during the field surveys and a total of eight masked shrike (*Lanius nubicus*) were recorded throughout the survey period. Both of these species are considered Priority Biodiversity Features (PBF) under EBRD (refer to 8.4.1.12).

In the south-east of the Project there is the National Ecological Network in Macedonia (MAK-NEN)[2] in close proximity with 'Lake Mantovo and river Lakavica KBA' and Important Bird and Biodiversity Area (IBA), however it could not be mapped. MAK-NEN was a strategic framework designed and implemented between 2008-2011 to maintain and enhance ecological connectivity across the country, supporting biodiversity conservation and sustainable land use. Consultation will be undertaken with the European Centre for Nature Conservation (ECNC) and the Macedonian Ecological Society (MES) as part of the Stakeholder Engagement Plan (See Volume V) to discuss this program. It is expected that this consultation will inform the mitigation measures during construction and mitigation of the Project.

Appendix A includes a table with the full list of species identified through IBAT, surveys and literature review. The table also identified which species are designating features of internationally recognised or legally protected areas.

Internationally recognised areas

There are a total of 16 internationally recognised areas (KBA and IBAs) within 50km of the Project. The majority of these sites are designated for various species of migratory and freshwater birds, whose habitats may overlap with the Project area. The protected areas within a 50km buffer zone are included in Table 8.9 below and Figure 8.3 above.

It is worth noting that the Project components do not overlap with any internationally recognised or legally protected areas. However, the northern section of Lake Mantovo and river Lakavica Key Biodiversity Area (KBA) and Important Bird and Biodiversity Area (IBAs), partially overlaps with the southern boundary of the 2km AoI of the Project. This site is considered a KBA and IBA for two qualifying species - European roller which is IUCN LC and masked shrike (*Lanius nubicus*) which is IUCN LC (KBA, 2025). In 2008, the site became an IBA due to significant populations of European roller, as these were considered NT at the time, and for regionally

[2] MAK-NEN map - kompresirana.pdf

important population of masked shrike (LC). However, in 2025, this site only qualifies as KBA due to the previously established criteria and thresholds for the identification of the IBA. Current data indicates that it does not meet global KBA criteria and thresholds set out in the Global Standard (KBA, 2025).

Table 8.9: Internationally recognised areas (KBA and IBAs) within 50km of the site.

Name	Designation	Distance and direction from the Project	Description of the internationally recognised area
Lake Mantovo and river Lakavica	KBA and IBA	This IBA/KBA is located 160m from WTG35 and 100m from the construction boundary around WTG35. The Project itself or temporary facilities are not located within the IBA/KBA, however the IBA/KBA is within the 500m AoI of the Project.	This site is considered a KBA and IBA for two qualifying species - European roller (*Coracias garrulus*) and masked shrike (*Lanius nubicus*).
Ovche Pole	KBA	8.5km northwest	This site is considered a KBA for qualifying species - European roller (*Coracias garrulus*), lesser grey shrike (*Lanius minor*), lesser kestrel (*Falco naumanni*) and eastern imperial eagle (*Aquila heliaca*). The latter two are considered VU under the IUCN Red List.
River Topolka-river Babuna-river Bregalnica	KBA and IBA	11km west	This site is considered a KBA and IBA for 15 qualifying species. Most of these are LC under the IUCN Red List. However, the eastern imperial eagle (*Aquila heliaca*) - VU and Egyptian vulture (*Neophron percnopterus*) - EN are also included.
Gradsko-Rosoman-Negotino	KBA and IBA	12.5km southwest	This site is considered a KBA and IBA for 11 qualifying species. Most of these are LC under the IUCN Red List. However, the eastern imperial eagle (*Aquila heliaca*) - VU and Egyptian vulture (*Neophron percnopterus*) - EN are also included.
Preod-Gjugjance	KBA and IBA	28km northwest	This site is considered a KBA and IBA for two qualifying species. This includes the eastern imperial eagle (*Aquila heliaca*) - VU and lesser kestrel (*Falco naumanni*).
River Zletovska Valley	KBA and IBA	15km northwest	This site is considered a KBA and IBA for two qualifying species. This includes the eastern imperial eagle (*Aquila heliaca*) - VU and Eurasian Thick-knee (*Burhinus oedicnemus*) - LC.
Osogovo Mountains	KBA	25km north	This site is considered a KBA for one qualifying species - lanner falcon (*Falco biarmicus*), considered LC globally but EN in Europe.
River Pchinja-river Petroshnica-river Kriva Reka	KBA	34km northwest	This site is considered a KBA and IBA for 14 qualifying species. Most of these are LC under the IUCN Red List. However, the eastern imperial eagle (*Aquila heliaca*) - VU and Egyptian vulture (*Neophron percnopterus*) - EN are also included.
River Raec Valley	KBA	37km southwest	This site is considered a KBA for three qualifying species. This includes one LC species, the lesser kestrel (*Falco naumanni*) - VU and Egyptian Vulture (*Neophron percnopterus*) - EN.
Lake Tikvesh	KBA	35km southwest	This site is considered a KBA and IBA for 11 qualifying species. Most of these are LC under the IUCN Red List. However, the lesser kestrel (*Falco naumanni*) - VU and Egyptian vulture

Name	Designation	Distance and direction from the Project	Description of the internationally recognised area
			(*Neophron percnopterus*) - EN are also included.
Tikvesh region	KBA	17km southwest	This site is considered a KBA and IBA for nine qualifying species. Most of these are LC under the IUCN Red List. However, the lesser kestrel (*Falco naumanni*) - VU, Egyptian vulture (*Neophron percnopterus*) - EN and eastern imperial eagle (*Aquila heliaca*) - VU are also included.
Boshavija KBA	KBA	36.5km southwest	This site is considered a KBA for one qualifying species - Egyptian vulture (*Neophron percnopterus*), considered EN.
Vardar River	KBA and IBA	10km south	This site is considered a KBA and IBA for eight qualifying species. Most of these are LC under the IUCN Red List. However, three VU species: the marbled polecat (*Vormela peregusna*), European ground squirrel (*Spermophilus citellus*) and *Salmo pelagonicus* are also included.
Demir Kapija Gorge	KBA and IBA	20km south	This site is considered a KBA and IBA for eight qualifying species. Most of these are LC under the IUCN Red List. However, one EN species: Egyptian vulture (*Neophron percnopterus*) is also included.
Belasica	KBA	34km southeast	This site is considered a KBA for one qualifying species – zambaku shqiptar (*Lilium albanicum*), considered LC.
Taor Gorge	KBA	39km west	This site is considered a KBA and IBA for six qualifying species. Most of these are LC under the IUCN Red List. However, one EN species: Egyptian vulture (*Neophron percnopterus*) is also included.

Legally protected areas

There are a total of 36 legally protected areas within a 50km radius of the Project. They include a Special Areas of Conservation (SAC) as per the EU habitats Directive a Special Protection Areas (SPA) as per the EU Birds Directive, Emerald Network sites, natural monuments, protected landscapes, state game husbandries as well as designated sites not yet reviewed.

Emerald Network designations have been included in Table 8.10 and Figure 8.4. An assessment of the impacts upon these designations is not included as it is considered these will not be affected by the Project given the nature of the works and the distance to the designations. Species for which these sites have been designated are considered as part of this assessment under the relevant species group.

The protected management categories included in Table 8.10 are based on the International Union for the Conservation of Nature (IUCN) guidance (Dudley, 2008). These categories include:

- Category Ia: Strict nature reserves
- Category Ib: Wilderness area
- Category II: National park
- Category III: Natural monument or feature
- Category IV: Habitat/species management area
- Category V: Protected landscape/seascape

– Category VI: Protected area with sustainable use of natural resources

Table 8.10: EU/nationally protected areas within 50km of the site.

Name	Designation	Distance and direction from the Project	Description of the legally protected area/IUCN Management Category
Osogovo	SPA	46km northeast (Bulgaria)	Special Protection Areas (SPAs) are designated regions aimed at protecting bird species and their habitats, particularly under the EU Birds Directive. It protects 26 bird species listed under the Birds Directive.
Osogovska planina	SAC	46km northeast (Bulgaria)	Special Areas of Conservation (SACs) are designated areas aimed at protecting specific habitats and species of European importance, established under the EU Habitats Directive. It protects 35 species of the Nature Directives and 32 habitat types of the Habitats Directive.
Ovce Pole	SCI	18.38km northwest	Ovče Pole is a Site of Community Importance (SCI) under the Habitats Directive. This reflects its importance for the conservation of priority species and habitats and its role in enhancing the coherence of the Natura 2000 network. The site is importing for protecting maintaining or restoring favourable conservation status for Annex I habitats and Annex II species of the Directive.
Dolna Bregalnica	SPA	7.29km west	Dolna Bregalnica qualifies as a conservation site in line with the Birds Directive. It forms part of a key river corridor supporting Annex I bird species. It contains wetland and riparian ecosystems essential to both resident and migratory bird species. It strengthens the functional continuity of Natura 2000 bird sites within the Bregalnica basin.
Maleshevo	Protected Landscape	45km east	IUCN Management Category V
Osogovski Planini	Protected Landscape	18km north	IUCN Management Category V
Osogovo	State Game Husbandries	44km northeast	IUCN Management Category: Not Assigned
Kuklica Kratovo	Natural Monument	43km northwest	IUCN Management Category III
Demir Kapija	Emerald Network	24km south	IUCN Management Category: Not Assigned
Klisura na Bregalnica	Emerald Network	11km west	IUCN Management Category: Not Assigned
Maleshevski Planini	Emerald Network	45km east	IUCN Management Category: Not Assigned
Kozuf	Emerald Network	37km south	IUCN Management Category: Not Assigned
Orlovo Brdo	Emerald Network	8km southwest	IUCN Management Category: Not Assigned
Babuna - Topolka	Emerald Network	33km west	IUCN Management Category: Not Assigned
Monospitovsko Blato	Emerald Network	42km southeast	IUCN Management Category: Not Assigned
Raechka klisura	Emerald Network	33km southwest	IUCN Management Category: Not Assigned
Katlanovo-Taor	Emerald Network	40km west	IUCN Management Category: Not Assigned
Belasica	Emerald Network	38km southeast	IUCN Management Category: Not Assigned
Bogoslovec	Emerald Network	12km west	IUCN Management Category: Not Assigned

Name	Designation	Distance and direction from the Project	Description of the legally protected area/IUCN Management Category
Orlovo Brdo	Designated area not yet reviewed	12km southwest	IUCN Management Category III
Crni orevi, Demir Kapija	Designated area not yet reviewed	26km south	IUCN Management Category III
Cham Chiflik	Designated area not yet reviewed	33km southeast	IUCN Management Category IV
Kozle	Designated area not yet reviewed	45km northwest	IUCN Management Category III
Karaslari	Designated area not yet reviewed	31km west	IUCN Management Category III
Drenachka klisura	Designated area not yet reviewed	40km southwest	IUCN Management Category III
Kale Banjicko	Designated area not yet reviewed	48km west	IUCN Management Category III
Kalnica	Designated area not yet reviewed	32km southwest	IUCN Management Category III
Klisura Demir Kapija	Designated area not yet reviewed	25km north	IUCN Management Category III
Karshi Bavchi	Designated area not yet reviewed	35km northwest	IUCN Management Category III
Monospitovsko blato	Designated area not yet reviewed	44km southeast	IUCN Management Category III
Konche	Designated area not yet reviewed	16km southeast	IUCN Management Category III
Tikvesh	Designated area not yet reviewed and Emerald Network	37km southwest	IUCN Management Category Ia
Crna topola, s.Machevo	Designated area not yet reviewed	35km east	IUCN Management Category III
Iberliska Reka	Designated area not yet reviewed	21km south	IUCN Management Category IV
Katlanovski predel	Designated area not yet reviewed	41km northwest	IUCN Management Category III
Prevalec	Designated area not yet reviewed	38km west	IUCN Management Category III
Konopishte	Designated area not yet reviewed	48km southwest	IUCN Management Category III

8.4.1.2 Habitats

The Project location is mainly hilly with elevation ranging between 500m and 900m above sea level. A total of 20 different habitat types were identified within 500m of the Project however, 14 were identified during the field surveys undertaken in May, June and September 2025. The remaining six habitat types were identified using ESA WorldCover data to fill any gaps (ESA, 2021).

The three main habitat types identified within the 500m AoI are; Eastern *Quercus pubescens* woods (Eastern *Quercus pubescens* woods) (25.65%), Arable land (21.03%) and Helleno-Balkanic [Satureja montana] steppes (19.37%).

In total, in the 500m AoI, there are eight natural and 12 modified habitats. The natural habitats include Eastern *Quercus pubescens* woods, Helleno-Balkanic steppes, grassland, tree cover,

lines of trees; hedgerows, shrubland, temporary running waters and bare/sparse vegetation. All habitats present within 500m AoI are presented in Figure 8.5

Habitats within the 2km buffer for birds and bats include the same habitats as above. The habitats found in the bird and bat AoI (within 2km of the red line boundary) are presented in Figure 8.6. All habitat types within the 500m and 2km AoI are presented in Table 8.11.

A brief description of the main habitats present in the AoI is included below.

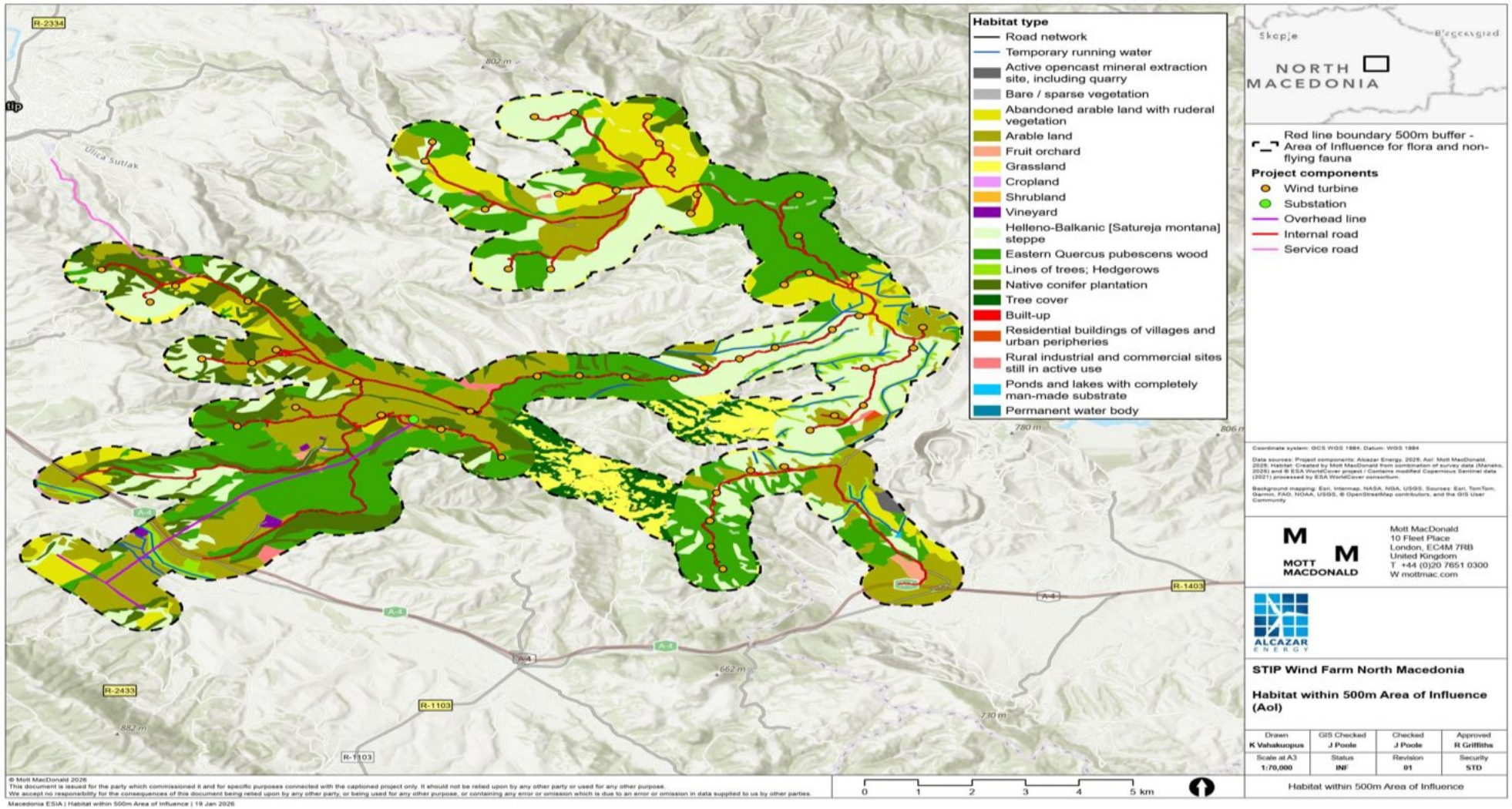
Helleno-Balkanic [Satureja montana] steppes: perennial, steppe-like low open grasslands on shallow stony soils of the sub-Mediterranean and sub-Pannonic Quercion frainetto and Fagion moesiacum zones of the Balkan peninsula. This habitat belongs to perennial calcareous grassland and basic steppes and is included in the semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) of the EU Habitat Directive.

Moesian white oak woods: Thermophilous, sub-Mediterranean *Quercus pubescens* and Quercus virgiliana woods of the southern Dinarides, the Balkan Range, and neighbouring regions. They belong the Eastern sub-Mediterranean white oak woods. They are represented by small woodlands in the dales and ravines in the Project area i.e. biotopes with higher humidity. They were once more widespread but were heavily exploited by the people from the surrounding villages, mostly for firewood. This habitat belongs to the Thermophilous deciduous woodland that is included in of the EU Habitats Directive.

Arable land with unmixed crops grown by low-intensity agricultural methods: Traditionally and extensively cultivated crops, in particular wheat including *Agrostemma githago, Centaurea cyanus, Legousia speculum-veneris, Chrysanthemum segetum, Calendula arvensis, Adonis spp., Consolida spp., Nigella spp., Papaver spp*.

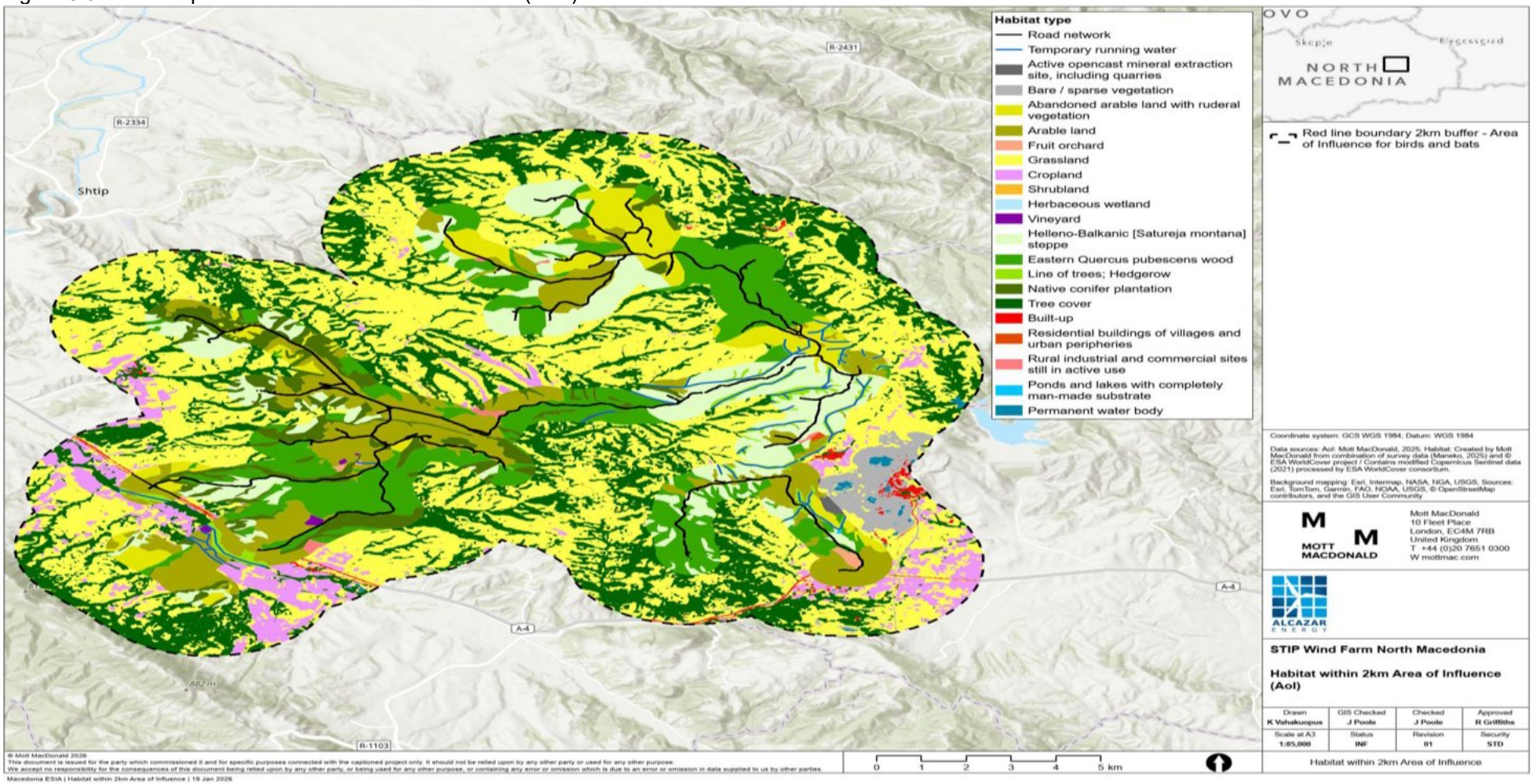
There is a likelihood of the presence of termophilous oak vegetation within the Project area. This oak forest vegetation is present in small patches, mostly in dales and ravines in the area and dominated by the species *Querco-Carpinetum orientalis*. Although degraded, this habitat type is recognized as priority habitat 91AA Eastern white oak woods according to the European Union (EU) Habitats Directive. The other two dominant habitats are semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) and Pseudo-steppe with grasses.

Figure 8.5: Habitats present within the AoI (500m).



Source: Mott MacDonald, 2025.

Figure 8.6: Habitats present within the bird and bats AoI (2km).



Source: Mott MacDonald, 2025.

Table 8.11: Habitat types and calculations within the Project 500m and 2km AoI.

Habitat code	Status	Habitat type	Area (ha) in 500m buffer	% of area (500m buffer)	Area (ha) in 2km buffer	% of area (2km buffer)	Field survey comments
G1.73 Eastern *Quercus pubescens* woods *91AA: Eastern white oak woods.	Natural EBRD Critical Habitat - Annex 1 Priority Habitat European Red List of Habitats - LC	Eastern *Quercus pubescens* woods	1894.68	25.65	1895.02	9.98	Mainly degraded oak forest at wind turbines No. 39, 40 and 41; transmission lines; access roads.
I1.3	Modified	Arable land	1553.64	21.03	1553.64	8.19	Wind turbines No. 6, 7, 8, 11, 14, 48 and 50; transmission lines; access roads.
E1.21 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia))	Natural (Annex 1 Habitat - PBF) European Red List of Habitats - VU	Helleno-Balkanic [Satureja montana] steppes	1430.79	19.37	1430.79	7.54	Wind turbines No. 2, 9, 51, 52, 42, 43, 44 and 45; transmission lines; access roads. The typical steppe vegetation type is rare in the area. It is mostly represented by abandoned fields in various stages of succession to hill pastures.
G3.F1	Modified	Native conifer plantations	724.68	9.81	724.82	3.82	Wind turbine No. 1; transmission lines; access roads.
E5.1	Modified	Abandoned arable land with ruderal vegetation	684.57	9.27	684.57	3.61	Wind turbines No. 3 and 4; transmission lines; access roads.
A12A2*	Natural	Grassland	478.07	6.47	6946.02	36.59	ESA WorldCover 10m, 2021
A12A3 // A11A1A2-4A3C1(C2)-R1(R2)*	Natural	Tree cover	267.84	3.63	4085.46	21.52	ESA WorldCover 10m, 2021
G5.1	Natural	Lines of trees; Hedgerows	221.07	2.99	221.08	1.16	Transmission lines; access roads.
J4.2	Modified	Road network	27.46	0.37	27.46	0.14	-

Habitat code	Status	Habitat type	Area (ha) in 500m buffer	% of area (500m buffer)	Area (ha) in 2km buffer	% of area (2km buffer)	Field survey comments
J2.3	Modified	Rural industrial and commercial sites still in active use	23.62	0.32	23.62	0.12	-
G1.D4	Modified	Fruit orchards	19.67	0.27	19.67	0.10	Transmission lines; access roads.
A11A3(A4) (A5) // A23*	Modified	Cropland	14.92	0.20	827.31	4.36	ESA WorldCover 10m, 2021
J3.2	Modified	Active opencast mineral extraction sites, including quarries	12.75	0.17	12.73	0.07	-
FB.4	Modified	Vineyards	12.21	0.17	12.21	0.06	Wind turbine No. 10; transmission lines; access roads.
A12A4 // A11A2*	Natural	Shrubland	7.82	0.11	82.36	0.43	ESA WorldCover 10m, 2021
C2.5 3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	Natural (Annex 1 Habitat - PBF) European Red List of Habitats - DD	Temporary running water	5.75	0.08	5.75	0.03	Transmission lines
J1.2	Modified	Residential buildings of villages and urban peripheries	3.34	0.05	3.34	0.02	-
B16A1(A2) // B15A2*	Natural	Bare / sparse vegetation	1.78	0.02	307.52	1.62	ESA WorldCover 10m, 2021
J5.31	Modified	Ponds and lakes with completely man-made substrate	1.08	0.01	1.08	0.01	-
B15A1*	Modified	Built-up	0.88	0.01	85.66	0.45	ESA WorldCover 10m, 2021
Total			**7386.63**	**100.00**	**18981.18**	**100.00**	

Source: Mott MacDonald with data from Maneko, 2025 and *ESA WorldCover 10m, 2021.

Three important habitats are highlighted in the baseline reports. These are classed as Annex I habitats under the EU Habitats Directive and have an associated European Red List of Habitats status (see below). The habitats of importance are:

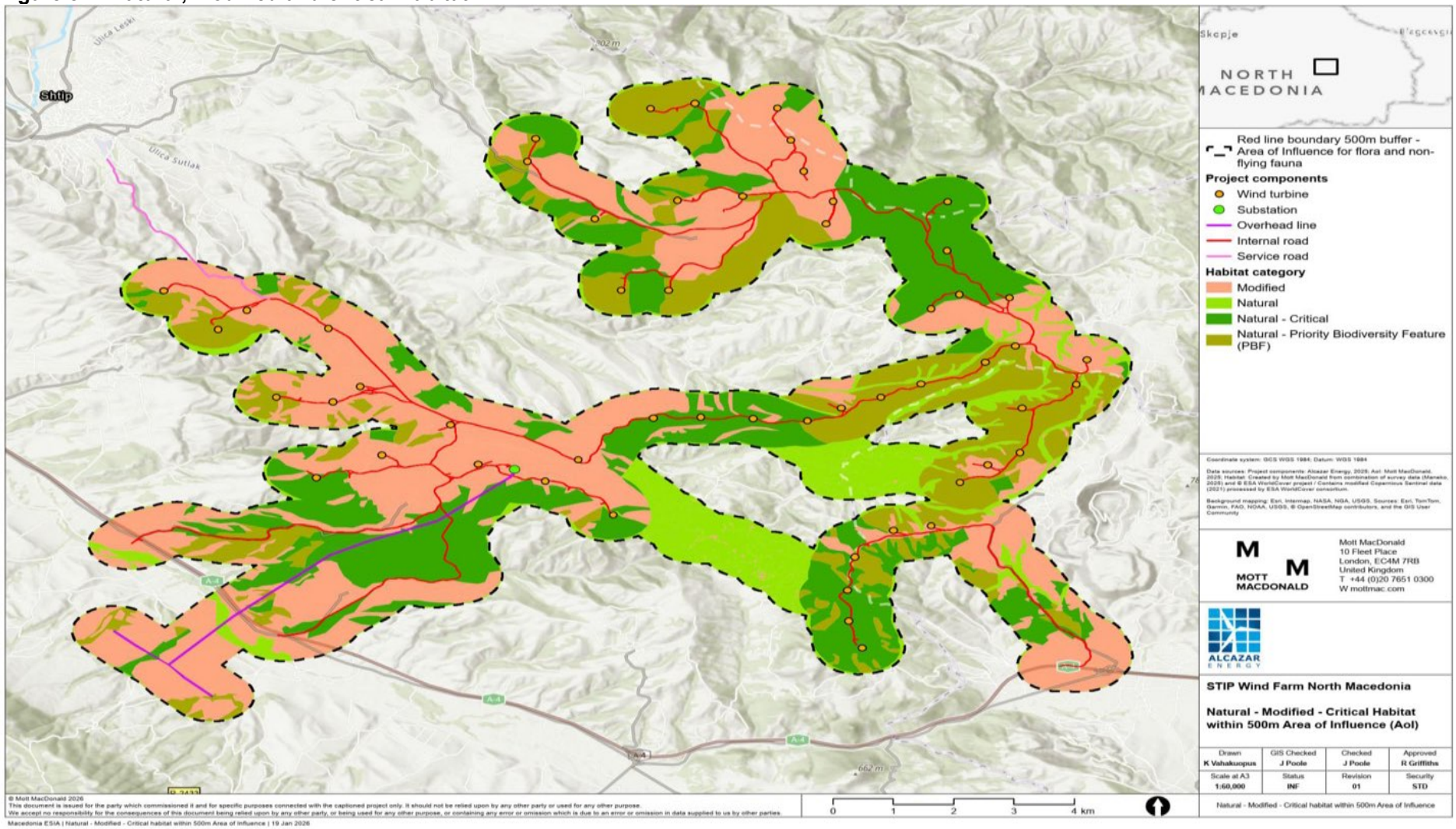
- Helleno-Balkanic [Satureja montana] steppes (vulnerable under the European Red List of Habitats).
- Eastern *Quercus pubescens* woods (LC under the European Red List of Habitats). This habitat is considered primarily degraded in the baseline reports due to extensive exploitation in the past.
- Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion (DD under the European Red List of Habitats).

Critical Habitat and Priority Biodiversity Features (PBF)

According to IFC PS6, EBRD ESR6 and EIB, one habitat is listed as Critical Habitat; G1.73 - Eastern *Quercus pubescens* woods. This habitat type is listed as an Annex I priority habitat type under the EU Habitats Directive (Council Directive 92/43/EEC).

Field surveys identified two habitats that are classified as PBF according to EBRD: Helleno-Balkanic [Satureja montana] steppes and intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion. Both of these habitats are listed under Annex I if the EU Habitats Directive. The CHA is presented in Chapter 10. A map presenting the modified, natural and critical habitats are shown in Figure 8.7.

Figure 8.7: Natural, modified and critical habitat



Source: Mott MacDonald, 2025

8.4.1.3 Flora

Based on IBAT data within the 50km buffer, two IUCN Endangered (EN) species *Pilularia minuta* and *Rhododendron myrtifolium* and one VU *Brachythecium geheebii* were identified, and three EN and one VU species were identified nationally (presented in Table 8.12.). *Marsilea quadrifolia* is also considered VU in Europe under the IUCN Red List. None of these species are considered to be restricted range as per the IFC definition[3].

Field survey results

Twelve species were identified during the field survey undertaken. These species include four LC, and eight NE under the IUCN Red List. None of the flora species recorded on site were identified as protected or strictly protected in Macedonia.

Table 8.12: Flora species of conservation concern potentially present within the 50km buffer.

Scientific name	Common name	IUCN status	National status	Habitat and ecology and likelihood of occurrence in the AoI
Pilularia minuta	Dwarf Pillwort	EN	NE	This species is usually found in temporary pools at low elevation in diverse landscapes such as forests, matorrals or agricultural lands. It is a small amphibious fern of small stature, with a threadlike rhizome (Geophyte with rhizome). The germination of the spores requires very humid (water saturated) or flooded conditions; the maturation of the sporocarpes only takes place after complete exposure to air at the end of the spring. This species was not recorded during the field surveys. It is considered unlikely that this species is present in the AoI given its reliance on very humid or flooded conditions.
Rhododendron myrtifolium	-	EN	NE	This shrub, usually less than 60 cm, is found in forest pine scrub to open moorland on acid and limestone. It can form large stands in the alpine heaths growing along with *Juniperus nana*. The species prefers humid places protected against the wind, where erosion is limited, often on northern aspect slopes. This species was not recorded during the field surveys. It is considered unlikely that this species is present in the AoI given its preference for humid places with limited erosion. As the site is located on mountainous landscape, it is considered the right conditions are likely not present for this species.
Brachythecium geheebii	-	VU	NE	In the Balkans and Hungary, this species grows mostly on rocks in shady areas, but it is also found in beech forests. In mountainous areas, it occurs on tree bases. It usually occurs at high elevations, except in Norway where it is found at lower elevations. This species was not recorded during the field surveys. This species could occur in the AoI given suitable habitat is present.
Marsilea quadrifolia	Water Shamrock	LC (VU in Europe)	EN	Typically grows in the stagnant waters and sporadically drying meadows, shallow margins and draw-down zones of lakes, marshes, river margins, oxbow lakes and sometimes ditches. Its elevation range is from sea level up to 400 m. It is intolerant of competition and usually occurs on otherwise bare soils. It can be found in the following Habitats Directive habitats:

[3] A restricted-range species is one whose global range is limited to less than 50,000 km², typically measured as the extent of occurrence (EOO)

Scientific name	Common name	IUCN status	National status	Habitat and ecology and likelihood of occurrence in the AoI
				– 3150 Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation. – 3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*. – 3110 Oligotrophic waters containing very few minerals of sandy plains. Given this species' preference for aquatic habitats, as well as the elevation range having an upper limit of 400m above sea level (and the site having an elevation range of 500-900m), it is considered unlikely this species is present in the AoI. This species was not recorded during the field surveys.
Lindernia procumbens	Creeping lindernia	LC	VU	The species is a classic species of nutrient-rich or organic silt in the drawdown zones of lakes, reservoirs and ponds, also occurring on the beds of drained fishponds and oxbow lakes, as well as rice fields, sandy humid waste ground, marshes, river banks and wet low-lying areas. Given this species' preference for aquatic habitats, it is considered unlikely to be present in the AoI. This species was not recorded during the field surveys.
Menyanthes trifoliata	Bogbean	LC	EN	*M. trifoliata* is found in various wetland habitats such as fens, pools, marshes, older woods, ditches, bogs, lake shores, swampy prairies, particularly in acid or oligotrophic conditions. Given this species' preference for aquatic habitats, it is considered unlikely to be present in the AoI. This species was not recorded during the field surveys.
Trapa natans	Water Caltrop	LC	EN	This species is an annual floating-leaved plant that grows in standing waters such as lakes, ponds and marshes, as well as in channels with weak currents. It primarily occurs in unpolluted nutrient-rich lowlands without too much calcium. Given this species' preference for aquatic habitats, it is considered unlikely to be present in the AoI. This species was not recorded during the field surveys.

Source: Mott MacDonald with data from IBAT (species names and statuses) and IUCN Red List (habitat and ecology).

Table 8.13 presents a list of species identified during the field surveys that are identified as Rare in Macedonia and most have not evaluated according to IUCN.

Table 8.13: Rare flora species identified during the field surveys.

Species	National Red List of Threatened Species	IUCN status	CITES Convention	Rare Species
Paeonia peregrina Mill.	-	LC (Europe); NE globally	-	x
Astragalus onobrychis L.	-	LC	-	x
Astragalus parnasii Boiss.	-	NE	-	x
Morina persica L.	-	NE	-	x
Orobanche amethystea Thuill.	-	NE	-	X
Orobanche reticulata subsp. pallidiflora (Wimm. & Grab.) Hayek	-	NE	-	x
Alium spherocephalon L.	-	LC (Europe)	-	Balkan endemic
Campanula cervicaria L.	-	NE	-	x
Orobanche reticulata	-	NE	-	x

Source: Maneko, 2025

8.4.1.4 Terrestrial mammals

Within 50km of the Project based on IBAT data, there are three globally threatened terrestrial mammal species, one of which is the European Ground Squirrel *Spermophilus citellus*, which is IUCN EN and two IUCN VU species, the Balkan Snow Vole *Dinaromys bogdanovi* and Marbled Polecat *Vormela peregusna*. There are 42 species of mammals (one Near Threatened (NT) and 38 Least Concern (LC)). In addition, two nationally VU species are potentially present within this buffer: the Eurasian otter *Lutra lutra* and brown bear *Ursus arctos*. The species of concern are presented in Table 8.14 with a description of suitable habitats and likelihood of occurrence within the AoI.

Field survey results

Eight species were identified during the field survey undertaken. All of these are considered LC under the IUCN Red List and NE nationally. Of these species, badger (*Meles meles*) was recorded in May and June 2025 which is Protected under the “Law on Nature”. Brown hare (*Lepus europaeus*), Roe deer (*Capreolus capreolus*) and badger have seasonal protection under the “Law on Hunting”.

Table 8.14: Mammal species of conservation concern potentially present within the 50km buffer.

Scientific name	Common name	IUCN status	National status	Habitat and ecology and likelihood of occurrence in the AoI
Spermophilus citellus	European Ground Squirrel	EN	NE	This species has two ranges within Europe divided by the Carpathian mountains. The south-eastern portion extends from southern Serbia, North Macedonia and Greece through Bulgaria and southern Romania to Turkish Thrace, Moldova and Ukraine. In North Macedonia the species is found in Mount Jakupica and at least 15 scattered ground squirrel colonies are found in the lowlands of south-eastern North Macedonia (excluding Strumica area), all patchily distributed and embedded between fields and vineyards. The Project AoI is outside the range for this species in Macedonia. It is unlikely that this species will be present in the Project AoI. No signs of European Ground Squirrel were recorded during the surveys.

Scientific name	Common name	IUCN status	National status	Habitat and ecology and likelihood of occurrence in the AoI
Dinaromys bogdanovi	Balkan Snow Vole	VU	NE	The Balkan Snow Vole has highly specific habitat requirements and the adaptive zone occupied imposes strong pressures of stabilising selection. This species is found exclusively in rocky karst limestone areas, in accumulations of rocks and boulders, on cracks in cliffs, escarpments, cave entrances, shafts and crevices in rocky substrates. Most records (c. 70%) are from elevations above 1,400 m. It is considered unlikely this species is present within the AoI given the lack of suitable habitat and elevation requirements.
Vormela peregusna	Marbled Polecat	VU	NE	This species inhabits desert, semi-desert and steppe habitats, but, at least in Israel, also cultivated landscapes. It is a specialised predator, feeding mainly on desert and steppe rodents such as gerbils, ground squirrels and birds. It is considered unlikely this species is present within the AoI given the lack of suitable habitat.
Lutra lutra	Eurasian Otter	NT	VU	It is known from a wide variety of aquatic habitats, including highland and lowland lakes, rivers, streams, marshes, swamp forests and coastal areas. It is very adaptable, using saltwater as well as freshwater habitats, and even sewerage systems in urban areas. In most parts of its range Otter distribution is correlated with the presence of riverbank vegetation or rock crevices. Otters in different regions may depend upon different features of the habitat, but the important component of Otter habitat, for breeding purposes and daily rest, is the presence of holes in the riverbank, including rock crevices, cavities among tree roots, piles of rock, wood or debris. It is considered unlikely this species is present in the AoI for terrestrial ecology due to the lack of permanent water bodies.
Ursus arctos	Brown Bear	LC	VU	Today, most of the Bear's former range is no longer suitable habitat due to human habitat alteration and human presence. Components of habitat can be grouped into three main categories: food, security cover, and den sites. Bear movements and habitat use are strongly affected by the availability of food. Furthermore, population density is positively associated with food availability. Areas with a high availability of preferred foods, such as berries, fruits, hard mast, colonial Hymenoptera, and ungulates, are of special importance to Brown Bears. The areas surrounding the Project are generally outside the main concentration of Brown Bear which are largely found in Mavrovo National Park in Western Macedonia. According to IUCN (McLellan et al, 2017), brown bear are largely extinct in Macedonia with resident ranges in Western Macedonia and non-breeding ranges to the East. This species is therefore unlikely to be present in the AoI given its distribution in Macedonia.

8.4.1.5 Bats

The IBAT data identified 21 species of bats within 50km of the Project. Of these, four are IUCN VU; Long-fingered bat (*Myotis capaccinii*), Mehely's Horseshoe b*at* (*Rhinolophus mehelyi)* and Schreiber's Bent-winged bat (*Miniopterus schreibersii*) and barbastrelle bat (*Barbastella barbastellus*). Of the remaining 17 bat species, two are Near Threatened (NT) and 15 (LC)). Of the 21 species, five species are migratory,20 are listed on Annex IV of the Habitats Directive (excluding *Myotis aurascens*) and 11 are listed under Annex II of the Habitats Directive. All bat

species are protected in North Macedonia. The list of species of concern is presented in Table 8.15 below.

Field survey results

Fifteen bat species were identified during the field survey undertaken between October 2024 and October 2025, as well as one Myotis genera (identified to this level given the difficulty to identify species within this). Therefore, six species of this genus (*M. capaccinii, M. blythii, M. emarginatus, M. myotis, M. mystacinus* and *M. aurascens*) have been considered in the assessment.

Thirteen of the species identified are considered LC under the IUCN Red List, one NT and three are considered VU (*Barbastella barbastellus*, *Myotis capaccinii* and *Miniopterus schreibersii*). Bats have not been assessed as part of the National Red List. Field surveys found no natural bat shelters or roosts within human settlements in the study area. Only a limited number of buildings were available for inspection, as most are seasonally occupied. Cultural beliefs among the local population discouraged entry into some abandoned structures due to negative associations with bats. The wind farm site lacks mature forest stands and old trees, which are typically important for bat roosting, indicating low availability of suitable natural roosting habitats.

No mature trees or other structures containing features typically suitable for roosting (e.g., cavities, cracks, peeling bark, crevices) were recorded. While scattered smaller trees were present, these did not exhibit characteristics associated with roost potential. This finding supports the proportionality and adequacy of the adopted 500 m roost-focused survey radius.

The bat survey locations have been mapped relative to the Projects components and these are presented in Figure 8.2**Error! Reference source not found.**.

Table 8.15: Bat species of conservation concern potentially present within the 50km buffer.

Scientific name	Common name	IUCN status	National status	Habitat and ecology and likelihood of occurrence in the AoI
Myotis capaccinii	Long-fingered Bat	VU	NE	The Long-fingered Bat (Myotis capaccinii) depends strictly on aquatic habitats. It forages over wetlands and waterways (including artificial waterbodies, such as canals and reservoirs), also scrub. It seems to prefer clutter-free water surfaces when foraging, probably because the echolocation of preys is facilitated above them (Almenar et al. 2009). It generally roosts in underground habitats (principally caves). In the Balkans it is confined to karst areas. Given the lack of permanent water bodies in the AoI, it is considered unlikely that this species occurs on site.
Rhinolophus mehelyi	Mehely's Horseshoe Bat	VU	NE	*Rhinolophus mehelyii* roosts year-round in caves and mines and only rarely in other artificial underground sites. The species forages in the forest, but also frequently in semi-open habitats, whereas open habitats are avoided or preferred in different populations, and foraging sites are preferentially close to water. This species was not recorded during the 2025 Surveys.
Miniopterus schreibersii	Schreiber's Bent-winged Bat	VU	NE	This bat roosts almost exclusively in natural and artificial underground sites. It forages mainly in deciduous woodlands and mature orchards, gardens, along hedgerows separating pastures and riverine forests and in urban areas. In the Mediterranean area, they can use grasslands but avoid arable land and maquis. This species has been identified during the field surveys. Therefore, this species occurs in the AoI.
Barbastella barbastellus	Barbastelle Bat	VU (Europe)	NE	A typical forest bat that, in summer, typically forms small reproductive groups of adult females (a dozen or so) and

Scientific name	Common name	IUCN status	National status	Habitat and ecology and likelihood of occurrence in the AoI
				their pups in tree cavities (especially under flaking bark in dead trees) or more rarely rock crevices. This species has been identified during the field surveys. Therefore, this species occurs in the AoI.

Source: Mott MacDonald with data from IBAT and Maneko, 2025.

Analysis was undertaken on bat activity and bat activity indexes were calculated for each species and each month (refer to Appendix B). The results show the majority of activity for each species is low across most months. However, medium activity was recorded for Savi's pipistrelle (*Hypsugo savii*), in May and June, Common bent-wing bat (*Miniopterus schreibersii*) in October and September, Myotis sp. in August, *Pipistrellus kuhlii* in April to first week of September, *Pipistrellus nathusii* in April and August/ September, *Pipistrellus pipistrellus* in June and September and *Pipistrellus pygmaeus* in June. High activity was recorded for *Pipistrellus kuhlii* in May and Very High activity was recorded for *Pipistrellus pipistrellus* in July. All of these species are high risk for collision with wind turbines with the exception of Myotis sp. which are medium to low.

Critical Habitat and PBFs – Bats

The Project meets the thresholds for five critical habitat species under EIB Criterion 1 (barbastelle bat, Schreiber's bent-winged bat, Geoffroy's bat, greater mouse-eared bat and lesser horseshoe bat) and 11 bat species for PBFs under EBRD ESR6 Criteria 1 and 3 supporting species listed under Annex II of the Habitats Directive and migratory bird species, regularly occurring within the EAAA. For further details on critical habitat and PBFs refer to Chapter 10.

8.4.1.6 Birds

The IBAT data returned records of eight bird species of which three are IUCN EN (White-headed Duck *Oxyura leucocephala*, Egyptian Vulture *Neophron percnopterus* and Saker Falcon *Falco cherrug*) and five are IUCN VU are likely to be present within the 50km from the Project site. In addition to these species, there are 10 bird species that are IUCN NT. Several of these are designated species for the protected areas. Table 8.16 presents the avifauna species of conservation concern potentially present within the 50km buffer.

Field survey results

One hundred and fifty-seven species were identified during the field surveys undertaken in 2024/25. Two species are considered VU under the IUCN Red List (Eastern imperial eagle and European turtle dove) and four species considered NT under the IUCN Red List (redwing, rock partridge, grey partridge and woodchat shrike). All other species recorded are considered LC under the IUCN Red List. Fifteen target species will also be assessed for collision risk with the WTG. A total of 44 LC species were identified within the AoI and considered breeding. A total of 60 species were identified within the AoI and are full migratory species.

The bird species of conservation concern potentially present within the 50km buffer are presented in Table 8.16. This table includes EN and VU species recorded on IBAT and NT species which were recorded during field surveys. Any NT recorded on IBAT but not recorded during the field surveys have been omitted. Avifauna have been grouped in the table to assist with the assessment process.

Table 8.16: Avifauna species of conservation concern potentially present within the 50km buffer.

Name	IUCN	Bern Convention	Birds Directive	Status on site	Habitat and ecology and likelihood of occurrence in the AoI
Large raptors (EN/VU)					
Egyptian vulture, *Neophron percnopterus*	EN	2	I	Summer	Egyptian vulture is a native summer breeder and passage migrant in North Macedonia and occupies open arid landscapes which include grassland and rock outcrops. As well as arable land, pasture and occasionally urban areas. They nest mainly on cliffs and rocky ledges and occasionally buildings, pylons and trees. Egyptian vulture are a qualifying species of the River Topolka river/Babuna river Bregalnica KBA/IBA 11km west and other KBAs in the AoI of the Project. There were 12 breeding territories in North Macedonia in 2020, three of which are distributed in central N. Macedonia where the Project is situated (Saravia, V et al., 2020). Although, no birds were recorded during the field surveys given the habitats within the AoI are suitable for Egyptian vultures and they are known to breed in the area, it is considered this species occurs in the AoI.
Greater spotted eagle, *Clanga clanga*	VU	2	I	Wintering	Greater spotted eagle is a non-breeding migrant species of North Macedonia and occupies a variety of woodlands near wetlands, marshes and rivers. It also, uses agricultural areas such as arable land and pasture particularly during migration and when wintering. There are limited records of greater spotted eagle in North Macedonia (BirdLife International., 2021). It was not recorded during any of the 2024/2025 bird surveys and considering it is a rare passage and winter visitor; therefore, it is considered unlikely this species is present in the AoI.

Name	IUCN	Bern Convention	Birds Directive	Status on site	Habitat and ecology and likelihood of occurrence in the AoI
Eastern imperial eagle, *Aquila heliaca*	VU	2	I	Year round	Eastern imperial eagle is a native resident and passage migrant in North Macedonia. They occupy woodlands, steppe and agricultural areas with scattered trees and nest on cliff faces as well as pylons. Eastern imperial eagle are a qualifying species of Ovche Pole KBA 8.5km northwest, River Topolka river/Babuna river Bregalnica KBA/IBA 11km west and other KBAs in the AoI of the Project. This species was recorded within the AoI during the vantage point surveys in 2025. In addition, two adult individual and a juvenile eagle were recorded during the raptor surveys within the AoI. Therefore, this species occurs in the AoI.
Large raptors (NT/LC)					
Pallid harrier, *Circus macrourus*	NT	2	I	Migration	Pallid harrier is a migratory species in North Macedonia which occasionally breeds. They occupy steppe habitats, wetlands and marshes often near rivers and lakes. There are limited records of pallid harrier in North Macedonia (Terraube et al., 2021). It was not recorded during any of the 2024/2025 bird surveys and considering it is a rare passage visitor, it is considered unlikely this species is present in the AoI.
Eurasian griffon vulture, *Gyps fulvus*	LC	2	I	Year round	Eurasian griffon vulture is a native breeder and resident species of North Macedonia and occupies open landscapes such as mountains and hills. It nests in large colonies on rock outcrops and cliff faces often at high elevations. There are several KBA/IBA in the area. Despite being heavily persecuted in N. Macedonia, reintroduction of griffon vultures to Bulgaria has helped recover populations in the Balkans. Radio tagged released birds have been recorded migrating through N. Macedonia in 2021 (Peshev, H et al., 2021) Although no individuals were observed during the field surveys, the presence of suitable nesting and foraging habitats within the AoI, combined with the species' known distribution in the region, supports the likelihood that Eurasian Griffon Vultures occur within the AoI.
Northern goshawk, *Accipiter gentilis*	LC	2		Year round	Northern goshawk is a native resident species of North Macedonia and occupies mature woodlands, including coniferous, deciduous, and mixed forests where they nest. This species was recorded within the AoI during the non-breeding vantage point surveys in 2024/25. Therefore, this species occurs in the AoI.
Short-toed snake eagle, *Circaetus gallicus*	LC	2	I	Summer	Short-toed snake eagle is a native summer breeder in North Macedonia and occupies woodlands and wetlands as well as grasslands with access to rocky slopes/cliffs and scattered trees which they use for breeding. This species was recorded on two occasions within the AoI during the ornithology surveys in 2025. Therefore, this species occurs in the AoI.
Western marsh harrier, *Circus aeruginosus*	LC	2	I	Year round	Western marsh harrier is a native resident species of North Macedonia and occupies dense marsh vegetation as well as wetlands, floodplains and reedbeds where they nest. This species was recorded within the AoI during the vantage point

Name	IUCN	Bern Convention	Birds Directive	Status on site	Habitat and ecology and likelihood of occurrence in the AoI
					surveys in 2024/25. Therefore, this species occurs in the AoI.
Hen harrier, *Circus cyaneus*	LC	2	I	Wintering	Hen harrier is a non-breeding migrant species of North Macedonia and occupies a variety of open landscapes including grassland, shrublands and marshes. It also, uses agricultural areas such as arable land and pasture particularly during migration and when wintering. This species was recorded within the AoI during the vantage point surveys in 2024/25. Therefore, this species occurs in the AoI.
Montagu's harrier, *Circus pygargus*	LC	2	I	Migration	Montagu's harrier is a migratory species in North Macedonia which occasionally breeds. They occupy open lowland habitats such as grasslands, wetlands and occasionally arable farmland. It nests on tall vegetation often in grassland and marshes. This species was recorded on two occasions within the AoI during the ornithology surveys in 2025. Therefore, this species occurs in the AoI.
Eurasian buzzard, *Buteo buteo*	LC	2		Year round	Eurasian buzzard is a native resident species of North Macedonia and occupies dense woodlands as well as open areas such as arable fields and woodland edges. It will often nest in tall trees and woodland. This species was recorded within the AoI during the vantage point surveys in 2024/25. In addition, five confirmed territories were identified during the raptor surveys. Therefore, this species occurs in the AoI.
Long-legged buzzard, *Buteo rufinus*	LC	2	I	Year round	Long-legged buzzard is a native resident species of North Macedonia and occupies open areas such as steppe and dry grasslands and temperate shrublands. It will often nest on rocky outcrops or cliffs and occasionally scattered trees. This species was recorded within the AoI during the vantage point surveys in 2024/25. Therefore, this species occurs in the AoI.
European honey buzzard *Pernis apivorus*	LC	2		Migration	European honey buzzard is a native breeding and passage migrant in North Macedonia. It typically breeds in mixed and deciduous woodland. This species was recorded within the AoI during the vantage point surveys in 2024/25. In addition, two confirmed territories were identified in the AoI during the raptor surveys. Therefore, this species occurs in the AoI.
Lesser spotted eagle, *Clanga pomarina*	LC	2	I	Migration	Lesser spotted eagle is a migratory species in North Macedonia and occupies deciduous woodland near wetlands and river valleys. The lesser spotted eagle is a known breeding species in Macedonia with an estimated population of 5-15 pairs (BirdLife International, 2021). Although no individuals were observed during the field surveys, the presence of suitable nesting and foraging habitats within the AoI, combined with the species' known distribution in the region, supports the likelihood that Lesser spotted eagle occur within the AoI.
Golden eagle, *Aquila chrysaetos*	LC	2	I	Year round	Golden eagle is a native resident breeding species in North Macedonia. They occupy open and mountainous habitat often over woodlands. There are estimated 60-80 pairs of golden eagle in N. Macedonia (BirdLife International, 2021). They

Name	IUCN	Bern Convention	Birds Directive	Status on site	Habitat and ecology and likelihood of occurrence in the AoI
					also, occupy huge territories over 15km (Sidiropoulos, L et al., 2024). Although no individuals were observed during the field surveys, the presence of suitable nesting and foraging habitats within the AoI, combined with the species' known distribution in the region, supports the likelihood that golden eagle occur within the AoI.
Booted eagle *Hieraaetus pennatus*	LC	2	I	Year round	Booted eagle is a native resident breeding species in North Macedonia. They occupy open and mountainous habitat often over woodlands. This species was recorded within the AoI during the ornithology surveys in 2025. Therefore, this species occurs in the AoI.
Small raptors (EN/VU)					
Saker falcon, *Falco cherrug*	EN	2	I	Migration	Saker Falcon is found in North Macedonia primarily as a passage migrant, however, there have been historic records of 0-3 pairs breeding (BirdLife International, 2025). They prefer steppe, semi-desert and grasslands. It was not recorded during any of the 2024/2025 bird surveys and considering it is a rare passage visitor, it is considered unlikely this species is present in the AoI.
Red-footed falcon, *Falco vespertinus*	VU	2	I	Migration	Red-footed falcon is a migratory species in North Macedonia and occupies lowland habitats such as meadows and agricultural land with scattered trees and often near wetlands. It was not recorded during any of the 2024/2025 bird surveys and considering it is a rare passage visitor, with limited suitable habitat within the AoI, it is considered unlikely this species is present in the AoI.
Small raptors (LC)					
Sparrowhawk, *Accipiter nisus*	LC	2		Year round	Eurasian sparrowhawk is a native resident species of North Macedonia and occupies dense woodlands as well as urban areas including parks and gardens. It will often nest in tall trees. This species was recorded within the AoI during the vantage point surveys in 2024/25. Therefore, this species occurs in the AoI.
Lesser kestrel, *Falco naumanni*	LC	2	I	Summer	Lesser kestrel is a native resident species of North Macedonia and occupies open areas such as grasslands, non-intensive agricultural fields as well as urban areas. It will often nest on rocky outcrops or cliffs and occasionally within buildings. Lesser kestrel are a qualifying species of Ovche Pole KBA 8.5km northwest and other KBAs in the AoI of the Project. This species was recorded within the AoI during the ornithology surveys in 2025. Therefore, this species occurs in the AoI.
Kestrel, *Falco tinnunculus*	LC	2		Year round	Kestrel is a native resident species of North Macedonia and occupies open areas such as grasslands, agricultural fields as well as urban areas. It will often nest on rocky outcrops or cliffs and occasionally within trees and buildings. This species was recorded within the AoI during the vantage point surveys in 2025. In addition, six confirmed territories were identified during the raptor surveys in 2025. Therefore, this species occurs in the AoI.

Name	IUCN	Bern Convention	Birds Directive	Status on site	Habitat and ecology and likelihood of occurrence in the AoI
Lanner falcon, *Falco biarmicus*	LC	2	I	Year round	Lanner falcon is a native resident species in North Macedonia and occupies open habitats such as meadows with rocky cliffs which it will use for nesting and occasionally woodlands and trees. They often use the nests of other birds. There are estimated 20-30 pairs of lanner falcon in N. Macedonia (BirdLife International, 2021). Also, within the protected sites AoI is the Osogove mountains IBA which support populations of lanner falcon meeting IBA criteria (Key Biodiversity Areas Partnerships, 2025). Although no individuals were observed during the field surveys, the presence of suitable nesting and foraging habitats within the AoI, combined with the species' known distribution in the region, supports the likelihood that lanner falcon occur within the AoI.
Peregrine falcon, *Falco peregrinus*	LC	2	I	Year round	Peregrine falcon is a native resident species in North Macedonia and occupies a wide variety of environments including urban areas, rocky cliffs and mountains and coastal zones all often near water. Their nests are often built on rock ledges or cliffs and are known to nest on tall buildings. This species was recorded within the AoI during the vantage point surveys in 2025. Therefore, this species occurs in the AoI.
Other birds (EN/VU)					
White-headed duck, *Oxyura leucocephala*	EN	2	I	Migration	White-headed duck is found in North Macedonia primarily as a passage migrant. They prefer shallow wetlands and lakes. It was not recorded during any of the 2024/2025 bird surveys and considering it is a rare passage visitor, it is considered unlikely this species is present in the AoI.
Lesser white-fronted goose, *answer erythropus*	VU	2	I	Migration	Lesser white-fronted goose is found in North Macedonia primarily as a passage migrant and occasional winter visitor. They prefer Wetlands, bogs, and lakes. It was not recorded during any of the 2024/2025 bird surveys and considering it is a rare passage visitor, it is considered unlikely this species is present in the AoI.
European turtle dove, *Streptopelia turtur*	VU	2	I and II	Summer	European turtle dove is a migrant breeder and passage migrant which occupies open or semi-open landscapes with a mix of woodland edges, hedgerows and farmland with scattered trees or shrubs. This species was recorded within the AoI during the breeding bird surveys in 2025. Therefore, this species occurs in the AoI.
Other breeding birds (NT/LC)					
Woodchat shrike *Lanius senator*	NT	2	I	Summer	Woodchat Shrike is a native breeding species in North Macedonia, typically found in open wooded areas, orchards, and pastureland with scattered trees and bare or sandy ground. It nests are usually built in trees or shrubs. This species was recorded within the AoI during the breeding bird surveys in 2025 across the whole Project site with peak counts of 10 individuals in July 2025. Therefore, this species occurs in the AoI.

Name	IUCN	Bern Convention	Birds Directive	Status on site	Habitat and ecology and likelihood of occurrence in the AoI
Rock partridge *Alectoris graeca*	NT	3	I	Year round	Rock partridge is a native resident species in North Macedonia and occupies dry, open, and rocky upland areas, including mountain slopes and forested hillsides. This species was recorded within the AoI during the breeding bird surveys in 2025. Therefore, this species occurs in the AoI.
Redwing *Turdus iliacus*	NT	2	I	Winter	Redwing is a wintering species in North Macedonia and occupies open countryside, farmland, hedgerows, and orchards. This species was recorded within the AoI during the breeding bird surveys in 2025. Therefore, this species occurs in the AoI.
Grey partridge *Perdix perdix*	NT	3	II and III	Year round	Grey partridge is a native resident species in North Macedonia and occupies grassland habitats such as meadows and agricultural land often nests in winter wheat and arable fields. This species was recorded within the AoI during the breeding bird surveys in 2025. Therefore, this species occurs in the AoI.
Maked shrike *Lanius nubicus*	LC	2	I	Summer	Masked shrike is native breeding species in North Macedonia and occupies open woodland bushes and scattered scrub. Nests are usually built in trees and shrubs. This species was recorded within the AoI during the breeding bird surveys in 2025 with peak count of two individuals. Therefore, this species occurs in the AoI
Eurasian roller, *Coracias garrulus*	LC	2	I	Summer	Eurasian roller is a native resident species in North Macedonia and occupies lowland habitats such as meadows with scattered trees and woodlands. They often nest in tree cavities, holes in cliffs and occasionally abandoned buildings. There are estimated 200-300 pairs of European roller in N. Macedonia (BirdLife International, 2021). Also, within the protected sites AoI is the Lake Mantovo and river Lakavica IBA/KBA which support populations of lanner falcon meeting IBA criteria (Key Biodiversity Areas Partnerships, 2025). Although no individuals were observed during the field surveys, the presence of suitable nesting and foraging habitats within the AoI, combined with the species' known distribution in the region, supports the likelihood that lanner falcon occur within the AoI.
Common quail *Coturnix coturnix*;	LC	3	IIB	Summer	Common quail is a native resident species in North Macedonia and occupies grassland habitats such as meadows and agricultural land often nests in winter wheat and arable fields. This species was recorded within the AoI during the breeding bird surveys in 2025. Therefore, this species occurs in the AoI.
Black woodpecker, *Dryocopus martius*	LC	2	I	Year round	Black Woodpecker is a native resident species in North Macedonia, occurring year-round in suitable forest habitats across the country. Black Woodpecker nests in mature forests, particularly those with tall broadleaf trees, often mixed with conifers This species was recorded within the AoI during the breeding bird surveys in 2025. Therefore, this species occurs in the AoI.

Name	IUCN	Bern Convention	Birds Directive	Status on site	Habitat and ecology and likelihood of occurrence in the AoI
Eurasian thick-knee *Burhinus oedicnemus*	LC	2	I	Summer	Eurasian thick-knee is breeding species in North Macedonia and occupies open, dry lowland habitats. There are an estimated 200-400 pairs in North Macedonia (BirdLife International, 2025). Eurasian thick-knee are a qualifying species of the River Zletovska Valley KBA/IBA 15km northwest. Although no individuals were observed during the field surveys, the presence of suitable nesting and foraging habitats within the AoI, combined with the species' known distribution in the region, supports the likelihood that Eurasian thick-knee occur within the AoI
Lesser grey shrike, *Lanius minor*	LC	2	I	Summer	Lesser Grey Shrike is a breeding species in North Macedonia and occupies dry, open lowlands with scattered trees or shrubs. They nest in small trees or tall shrubs, often in hedgerows or field margins. Lesser grey shrike are a qualifying species of Ovche Pole KBA 8.5km northwest of the Project. This species was recorded within the AoI during the ornithology surveys in 2025. Therefore, this species occurs in the AoI.
Nocturnal species (LC)					
Eurasian eagle owl *Bubo bubo*;	LC	2	I	Year round	Eurasian eagle owl is a nocturnal native resident species in North Macedonia and occupies a wide variety of environments including woodlands, rocky cliffs and mountains. Their nests are often built on rock ledges or cliffs and are known to nest in the abandoned nest of other birds. There are estimated 200-400 pairs of Eurasian eagle owl in N. Macedonia (BirdLife International, 2021). Also, within the protected sites AoI is the Osogove mountains IBA which support populations of Eurasian eagle owl (Key Biodiversity Areas Partnerships, 2025). Although no individuals were observed during the field surveys, the presence of suitable nesting and foraging habitats within the AoI, combined with the species' known distribution in the region, supports the likelihood that Eurasian eagle owl occur within the AoI.
Long-eared owl *Asio otus*	LC	2		Year round	Long-eared owl is a native breeding species in North Macedonia. They nest in dense vegetation, often in coniferous or mixed woodlands and forest edges. This species was recorded within the AoI during the nocturnal surveys in 2025. Therefore, this species occurs in the AoI.
Little owl Athene noctua;	LC	2		Year round	Little owl is a nocturnal native resident species in North Macedonia and occupies open habitats with scattered trees such as grasslands, orchards and agricultural fields and sometimes found in urban areas in old buildings. They often nest in tree cavities, holes in cliffs and occasionally abandoned buildings. This species was recorded within the AoI during the nocturnal surveys in 2025. Therefore, this species occurs in the AoI.
Scops owl *Otus scops*;	LC	2		Summer	Scops owl is a nocturnal native resident species in North Macedonia and occupies woodlands and areas with large mature trees such as orchards and

Name	IUCN	Bern Convention	Birds Directive	Status on site	Habitat and ecology and likelihood of occurrence in the AoI
					urban parkland. They often nest in tree cavities, nest boxes and occasionally abandoned buildings. This species was recorded within the AoI during the nocturnal surveys in 2025. Therefore, this species occurs in the AoI.
Tawny owl *Strix aluco*;	LC	2		Year round	Tawny owl is a nocturnal native resident species in North Macedonia and occupies woodlands and areas with large mature trees such as urban parkland. They often nest in tree cavities, nest boxes and occasionally abandoned buildings. This species was recorded within the AoI during the nocturnal surveys in 2025. Therefore, this species occurs in the AoI.
European nightjar *Caprimulgus europaeus*.	LC	2	I	Summer	European nightjar is a native migratory species in North Macedonia and occupies open landscapes such as heathland and forest clearings as well as young confider plantations where they nest. This species was recorded within the AoI during the nocturnal surveys in 2025. Therefore, this species occurs in the AoI.

Source: IBAT (2025) BirdLife (2025)

Critical Habitat and PBF – Birds

All species were assessed at part of the CHA to identify if they meet critical habitat thresholds or thresholds for PBF. According to EBRD guidance, 63 bird species are considered PBF feature as they are listed under Annex I of the Birds Directive and regularly occur within the AoI. The CHA is presented in Chapter 10.

8.4.1.7 Herpetofauna

Within the 50 km buffer of the Project area, IBAT data indicates that the global ranges of seven reptile and four amphibian species of conservation concern overlap with the site. Of these, the two reptile species listed as Vulnerable (VU) on the IUCN Red List are Hermann's tortoise (*Testudo herman*ni) and Greek tortoise / Spur-thighed tortoise (*Testudo graeca*), the latter being VU in Europe and three amphibian species also listed as VU: Common fire salamander (*Salamandra salamandra*), Macedonian crested newt (*Triturus macedonicus*), and Italian crested newt (*Triturus carnifex*). In addition, 18 reptile and four amphibian species listed as Least Concern (LC) by the IUCN are considered potentially present.

The National Red List also considers the Macedonian crested newt nationally VU and the Alpine newt (*Ichthyosaura alpestris*) EN for reptiles, and the Hermann's tortoise, the cat snake (*Telescopus fallax*), *Pseudopus apodus* and Greek tortoise/ spur-thighed tortoise as VU, and the viviparous lizard (*Zootoca vivipara*), javelin sand boa (*Eryx jaculus*) and sand lizard (*Lacerta agilis*) as EN nationally.

Field surveys conducted in May, June, and September 2025 confirmed the presence of several of these species. Hermann's tortoise was recorded during surveys in May, June, and September; Common fire salamander was recorded in May; and Greek tortoise / Spur-thighed tortoise was recorded in May and June. These findings are summarised in Table 8.17 below.

Field survey results

Eight amphibian species were identified during the field surveys, including one IUCN VU species (common fire salamander), and seven LC species. In addition, 18 reptile species were identified, including two IUCN and nationally VU species (Hermann's tortoise and Greek

tortoise), and 16 IUCN LC species. None of these are considered migratory. In addition, Hermann's tortoise *Testudo hermanni*, Greek/ spur-thighed tortoise *Testudo graeca*, European ratsnake *Zamenis situla* and four-lined snake *Elaphe quatuorlineata* are all listed under both Annex II and Annex IV of the Habitats Directive. and are found in the AoI.

The European ratsnake is a thermophilic species often found in scrubland, macchia, karst habitats, field edges, marshes, stream edges, vineyards, olive groves, on stone walls, and in rural gardens and buildings, as well as in a variety of temperate and Mediterranean montane forest types. The four-lined snake is found in hedgerows, close to woodland edges, in open woodland, rocky overgrown areas and traditionally cultivated land.

Table 8.17: Herpetofauna species of conservation concern potentially present within the 50km buffer.

Scientific name	Common name	IUCN status	National status	Habitat and ecology and likelihood of occurrence in the AoI
				Amphibians
Salamandra salamandra	Common Fire Salamander	VU	LC	This species is associated with wet cool deciduous, mixed, or rarely, coniferous forests with well shaded brooks and small rivers. Within the mountain forest belt, the species can be found in woodlands, glades and forest edges, rocky slopes, dense bush, and herbaceous vegetation. The species prefers microhabitats covered with dense leaf-litter and moss. It does tolerate some habitat modification and has even been found in gardens. This species was confirmed in the AoI in 2025.
Triturus macedonicus	Macedonian Crested Newt	VU	VU	The species occurs in a wide variety of terrestrial habitats, from beech woodlands to arid Mediterranean climates. It can be found in ponds and lakes as well as in modified habitats such as quarries and artificial water bodies such as stony wells, tanks and drinking troughs. Its breeding and larval development takes place in various stagnant, preferably permanent or long standing, temporary aquatic habitats. It is considered unlikely that this species will be present in the AoI given the lack of permanent water habitats used in its larval development phases.
Triturus carnifex	Italian Crested Newt	VU	NE	This species occurs in a wide variety of terrestrial habitats from beech woodlands to arid Mediterranean climates, as well as modified habitats such as quarries. Its breeding and larval development take place in various stagnant permanent and temporary aquatic habitats. It is considered unlikely that this species will be present in the AoI given the lack of permanent water habitats and seeing as the landscape and gradient do not suit water accumulation.
Ichthyosaura alpestris	Alpine Newt	LC	EN	This is a mostly aquatic species that is generally found close to water. It is widespread in both alpine and lowland habitats including wet, shaded coniferous, mixed and deciduous forests, sub-alpine meadows and pastureland. It can be found in slightly modified habitats, although it is less common in large, cultivated fields. It is considered unlikely that this species will be present in the AoI given the lack of permanent water habitats.
				Reptiles

Scientific name	Common name	IUCN status	National status	Habitat and ecology and likelihood of occurrence in the AoI
Testudo hermanni	Hermann's Tortoise	VU	VU	This species can be considered a typical inhabitant of Mediterranean maquis and shrublands. It prefers open patchy evergreen Mediterranean Oak forest, but in its absence inhabits maquis, garrigue, dune scrub and maritime grasslands, as well as agricultural and railway edge habitats. In the temperate area of the Balkan Peninsula preferred habitat systems are Oak forests intersected with meadows and agricultural land - orchards and vineyards. This species is predominantly vegetarian, eating leaves, flowers and fruits of many plant species. This species was confirmed in the AoI in 2025.
Testudo graeca	Greek Tortoise / Spur-thighed Tortoise	VU (Europe)	VU	This species inhabits a variety of dry, open scrubby habitats, meadows and pastures, sand dunes, forests, heathlands, and open habitats through its wide range, generally on a sandy-calcareous substrate. It is also found in more open, rocky areas and areas of strongly salty substrate and sparse vegetation, as well as accumulations of large rocks. It is a generalist vegetarian, feeding on a wide variety of leaves, buds, flowers, seeds and fruits of grasses, herbs and shrubs, as well as small invertebrates such as snails, arthropods. This species was confirmed in the AoI in 2025.
Zootoca vivipara	Viviparous Lizard	LC	EN	This species can be found in a wide variety of habitats including grassland, meadows, humid scrubland, hedgerows, open woodland, woodland edges, peat bogs, stream edges, coastal areas (sea cliffs and sand dunes) and rural gardens. It is generally associated with high humidity and rich herbaceous vegetation. This species is highly dependent on humidity and water availability. It is considered unlikely that this species will be present in the AoI given its dependence on water availability.
Eryx jaculus	Javelin Sand Boa	LC	EN	In Europe, this species has been recorded from Romania, through Bulgaria, Albania, North Macedonia, Greece. It can be found inhabiting open dry steppes and semi-deserts. It appears to prefer clay and stony soils, and is more rarely encountered on stabilised sands, in vineyards and gardens. It can be found in arable land with sufficiently loose soil for burrowing. Its habitats everywhere are associated with arid landscapes. This species' upper elevation limit is 1700m above sea level. This species could occur in the AoI given suitable arable land and elevation ranges are present.
Telescopus fallax	Cat Snake	LC	VU	This species occurs in all sorts of warm rocky or stony areas. It is mostly found amongst rocks in shrubby landscapes. It can also be found in open or degraded woodland, among old walls and ruins, and on sandy beaches with plant cover (in Türkiye and Europe) and sometimes close to human habitation, and orchards and gardens with drystone walls. It is considered unlikely that this species will be present in the AoI given its preference for clay and stony soils.
Pseudopus apodus		LC	VU	This species is found in dry, well-vegetated rocky slopes, marquis, traditionally cultivated areas, and close to human settlements. It is common in gardens, vineyards and is sometimes found in agricultural land. It occurs in foothill plains and valleys of rivers, and inhabits sparse deciduous forests, tugay-bushes, shrubs, hollows, woodland edges and foothills. Animals may be found hiding under bushes, among stones or in rodent burrows.

Scientific name	Common name	IUCN status	National status	Habitat and ecology and likelihood of occurrence in the AoI
				It is considered unlikely that this species will be present in the AoI given its preference for rocky slopes.
Lacerta agilis	Sand Lizard	LC	EN	The species can be found in meadows, heathland, coastal dunes, grassland, steppe, subalpine and alpine meadows, shrubland, hedgerows, open woodland, in alpine areas, traditionally managed agricultural land and rural gardens. Sometimes it is present in sandy semi-desert areas. It is frequently found in drier and more open habitats than related species, including roadsides, hedgerows and quarries. In the forest zone, typical biotopes are mainly forest edges, clearings, floodplain forests, floodplain meadows, watershed meadows and coastal slopes, and only to a small extent anthropogenic biotopes. The most preferred natural biotopes are still the slopes of ravines, gullies, coastal slopes and other natural depressions, where the agile lizard reaches its greatest abundance. In the semi-desert zone, the population density of lizards is not very high. The biotopes preferred here, as in the steppe zone, belong to the biotopes of open spaces: floodplain meadows, slopes and other natural depressions. It is considered unlikely that this species will be present in the AoI given its habitat preferences.

Source: Mott MacDonald with IBAT and IUCN Red List data.

Critical Habitat and PBF - Herpetofauna

All species were assessed at part of the CHA to identify if they meet critical habitat thresholds or thresholds for PBF. The CHA concluded that four reptiles meet critical habitat criteria under EIB and regularly occur within the AoI (four-lined snake,European ratsnake, Hermann's tortoise and Greek Tortoise / spur-thighed tortoise). In addition, four reptiles and two amphibians meet PBF criteria under EBRD and regularly occur within the AoI. A summary of the CHA is presented in section 8.4.1.12. The CHA is presented in Chapter 10.

8.4.1.8 Invertebrates

A total of 68 species from the insecta class were identified through the IBAT data within 50km of the Project. Of these, twelve are considered globally threatened. Of the threatened species, six are IUCN EN and the six are IUCN VU. The remaining species are IUCN LC or IUCN NT. None of the species have been nationally assessed against IUCN criteria. Table 8.18 below lists the globally threatened species and highlights the habitats and ecology of each species and their likelihood within the AoI of the Project.

Invertebrates were scoped out of field surveys on the basis that species of conservation concern are not expected to occur within the Project AoI, with available distribution data indicating that their known ranges lie outside the development footprint. Although four IUCN VU species are highlighted in the table below as potentially present due to broad habitat associations, there is no evidence that the degraded, fragmented and low-quality habitats present within the site support these species, nor that the Project area falls within their functional ecological range. Consequently, targeted invertebrate surveys are not considered necessary.

Table 8.18: Invertebrate species of conservation concern potentially present within the 50km buffer

Scientific name	Common name	IUCN status	Habitat and ecology and likelihood of occurrence in the AoI
Dasypoda frieseana	-	EN	This species is known to forage pollen only on *Cephalaria* and *Scabiosa* plants (*Caprifoliaceae*). The species lives in Mediterranean-type shrubby vegetation with many of these plants present. This type of habitat is decreasing in Europe. It is considered unlikely that this species is present in the AoI given that no *Cephalaria* or *Scabiosa* plants were identified during the field surveys.
Bradyporus macrogaster	Big-Bellied Glandular Bush-Cricket	EN	The species inhabits steppe-like habitats dominated by xeric grasses and sparse scrub, in some areas like the Eastern Rhodopes in Bulgaria and the Aegean coast of Anatolia it enters Mediterranean vegetation, such as sparse xerothermic oak forests or scrub or mesoxeric grass associations. At the edge of its range, it is strongly affiliated with limestone areas with grass-scrub vegetation, probably microclimatically resembling Mediterranean habitats. This species is unlikely to occur within the Project AoI as it is considered possibly extinct in Northern Macedonia.
Ammobates melectoides	-	EN	The species prefers various grasslands, steppe or forest steppe biotopes with abundant areas with bare soil. The global range for this species does not overlap with the Project AoI and therefore it is unlikely that it would be present within the AoI.
Paragus majoranae	-	EN	The preferred environment for this species is open forest ground, open grassy areas, both humid and semi-arid, along brooks and rivers in warm-dry Oak (*Quercus*) forest, and upwards through Beech (*Fagus*) forest into the Spruce (*Picea*) zone up to 1,500 metres in the Balkan countries. It is largely confined to relict areas of unmodified forest. It's area of occupancy (AOO) is 196 km2 in Europe. It has a patchy distribution which does not overlap with the Project AoI and therefore is unlikely to be present in the AoI.
Merodon kozufensis	-	EN	The habitat of this species is inside, or very close to beech forests. Considered unlikely to be present in the AoI due to lack of suitable habitats.
Ropalopus ungaricus	-	VU	Larvae develop in alive but injured or diseased small branches or trunks of *Acer*, especially *A. pseudoplatanus*. Citations of other broad-leaved tree hosts are dubious. The beetle prefers solitary trees or open woodlands, edges of forests or coppices, and pollard trees - the trees of the old cultural landscape are important rather than forest trees. This species is unlikely to occur as its range does not overlap with the Project AoI.
Cerophytum elateroides	-	VU	It is usually found in open forests, in cities' old parks, in floodplain forests and in large trees of hedgerows. The development takes place in decaying wood of old broad-leaved trees, mainly large *Populus* trees, and also *Acacia*, *Acer*, *Aesculus*, *Alnus*, *Betula*, *Carpinus*, *Castanea sativa*, *Fagus*, *Juglans*, *Platanus*, *Quercus*, *Salix*, *Tilia*, *Ulmus*, etc. It does not favour the tree species, but a specific wood quality with the right stage of decay and mycelium of peculiar fungi. This species is unlikely to occur as its range does not overlap with the Project AoI.
Andreiniimon nuptialis	Splendid Bush-cricket	VU	This species is found in warm, moist habitats, usually bushes along rivers or in broadleaf forests. It is always found close to streams and rivers. It is considered unlikely that this species is found in the AoI given the lack of permanent water bodies such as rivers and streams.

Scientific name	Common name	IUCN status	Habitat and ecology and likelihood of occurrence in the AoI
Asiotmethis limbatus	Bordered Stone Grasshopper	VU	The species inhabits dry inland grasslands or Pontic steppes, open bare areas dominated by grass vegetation on stony (carbonate, volcanic) substrate. Potentially occurring in the AoI given the presence of dry grasslands however, unlikely as it is at the upper range of its elevation (0-600masl).
Montana macedonica	Macedonian Steppe Bush-cricket	VU	*M. macedonica* lives in very dry, stony grasslands with sparse grass between 100 and 1,680m above sea level. The bush-crickets live on the ground and avoid the shade of bushes and trees. It is considered unlikely that this species is found in the AoI given the lack of stony grasslands in the AoI.
Anisarthron barbipes	-	VU	This species lives in mixed broadleaf forests, hedgerow and urban trees in cities. It is considered unlikely that this species is found in the AoI given the lack of suitable habitat.
Merodon vladimiri	-	VU	There are no data about the habitats, but it is likely to prefer open habitats and grassland. Other closely related species have been found in open grassland habitats, in relatively restricted subpopulations, so it is likely that this species occurs in the same type of habitats and is also very restricted. This species is unlikely to occur in the AoI given that it is only known from one location in North Macedonia in 2003 and does not overlap with the Project AoI.

8.4.1.9 Freshwater species

The IBAT data includes freshwater fish, arthropods, molluscs and aquatic plants within 50km of the Project. These species have not been included in the assessment as there are no permanent waterbodies within the AoI (refer to Section 8.4.1.2 above). However, these species are all listed in Appendix A.

8.4.1.10 Fungi

Ten globally threatened species of fungi were identified in the 2024 IBAT data as potentially being present within the 50km buffer. One is IUCN EN (*Hyphoderma etruriae*), while the remaining nine are VU. *Hyphoderma etruriae* is considered to be restricted range according to the IFC definition[4]. Whilst the Extent of Occupancy (EOO) is not known, the species is known from only 10 localities across North Macedonia and Italy. In North Macedonia it is recorded in the southeastern part of the country. There is an unsubstantiated report of one locality in northwestern Greece near the North Macedonian border (Bernicchia et al, 2019). There are an additional five species of fungi that are IUCN NT.

Nationally, two of the globally threatened VU species (fen puffball and boleto sardo) are considered CR and EN respectively, and a further two are VU (Dupain's bolete and ruddy bolete). Table 8.19 presents the species of conservation concern listed above.

No fungi surveys were undertaken for this Project; however, habitat survey were undertaken in May, June and September 2025 within the AoI (refer to 8.4.1.2 for detail). These surveys highlighted that the habitat types are not suitable for significant fungal species. The protected species are mainly located in forest habitats (beech, fir, pine, juniper) and from wetlands which are not present within the AoI.

[4] Restricted Range Terrestrial vertebrates and plants: Species with an EOO of less than 50,000 km².

Table 8.19: Fungi species of conservation concern potentially present within the 50km buffer.

Scientific name	Common name	IUCN status	National status	Habitat and ecology and likelihood of occurrence in the AoI
Hyphoderma etruriae	Етрурска коричка	EN	NE	Hyphoderma etruriae is a wood-inhabiting fungus requiring old shrubs of different Juniperus species, where it grows in hollows caused by old wounds, on trunks and big branches. It has been recorded from sea level up to 200 m of altitude. Given the altitude range of this species, it is considered unlikely to be present in the AoI.
Hapalopilus croceus	Orange Polypore	VU	NE	Grows on old and coarse veteran trees, mainly oak (*Quercus*) and more rarely on Chestnut (*Castanea*) in old growth forests, also on old oak trees in farmland, parks and pastures. It is a saprotroph and seems also to be a weak parasite on old and coarse oversized, living and dead trees. In Europe, most observations are from living, old, giant and hollow oaks. Unlikely to occur in the AoI given the lack of mature oak trees.
Buglossoporus quercinus	Oak Polypore	VU	NE	A polypore associated with a central brown heart rot of oak. Its basidiomata are frequently associated with large old oak trees (*Quercus* spp.) and it primarily occurs in relatively open habitats such as pasture woodland, parkland and other mosaic deciduous forests. This species could occur in the AoI given the presence of *Quercus* habitats.
Tricholoma acerbum	bittermusseron	VU	NE	The species is mainly associated with *Quercus* spp. (mycorrhiza), but apparently also with *Castanea*, *Tilia* and *Corylus*, possibly also with *Fagus*. The species occurs in montane forests with deciduous Quercus species (such as Quercus robur, maybe also Q. pubescens) and Castaneus in southern Europe, but in Mediterranean areas also with the sclerophyllous Quercus ilex. This species could occur in the AoI given the presence of *Quercus* habitats.
Bovista paludosa	Fen Puffball	VU	CR	Frequently growing among mosses, solitary or in small groups in a rather wide range of wet mossy habitats. It occurs most often in alkaline to neutral fens, bogs and mires, wet meadows including boggy peat meadows, wet heaths, sometimes in forest meadows. Given this species' preference for wetland habitats, it is considered unlikely to be present in the AoI.
Arrhenia discorosea	Kalichovka fialovoružová	VU	NE	A wood inhabiting saprotrophic fungus found on decaying, sometimes standing trunks of aspen or poplar (*Populus*), but also other tree species such as *Fraxinus*, *Ulmus* and *Tilia*. Whilst *Fruxinus* and *Ulmus* habitats are present in the AoI, it was confirmed in the bat surveys that the wind park lacks forests with old trees. Therefore, it is considered unlikely this species is present in the AoI.
Alessioporus ichnusanus	Boleto Sardo	VU	EN	The principal habitat of this heliophilous species is represented by deciduous, semideciduous or evergreen forests of xero-thermophilus species found mainly in submediterranean climate regions and at supramediterranean altitudinal levels. The species is mostly associated with pure or mixed evergreen sclerophyllous and deciduous oak communities (*Quercus ilex, Q. suber, Q. coccifera, Q. cerris, Q. robur, Q. pubescens, Q. petraea, Q. pyrenaica, Q. frainetto*).

Scientific name	Common name	IUCN status	National status	Habitat and ecology and likelihood of occurrence in the AoI
				This species could occur in the AoI given the presence of *Q. pubescens* and *Q. frainetto*.
Hygrocybe ovina	Blushing Waxcap	VU	NE	Rich fungal communities occurring in traditionally managed old semi-natural grasslands. These habitats are characterized by low levels of available nitrogen and phosphorus in the soil, and by low vegetation. This species could occur in the AoI given the presence of semi-natural grasslands.
Hygrocybe punicea	Crimson Waxcap	VU	NE	Characteristic species of old, unimproved, semi-natural grasslands in Europe. Only rarely is it found in other types of habitats (e.g. fixed dunes, deciduous woods). Suitable grasslands are traditionally managed for a long period of time by grazing (by cattle, horses, sheep, deer) and/or regular hand mowing. These sites are characterized by low levels of available nitrogen and phosphorus in the soil and low vegetation. This species could occur in the AoI given the presence of semi-natural grasslands.
Xeromphalina junipericola	Фоина труба	VU	NE	*Xeromphalina junipericola* grows on trunks of old growth *Juniperus* spp. (*J. excelsa* in North Macedonia). It is likely that it prefers *J. foetidissima* and *J. excelsa* as its main hosts in Eastern Mediterranean (North Macedonia and Turkey). Given the lack of *Juniperus* species in the AoI, it is considered unlikely that this species is present.
Rubroboletus dupainii	Dupain's Bolete	NT	VU	It is ectomycorrhizal with trees in Fagaceae, typically *Quercus* (e.g. *Q. cerris, petraea, pubescens, suber, ilex, rotundifolia*), but also *Fagus* and *Castanea*. The species mainly occurs in termophilous deciduous natural, or semi-natural forests dominated by *Quercus*, often old growth, sometimes preferring more open areas. Whilst *Quercus* habitats are present in the AoI, it was confirmed in the bat surveys that the wind park lacks forest stands with old trees. Therefore, it is considered unlikely this species is present in the AoI.
Rubroboletus rhodoxanthus	Ruddy Bolete	NT	VU	Forms mycorrhiza with beech (*Fagus*) and oaks (*Quercus*) in broadleaf deciduous and evergreen forests in climax state on calcareous sandy or sandy-loamy soils. It may also occur in chestnut coppices, in roadside verges and in parks with isolated old trees. It grows from sea level and up into mountainous areas. Given the preference for *Quercus*, this species could be present in the AoI.

8.4.1.11 Invasive species

According to the Global Register of Introduced and Invasive Species - North Macedonia (Trajanovski, 2020), there are 63 known Alien species of which a total of 14 are considered to be Invasive Alien Species (IAS). Of the 14 IAS, four are from the Animalia Kingdom consisting of; three freshwater/ brackish fish and one freshwater gastropod. Ten are from Plantae Kingdom; two freshwater Liliopsida and eight terrestrial Magnoliopsida. It is highly unlikely that the freshwater species would be present as there are no permanent waterbodies within the AoI of the Project.

The desk study identified the following terrestrial invasive species in North Macedonia:

1. Common ragweed *Ambrosia artemisiifolia L.*
2. Canadian horseweed *Conyza canadensis (L.) Cronq.*
3. Canadian goldenrod *Solidago canadensis L.*
4. Black locust *Robinia pseudoacacia L.*
5. Box Elder *Acer negundo L.*
6. Golden rain tree *Koelreuteria paniculata Laxm.*
7. Tree of heaven *Ailanthus altissima Swingle*
8. Silverleaf nightshade *Solanum elaeagnifolium Cav.*

However, no invasive species were identified during any of the field surveys in the Project study area. IAS will be considered in the impact assessment and mitigation measures of this ESIA.

8.4.1.12 Critical Habitat and Priority Biodiversity Features

A Critical Habitat Assessment (CHA) has been developed based on the baseline information presented in this chapter in accordance with IFC PS6 (IFC, 2019), EBRD ESR6 (EBRD, 2025) and EIB ESS4 (EIB, 2022) and Priority Biodiversity Features according to EBRD (EBRD, 2025). The CHA is presented in Chapter 10 and a summary of the results are presented below.

The Project is located in Critical Habitat in accordance with IFC PS6, EBRD ESR6 and EIB ESS4 due to the presence of Annex I ‘priority habitat’ listed under EU Habitats Directive (Eastern white oak woods). The Project’s bird and bat EAAA is critical habitat under EIB ESS4 due to five bat species (barbastelle bat, Schreiber's bent-winged bat, Geoffroy's bat, greater mouse-eared bat and Lesser horseshoe bat) and four reptile species (four-lined snake, European ratsnake, Hermann’s tortoise and Greek Tortoise / spur-thighed tortoise), listed in Annex II and Annex IV of Habitats Directive.

The Project meets the thresholds for 80 PBFs under EBRD ESR6 Criteria 1 and 3 supporting threatened species and migratory bird species, regularly occurring within the EAAA. Table 8.20 presents a summary of which lender requirements are triggered by Critical Habitat/ PBF. The full list of species meeting Critical Habitat and PBF thresholds are presented in Table 8.21.

Table 8.20: Critical Habitat and Priority Biodiversity Features

Criterion	IFC PS6 Critical Habitat Thresholds	EBRD ESR6 Critical Habitat Thresholds	EBRD Priority Biodiversity Features Thresholds	EIB Critical Habitat definitions
Internationally recognised and legally protected areas	Not Critical Habitat	Not Critical Habitat	N/A	Not Critical Habitat
1. Threatened species: IUCN Critically Endangered (CR) or Endangered (EN) Species, EU protected species	Not Critical Habitat	Not Critical Habitat	**PBF present** - See Table 8.21	**Critical Habitat** Annex II and Annex IV Habitats Directive recorded in the AoI: -Four-lined Snake -European ratsnake Hermann’s tortoise - Greek Tortoise / spur-thighed tortoise -Barbastelle bat -Schreiber’s bent-winged bat -Geoffroy’s bat -Greater mouse-eared bat

Criterion	IFC PS6 Critical Habitat Thresholds	EBRD ESR6 Critical Habitat Thresholds	EBRD Priority Biodiversity Features Thresholds	EIB Critical Habitat definitions
				-Lesser horseshoe bat
2. Endemic or Restricted-Range (<100,000 km²) Species	Not Critical Habitat	Not Critical Habitat	No PBF	Not Critical Habitat
3. Migratory or Congregatory Species	Not Critical Habitat	Not Critical Habitat	**PBF present** - See Table 8.21	Not Critical Habitat
4. Unique or Threatened Ecosystems	**Critical Habitat** Annex I priority habitat recorded in the AoI: - Eastern white oak woods	**Critical Habitat** Annex I priority habitat recorded in the AoI: - Eastern white oak woods	**PBF present** Annex I habitat recorded in the AoI: - Helleno-Balkanic *(Satureja m ontana)* steppes - Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion - Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*)	**Critical Habitat** Annex I priority habitat recorded in the AoI: - Eastern white oak woods
5. Key Evolutionary Processes	Not Critical Habitat	Not Critical Habitat	No PBF	Not Critical Habitat
6. Social, economic or cultural importance	N/A	N/A	N/A	Not Critical Habitat

Source: Mott MacDonald, 2026.

Table 8.21: Critical Habitat and Priority Biodiversity Features under EBRD

Class and Scientific name	Common name	IUCN Status	Movement pattern	EU Habitats Directive	EU Birds Directive	CH	PBF	Criteria
Mammalia								
Barbastella barbastellus	Barbastelle Bat	NT		II, IV		Yes	Yes	1
Miniopterus schreibersii	Schreiber's Bent-winged Bat	VU	Full Migrant	II, IV		Yes	Yes	1 and 3
Myotis emarginatus	Geoffroy's Bat	LC		II, IV		Yes	Yes	1
Myotis myotis	Greater Mouse-eared Bat	LC	Full Migrant	II, IV		Yes	Yes	1 and 3
Nyctalus leisleri	Leisler's Bat	LC	Full Migrant	IV			Yes	3
Nyctalus noctula	Common Noctule	LC	Full Migrant	IV			Yes	3

Class and Scientific name	Common name	IUCN Status	Movement pattern	EU Habitats Directive	EU Birds Directive	CH	PBF	Criteria
Pipistrellus nathusii	Nathusius' Pipistrelle	LC	Full Migrant	IV			Yes	3
Vespertilio murinus	Parti-coloured Bat	LC	Full Migrant	IV			Yes	3
Rhinolophus hipposideros	Lesser Horseshoe Bat	LC		II, IV		Yes	Yes	1
Eptesicus serotinus	Serotine	LC	Full Migrant	IV			Yes	3
Pipistrellus pipistrellus	Common Pipistrelle	LC	Full Migrant	IV			Yes	3
Aves								
Neophron percn opterus	Egyptian vulture	EN	Full migrant		I		Yes	1 and 3
Alectoris graeca	Rock partridge	NT			I and IIB		Yes	1
Anthus campestris	Tawny pipit	LC	Full Migrant		I		Yes	1 and 3
Anthus pratensis	Meadow pipit	LC	Full Migrant				Yes	3
Anthus spinoletta	Water pipit	LC	Full Migrant				Yes	3
Anthus trivialis	Tree pipit	LC	Full Migrant				Yes	3
Apus pallidus	Pallid swift	LC	Full Migrant				Yes	3
Aquila heliaca	Eastern imperial eagle	VU	Full Migrant		I		Yes	1 and 3
Burhinus oedicnemus	Eurasian Thick-knee	LC			I		Yes	1
Buteo rufinus	Long-legged buzzard	LC	Full Migrant		I		Yes	1 and 3
Calandrella brachydactyla	Greater short-toed lark	LC	Full Migrant		I		Yes	1 and 3
Caprimulgus europaeus	Nightjar	LC	Full Migrant		I		Yes	1 and 3
Carduelis spinus	Eurasian siskin	LC	Full Migrant				Yes	3
Cecropis rufula	Red-rumped swallow	LC	Full Migrant				Yes	3
Circaetus gallicus	Short-toed snake eagle	LC	Full Migrant		I		Yes	1 and 3
Circus aeruginosus	Western marsh harrier	LC	Full Migrant		I		Yes	1 and 3
Circus cyaneus	Hen harrier	LC	Full Migrant		I		Yes	1 and 3
Circus pygargus	Montagu's harrier	LC	Full Migrant		I		Yes	1 and 3
Columba oenas	Stock dove	LC	Full Migrant				Yes	3
Columba palumbus	Woodpigeon	LC	Full Migrant		II and III		Yes	3
Coracias garrulus	European roller	LC	Full Migrant				Yes	3

Class and Scientific name	Common name	IUCN Status	Movement pattern	EU Habitats Directive	EU Birds Directive	CH	PBF	Criteria
Cuculus canorus	Cuckoo	LC	Full Migrant				Yes	3
Curruca communis	Common whitethroat	LC	Full Migrant				Yes	3
Curruca crassirostris	Eastern orphean warbler	LC	Full Migrant				Yes	3
Curruca curruca	Lesser whitethroat	LC	Full Migrant				Yes	3
Curruca nisoria	Barred warbler	LC	Full Migrant				Yes	3
Delichon urbicum	House martin	LC	Full Migrant				Yes	3
Dryocopus martius	Black Woodpecker	LC			I		Yes	1
Emberiza melanocephala	Black-headed bunting	NE	Full Migrant	LC			Yes	3
Emberiza schoeniclus	Reed bunting	LC	Full Migrant				Yes	3
Falco naumanni	Lesser kestrel	LC	Full Migrant		I		Yes	1 and 3
Falco peregrinus	Peregrine	LC			I		Yes	1
Falco subbuteo	Hobby	LC	Full Migrant		I		Yes	1 and 3
Fringilla montifringilla	Brambling	LC	Full Migrant				Yes	3
Hieraaetus pennatus	Booted eagle	LC	Full Migrant		I		Yes	1 and 3
Hirundo rustica	Barn swallow	LC	Full Migrant				Yes	3
Lanius collurio	Red-backed shrike	LC	Full Migrant		I		Yes	1 and 3
Lanius excubitor	Great grey shrike	LC	Full Migrant				Yes	3
Lanius minor	Lesser grey shrike	LC	Full Migrant		I		Yes	1 and 3
Lanius nubicus	Masked shrike	LC	Full Migrant		I		Yes	1 and 3
Lanius senator	Woodchat Shrike	NT	Full Migrant				Yes	3
Lullula arborea	Woodlark	LC			I		Yes	1
Luscinia megarhynchos	Nightingale	LC	Full Migrant				Yes	3
Melanocorypha calandra	Calandra Lark	LC			I		Yes	1
Merops apiaster	Bee-eater	LC	Full Migrant				Yes	3
Muscicapa striata	Spotted flycatcher	LC	Full Migrant				Yes	3
Oenanthe oenanthe	Northern wheatear	LC	Full Migrant				Yes	3
Oriolus oriolus	Golden oriole	LC	Full Migrant				Yes	3
Otus scops	Scops owl	LC	Full Migrant				Yes	3

Class and Scientific name	Common name	IUCN Status	Movement pattern	EU Habitats Directive	EU Birds Directive	CH	PBF	Criteria
Pernis apivorus	European honey buzzard	LC	Full Migrant		I		Yes	1 and 3
Phoenicurus phoenicurus	Common redstart	LC	Full Migrant				Yes	3
Phylloscopus collybita	Common Chiffchaff	LC	Full Migrant				Yes	3
Phylloscopus trochilus	Willow Warbler	LC	Full Migrant				Yes	3
Regulus ignicapilla	Firecrest	LC	Full Migrant				Yes	3
Saxicola rubetra	Whinchat	LC	Full Migrant				Yes	3
Streptopelia turtur	European turtle dove	VU	Full Migrant				Yes	3
Sylvia atricapilla	Eurasian Blackcap	LC	Full Migrant				Yes	3
Sylvia borin	Garden warbler	LC	Full Migrant				Yes	3
Sylvia communis	Whitethroat	LC	Full Migrant				Yes	3
Turdus iliacus	Redwing	NT	Full Migrant		II		Yes	3
Turdus pilaris	Fieldfare	LC	Full Migrant		II		Yes	3
Upupa epops	Hoopoe	LC	Full Migrant				Yes	3
Spinus spinus	Siskin	LC	Full Migrant				Yes	3
Amphibia								
Bombina variegata	Yellow-bellied Toad	LC	N/A	II			Yes	1
Salamandra salamandra	Common Fire Salamander	VU	N/A				Yes	1
Reptilia								
Elaphe quatuorlineata	Four-lined Snake	LC	N/A	II (priority), IV		Yes	Yes	1
Testudo graeca	Greek Tortoise / Spur-thighed Tortoise	VU (Europe)	N/A	II, IV		Yes	Yes	1
Testudo hermanni	Hermann's Tortoise	VU	N/A	II, IV		Yes	Yes	1
Zamenis situla	European ratsnake	LC	N/A	II (priority)		Yes	Yes	1
Grand Total						**9**	**80**	

Source: Mott MacDonald, 2026

The outcomes of the CHA presented in this section form the ecological baseline against which all subsequent biodiversity assessments in this ESIA have been developed. The sensitivity ratings, impact pathways and receptor groupings used in Section 5 are directly informed by the confirmed Critical Habitat and Priority Biodiversity Feature triggers identified here. Mitigation commitments presented in Section 8.6 have been designed to respond specifically to these CHA outcomes, ensuring alignment with the requirements of IFC PS6, EBRD PR6/ESR6 and

the EIB Standard 3. The residual impact evaluation in Section 8.7 also draws explicitly from the CHA findings to determine significance and the feasibility of achieving No Net Loss or Net Gain, as further detailed in Section 8.7.2. This ensures full traceability between the CHA conclusions and the overall biodiversity conclusions of the ESIA.

8.5 Impact Assessment

8.5.1 Receptor sensitivity

Table 8.22 presents all biodiversity receptors identified and discussed in the baseline chapter of this ESIA. The sensitivity of each receptor has been determined using the criteria outlined in Table 8.6 also includes a justification for the inclusion of each receptor in the impact assessment, based on potential presence within the relevant AoI and potential vulnerability to Project-related pressures. The sensitivity ratings applied to each receptor group in this assessment are directly informed by the Critical Habitat and Priority Biodiversity Feature designations identified in Section 4.1.12. Specifically, the presence of *Quercus pubescens* priority woodland habitat, the four-lined snake (*Elaphe quatuorlineata*) and European ratsnake (*Zamenis situla*), all of which trigger Critical Habitat under EBRD and EIB, underpin the assignment of Very High sensitivity to these receptors. Likewise, the Annex I habitats, Annex I birds, Annex II bats and associated amphibian/reptile species confirmed as Priority Biodiversity Features in the CHA are the basis for the High to Medium sensitivity ratings applied herein.

Table 8.22 Sensitivity of biodiversity receptors

Receptor	Analysis of sensitivity	Sensitivity	Inclusion in impact assessment
Internationally Recognised and Legally Protected Areas			
Tikvesh nationally protected area (not yet reviewed)	IUCN Management Category Ia – strict nature reserve	Very High	No – impacts are unlikely due to the distance to this designation.
Lake Mantovo and river Lakavica KBA and IBA	This is designated as a KBA and IBA which are internationally recognised sites	High	Yes
Other internationally recognised areas (not in the AoI)	These are designated as KBAs and/or IBAs which are internationally recognised sites	High	No – impacts are unlikely due to the distance to this designation. Any relevant designated biodiversity features will be included in the assessment below.

Receptor	Analysis of sensitivity	Sensitivity	Inclusion in impact assessment
Osogovo SPA and Osgovo planina SAC	Natura 2000 sites	High	No - The SPA and SAC are located in Bulgaria, 46km from the Project along the border with Macedonia. The baseline identified a number of qualifying species associated with the SAC and SPA which could be present within the AoI of the Project. While there will be no significant effects as there will be no direct habitat loss or fragmentation within the SAC or SPA boundaries, potential indirect impacts to qualifying features (SPA – 26 species and SAC – 35 species) have been considered as part of this ESIA. The potential indirect impacts include collision risk, disturbance and cumulative impacts to qualifying features. In conclusion, a full Appropriate Assessment is not required but a targeted assessment of impacts on biodiversity features has been undertaken to confirm the absence of significant effects.

Receptor	Analysis of sensitivity	Sensitivity	Inclusion in impact assessment
Ovce Pole SCI and Dolna Bregalnica SPA	Potential Natura 2000 sites	High	No - The SCI and SPA are located within Macedonia 7.29km west and 18.38km northwest respectively from the Project. The baseline identified a number of qualifying species associated with the SCI and SPA which could be present within the AoI of the Project. While there will be no significant effects as there will be no direct habitat loss or fragmentation within the SCI or SPA boundaries, potential indirect impacts to species and habitats under the EU Birds Directive and Habitats Directive have been considered as part of this ESIA. The potential indirect impacts include collision risk, disturbance and cumulative impacts. In conclusion, a full Appropriate Assessment is not required but a targeted assessment of impacts on biodiversity features has been undertaken to confirm the absence of significant effects
Nationally protected areas	These include designations ranging from IUCN Management Category III to V	Medium	No – impacts are unlikely due to the distance to this designation.
Habitats			
Eastern *Quercus pubescens* woods and	Classified as critical habitat under EBRD ESR6.	Very high	Yes
Helleno-Balkanic [Satureja montana] steppes and intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	Listed under Annex I of the Habitats Directive Classified as PBF under EBRD ESR6.	High	Yes
Tree cover, shrubland and grassland	Natural habitats that are not considered critical habitat or PBF.	Medium	No – these habitats are included in the area between the 500m AoI and the 2km buffer and therefore are not included in the assessment.

Receptor	Analysis of sensitivity	Sensitivity	Inclusion in impact assessment
Abandoned arable land with ruderal vegetation, vineyards, fruit orchards, native conifer plantations, lines of trees: hedgerows, arable land, cropland, ponds and lakes with completely man-made substrate and bare/sparse vegetation.	Artificial and converted habitats and modified habitats with limited biodiversity value.	Low	Yes
Residential buildings of villages and urban peripheries, built-up, rural industrial and commercial sites still in active use and active opencast mineral extraction sites, including quarries.	Highly modified habitats of no biodiversity value	Negligible	No – impacts are unlikely given the lack of biodiversity features.
Flora			
Flora (Medium)	IUCN VU species Nationally VU Rare species	Medium	Yes -Perennial pleurocarpous moss *Brachythecium geheebii* -Rare species identified in Table 8.13.
Flora (Low)	All NT/LC/NE flora	Low/negligible	Yes
Terrestrial Mammals			
Terrestrial Mammals (Very High)	Species listed under Annex IV of the Habitats Directive	Very High	No
Terrestrial Mammals (High)	IUCN EN species	High	No
Terrestrial Mammals (Medium)	IUCN/ nationally VU species	Medium	No
Terrestrial mammals (Low)	All NT/LC/NE terrestrial mammals	Low/negligible	Yes
Bats			
Bats (Very High)	Classified as critical habitat under EIB	Very High	Yes barbastelle bat, Schreiber's bent-winged bat, Geoffroy's bat, greater mouse-eared bat and Lesser horseshoe bat
Bats (High)	Species listed under Annex II of the Habitats Directive Protected Species Migratory bats	High	Yes
Bats (Medium)	IUCN VU species	Medium	All VU species included above.
Bats (Low)	All NT/LC/NE bats	Low/negligible	Yes
Birds			

Receptor	Analysis of sensitivity	Sensitivity	Inclusion in impact assessment
Large raptors:	IUCN EN species	High	Yes
Large (Migratory) raptors:	IUCN VU/NT/LC species	High	Yes
Large (Non-migratory) raptors	IUCN LC species	Low	Yes
Small (Migratory) raptors	IUCN LC species	High	Yes
Small (Non-migratory) raptors	IUCN LC species	Low	Yes
Other migratory birds:	IUCN VU/NT/LC species	High	Yes
Other breeding birds	IUCN NT/LC species	Low	Yes
Nocturnal (migratory) birds	IUCN LC species	High	Yes
Nocturnal (Non-migratory) birds	IUCN LC species	Low	Yes
Amphibians			
Amphibians (High)	Nationally EN species Species listed under Annex II of the Habitats Directive Protected Species PBF	High	Yes -Alpine Newt -Macedonian Crested Newt -Yellow-bellied Toad -Common Fire Salamander
Amphibians (Medium)	IUCN VU species Nationally VU species Protected Species	Medium	Yes - Macedonian Crested Newt - Italian Crested Newt
Amphibians (Low)	All NT/LC/NE amphibians	Low/negligible	Yes
Reptiles			
Reptiles (Very High)	Species listed under Annex II (priority) of the Habitats Directive Critical Habitat Features	Very High	Yes -Four-lined Snake -European ratsnake-Hermann's Tortoise -Greek Tortoise / Spur-thighed Tortoise
Reptiles (High)	Nationally EN species Species listed under Annex II of the Habitats Directive PBF	High	Yes -Javelin Sand Boa -Viviparous Lizard -Sand Lizard
Reptiles (Medium)	IUCN VU species Nationally VU species	Medium	No – all species already included above
Reptiles (Low)	All NT/LC/NE reptiles	Low/negligible	Yes
Invertebrates			
Invertebrates (Very High)	Species listed under Annex IV of the Habitats Directive	Very High	No – the Project AoI does not contain suitable habitats for these species.
Invertebrates (High)	IUCN EN species	High	No

Receptor	Analysis of sensitivity	Sensitivity	Inclusion in impact assessment
Invertebrates (Medium)	IUCN VU species	Medium	Yes - VU Species identified in Table 8.18: Invertebrate species of conservation concern potentially present within the 50km buffer Table 8.18
Invertebrates (Low)	All NT/LC/NE invertebrates	Low/negligible	No
Fungi			
Fungi (High)	Nationally CR/EN species	High	Yes - Boleto Sardo (EN) No - Fen Puffball
Fungi (Medium)	IUCN VU species Nationally VU species	Medium	Yes (IUCN VU) - Orange Polypore, Oak Polypore, bittermusseron, Blushing Waxcap and Crimson Waxcap Yes (Nationally VU) - Ruddy Bolete
Fungi (Low)	All NT/LC/NE fungi	Low/negligible	No

Source: Mott MacDonald, 2025

8.5.2 Construction impacts

8.5.2.1 Overview

The construction phase of the proposed wind farm has the potential to generate a range of impacts on biodiversity receptors within and surrounding the Project area. These impacts may arise from land clearance, infrastructure development, increased human activity, and associated disturbances. Key ecological concerns include habitat loss and fragmentation, noise and vibration disturbance, barrier effects on species movement, pollution, and the introduction of invasive species. These pressures can affect both terrestrial and avian species, particularly those of conservation concern or those reliant on undisturbed habitats.

Given the ecological sensitivity of the Project's AoI, it is essential to assess these impacts systematically. Table 8.25 evaluates the magnitude of construction related impacts against terrestrial biodiversity and bird and bat receptors identified in the baseline chapter, respectively. The analysis considers receptor sensitivity (as defined in Table 8.22) and provides a justification for the magnitude of the impact to determine significance of potential impacts and guide mitigation and management strategies in subsequent chapters. Impacts on ecosystem services are assessed in Chapter 9 of Volume II of the ESIA.

8.5.2.2 Habitat Loss

The direct habitat loss calculations as a result of the Project's activities are presented in Table 8.23. Habitat loss calculations were produced by overlaying the February 2025 Project layout onto EUNIS and ESA WorldCover habitat maps in GIS, consistent with IFC PS6, EBRD ESR6 and EIB ESS4 guidance. This includes a breakdown of the nature of the impact (temporary or permanent), the component causing the impact, the habitat type affected and the predicted area loss.

Temporary impacted areas include widening of existing roads (1.75m buffer either side of the road) for construction traffic and the platforms. Permanent direct loss includes crane pads,

foundations, existing road widening, car park and substation. The impact due to the OHL assume a 5m impact either side of the transmission line, however this is considered to be habitat alteration due to vegetation kept at 8m height and not a permanent loss.

The proportion of total permanent impact per habitat type has been calculated according to the total habitat lost. The proportion of permanent habitat loss per habitat type has also been calculated in the context of the wider 500m AoI. Based on these calculations, the majority of habitat loss will the arable land (29.38%). In the wider context of the area, the loss of Eastern *Quercus pubescens* woods is approximately 7.74ha, 0.41% within 500m of the Project. The loss of Helleno-Balkanic [*Satureja montana*] steppes will be 7.91ha, 0.55% within 500m of the Project. There will be no premanent loss of Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion. These may be temporarily impacted during vegetation clearance and construction of the transmission line.

The optional roads proposed as part of the Project have not been considered as part of the permanent impacted area calculations and instead are included as a separate calculation. Impacts of this road will need to be considered following a decision to build the optional road.

Table 8.23 presents the direct habitat loss as a result of permanent and temporary impacts on site, breaking them down by Project stage (Phases 1-3). This table presents the temporary and permanently impacted areas per habitat, transmission line area impact and optional road impacts for each phase of the Project. As per the Project description, Stip 1 will be the first phase and consists of WTG 1–21, overhead line (OHL), substation and Stip 1 internal roads. Stip 2 includes; WTG 22–38 and Stip 2 internal roads and Stip 3 includes WTG 39–54, Stip 3 internal roads.

Table 8.23 Direct habitat loss as a result of permanent and temporary impacts for the Project

	Temporary impacted areas (ha)			**Permanent impacted area (ha)**						**Habitat within 500m AoI**		**Habitat alteration (8m height)**	**Optional Road**	
Habitat type	Widening of existing roads (1.75m buffer)	Platforms	**Total temporary impact (ha)**	Crane pad	Foundations	Existing road widening (5.5m road + 0.5m buffer)	Car park and substation	**Total permanent impact (ha)**	**Proportion of total permanent impact (%)**	Ha	% of permanent loss within 500m AoI	Transmission line (with a 5m buffer)	Temporary loss Plan B road (1.75m buffer)	**Permanent loss Plan B Road**
Helleno-Balkanic [Satureja montana] steppes	5.36	7.13	**12.49**	0.87	0.88	6.16	0	**7.91**	**12.84%**	1430.79	0.55%	0.9	0	0
Abandoned arable land with ruderal vegetation	2.18	4.01	**6.19**	0.34	0.28	5.53	0	**6.15**	**9.98%**	684.57	0.90%	1.85	0	0
Fruit orchards	0	0.07	**0.07**	0	0	0.12	0	**0.12**	**0.19%**	19.67	0.61%	0	0	0
Vineyards	0	0	**0**	0	0	0	0	**0**	**0.00%**	12.21	0.00%	0	0.01	0
Native conifer plantations	1.08	0.72	**1.8**	0.05	0.05	2.17	0.02	**2.29**	**3.72%**	724.68	0.32%	2.7	0.16	0.3
Lines of trees; Hedgerows	0.02	0.2	**0.22**	0	0	0.31	0	**0.31**	**0.50%**	221.07	0.14%	0.7	0	0
Arable land	6.56	6.1	**12.66**	0.69	0.68	11.51	5.22	**18.1**	**29.38%**	1553.64	1.17%	6.63	0.23	0.49
Eastern *Quercus pubescens* woods	5.61	4.97	**10.58**	0.74	0.61	6.39	0	**7.74**	**12.56%**	1894.68	0.41%	9.7	0.71	1.08

	Temporary impacted areas (ha)			Permanent impacted area (ha)						Habitat within 500m AoI		Habitat alteration (8m height)	Optional Road	
Rural industrial and commercial sites still in active use	0	0	**0**	0	0	0.06	0	**0.06**	**0.10%**	23.62	0.25%	0	0	0
Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion (Temporary running water)	0	0	**0**	0	0	0	0	**0**	**0.00%**	5.75	0.00%	0.03	0	0
Road network	4.72	1.63	**6.35**	0.01	0	18.87	0.05	**18.93**	**30.73%**	27.46	68.95 %	0.01	0.43	1.33
Total (ha)	**25.53**	**24.83**	**50.36**	**2.7**	**2.5**	**51.12**	**5.29**	**61.61**		**6598.14**		**22.52**	**1.54**	**3.2**

Source: Mott MacDonald, 2026.

Table 8.24 Direct habitat loss as a result of permanent and temporary impacts on site per Project stage.

	Temporary impacted areas (ha)			**Permanent impacted area (ha)**							**Optional Road**	
Habitat type	Widening of existing roads (1.75m buffer)	Platforms	**Total temporary impact (ha)**	Crane pad	Foundations	Existing road widening (0.5m buffer)	Car park and substation	**Total permanent impact (ha)**	**Proportion of total permanent impact (%)**	Transmission line (with a 5m buffer)	**Temporary loss Plan B road (1.75m buffer)**	**Permanent loss Plan B Road**
Phase 1												
Helleno-Balkanic [Satureja montana] steppes	0.89	2.76	**3.65**	0.25	0.23	1.75	0	**2.23**	7.79%	0.9	0	0
Abandoned arable land with ruderal vegetation	0.27	0.54	**0.81**	0.05	0.05	0.44	0	**0.54**	1.89%	1.85	0	0
Fruit orchards	0	0	**0**	0	0	0	0	**0**	0.00%	0	0	0
Vineyards	0	0	**0**	0	0	0	0	**0**	0.00%	0	0.01	0
Native conifer plantations	1.08	0.72	**1.8**	0.05	0.05	2.17	0.02	**2.29**	8.00%	2.7	0.16	0.3
Lines of trees; Hedgerows	0.02	0.06	**0.08**	0	0	0.07	0	**0.07**	0.24%	0.7	0	0
Arable land	3.42	4.29	**7.71**	0.4	0.37	6.88	5.22	**12.87**	44.95%	6.63	0.23	0.49
Eastern *Quercus pubescens* woods	1.09	2.54	**3.63**	0.32	0.27	1.99	0	**2.58**	9.01%	9.7	0.71	1.08

	Temporary impacted areas (ha)			**Permanent impacted area (ha)**							**Optional Road**	
Habitat type	Widening of existing roads (1.75m buffer)	Platforms	**Total temporary impact (ha)**	Crane pad	Foundations	Existing road widening (0.5m buffer)	Car park and substation	**Total permanent impact (ha)**	**Proportion of total permanent impact (%)**	Transmission line (with a 5m buffer)	**Temporary loss Plan B road (1.75m buffer)**	**Permanent loss Plan B Road**
Rural industrial and commercial sites still in active use	0.03	0	**0.03**	0	0	0.01	0	**0.01**	0.03%	0	0	0
Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion (Temporary running water)	0	0	**0**	0	0	0	0	**0**	0.00%	0.03	0	0
Road network	2.7	0	**2.7**	0.01	0	7.98	0.05	**8.04**	28.08%	0.01	0.43	1.33
Total (ha) – Phase 1	**9.5**	**10.91**	**20.41**	**1.08**	**0.97**	**21.29**	**5.29**	**28.63**		**22.52**	**1.54**	**3.2**
Phase 2												
Helleno-Balkanic [Satureja montana] steppes	3.64	1.43	**5.07**	0.34	0.32	2.78	0	**3.44**	22.57%	0	0	0
Abandoned arable land	0.26	0.48	**0.74**	0	0	1.48	0	**1.48**	9.71%	0	0	0

	Temporary impacted areas (ha)			**Permanent impacted area (ha)**							**Optional Road**	
Habitat type	Widening of existing roads (1.75m buffer)	Platforms	**Total temporary impact (ha)**	Crane pad	Foundations	Existing road widening (0.5m buffer)	Car park and substation	**Total permanent impact (ha)**	**Proportion of total permanent impact (%)**	Transmission line (with a 5m buffer)	**Temporary loss Plan B road (1.75m buffer)**	**Permanent loss Plan B Road**
with ruderal vegetation												
Fruit orchards	0	0.07	**0.07**	0	0	0.12	0	**0.12**	0.79%	0	0	0
Lines of trees; Hedgerows	0	0.14	**0.14**	0	0	0.24	0	**0.24**	1.57%	0	0	0
Arable land	1.89	1.1	**2.99**	0.2	0.21	2.32	0	**2.73**	17.91%	0	0	0
Eastern *Quercus pubescens* woods	3.04	0.97	**4.01**	0.3	0.25	1.83	0	**2.38**	15.62%	0	0	0
Road network	0	1.63	**1.63**	0	0	4.85	0	**4.85**	31.82%	0	0	0
Total (ha) – Phase 2	**8.83**	**5.82**	**14.65**	**0.84**	**0.78**	**13.62**	**0**	**15.24**		0	**0**	**0**
Phase 3												
Helleno-Balkanic [Satureja montana] steppes	0.83	2.94	**3.77**	0.28	0.33	1.63	0	**2.24**	12.62%	0	0	0
Abandoned arable land with ruderal vegetation	1.65	2.99	**4.64**	0.29	0.23	3.61	0	**4.13**	23.27%	0	0	0

	Temporary impacted areas (ha)			**Permanent impacted area (ha)**							**Optional Road**	
Habitat type	Widening of existing roads (1.75m buffer)	Platforms	**Total temporary impact (ha)**	Crane pad	Foundations	Existing road widening (0.5m buffer)	Car park and substation	**Total permanent impact (ha)**	**Proportion of total permanent impact (%)**	Transmission line (with a 5m buffer)	**Temporary loss Plan B road (1.75m buffer)**	**Permanent loss Plan B Road**
Native conifer plantations	0	0.01	**0.01**	0	0	0	0	**0**	0.00%	0	0	0
Arable land	1.25	0.71	**1.96**	0.09	0.1	2.31	0	**2.5**	14.08%	0	0	0
Eastern *Quercus pubescens* woods	1.48	1.46	**2.94**	0.12	0.09	2.57	0	**2.78**	15.66%	0	0	0
Road network	2.02	0	**2.02**	0	0	6.04	0	**6.04**	34.03%	0	0	0
Rural industrial and commercial sites still in active use	0	0	**0**	0	0	0.06	0	**0.06**	0.34%	0	0	0
Total (ha) – Phase 3	**7.23**	**8.11**	**15.34**	**0.78**	**0.75**	**16.22**	**0**	**17.75**		0	**0**	**0**

Source: Mott MacDonald, 2026.

8.5.2.3 Terrestrial biodiversity

Table 8.25 Construction impact significance on terrestrial ecology

Receptor	Impact magnitude justification	Sensitivity	Magnitude	Significance
Lake Mantovo and river Lakavica KBA and IBA	No direct habitat loss will occur within Lake Mantovo and river Lakavica KBA and IBA. WTG 35 is located approximately 160m from the KBA/IBA which means construction works could be 100m from the KBA/IBA. Construction activities could disrupt local wildlife within the northern section of the KBA/IBA. However, this disturbance will be minimal and temporary. Qualifying species European roller were not recorded in the AoI during the field surveys and a total of eight masked shrike records were recorded throughout the survey period.	High	Minor - Adverse	Minor – not significant
Habitats				
Eastern *Quercus pubescens* woods	The Project will result in the direct loss of 18.32ha of this habitat (10.58ha will be temporary and 7.74ha will be permanent). Construction activities could disrupt wildlife utilising this habitat. In addition, dust dispersal through movement of heavy machinery may impact bare/sparse vegetation.	Very high	Moderate - Adverse	Moderate
Helleno-Balkanic [Satureja montana] steppes	The Project will result in the direct loss of 20.4ha of Helleno-Balkanic [Satureja montana] steppes (12.49ha will be temporary and 7.91ha will be permanent). Construction activities could disrupt wildlife utilising this habitat. In addition, dust dispersal through movement of heavy machinery may impact bare/sparse vegetation.	High	Moderate - Adverse	Moderate
Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion (temporary running waters)	The Project may result in the temporary loss of 0.04ha of temporary running waters during construction.	High	Negligible	Not Significant

Receptor	Impact magnitude justification	Sensitivity	Magnitude	Significance
Abandoned arable land with ruderal vegetation, vineyards, fruit orchards, native conifer plantations, lines of trees: hedgerows, arable land, cropland, ponds and lakes with completely man-made substrate and bare/sparse vegetation.	The Project will result in the temporary loss of 27.29ha and permanent loss of 45.96ha modified habitat. Construction activities could disrupt wildlife utilising this habitat. In addition, dust dispersal through movement of heavy machinery may impact bare/sparse vegetation.	Low	Moderate - Adverse	Not significant
Flora				
Flora (Medium)	Potential physical damage from construction activities and disturbance to shady rocky areas found in the AoI. Potential spread of invasive species.	Medium	Moderate - Adverse	Minor – not significant
Flora (low)	There will be permanent loss of flora due to ground clearance and excavations under the Project footprint. Flora on areas left as bare ground have the potential to recover naturally but, most is considered to be lost as a result of the Project. Potential spread of invasive species.	Low/negligible	Moderate - Adverse	Not significant
Terrestrial mammals				
Terrestrial mammals	Temporary disturbance from noise and vibration due to the movement of construction traffic and ground clearance and excavation. This may lead to temporary displacement of species. However, this will be temporary in nature.	Low/negligible	Minor - Adverse	Not significant
Bats				
Bats	No roosting habitat will be impacted due to the Project. Potential disruption to foraging/ commuting from noise and vibration impacts during construction due to habitat loss, fragmentation and pollution. However, these will be temporary in nature and during daylight hours when bats are not active. In addition, impacts from disturbance related to artificial lighting.	Very High High Medium Low	Minor – Adverse	Moderate Minor – not significant Minor – not significant Not Significant
Birds				
Large raptors: IUCN EN species- Egyptian vulture	Potential displacement to Egyptian vulture as a result of disruption from noise and vibration and physical damage to relevant habitats related to construction activities.	High	Moderate - Adverse	Moderate

Large raptors: IUCN VU/NT/LC migratory species	Potential destruction of nest sites, in particular Eastern imperial eagle as immature individuals were recorded in the AoI which suggests potential nest site nearby. Construction may also cause displacement as a result of disruption from noise and vibration and physical damage to relevant habitats related to construction activities.	High	Moderate - Adverse	Moderate
Large raptors IUCN LC non-migratory species	Potential destruction of nest sites, in particular Eurasian buzzard. Construction may also cause displacement as a result of disruption from noise and vibration and physical damage to relevant habitats related to construction activities.	Low	Minor - Adverse	Minor – not significant
Small raptors IUCN LC migratory species	Potential destruction of nest sites, in particular kestrel. Construction may also cause displacement as a result of disruption from noise and vibration and physical damage to relevant habitats related to construction activities.	High	Moderate - Adverse	Moderate
Small raptors IUCN LC non-migratory species	Potential destruction of nest sites, in particular kestrel. Construction may also cause displacement as a result of disruption from noise and vibration and physical damage to relevant habitats related to construction activities.	Low	Minor - Adverse	Minor – not significant
Other migratory birds: IUCN VU/NT/LC species	Although no breeding evidence of IUCN VU turtle dove was recorded the habitats in the AoI have the potential to provide nesting opportunities for turtle dove and other migratory bird species. Therefore, there is potential destruction of nest sites, displacement as a result of disruption from noise and vibration and physical damage to relevant habitats related to construction activities.	High	Moderate - Adverse	Moderate

Other breeding birds IUCN NT/LC species	A total of 44 LC species were recorded breeding within the AoI. Woodchat shrike were recorded across the site and likely breed in habitat throughout the site. There is potential for destruction of nest sites, displacement as a result of disruption from noise and vibration and physical damage to relevant habitats related to construction activities.	Low	Minor - Adverse	Minor – not significant
Nocturnal birds: IUCN LC migratory species	There is potential destruction of nest sites, displacement as a result of disruption from noise and vibration and physical damage to relevant habitats. As well as disturbance impacts related to artificial lighting as a result of construction activities.	High	Moderate - Adverse	Moderate
Nocturnal birds: IUCN LC non- migratory species	A total of five LC nocturnal species were recorded within the AoI. There is potential destruction of nest sites, displacement as a result of disruption from noise and vibration and physical damage to relevant habitats. As well as disturbance impacts related to artificial lighting as a result of construction activities.	Low	Minor - Adverse	Minor – not significant
Amphibians				
Amphibians	Construction activities can lead to the loss of breeding sites/ damp refuges, as well as soil disturbance that destroys moist microhabitats. Altered drainage patterns may increase sedimentation, reducing water quality of the temporary watercourses. Amphibians are highly sensitive to chemical spills and dust due to their permeable skin. Limited mobility increases roadkill risk during movement, and individuals can become trapped in trenches and excavations. Noise, vibration, and human activity can cause displacement from breeding and foraging areas, while habitat disturbance may favour invasive species altering habitat.	High Medium Low	Moderate - Adverse	Moderate Minor – not significant Not Significant
Reptiles				

Reptiles	Reptiles are affected by the loss of basking sites, burrows, and shelter areas during land clearance, along with burrow collapse and removal of rocky crevices caused by soil excavation. Changes in moisture can influence prey availability, and chemical spills or dust degrade habitat quality. Construction traffic poses a mortality risk, and open trenches can trap individuals. Displacement occurs when reptiles avoid disturbed areas due to noise and human activity, forcing them into suboptimal habitats. Habitat disturbance also increases exposure to predators and invasive species. For species that rely on temporary watercourses, construction can alter these features through drainage changes, soil compaction, or diversion of surface water.	Very High	Moderate - Adverse	Moderate
		High		Moderate
		Low		Not Significant
Invertebrates				
Invertebrates	Habitat loss caused by vegetation clearance and soil removal, which destroys nesting sites and microhabitats for ground-dwelling and plant-associated species. Soil disturbance from excavation and compaction disrupts refuges, while altered drainage patterns can reduce moisture availability for species dependent on wetlands or temporary watercourses. Pollution from chemical spills, concrete washout, and dust deposition contaminates soil and water, impacting sensitive species. Construction activities also lead to direct mortality through crushing by machinery and vehicles, and displacement occurs as noise, vibration, and habitat alteration force individuals into less suitable areas.	Medium	Minor - Adverse	Minor – not significant
Fungi				
Fungi	Potential impacts from physical damage during construction activities and dust emissions damaging habitats.	High	Minor - Adverse	Minor – not significant
		Medium		Minor – not significant

8.5.3 Operation impacts

The operational phase of the proposed wind farm presents several ongoing risks to biodiversity, particularly for volant species such as birds and bats, as well as terrestrial fauna and habitats.

Unlike the construction phase, operational impacts are typically chronic and cumulative, occurring over the lifespan of the Project. Key concerns include collision mortality, behavioural changes, habitat alteration, and barrier effects.

Wind turbines can cause direct fatalities through collisions, especially among migratory birds and bats. These impacts are often species-specific, with small-ranged or highly congregatory species being particularly vulnerable. In addition, the presence and movement of turbines may alter flight paths, feeding behaviour, and breeding success. For terrestrial species, operational infrastructure may continue to fragment habitats and restrict movement, while noise and shadow flicker can cause stress or avoidance behaviour.

Indirect impacts may also arise from changes in predator-prey dynamics, displacement from preferred habitats, and cumulative effects from multiple wind farms in a region. These effects are especially relevant in ecologically sensitive areas or those supporting priority biodiversity features.

Table 8.26 assesses the magnitude of operational impacts against each terrestrial ecology receptor identified in the baseline chapter. Sensitivity ratings (as defined in Table 8.22) will be used to determine the significance of impacts).

8.5.3.1 Terrestrial biodiversity

Table 8.26 Operation impact significance on terrestrial ecology

Receptor	Impact magnitude justification	Sensitivity	Magnitude	Significance
Lake Mantovo and river Lakavica KBA and IBA	Operational activities should not impact this designation. Impacts to designated biodiversity features (birds) are discussed below.	High	Negligible	Not significant
Habitats				
Eastern *Quercus pubescens* woods	Operation activities such as vehicle and machinery movements for maintenance purposes could cause some dust emissions impacting this habitat. Due to activities in the construction phase causing impacts to habitats, the magnitude of the impact associated with maintenance activities are considered negligible.	Very high	Negligible	Not significant
Helleno-Balkanic [Satureja montana] steppes and Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion (temporary running waters)	Operation activities such as vehicle and machinery movements for maintenance purposes could cause some dust emissions impacting this habitat. Due to activities in the construction phase causing impacts to habitats, the magnitude of the impact associated with maintenance activities are considered negligible.	High	Negligible	Not significant

Receptor	Impact magnitude justification	Sensitivity	Magnitude	Significance
Abandoned arable land with ruderal vegetation, vineyards, fruit orchards, native conifer plantations, lines of trees: hedgerows, arable land, cropland, ponds and lakes with completely man-made substrate and bare/sparse vegetation.	Operation activities such as vehicle and machinery movements for maintenance purposes could cause some dust emissions impacting this habitat. Due to activities in the construction phase causing impacts to habitats, the magnitude of the impact associated with maintenance activities are considered negligible.	Low	Negligible	Not significant
Flora				
Flora	No additional land clearance will be undertaken during operation. Potential physical damage from movement of machinery and vehicles during maintenance activities works. Dust and pollution adjacent to access roads.	Medium Low/negligible	Negligible	Not Significant
Terrestrial mammals				
Terrestrial mammals	Habitat fragmentation and edge effects, altering food availability. Roads increase mortality risk from vehicle collisions and act as barriers to movement. Persistent noise and human activity cause displacement, while disturbed habitats favour generalist species, increasing competition and predation pressure. However, this is unlikely to be significantly increased from baseline.	Low/negligible	Negligible	Not significant
Bats				
Bats	Mortality may occur either through direct collision with rotating turbine blades or through barotrauma caused by rapid air pressure changes near the blades. Refer to Table 8.27 and Table 8.28 for detail on collision risk.	Very High High Medium Low	Moderate - Adverse	Moderate Moderate Minor – not significant Not Significant
Birds				
Large raptors: IUCN EN species- Egyptian vulture	Potential death from collision with wind turbines and OHL. CRA predicts low collision risk and only for LC species. Impacts from artificial light and noise causing displacement.	High	Minor - adverse	Moderate
Large raptors: IUCN VU/NT/LC migratory species	Potential death from collision with wind turbines and OHL. CRA predicts low collision risk and only for LC species. Impacts from artificial light causing displacement.	High	Minor - adverse	Moderate

Receptor	Impact magnitude justification	Sensitivity	Magnitude	Significance
Large raptors IUCN LC non-migratory species	Potential death from collision with wind turbines and OHL. CRA predicts low collision risk. Impacts from artificial light and noise causing displacement.	Low	Minor - adverse	Minor – not significant
Small raptors IUCN LC migratory species	Potential death from collision with wind turbines and OHL. CRA predicts low collision risk. Impacts from artificial light and noise causing displacement.	High	Minor - adverse	Moderate
Small raptors IUCN LC non-migratory species	Potential death from collision with wind turbines and OHL. CRA predicts low collision risk. Impacts from artificial light and noise causing displacement.	Low	Minor - adverse	Minor – not significant
Other migratory birds: IUCN VU/NT/LC species	Potential death a from collision with wind turbines and OHL. Impacts from artificial light and noise causing displacement.	High	Minor - adverse	Moderate
Other breeding birds IUCN NT/LC species	Potential death from collision with wind turbines. Impacts from artificial light and noise causing displacement.	Low	Minor - adverse	Minor – not significant
Nocturnal birds: IUCN LC migratory species	Potential death a from collision with wind turbines. Impacts from artificial light and noise causing displacement.	High	Minor - adverse	Moderate
Nocturnal birds: IUCN LC non-migratory species	Potential death from collision with wind turbines. Impacts from artificial light and noise causing displacement.	Low	Minor - adverse	Minor – not significant
Amphibians				
Amphibians	Long-term habitat fragmentation from permanent infrastructure and roads, which disrupt connectivity between breeding sites and foraging areas. Altered hydrology caused by roads and drainage systems can reduce water availability in wetlands and seasonal pools, impacting reproduction. Traffic and maintenance activities increase mortality risk and cause displacement from preferred habitats. Edge effects and microclimate changes along cleared areas (i.e. adjacent to the roads, transmission line corridor, carpark, substation, turbines etc) can reduce moisture levels, making conditions unsuitable for many species.	Very High High Medium Low	Minor - Adverse	Moderate Minor – not significant Minor – not significant Not Significant
Reptiles				

Receptor	Impact magnitude justification	Sensitivity	Magnitude	Significance
Reptiles	Permanent loss of basking sites and shelter areas due to turbine pads and roads. Roads fragment habitats and act as barriers, limiting movement and access to resources. For species that rely on temporary watercourses, altered drainage can eliminate critical hydration and prey-rich zones. Maintenance traffic increases collision risk, while ongoing human presence and noise cause displacement into suboptimal habitats. Edge effects can change thermal conditions, reducing suitable basking opportunities.	Very High High Low	Minor - Adverse	Moderate Minor – not significant Not Significant
Invertebrates				
Invertebrates	Potential injury/death from vehicle and machinery movements for repairs, dust and emissions.	Medium	Negligible	Not significant
Fungi				
Fungi	Potential physical damage to individual species or their habitats from movement of machinery and vehicles during repair works. Dust and emissions.	High Medium	Negligible	Not significant

Source: Mott MacDonald, 2025

8.5.4 Collision Risk for Bats

The operation of wind turbines poses a recognised risk to bats, primarily through direct collision with turbine blades and barotrauma caused by rapid pressure changes near moving blades. These impacts can occur during commuting flights or foraging activity, particularly in open landscapes or areas with high insect abundance that attract bats. While roosts were not identified within the study area, the potential for interaction remains due to the presence of species recorded during field surveys in 2024–2025.

To assess this risk, Table 8.27 summarises the level of collision risk for European and Mediterranean bat species, as defined by EUROBATS guidance. This classification considers species-specific flight behaviour, altitude, and habitat use. Table 8.28 provides the list of species (or species groups) detected during the surveys, their associated risk levels based on these criteria and level of activity during the months (based on bat activity index). The absence of roosts reduces the likelihood of concentrated commuting routes; however, species recorded indicate that foraging and dispersal movements may still bring individuals into proximity with turbines, sustaining a measurable risk of collision and barotrauma.

Table 8.27: Level of collision risk with wind turbines for European and Mediterranean bat species to which EUROBATS applies (state of knowledge: September 2014) (Rodrigues et al., 2015)

High risk	Medium risk	Low risk	Unknown
Nyctalus spp.	*Eptesicus* spp.	*Myotis* spp.**	*Rousettus aegyptiacus*

High risk	**Medium risk**	**Low risk**	**Unknown**
Pipistrellus spp.	*Barbastella* spp.	*Plecotus* spp.	*Taphozous nudiventris*
Vespertilio murinus	*Myotis dasycneme**	*Rhinolophus* spp.	*Otonycteris hemprichii*
Hypsugo savii			*Miniopterus pallidus*
Miniopterus schreibersi			
Tadarida teniotis			

* in water rich area, ** exclusive *Myotisdasycneme*in water rich area

Table 8.28: Collision risk for bats identified within the Project AoI

Scientific Name	Common Name	IUCN	PBF/ CH	Annex of the Habitat Directive	Collision Risk according to EUROBATS	Sensitivity	Activity level[5] (Months)
Hypsugo savii	Savi's pipistrelle	LC		IV	High	Low	Medium (May, June)
Miniopterus schreibersii	Schreiber's bent-winged bat	VU	CH	II, IV	High	Very High	Medium (October and September)
Nyctalus leisleri	Leisler's bat	LC	PBF	IV	High	High	Low
Nyctalus noctula	Common noctule	LC	PBF	IV	High	High	Low
Pipistrellus kuhlii	Kuhl' pipistrelle	LC		IV	High	Low	High (May) Medium (April to first week of September)
Pipistrellus nathusii	Nathusius' Pipistrelle	LC	PBF	IV	High	High	Medium (April and August/ September)
Pipistrellus pipistrellus	Common pipistrelle	LC	PBF	IV	High	High	Very High (July) Medium (June and September)
Pipistrellus pygmaeus	Soprano pipistrelle	LC		N/A	High	Low	Medium (June)
Vespertilio murinus	Parti-coloured bat	LC	PBF	IV	High	High	Low
Tadarida teniotis	European free-tailed bat	LC		IV	High	Low	Low
Barbastella barbastellus	Barbastrelle bat	VU	CH	II, IV	Medium	Very High	Low
Eptesicus serotinus	Eurasian serotine	LC	PBF	N/A	Medium	High	Low
Myotis sp.					Low		Medium (August)
Plecotus austriacus	Grey long-eared bat	NT		IV	Low	Low	Low
Rhinolophus hipposideros	Lesser horseshoe bat	LC	CH	II, IV	Low	Very High	Low
Rhinolophus ferrumequinum	Greater horseshoe bat	LC		II, IV	Low	High	Low

In addition to the global and regional population considerations described above, the assessment of collision risk for bats has also been informed by the Priority Biodiversity Feature designations identified in the CHA (Section 4.1.12). For Annex II-listed bat species that qualify as PBFs and Annex II and IV-listed listed bat species that qualify as critical habitat features, significance has been evaluated not only in terms of broader population trends but also with respect to the thresholds and criteria applied under EBRD PR6/ESR6, IFC PS6 and EIB ESS4. This ensures that the collision risk conclusions reflect both conventional mortality assessment and the lender-specific requirements associated with PBF/ critical habitat species.

8.5.5 Avifauna Collision Risk Assessment

A Collision Risk Assessment (CRA) has been developed based on the baseline information presented in this chapter and is presented in Chapter 9.

In conclusion, the collision risk was calculated of the seven target species: Eurasian buzzard, Long-legged buzzard (PBF under EBRD ESR6), Eurasian honey buzzard (PBF under EBRD ESR6), Booted eagle (PBF under EBRD ESR6), Eastern imperial eagle (PBF under EBRD ESR6), Common kestrel and Western marsh harrier. Only Eurasian buzzard and Common kestrel had at least one collision within a year (3.2 and 1.3 respectively). None of the 30-year collision estimates would result in significant losses (>1%) of the global populations of any of the target species.

The number of birds recorded at collision risk height within the location of the OHL is not anticipated to threaten the global bird populations of the birds recorded.

Consistent with the Critical Habitat Assessment (Section 4.1.12), the significance of collision risk effects has also been interpreted in the context of Priority Biodiversity Feature status for Annex I bird species regularly occurring within the Project area. While global population significance has been considered, the assessment also accounts for the lender-specific criteria applied by EBRD, EIB and IFC, which focus on site-level regular occurrence, ecological functionality and the maintenance of PBF values.

8.5.6 Rapid Cumulative Impact Assessment

A Rapid Cumulative Impact Assessment (RCIA) for avifauna and bats has been developed based on the baseline information presented in this chapter and the CRA. This section includes an assessment of cumulative impacts on bird and bat species, taking into account the presence of one other wind farm development located within 20 km of the Project site. Based on publicly available information, Critical Habitat was not identified for the other wind farm in line with IFC PS6, and therefore cumulative impacts on Critical Habitat were scoped out.

8.5.6.1 Overview

Within 20km of Stip wind farm, there is one operational Project: Bogoslovec windfarm. Bogoslovec windfarm, located 19km from the Project, when assessed collectively, have the potential to intersect with key flight paths, foraging grounds, and breeding habitats, increasing the potential for displacement, habitat fragmentation, and collision risk for birds and bats.

8.5.6.2 Methodology

This RCIA, follows the methodology in accordance with IFC Good Practice Handbook: Cumulative Impact Assessment and Management (IFC, 2013). This approach evaluates potential cumulative impacts on key valued ecological components (VECs) by considering the

[5] Activity level is based on the thresholds for bat activity index calculated as part of the baseline. Refer to Appendix B for the bat report.

combined effects of both wind farms alongside other regional developments and natural drivers. The assessment aims to determine whether cumulative impacts remain within sustainable thresholds, safeguard the viability of bird and bat populations, and ensure Project feasibility. It also addresses community concerns, supports governance structures for managing impacts at the landscape scale, and mitigates reputational risks. The methodology emphasizes a rapid, risk-based screening of spatial and temporal overlap in species sensitivities, migratory patterns, and habitat use to inform adaptive management and mitigation strategies.

Valued Environmental and Social Components (VECs)

Birds

The operational Project: Bogoslovec windfarm and the Proposed Project Development share twelve species recorded in the AoI of the Proposed Development and these consisted of the following, Northern goshawk, Eurasian Sparrowhawk, Eastern imperial eagle, Eurasian buzzard, Long-legged buzzard, Western marsh harrier, Montagu's harrier, Hen harrier, Lesser kestrel, Kestrel, Peregrine and Eurasian hobby. There were an additional five species not recorded within the AoI of the Project Development: Levant's sparrowhawk, Golden Eagle, Red-footed falcon, Black kite and Egyptian vulture.

Collision risk for the 12 shared species was undertaken. Of these, the Project undertook CRA for seven species (Booted eagle not recorded in Bogoslovec wind farm). The shared species list was derived by comparing VP and transect records from both Projects, with collision estimates for Bogoslovec taken from its ornithological CRA. The cumulative collision risk per annum of the two Projects is listed below:

Table 8.29: Cumulative estimated collision risk Bogoslovec wind farm and Project Development

Species	Bogoslovec collision risk per annum	Project collision risk per annum	Cumulative collision risk per annum	30-year collision estimate	Global population	% of global population
Eastern imperial eagle	0.054	0.1	0.154	4.62	3500	<1%
Kestrel	0.65	1.3	1.95	58.5	4,330,000	<1%
Long-legged buzzard	0.021	0.2	0.221	6.63	100,000	<1%
European honey buzzard	0.0475	0.4	0.4475	13.43	294,000	<1%
Western marsh harrier	0.0074	<0.1	<0.1	<3	500,000	<1%
Eurasian buzzard	2.15	3.2	5.35	160.5	2,038,000	<1%

Source: Mott Macdonald, 2025 and Maneko Solutions 2017

The principal mitigation recommended in the ESIA for birds comprises a observer led shutdown for the most sensitive time of year for these species (April-September). In addition, it comprises a program of post-construction monitoring aimed at reducing risks to migratory birds and informing Adaptive Management strategies through an improved understanding of bird behaviour (Section 7).

Bats

Bat activity index was low to medium activity of bats in the surveyed area of Bogoslovec. Highest bat activity was recorded during period of activity of local populations (June) and during autumn migration (August until October). Obtained values of bat activity index for high to medium collision risk species varied from 0.1-1.7. These values corresponding with low activity of bats in surveyed areas.

A total of nine bat species were recorded during 12 month of surveys at Bogoslovec wind farm and fifteen were recorded during the 12 months of surveys at Stip. Table 8.30 lists the species and identifies which are selected as Priority Bat VECs; Schreiber's bent-winged bat, Kuhl' pipistrelle and Common pipistrelle.

Table 8.30: List of Bat species in the study area and identification of VEC

Common Name	Scientific Name	Reasons for inclusion/ exclusion
Savi's pipistrelle	*Hypsugo savii*	Excluded - Recorded in Stip Wind Farm study area Not recorded in Bogoslovec wind farm.
Schreiber's bent-winged bat	*Miniopterus schreibersii*	Included - Recorded in Stip Wind Farm study area and Bogoslovec wind farm. Medium activity, high sensitivity and high collision risk. Critical habitat feature
Leisler's bat	*Nyctalus leisleri*	Excluded - Recorded in Stip Wind Farm study area low activity. Not recorded in Bogoslovec wind farm.
Common noctule	*Nyctalus noctula*	Excluded - Recorded in Bogoslovec wind farm and Stip Wind Farm study area low activity.
Kuhl' pipistrelle	*Pipistrellus kuhlii*	Included - Recorded in Bogoslovec wind farm and Stip Wind Farm study area. High sensitivity, high collision risk and high – medium activity in the Stip area.
Nathusius' Pipistrelle	*Pipistrellus nathusii*	Excluded - Recorded in Stip Wind Farm study area Not recorded in Bogoslovec wind farm.
Common pipistrelle	*Pipistrellus pipistrellus*	Included - Recorded in Bogoslovec wind farm and Stip Wind Farm study area, very high and medium activity, high collision risk, low sensitivity.
Soprano pipistrelle	*Pipistrellus pygmaeus*	Excluded - Recorded in Bogoslovec wind farm and Stip Wind Farm study area, low sensitivity and medium activity.
Parti-coloured bat	*Vespertilio murinus*	Excluded - Recorded in Stip Wind Farm study area. Not recorded in Bogoslovec wind farm.
European free-tailed bat	*Tadarida teniotis*	Excluded - Recorded in Bogoslovec wind farm and Stip Wind Farm study area, low activity
Barbastrelle bat	*Barbastella barbastellus*	Excluded - Recorded in Stip Wind Farm study area
Eurasian serotine	*Eptesicus serotinus*	Excluded - Recorded in Bogoslovec wind farm and Stip Wind Farm study area
	Myotis sp.	Excluded - Recorded in Bogoslovec wind farm and Stip Wind Farm study area
Greater mouse-eared bat	*Myotis myotis*	Excluded - Recorded in Bogoslovec wind farm study area. Not recorded in Stip
Grey long-eared bat	*Plecotus austriacus*	Excluded - Recorded in Stip Wind Farm study area. Low activity
Lesser horseshoe bat	*Rhinolophus hipposideros*	Excluded - Recorded in Stip Wind Farm study area. Low activity
Greater horseshoe bat	*Rhinolophus ferrumequinum*	Excluded - Recorded in Stip Wind Farm study area. Low activity

The mitigation recommended in the ESIA for bats comprises a program of post-construction monitoring aimed at reducing risks to Priority Bat VECs and informing Adaptive Management strategies through an improved understanding of bat behaviour.

8.5.7 Decommissioning impacts

8.5.7.1 Overview

Decommissioning is expected to include the removal of turbines and aboveground infrastructure, removal of foundations and reinstatement of access tracks and hardstanding. Temporary works will involve plant/vehicle movements, excavation, storage of materials, and site restoration. The decommissioning phase therefore has the potential to generate a range of temporary impacts on biodiversity receptors within and surrounding the Project area. Key ecological concerns include temporary degradation of habitats, noise and vibration disturbance, barrier effects on species movement, pollution, and the introduction/moving of invasive species. These pressures can affect both terrestrial and avian species, particularly those of conservation concern or those reliant on undisturbed habitats.

In the long term, decommissioning can deliver benefits by removing operational impacts and restoring the site to more natural habitats. Turbine removal eliminates collision risks for birds and bats. The removal of artificial lighting, noise, and maintenance traffic reduces disturbance to fauna, and removal of hardstanding and associated infrastructure enables habitat recovery. Well planned reinstatement with native species can improve ecological connectivity and reduces pathways for invasive non-native species.

This is a preliminary assessment of decommissioning impacts, and it is recommended that this is updated once further design is available for this phase. In particular, any changes to the wind farm since pre-construction design should be considered, as well as the findings related to biodiversity from monitoring throughout the lifecycle of the Project.

Impacts arising from decommissioning are inherently challenging to predict. The potentially substantial time interval between commissioning and decommissioning, during which site conditions, GIIP and relevant standards may evolve significantly, adds further uncertainty. Therefore, it is recommended that the assessment of decommissioning impacts and the identification of appropriate mitigation measures are reviewed at least one year prior to decommissioning, to ensure their continued relevance and appropriateness.

8.5.7.2 Terrestrial biodiversity

Table 8.31 Decommissioning impact significance on terrestrial ecology

Receptor	Impact	Sensitivity	Magnitude	Significance
Lake Mantovo and river Lakavica KBA and IBA	No direct work will be undertaken in the IBA/KBA. Decommissioning activities may disrupt local wildlife within the northern section of the IBA/KBA near WTG 35. However, this disturbance will be minimal and temporary.	High	Short-term: Minor – Adverse Long-term Minor – beneficial	Minor – not significant
Habitats				

Receptor	Impact	Sensitivity	Magnitude	Significance
Eastern *Quercus pubescens* woods	Decommissioning activities could disrupt wildlife utilising this habitat. In addition, dust dispersal through movement of heavy machinery may impact bare/sparse vegetation. Due to the impacts associated with the construction and operation phase, the magnitude of the impacts for this phase are considered to be negligible. In the long-term, Eastern *Quercus pubescens* woods will be reinstated through natural regeneration/ planting and therefore the impact magnitude is considered minor – beneficial.	Very high	Negligible Long-term Minor – beneficial	Not significant Minor – not significant
Helleno-Balkanic [Satureja montana] steppes and Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion (temporary running waters)	Decommissioning activities could disrupt wildlife utilising this habitat. In addition, dust dispersal through movement of heavy machinery may impact bare/sparse vegetation. Due to the impacts associated with the construction and operation phase, the magnitude of the impacts for this phase are considered to be negligible. In the long-term, Helleno-Balkanic [Satureja montana] steppes will be reinstated through natural regeneration/ planting and therefore the impact magnitude is considered minor – beneficial.	High	Negligible Long-term Minor – beneficial	Not significant Minor – not significant
Abandoned arable land with ruderal vegetation, vineyards, fruit orchards, native conifer plantations, lines of trees: hedgerows, arable land, cropland, ponds and lakes with completely man-made substrate and bare/sparse vegetation.	Decommissioning activities could disrupt wildlife utilising this habitat. In addition, dust dispersal through movement of heavy machinery may impact grassland. Due to the impacts associated with the construction and operation phase, the magnitude of the impacts for this phase are considered to be negligible. In the long term, these habitats may be replanted or left to regenerate which will result in a minor-beneficial impact magnitude.	Low	Negligible Long-term Minor – beneficial	Not significant Minor – not significant
Flora				
Flora	Flora on areas left as bare ground have the potential to recover naturally. Areas affected by the construction and operation phase will already be heavily modified by this stage in the Project, and therefore minor impacts are anticipated. In the long-term, flora will naturally regenerate or planting of high sensitive species which will result in a minor-beneficial impact magnitude.	Medium Low/negligible	Short-term: Minor – Adverse Long-term Minor – beneficial	Minor – not significant Minor – not significant Not Significant
Terrestrial mammals				

Receptor	Impact	Sensitivity	Magnitude	Significance
Terrestrial mammals	Temporary disturbance from noise and vibration due to the movement of construction traffic and ground clearance and excavation. This may lead to temporary displacement of species. However, this will be temporary in nature. In the long-term, habitats suitable for terrestrial mammals will be reinstated or naturally regenerate which will result in a minor-beneficial impact magnitude.	Low/negligible	Minor – Adverse Long-term Minor – beneficial	Not significant
Bats				
Bats	Potential disruption to foraging/ commuting from noise and vibration impacts during construction due to habitat loss, fragmentation and pollution. However, these will be temporary in nature and during daylight hours when bats are not active. In addition, impacts from disturbance related to artificial lighting. In the long-term, habitats suitable bats will be reinstated or naturally regenerate and impacts from collision/ barotrauma will be removed which will result in a moderate-beneficial impact magnitude.	Very High Medium Low	Short-term: Minor - Adverse Long-term: Moderate - Beneficial	Moderate Minor – not significant Not Significant
Birds				
Large raptors: IUCN EN species- Egyptian vulture	Potential disruption from noise and vibration impacts during decommissioning. However, these will be temporary in nature. In addition, potential impacts could occur from direct physical impacts to habitats supporting these species and disturbance related to artificial lighting. In the long-term, habitats suitable for raptors (e.g. Egyptian vulture) will be reinstated or naturally regenerate and less disturbed which will result in a minor-beneficial impact magnitude.	High	Short term: Minor – Adverse Long-term Minor – beneficial	Moderate
Large raptors: IUCN VU/NT/LC migratory species	Potential disruption from noise and vibration impacts during decommissioning. However, these will be temporary in nature. In addition, potential impacts could occur from direct physical impacts to habitats supporting these species and disturbance related to artificial lighting. In the long-term, habitats suitable for raptors (e.g. Eastern imperial eagle) will be reinstated or naturally regenerate and less disturbed which will result in a minor-beneficial impact magnitude.	High	Short term: Minor – Adverse Long-term Minor – beneficial	Moderate
Large raptors IUCN non-migratory LC species	Potential disruption from noise and vibration impacts during decommissioning. However, these will be temporary in nature. In addition, potential impacts could occur from direct physical impacts to habitats supporting these species and disturbance related to artificial lighting. In the long-term, habitats suitable for raptors will be reinstated or naturally regenerate and less disturbed which will result in a minor-beneficial impact magnitude.	Low	Short term: Minor – Adverse Long-term Minor – beneficial	Minor – not significant
Small raptors IUCN LC migratory species	Potential disruption from noise and vibration impacts during decommissioning. However, these will be temporary in nature. In addition, potential impacts could occur from direct physical impacts to habitats supporting these species and disturbance related to artificial lighting. In the long-term, habitats suitable for raptors will be reinstated or naturally regenerate and less disturbed which will result in a minor-beneficial impact magnitude.	High	Short term: Minor – Adverse Long-term Minor – beneficial	Moderate

Small raptors IUCN LC species	Potential disruption from noise and vibration impacts during decommissioning. However, these will be temporary in nature. In addition, potential impacts could occur from direct physical impacts to habitats supporting these species and disturbance related to artificial lighting. In the long-term, habitats suitable for raptors will be reinstated or naturally regenerate and less disturbed which will result in a minor-beneficial impact magnitude.	Low	Short term: Minor – Adverse Long-term Minor – beneficial	Minor – not significant
Other migratory birds: IUCN VU/NT/LC species	Potential disruption from noise and vibration impacts during decommissioning. However, these will be temporary in nature. In addition, potential impacts could occur from direct physical impacts to habitats supporting these species and disturbance related to artificial lighting. In the long-term, habitats suitable for breeding birds will be reinstated or naturally regenerate and less disturbed which will result in a minor-beneficial impact magnitude.	High	Short term: Minor – Adverse Long-term Minor – beneficial	Moderate
Other breeding birds IUCN NT/LC species	Potential disruption from noise and vibration impacts during decommissioning. However, these will be temporary in nature. In addition, potential impacts could occur from direct physical impacts to habitats supporting these species and disturbance related to artificial lighting. In the long-term, habitats suitable for breeding birds will be reinstated or naturally regenerate and less disturbed which will result in a minor-beneficial impact magnitude.	Low	Short term: Minor – Adverse Long-term Minor – beneficial	Negligible
Nocturnal birds: IUCN LC migratory species	Potential disruption from noise and vibration impacts during decommissioning. However, these will be temporary in nature. In addition, potential impacts could occur from direct physical impacts to habitats supporting these species and disturbance related to artificial lighting. In the long-term, habitats suitable for nocturnal birds will be reinstated or naturally regenerate which will result in a minor-beneficial impact magnitude.	High	Short term: Minor – Adverse Long-term Minor – beneficial	Moderate
Nocturnal birds: IUCN LC species	Potential disruption from noise and vibration impacts during decommissioning. However, these will be temporary in nature. In addition, potential impacts could occur from direct physical impacts to habitats supporting these species and disturbance related to artificial lighting. In the long-term, habitats suitable for nocturnal birds will be reinstated or naturally regenerate which will result in a minor-beneficial impact magnitude.	Low	Short term: Minor – Adverse Long-term Minor – beneficial	Minor – not significant
Amphibians				
Amphibians	Noise, vibration, and human activity can cause displacement from breeding and foraging areas, while habitat disturbance may favour invasive species altering habitat. Mortality from vehicle movement and removal of infrastructure. In the long-term, habitats suitable for amphibians will be reinstated or naturally regenerate which will result in a minor-beneficial impact magnitude.	Very High High Medium Low	Short term: Minor – Adverse Long-term Minor – beneficial	Moderate Moderate Minor – not significant Not Significant
Reptiles				

Reptiles	Displacement occurs could occur through avoidance of disturbed areas due to noise and human activity, forcing them into suboptimal habitats. Habitat disturbance also increases exposure to predators and invasive species. Mortality from vehicle movement and removal of infrastructure. In the long-term, habitats suitable for reptiles will be reinstated or naturally regenerate which will result in a minor-beneficial impact magnitude.	Very High High Low	Short term: Minor – Adverse Long-term Minor – beneficial	Moderate Minor – not significant Not Significant
Invertebrates				
Invertebrates	Temporary disturbance from noise and vibration due to the movement of decommissioning traffic and ground clearance and excavation. This may lead to temporary displacement of species. However, this will be temporary in nature. In the long-term, habitats suitable for invertebrates will be reinstated or naturally regenerate which will result in a minor-beneficial impact magnitude.	High Medium	Short term: Minor – Adverse Long-term Minor – beneficial	Minor – not significant Minor – not significant
Fungi				
Fungi	Potential impacts from physical damage during construction activities and dust emissions damaging habitats. In the long-term, habitats suitable for fungi will be reinstated or naturally regenerate which will result in a minor-beneficial impact magnitude.	High Medium	Short term: Minor – Adverse Long-term Minor – beneficial	Minor – not significant Minor – not significant

8.6 Mitigation Measures

This ESIA adopts the mitigation hierarchy to address biodiversity risks associated with wind farm development, prioritising avoidance and minimisation measures before considering restoration or offsetting. Avoidance strategies should be applied early in the Project lifecycle, particularly during site selection and design.

8.6.1 Design considerations

The Urban Plan (State Urban Planning) for Stip Wind Farm was received from the Ministry in 2010. The original plan was reviewed by the Project, and changes have been made to the design to avoid impacts on local communities and structures, minimise the acquisition of privately owned land, and prevent removal of trees and other natural assets. This chapter has been produced on the basis of a design from February 2025. A detailed inventory of trees to be removed will be undertaken during Construction to minimise tree removal and calculate net loss. The Project has been designed so that trees or hedgerows will not been removed in such numbers as to significantly change the nature of the landscape. Design refinement has prioritised avoidance of Critical Habitat and Priority Biodiversity Features identified in Section 4.1.12, particularly Eastern Quercus pubescens woods and Annex I steppe habitats.

Existing roads will be improved where possible to avoid building new ones. Roads have been designed to minimise fragmentation of natural/critical habitats. Routing also considered high-use raptor flight areas and mapped bat activity corridors identified in the VP and acoustic surveys, to minimise operational collision and displacement risk from the outset.

Electrocution risk for large raptors is primarily determined by the interaction between species body size and behaviour and the spacing and configuration of energised and grounded components on power line structures, with highest risk occurring on low- and medium-voltage lines where conductor separation is insufficient to prevent simultaneous contact during perching or take-off. Spacing (over 2.5m) can reduce risk of electrocution with transmission lines where technically feasible, however will not reduce risk of collision, therefore bird diverters are recommended below.

Where further design considerations are not possible, the measures for construction and operation have been designed to robustly mitigate impacts at each stage. These design measures support the Project's commitment to achieving No Net Loss for PBF and Net Gain for Critical Habitat in accordance with IFC PS6, EBRD ESR6 and EIB ESS4.

8.6.2 Construction Mitigation

8.6.2.1 Avoidance and minimisation

Avoidance measures include designating access routes to avoid sensitive habitats, limit construction vehicle movement, use low noise machinery. Where possible, works should take place during daylight hours only. Avoid tree felling and vegetation clearance outside construction boundary. Implement exclusion zones and fencing to protect habitats.

Minimisation measures are essential during construction. These include:

- Scheduling activities to avoid sensitive periods (e.g. breeding or migration seasons) where possible and if not, implementing pre-work checks.

– Key times to avoid ground disturbance (vegetation removal, soil stripping and excavation, blasting) and therefore minimise impacts to small and medium sized breeding bird species is from March to mid-June (Phase 1) and for raptors includes February (Phases 2, 3). Key times to avoid nighttime work which will result in light pollution impacts is during spring and autumn migration seasons, particularly affecting migratory bird species.

- Installing bird flight diverters for raptors (e.g. Eastern imperial eagle) along the 7km transmission line, within the ground cables at alternating positions between both ground cables to minimise risk of collision/ electrocution.
- The use of artificial lighting will be temporary, for a duration of 20-24 months during construction works.
- Applying noise, dust, and waste controls to reduce disturbance.

These measures should be tailored to site-specific ecological conditions and informed by baseline data and stakeholder input. A detailed BMP has been produced to operationalise these strategies.

8.6.2.2 Prevention of Invasive Alien Species During Construction

The construction phase of wind farm development presents a high risk for the introduction and spread of invasive alien species (IAS) particularly through the movement of machinery, materials, and personnel. To mitigate this risk, the Project must implement a robust Invasive Species Management Plan (ISMP) as part of a BMP, aligned with international best practice.

Key prevention measures include:

- Pre-construction baseline surveys to identify existing IAS and assess site vulnerability (refer to section 8.4.1.11 for results).
- Cleaning and inspection protocols for all vehicles, machinery, and construction materials prior to site entry.

- Contractor training and awareness to ensure compliance with biosecurity measures.
- On-site biosecurity controls, such as designated wash-down areas, waste management procedures, and restricted access zones.
- Monitoring and rapid response protocols to detect and manage any IAS incursions during construction.
- Contingency planning for containment and eradication in the event of IAS establishment.

These measures should be detailed in the Environmental and Social Management Plan (ESMP) and BMP. Ongoing surveillance and adaptive management will be critical to ensuring long-term protection of native biodiversity.

8.6.2.3 Tree removal inventory and habitat loss calculations

A detailed inventory of trees and habitat removed during construction will be implemented to ensure actual construction related impacts on biodiversity are accurately quantified. This inventory will be ongoing during the construction phase as areas require clearance. The objective of the inventory is to confirm the actual extent of vegetation clearance and habitat loss to support net gain and no net loss where required.

The tree inventory will be conducted by a qualified biodiversity specialist and include:

- Mapping and identification of all tree species within the construction footprint (with particular attention to Eastern *Quercus pubescens* woods)
- Measurement of diameter at breast height (DBH), tree height, canopy cover
- Classification of tree age (sapling, mature, veteran)
- Assignment of habitat type (Eastern *Quercus pubescens* woods/ Helleno-Balkanic [*Satureja montana*] steppes)

Actual habitat loss will be calculated immediately following construction and include tree-based loss as well as area-based loss. These calculations will be compared against the predicted loss calculated in this ESIA and used to update no net loss/ net gain requirements as part of the Biodiversity Action Plan (BAP) refer to Section 8.6.5

8.6.2.4 Mitigation measures

This section describes mitigation measures for impacts expected during construction for terrestrial ecology. Each mitigation measures is detailed in Table 8.32 to address each of the construction phase impacts (identified in Section 8.5.2) for each biodiversity receptor. Only receptors associated with the impact have been included in the tables.

Where tortoises, amphibians or reptiles are encountered, directional clearance and species-specific translocation will be undertaken by qualified fauna handlers, consistent with Section 4 impact mitigation assumptions. Construction equipment and vehicles will follow IAS clean-down procedures to prevent the introduction or spread of invasive plant species.

Table 8.32: Mitigation measures for the construction phase impacts

Impact/ Receptors	Mitigation measures	Mitigation justification
Disturbance or injury to fauna during site clearance Terrestrial Ecology (Mammals, Birds, Amphibians,	• A biodiversity specialist should undertake a pre-construction check of the burrows and nests identified during an initial walk-over survey, areas to be excavated to identify any sensitive locations (such as shelters for small mammals and reptiles) and move these to where possible to reduce the possibility of injury/ death during excavation.	The mitigation measures are proposed due to the presence the following species in the AoI • IUCN VU/NT/LC mammal, amphibian, birds and bats • Annex IV reptile and amphibian species of the Habitats Directive

Impact/ Receptors	Mitigation measures	Mitigation justification
Bats and Reptiles):	● Trees should not be felled until checked by the biodiversity specialists for nests, there is potential for raptor nests to be present in the AoI. ● Vegetation clearance should be undertaken gradually to enable any small mammals enough time to relocate. Vegetation clearance to be slow and directional, and the Project site should be left for at least 24 hours following vegetation clearance before any excavations. ● Minimise noise and vibration disturbance through best practice and timing of such works (construction traffic movements, ground clearance, excavation, etc.) ● Site employees should be trained to be aware of significance of habitats and species, nests of fauna species, to avoid any destruction or displacement without an expert opinion on the status of the nests. Collaborate with biodiversity experts to implement a training and awareness program. ● Majority of tree clearance should be timed outside of the bird nesting season (March-September) to avoid loss of nests and reducing impact on nesting birds and nesting bird checks undertaken where this is not possible. ● Buffer zones around sensitive bird areas (i.e. woodland where there is a risk of raptor nests to be present).	● Annex II amphibian of the Habitats Directive Annex II bird species of the Birds directive also, evidence of breeding bird species present at all WTGs. In addition, all birds' nests are protected against damage and destruction under the EU Birds Directive.
Habitat degradation outside construction boundary- Terrestrial Ecology (Flora and habitats)	● Avoid loss of habitat outside of the construction boundaries: ● Use only existing and purposely built roads/tracks for construction vehicles. ● Enclose secure fencing sites to ensure that disturbance to off-site areas is reduced ● Restrict activities and waste storage to the Project site boundary. ● Signpost all retained habitats as no-go areas to reduce encroachment and maintain throughout construction.	The mitigation measures demarcation prevents accidental encroachment, limits footprint and reduces indirect damage to the following habitats and flora in the AoI: ● Critical habitat Eastern *Quercus pubescens* wood ● Helleno-Balkanic [Satureja montana] steppes and intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion . habitat listed under Annex I of the Habitats directive ● Rare flora species identified in Table 8.13
Direct harm to or disturbance to fauna species during construction- Terrestrial Ecology (Mammals, Birds, Amphibians, Bats and Reptiles) -	● Install bird diverters for raptors along the 7km OHL ● Implement and enforce speed limits within site boundaries to reduce dust and accidental damage to flora/ injury to fauna. ● No hunting, capturing or poisoning of fauna ● Enforce ≤30 km/h speed limit on access roads. ● Slow, directional excavations to ensure time for small mammal/ reptiles to move out of the way if present. ● Regular checks of open excavations to ensure trapped animals can escape. Inspect open trenches daily; install escape ramps every 25–50 m; cover trenches overnight where feasible; backfill unused excavations within 48 hours.	The mitigation measures reduces the risk of fatality to the following fauna present in the AoI : ● IUCN VU/NT/LC mammal, amphibian, birds and bats ● Annex IV reptile and amphibian species of the Habitats Directive ● Annex II amphibian of the Habitats Directive ● Annex II bird species of the Birds directive The use of bird diverters is considered appropriate due to the presence of multiple Important Bird Areas (IBA) sites and along a know migratory transit for associated birds.

Impact/ Receptors	Mitigation measures	Mitigation justification
	● Ensure appropriate food waste disposal is undertaken on site. Food waste generated by workforce during construction could attract animals. ● Keep a log of any fauna roadkill incidents during construction.	
Direct harm to or disturbance to fauna species during construction- Tortoises and other herptiles	● Conduct systematic tortoise (Testudo spp.) search and rescue immediately prior to clearance. Translocate all tortoise and other herptiles to pre-approved receptor sites within ≤1 km on the same day	The tortoise search, rescue and translocation, removes these slow-moving fauna from harm
Habitat loss and rare flora- Terrestrial Ecology (Flora and habitats)-	● Reinstate habitats after works have been completed (where applicable – e.g. temporarily affected areas such as excavations).	The mitigation measures helps protect and restore the following habitats and flora in the AoI
Artificial lighting disturbance- Terrestrial Ecology (bats and birds)	● Artificial lighting will be managed carefully to avoid attracting and dazing migrant birds. ● Lights should be designed to be as low to the ground as possible (specifically not above 8m). ● Where possible, works should take place during daylight hours only. The use of artificial lighting will be temporary during construction works and limited to construction activities that require night-time works give the nature of work activities (e.g. concrete pouring, turbine erection, etc). ● Directional lighting should be used to avoid light spillage, particularly towards linear features such as tree lines. Hoods/cowls can be used to direct light below the horizontal plane (ideally at an angle less than 70 degrees). ● Lights should be switched off at night (particularly during the months of April to October inclusive when bats are more active), or motion sensors and timers use	The mitigation measures help manage artificial lighting to avoid dazing migrant birds and attracting/displacing IUCN VU bats and birds (including nocturnal birds) present in the AoI
Spread of invasive alien species (IAS) particularly through the movement of machinery, materials, and personnel- Terrestrial Ecology (Flora and habitats)-	● Pre-construction baseline surveys to identify existing IAS and assess site vulnerability (refer to section 4.1.11). ● Cleaning and inspection protocols for all vehicles, machinery, and construction materials prior to site entry. ● Contractor training and awareness to ensure compliance with biosecurity measures. ● On-site biosecurity controls, such as designated wash-down areas, waste management procedures, and restricted access zones. ● Monitoring and rapid response protocols to detect and manage any IAS incursions during construction. ● Contingency planning for containment and eradication in the event of IAS establishment. ● These measures should be detailed in the Environmental and Social Management Plan (ESMP) and BMP. Ongoing surveillance and	The mitigation measures help manage control the spread of any IAS and protect the following habitats and flora present in the AoI: ● Critical habitat Eastern *Quercus pubescens* wood ● Helleno-Balkanic [Satureja montana] steppes ● Rare flora species identified in Table 8.13

Impact/ Receptors	Mitigation measures	Mitigation justification
	adaptive management will be critical to ensuring long-term protection of native biodiversity.	

8.6.3 Operational Mitigation

8.6.3.1 Habitat restoration

Following the completion of construction activities, habitat restoration of temporarily disturbed habitats (platforms, construction road buffer) must be undertaken within 6–12 months post-construction. Priority actions include:

- Revegetation using native species to restore ground cover and prevent erosion.
- Compensatory planting for any loss of natural habitat (Helleno-Balkanic [Satureja montana] steppes and critical habitat (Eastern Quercus pubescens woods), ideally at a restoration ratio of at least 1:10 (lost: restored) to account for uncertainty.
- Monitoring and adaptive management to assess restoration success and refine techniques over time.

These measures are detailed in a Vegetation Removal and Restoration Plan, developed in consultation with relevant stakeholders and integrated into the Project's BMP (refer to 8.6.4 below). Restoration should begin promptly after construction and be timed to avoid disturbance to breeding or migratory species.

8.6.3.2 Mitigation measures

This section describes mitigation measures for impacts expected during operation for terrestrial ecology. These are detailed in Table 8.33 for each of the impacts identified for the operation phase. Operational mitigation contributes to achieving No Net Loss for PBF and Net Gain for Critical Habitat, as required under EBRD ESR6 and EIB ESS4.

Table 8.33: Mitigation measures for the operational phase impacts

Impact/ Receptor	Mitigation measures	Mitigation justification
Habitat degradation outside construction boundary- Terrestrial Ecology (Flora and habitats)	• Restrict activities and waste storage to the Project site boundary. • Ensure vehicles adhere to designated roads to avoid damage to flora and habitats.	The mitigation measures avoid additional habitat loss/ disturbance to the following habitats: • Critical habitat Eastern *Quercus pubescens* wood • Helleno-Balkanic [Satureja montana] steppes and intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion • Rare flora species identified in Table 8.13
Direct harm to or disturbance to fauna species during operation- Terrestrial Ecology (Mammals, Birds, Amphibians, Bats and Reptiles)	• Ensure appropriate food waste disposal is undertaken on site during operation. • Adhere to speed limits during vehicle and machinery movements on site to minimise dust emissions and reduce the risk of /fauna injury. • The OHL will be marked with bird diverters throughout to increase visibility, in particular any line east of the A4 road where the majority of the at-risk flights were recorded. • Avoid attracting birds and other wildlife to predictable food sources, such as on-site or off-site waste disposal areas, or landfills; this is especially relevant when vultures/raptors or other carrion-eating birds are present. These types of mitigation measures may also need to be carried out in the surroundings of the wind energy facility in order to be effective. • Implementation of post-construction bird and bat fatality monitoring • Keep a log of any fauna roadkill incidents during operation.	The mitigation measures reduces the risk of fatality to the following fauna present in the AoI : • IUCN VU/NT/LC mammal, amphibian, birds and bats • Annex IV reptile and amphibian species of the Habitats Directive • Annex II amphibian of the Habitats Directive • Annex II bird species of the Birds directive The use of bird diverters is considered appropriate due to the presence of multiple Important Bird Areas (IBA) sites and along a know migratory transit for associated birds.
Artificial lighting disturbance- Terrestrial Ecology (bats and birds)	• Lighting of turbined will be in line with national permitting requirements • Specific lighting requirements for control building/substation to prevent lighting disturbance on terrestrial ecology, to the extent possible, are defined in the BMP and should be implemented by the Contractor • Lights should be designed to be as low to the ground as possible (specifically not above 8m) • Directional lighting should be used to avoid light spillage, particularly towards linear features such as tree lines. Hoods/cowls can be used to direct light below the horizontal plane (ideally at an angle less than 70 degrees)	The mitigation measures help manage artificial lighting to avoid dazing migrant birds and attracting/displacing IUCN VU bats and birds (including nocturnal birds) present in the AoI

Impact/ Receptor	Mitigation measures	Mitigation justification
	● Use of lighting to be minimised as much as possible (particularly during the months of April to October inclusive when bats and birds are more active), or motion sensors and timers used	
Collision risk- Terrestrial Ecology (bats and birds)-	● Cut in speed is 3 m/s. Turbines will not be operational during wind speed <3 m/s. ● A turbine management program will be developed by the Project company which may involve shut down on demand protocols for bird of conservation significance (see section 8.6.4). ●	The mitigation measures reduce the risk of fatality to the following fauna present in the AoI : ● IUCN VU/NT/LC birds and bats ● Annex II and migratory bird species of the Birds directive

Source: Mott MacDonald, 2025.

8.6.4 Biodiversity Management Plan Overview

This ESIA presents a framework for mitigating biodiversity impacts during the construction and operation phases of the proposed Project. The BMP includes site-specific actions, monitoring protocols, and adaptive management strategies to ensure effective mitigation and ensuring compliance with international standards such as IFC PS6 and EBRD ESR6. The Project is located in Critical Habitat and therefore a Biodiversity Action Plan (BAP) and Biodiversity Monitoring and Evaluation Plan (BMEP) will also be required.

The BMP includes additional sub-plans/ protocols for management of sensitive flora and fauna such as a Vegetation Removal and Restoration Plan and Fauna Protection and Relocation Plan to manage impacts during site work. A BAP will need to be developed to set out measures and additional plans to achieve net gain of Critical Habitat features and No Net loss for PBF.

A Vegetation Removal and Restoration Plan will be designed to minimise ecological impacts during site clearance and ensure the successful reinstatement of habitats post-construction. The plan should set out procedures for controlled vegetation removal, soil handling, while prioritising the protection of sensitive species and habitats identified in the baseline. It should also define restoration objectives, including the use of native species, habitat structure replication, and long-term monitoring to achieve No Net Loss or Net Gain targets. By integrating adaptive management and clear performance indicators, the plan ensures that vegetation removal is conducted responsibly, and restoration delivers measurable biodiversity outcomes.

A Fauna Protection and Relocation Plan has been developed as part of the BMP. This plan provides a structured approach to safely relocate terrestrial fauna from impacted areas to suitable receptor sites (locally where feasible). It outlines the methodology for pre-translocation surveys, selection of receptor habitats, handling and transport protocols, and post-release monitoring to maintain species viability and ecological integrity. By integrating adaptive management and expert oversight, the plan minimises residual impacts and supports long-term conservation outcomes for sensitive fauna.

A proactive approach to reducing potential impacts of wind farms on priority bird species (e.g. Eastern imperial eagle) can include timed turbine shutdowns, ensuring turbines are inactive when priority birds are nearby. Such shutdowns can be observer-led, automated, or a combination of both. In this case, observer-led shutdowns will be used, as the overall collision risk to birds is assessed as low, and the presence of trained personnel will provide an appropriate and proportionate level of safeguarding. This approach should be undertaken during the peak bird activity periods migration and breeding (March to September inclusive). This enables real-time monitoring and temporary shutdown when required, while avoiding

unnecessary interruptions to energy generation. When implemented effectively, it has minimal effect on potential energy output and offers a practical means of reducing risk to priority bird species.

Outlined in Section 8.8.1.1, the Project will require the development and implementation of a Bird and Bat Operational Monitoring Plan to ensure compliance with biodiversity commitments and to monitor potential impacts on avian and chiropteran species during the operational phase.

By integrating these measures alongside robust monitoring, reporting, and adaptive management, the BMP ensures that biodiversity risks are effectively managed throughout the Project lifecycle.

8.6.5 Biodiversity Action Plan (BAP) and Biodiversity Monitoring and Evaluation Plan (BMEP)

A Biodiversity Action Plan (BAP) for critical habitats is a strategic framework designed to ensure that development Projects achieve measurable biodiversity outcomes in line with international standards. In accordance with IFC PS6 and EBRD ESR6, the BAP should outline targeted actions to conserve and enhance habitats of high ecological value, including those supporting critical habitats. According to EIB ESS4, a BAP is not specifically required, however, a “compensation/offset implementation and management plan” should be developed.

The plan should integrate the mitigation hierarchy (avoidance, minimisation, restoration, and offsetting) while aligning with Net Gain objectives for which critical habitat was classified. By combining robust baseline assessments, adaptive management, and stakeholder engagement, the BAP serves as a practical tool to deliver compliance and long-term biodiversity benefits within Project landscapes.

A Biodiversity Management and Evaluation Plan (BMEP) is also required to detail the roadmap for implementing mitigation measures, monitoring biodiversity indicators, and evaluating progress toward achieving Net Gain objectives. By integrating robust monitoring protocols and transparent reporting, the BMEP enables continuous improvement and demonstrates accountability to stakeholders and financial institutions. The BAP and BMEP should be in place for the life of the Project.

The Biodiversity Action Plan (BAP) and Biodiversity Monitoring and Evaluation Plan (BMEP) will be developed as part of the Project’s post-ESIA commitments, and will directly reflect the Critical Habitat and Priority Biodiversity Features identified in the CHA (Section 4.1.12). Their design will specifically address those receptors for which the Project footprint or operational zone of influence could affect ecological integrity or long-term population viability, including the *Quercus pubescens* priority woodland habitat, Critical Habitat-trigger reptile species, Annex I bird assemblages and Annex II/PBF-listed bats.

8.7 Residual Impacts and Significance

8.7.1 Post-mitigation impact evaluation

Table 8.34 (construction) and Table 8.35 (operation) present the residual impacts following implementation of the general mitigation measures as per Table 8.32. Where the significance of the residual impacts are minor, moderate or major, additional analysis and mitigation must be undertaken as part of a Biodiversity Management Plan and/ or Biodiversity Action Plan in addition to the measures. Additional monitoring will also be undertaken as part of the bird and bat operational monitoring plan summarised in Section 8.8.1.1.

Table 8.34: Residual impact evaluation (Construction)

Receptor	Sensitivity	Impact magnitude	Pre-mitigation impact significant	Residual impact magnitude	Significance	Additional requirements
Internationally recognised and legally protected areas						
Lake Mantovo and river Lakavica KBA and IBA	High	Minor - Adverse	Minor – not significant	Negligible	Not Significant	N/A
Habitats						
Eastern *Quercus pubescens* woods	Very high	Moderate - Adverse	Moderate	Minor - Adverse	Moderate - Adverse	Net gain
Helleno-Balkanic [Saturej a montana] steppes	High	Moderate - Adverse	Moderate	Minor - Adverse	Minor - not significant	No net loss
Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion (temporary running waters)	High	Negligible	Not Significant			
Abandoned arable land with ruderal vegetation, vineyards, fruit orchards, native conifer plantations, lines of trees: hedgerows, arable land, cropland, ponds and lakes with completely man-made substrate and bare/sparse vegetation.	Low	Moderate - Adverse	Not significant			
Flora						
Flora (Medium)	Medium	Moderate - Adverse	Minor – not significant			
Flora (low)	Low/negligible	Moderate - Adverse	Not significant			
Terrestrial mammals						
Terrestrial mammals	Low/negligible	Minor - Adverse	Not significant			
Bats						
Bats (Very High)	Very High	Minor – Adverse	Moderate	Minor - Adverse	Moderate	Construction phase monitoring

Receptor	Sensitivity	Impact magnitude	Pre-mitigation impact significant	Residual impact magnitude	Significance	Additional requirements
Bats (High)	High	Minor - Adverse	Minor – not significant	Negligible	Not Significant	Construction phase monitoring
Bats (Medium)	Medium	Moderate - Adverse	Minor – not significant	Negligible	Not Significant	Construction phase monitoring
Bats (Low)	Low	Minor - Adverse	Not Significant			
Birds						
Large raptors: IUCN EN species- Egyptian vulture	High	Moderate-adverse	Moderate	Minor-Adverse	Minor	Pre-construction nest checks for works in breeding season
Large raptors: IUCN VU species- Eastern imperial eagle	Medium	Moderate-adverse	Moderate	Minor-Adverse	Minor	Pre-construction nest checks for works in breeding season
Large raptors IUCN LC species	Low	Minor-adverse	Minor – not significant	Minor-Adverse	Minor	Pre-construction nest checks for works in breeding season
Small raptors IUCN LC species	Low	Minor-adverse	Minor – not significant	Minor-Adverse	Minor	Pre-construction nest checks for works in breeding season
Other breeding birds: IUCN VU species	Medium	Moderate-adverse	Moderate	Minor-Adverse	Minor	Pre-construction nest checks for works in breeding season
Other breeding birds IUCN NT/LC species	Low	Minor-adverse	Minor – not significant	Minor-Adverse	Minor	Pre-construction nest checks for works in breeding season
Nocturnal birds: IUCN LC species	Low	Minor-adverse	Minor – not significant	Minor-Adverse	Minor	Pre-construction nest checks for works in breeding season
Amphibians						
Amphibians (High)	High	Moderate – Adverse	Moderate	Minor - Adverse	Minor	Translocation: -Alpine Newt

Receptor	Sensitivity	Impact magnitude	Pre-mitigation impact significant	Residual impact magnitude	Significance	Additional requirements
						-Macedonian Crested Newt -Yellow-bellied Toad -Common Fire Salamander
Amphibians (Medium)	Medium	Moderate – Adverse	Minor – not significant	Minor - Adverse	Minor	Translocation: - Macedonian Crested Newt - Italian Crested Newt
Amphibians (Low)	Low	Moderate – Adverse	Not Significant	Minor - Adverse		
Reptiles						
Reptiles (Very High)	Very High	Moderate – Adverse	Moderate	Minor - Adverse	Moderate	Translocation of critical habitat features (see BMP for details)
Reptiles (High)	High	Moderate – Adverse	Moderate	Minor - Adverse	Minor	Translocation of reptiles
Reptiles (Low)	Low	Moderate – Adverse	Not Significant			
Invertebrates						
Invertebrates	High	Minor – Adverse	Minor – not significant	Negligible	Not Significant	N/A
Invertebrates	Medium	Minor – Adverse	Minor – not significant	Negligible	Not Significant	N/A
Fungi						
Fungi	High	Minor – Adverse	Minor – not significant	Negligible	Not Significant	N/A
	Medium	Minor – Adverse	Minor – not significant	Negligible	Not Significant	N/A

Table 8.35: Residual impact evaluation (Operation)

Receptor	Sensitivity	Impact Significance	Pre-mitigation impact significant	Residual impact	Significance	Additional requirements
Internationally recognised and legally protected areas						
Lake Mantovo and river Lakavica KBA and IBA	High	Negligible	Not significant	Negligible	Not Significant	N/A
Habitats						
Eastern *Quercus pubescens* woods	Very high	Negligible	Not significant			

Receptor	Sensitivity	Impact Significance	Pre-mitigation impact significant	Residual impact	Significance	Additional requirements
Helleno-Balkanic [Saturej a montana] steppes and Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion (temporary running waters)	High	Negligible	Not significant			
Abandoned arable land with ruderal vegetation, vineyards, fruit orchards, native conifer plantations, lines of trees: hedgerows, arable land, cropland, ponds and lakes with completely man-made substrate and bare/sparse vegetation.	Low	Moderate - Adverse	Not significant			
Flora						
Flora (Medium)	Medium	Minor - Adverse	Minor – not significant	Negligible	Not Significant	N/A
Flora (low)	Low/negligible	Minor - Adverse	Not significant			
Terrestrial mammals						
Terrestrial mammals	Low/negligible	Minor - Adverse	Not significant			
Bats						
Bats (Very High)	Very High	Moderate – Adverse	Moderate	Minor – Adverse	Moderate	Timed curtailment in high activity periods and/or smart curtailment via acoustic detectors (see BMP for details), post-construction fatality monitoring and achieve net gain by implementing a Biodiversity Action Plan.

Receptor	Sensitivity	Impact Significance	Pre-mitigation impact significant	Residual impact	Significance	Additional requirements
Bats (High)	High	Moderate - Adverse	Moderate	Minor - Adverse	Minor – not significant	Bird and bat operational management plan
Bats (Medium)	Medium	Minor - Adverse	Minor – not significant	Minor - Adverse	Minor	Bird and bat operational management plan
Bats (Low)	Low	Minor - Adverse	Not Significant			
Birds						
Large raptors: IUCN EN species- Egyptian vulture	High	Moderate-adverse	Moderate	Minor-Adverse	Minor	Bird and bat operational management plan. No Net Loss of PBF birds at part of the BAP
Large raptors: IUCN VU/NT/LC migratory species	High	Moderate-adverse	Moderate	Minor-Adverse	Minor	Bird and bat operational management plan No Net Loss of PBF birds at part of the BAP
Large raptors IUCN LC non-migratory species	Low	Minor-adverse	Minor – not significant	Minor-Adverse	Minor	Bird and bat operational management plan.
Small raptors IUCN LC migratory species	High	Moderate-adverse	Moderate	Minor-Adverse	Minor	Bird and bat operational management plan No Net Loss of PBF birds at part of the BAP
Small raptors IUCN LC non-migratory species	Low	Minor-adverse	Minor – not significant	Minor-Adverse	Minor	Bird and bat operational management plan No Net Loss of PBF birds at part of the BAP
Other migratory birds: IUCN VU/NT/LC species	High	Moderate-adverse	Moderate	Minor-Adverse	Minor	Bird and bat operational management plan No Net Loss of PBF birds at part of the BAP

Receptor	Sensitivity	Impact Significance	Pre-mitigation impact significant	Residual impact	Significance	Additional requirements
Other breeding birds IUCN NT/LC species	Low	Minor-adverse	Minor – not significant	Minor-Adverse	Minor	Bird and bat operational management plan No Net Loss of PBF birds at part of the BAP
Nocturnal birds: IUCN LC migratory species	High	Minor-adverse	Minor – not significant	Minor-Adverse	Minor	Bird and bat operational management plan No Net Loss of PBF birds at part of the BAP
Nocturnal birds: IUCN LC non-migratory species	Low	Moderate-adverse	Moderate	Minor-Adverse	Minor	Bird and bat operational management plan
Amphibians						
Amphibians (High)	High	Moderate – Adverse	Moderate	Negligible	Not Significant	N/A
Amphibians (Medium)	Medium	Moderate – Adverse	Minor – not significant	Negligible	Not Significant	N/A
Amphibians (Low)	Low	Moderate – Adverse	Not Significant			
Reptiles						
Reptiles (Very High)	Very High	Moderate – Adverse	Moderate	Negligible	Not Significant	Achieve net gain through the implementation of a BAP
Reptiles (High)	High	Moderate – Adverse	Moderate	Negligible	Not Significant	N/A
Reptiles (Low)	Low	Moderate – Adverse	Not Significant			
Invertebrates						
Invertebrates	High	Minor – Adverse	Minor – not significant	Negligible	Not Significant	N/A
Invertebrates	Medium	Minor – Adverse	Minor – not significant	Negligible	Not Significant	N/A
Fungi						
Fungi	High	Minor – Adverse	Minor – not significant	Negligible	Not Significant	N/A
	Medium	Minor – Adverse	Minor – not significant	Negligible	Not Significant	N/A

In addition, the other chapters of this ESIA relevant to biodiversity (Noise and Vibration, Ecosystem Services and Waste Management) conclude that, after mitigation measures are put in place, no significant adverse effects on biodiversity features are foreseen.

8.7.2 No net loss / net gain requirements

Projects located in Critical Habitat are required to achieve net gain for the critical habitat features for which the area is classified. Projects located in Natural Habitat (IFC definition) or where the Ecologically Appropriate Area of Analysis (EAAA) is classified for Priority Biodiversity Features (EBRD definition), the Project must achieve no net loss for those features.

For this Project, Critical Habitat features comprise Eastern *Quercus pubescens* woods (Annex I priority habitat),four reptile species listed under Annex II and IV of the Habitats Directive (four-lined snake, European ratsnake, Hermann's tortoise and Greek Tortoise / spur-thighed tortoise) and five bat species (barbastelle bat, Schreiber's bent-winged bat, Geoffroy's bat, greater mouse-eared bat and Lesser horseshoe bat). Priority Biodiversity Features include Annex I steppe habitats, Annex I bird species, and Annex IV bat species recorded within the AoI.

In this case, Project components are located within G1.73 - Eastern *Quercus pubescens* woods which is a priority habitat listed under Annex I of the EU Habitats Directive which is considered critical habitat under EBRD ESR6 and EIB ESS4 definition. Following the implementation of additional mitigation measures, such as translocations and habitat restoration, the BAP will need to incorporate a robust metric to calculate no net loss and net gain analysis for these features. Potential options include the Habitat Hectares approach (Parkes et al, 2003; McCarthy et al, 2004) or the Global Biodiversity Metric (Ramboll, 2024), adapted for local context. The selected metric should be transparent, repeatable, and capable of capturing both habitat quality and extent changes over time. Table 8.36 includes the known Critical Habitat and PBF identified and requirements which have been preliminarily calculated using the Project layout overlayed in GIS with the habitat map. The calculations below are based on the habitat loss calculations presented in Table 8.23 (for the whole Project) and Table 8.24 (for Phase 1 of the Project only). The estimated loss of critical habitat and Helleno-Balkanic (*Satureja montana*) steppes are presented in Table 8.36 for the whole Project and Table 8.37 for Phase 1 of the Project. An inventory of trees and habitat to be removed will be undertaken prior to construction to accurately calculate habitat loss and update the net gain requirements as part of the BAP.

Eastern white oak woods and Helleno-Balkanic [*Satureja montana*] steppes are widespread within the study area and are not considered irreplaceable habitats; therefore, any losses can be adequately offset through habitat restoration and replanting measures.

Table 8.36: NNL/NG requirements (Project)

Habitat	Critical Habitat/ Priority Biodiversity Feature	NNL/NG requirement	Permanent loss (ha)
G1.73 - Eastern white oak woods	Critical Habitat	NG	7.74
E1.21 - Helleno-Balkanic [Satureja montana] steppes	Priority Biodiversity Feature	NNL	7.91

Table 8.37: NNL/NG requirements (Phase 1 only)

Habitat	Critical Habitat/ Priority Biodiversity Feature	NNL/NG requirement	Permanent loss (ha)
G1.73 - Eastern *Quercus pubescens* woods	Critical Habitat	NG	2.23
E1.21 - Helleno-Balkanic [Satureja montana] steppes	Priority Biodiversity Feature	NNL	2.58

In addition to net gain requirements for habitats, net gain is also required for Critical Habitat features; barbastelle bat, Schreiber's bent-winged bat, Geoffroy's bat, greater mouse-eared bat and Lesser horseshoe bat, four-lined snake,European ratsnake, Hermann's tortoise and Greek Tortoise / spur-thighed tortoise. No net loss targets are also required for PBF. The Project is not expected to result in a residual loss of flora, amphibians or reptiles after implementation of mitigation measures presented in Section 8.6. Based on the CRA, impacts to collision risk to birds is considered not significant. No roosts will be lost due to the Project; however migratory bats have been identified within the AoI. To protect sensitive bat species and prevent mortality of critical habitat species until post-construction fatality monitoring results are obtained, timed curtailment will be applied targeting high activity periods of the high collision risk critical habitat species. Timed curtailment will be applied in September and October when Schreiber's bent-winged bat is active (one hour prior to dusk to one hour after dawn) for specific WTGs as identified based on construction baseline and/or smart curtailment via acoustic bat detectors installed at height at the WTGs or at ground level to determine bat activity and inform necessary shutdowns.

Bird and bat fatalities will be monitored during operation and adaptive management implemented to achieve no net loss of PBF features. Delivery of No Net Loss for PBF and Net Gain for Critical Habitat will be achieved through the BMP and BAP.

8.8 Monitoring and Adaptive Management

8.8.1 Monitoring Plans

Following the identification of mitigation measures and the requirement for a BMP in Chapter 8.6, this chapter outlines the framework for biodiversity monitoring and adaptive management during the construction and operational phases of the Project. Monitoring is essential to evaluate the effectiveness of mitigation actions, detect unforeseen impacts, and inform timely adjustments to management strategies.

The monitoring plans will focus on key biodiversity receptors identified in the baseline assessment, with particular emphasis on restoration of habitats and birds and bats (refer to Section 8.8.1.1). Monitoring will include both compliance-based checks and ecological performance indicators, and will be designed to generate robust, repeatable data over time.

Adaptive management will be guided by the results of monitoring, ensuring that mitigation measures remain effective and responsive to changing ecological conditions. Detailed monitoring protocols, including frequency, methods, and responsibilities, have been developed as part of the BMP. Given the presence of several CH species in the EAAAs, a BAP will also need to be developed.

Monitoring indicators will specifically track Critical Habitat features and Priority Biodiversity Features identified in Section 4.1.12 to evaluate No Net Loss / Net Gain outcomes required under EBRD ESR6 and EIB ESS4.

8.8.1.1 Bird and Bat operational monitoring plan overview

To ensure that biodiversity impacts during the operational phase are effectively managed, a dedicated Operational Monitoring Plan for birds and bats will be developed and implemented as part of the BMP. This plan will follow the guidance provided in the Post-Construction Fatality Monitoring (PCFM) framework (IFC, 2023), which outlines best practices for assessing collision risk, mortality rates, and behavioural changes. In addition, this plan will monitor bird and bat activity within the Project study area to understand changes in baseline activity. The monitoring programme will be species-specific, seasonally appropriate, and designed to generate robust data to inform adaptive management. Results from the monitoring will be used to evaluate the

effectiveness of mitigation measures and, where necessary, refine operational practices to reduce biodiversity impacts. This program will be implemented for a minimum of three years.

Current levels of collision risk for birds, based on the CRA (Chapter 9), are assessed as not significant. Consequently, the need for curtailment implementation is considered unlikely to be required at this stage. However, these conclusions are based on a single year of survey data. As such, they should be treated as preliminary and subject to refinement as additional monitoring is undertaken. Continued monitoring during the operational phase, as detailed in the BMP, will be essential for validating these initial findings. Should subsequent data indicate elevated collision rates or notable behavioural changes, the need for operational adjustments, including curtailment, will be reviewed and implemented as appropriate. Monitoring will include carcass persistence and searcher efficiency trials, consistent with IFC PCFM requirements. Raptor shutdown-on-demand and bat curtailment protocols will be evaluated through monitoring to determine their effectiveness in reducing collision mortality.

8.8.2 Adaptive Management Framework

Adaptive management is a core component of the biodiversity mitigation strategy. It provides a structured, responsive approach to managing ecological risks by using monitoring data to inform and adjust mitigation measures over time. This framework ensures that biodiversity outcomes remain effective and relevant under changing environmental conditions or in response to unforeseen impacts. Adaptive management triggers, including thresholds for species mortality and habitat recovery relevant to CH and PBF receptors, will be defined in the Bird and Bat Operational BMP/BAP.

The adaptive management process will be guided by the results of the monitoring plans outlined in this chapter. Where monitoring identifies that mitigation measures are not achieving the intended outcomes, corrective actions will be implemented. These may include modifying turbine operation schedules, enhancing habitat restoration efforts, or introducing new deterrent technologies.

Post-construction fatality monitoring will be undertaken during the first three years of operation under baseline operational conditions. Timed curtailment for sensitive species until fatality rates are obtained will be implemented as a day one mitigation measure, and approach is detailed in the BMP. If monitoring after the first year identifies bat mortality exceeding adaptive-management triggers defined in the Bird and Bat Operational BMP, further operational mitigation will be introduced, or existing mitigation measure enhanced. This may include the implementation of night-time and/or seasonal curtailment, or smart curtailment via automated detection systems integrated into SCADA, and a decision tree approach linking triggers to thresholds and to a single/series of actions may be integrated into Operational Management Plan . Any fatality of a bat species qualifying as critical habitat or a PBF, repeated fatalities at individual turbines, or persistence of elevated mortality following the introduction of curtailment will trigger further escalation, including turbine-specific smart curtailment, installation of bat detectors, and targeted deployment of additional mitigation technologies. The effectiveness of these measures will be reviewed through continued monitoring, with further adjustments applied as necessary to ensure residual impacts remain consistent with the Project’s No Net Loss objective for PBF and net gain for critical habitat bats.

The adaptive management framework will be embedded within the BMP, and where applicable, the BAP, and will include:

- Defined triggers for action based on ecological thresholds or performance indicators.

- A decision-making process involving Project ecologists, stakeholders, and regulatory authorities.
- A feedback loop to ensure that lessons learned are incorporated into future management.

This approach supports continuous improvement and ensures that biodiversity protection remains a dynamic and responsive element of Project operations.

8.8.3 Reporting and Review Mechanisms

Effective reporting and review mechanisms are essential to ensure transparency, accountability, and continuous improvement in biodiversity management throughout the Project lifecycle. Monitoring results, including data on species presence, habitat condition, and mitigation effectiveness, will be compiled into regular reports, typically on a quarterly and annual basis aligned with the requirements of the BMP and, where applicable, the Biodiversity Action Plan (BAP).

Reports will be submitted to relevant regulatory authorities, Project stakeholders, and conservation partners, and will include:

- Summary of monitoring activities and findings
- Evaluation of mitigation performance
- Identification of any non-compliance or emerging risks
- Recommendations for adaptive management actions

Reports will include an assessment of progress toward No Net Loss for PBF and Net Gain for Critical Habitat features. A formal review process will be established to assess monitoring outcomes and determine whether adjustments to mitigation or management strategies are required. This process will involve ecological specialists, Project managers, and external stakeholders where appropriate, and will be guided by predefined ecological thresholds and decision-making criteria.

These mechanisms will ensure that biodiversity commitments are met and that the Project remains responsive to changing environmental conditions and new information.

8.8.4 Global Biodiversity Information Facility

In line with EBRD ESR6, the Project Proponent has committed to make baseline biodiversity data generated by the Project publicly available via the Global Biodiversity Information Facility (GBIF). Where appropriate, non-sensitive monitoring data will also be shared to support transparency and contribute to international biodiversity knowledge.

8.9 Conclusion and Recommendations

The biodiversity assessment for the Project has been undertaken in accordance with IFC PS6, EBRD ESR6 and EIB ESS4. The study integrated desk-based research, comprehensive field surveys, and stakeholder input to establish a robust ecological baseline and evaluate potential impacts across the Project lifecycle. Key conclusions are presented below.

8.9.1 Conclusions

8.9.1.1 Baseline findings

The Project area supports a mosaic of natural and modified habitats, including Annex I habitats under the EU Habitats Directive. Eastern *Quercus pubescens* woods (Annex I Priority Habitat)

were identified as Critical Habitat, while Helleno-Balkanic steppes and temporary running waters qualify as Priority Biodiversity Features (PBF) under the EBRD definition.

The Project is located in critical habitat under EIB ESS4 due to five bat species (barbastelle bat, Schreiber's bent-winged bat, Geoffroy's bat, greater mouse-eared bat and lesser horseshoe bat) and four reptile species (four-lined snake,European ratsnake, Hermann's tortoise and Greek Tortoise / spur-thighed tortoise), listed in Annex II and Annex IV of Habitats Directive.

Species of conservation concern were recorded, including but not limited to IUCN Vulnerable bat species (*Barbastella barbastellus, Miniopterus schreibersii, Myotis capaccinii*), raptors such as Eastern Imperial Eagle, and reptiles such as Hermann's tortoise.

No invasive alien species were recorded during field surveys, although regional presence warrants precautionary measures.

8.9.1.2 Impact Assessment

Construction Phase: Habitat loss and fragmentation are the primary impacts, with temporary and permanent disturbance affecting natural habitats and species. Noise and human activity may cause displacement of fauna. Particular attention will be placed on impacts to reptile critical habitat features. To this end, a Fauna Protection and Relocation Plan has been developed (see details in the BMP) and will be implemented during the construction phase.

Operational Phase: The results of the collision risk assessment concluded that collision risk for birds is not significant (minor) but is moderate for bats. These residual impacts can be mitigated through operational mitigation measures, post-construction fatality monitoring and implementing adaptive management.

Decommissioning Phase: Impacts are expected to be positive overall, with opportunities for habitat restoration and biodiversity enhancement.

8.9.1.3 Compliance

The Project has applied the mitigation hierarchy (avoidance, minimisation, restoration and offsetting) and commits to achieving no net loss for natural habitats and PBF, and net gain for Critical Habitat features. A BMP has been developed to guide implementation and monitoring during construction and operation for the first three stages of the mitigation hierarchy. An offset plan will be developed to achieve net gain for Critical Habitat (Eastern white oaks woods and relevant bat and reptile species).

8.9.2 Recommendations

To ensure biodiversity safeguards and compliance with international standards, the following recommendations are proposed:

8.9.2.1 Mitigation and Management

Implement species-specific measures:

- Terrestrial fauna: Undertake slow directional vegetation clearance to enable fauna to move. Enforce speed limits and checks of excavations. Ensure appropriate food waste disposal is undertaken on site. No hunting, capturing or poisoning of fauna
- Amphibians and reptiles: Conduct checks for fauna and, where needed erect exclusion fencing and undertake local translocation prior to disruptive works
- Bats and Birds: Artificial lighting will be managed carefully to avoid attracting and dazing migrant birds and bats.

- Birds: Install bird diverters for raptors on 7km OHL, undertake nesting bird checks. Implement observer led shutdown.

Implement the BMP measures aligning with IFC PS6 and EBRD ESR6, including:

- A Vegetation Removal and Restoration Plan including measures to prevent introduction of invasive species
- Fauna Protection and Relocation Plan
- A Bird and Bat operational monitoring plan

Develop and implement a BAP and BMEP aligned EBRD ESR6 to demonstrate net gain of critical habitat.

8.9.2.2 Monitoring and Adaptive Management

Establish a long-term biodiversity monitoring programme covering:

- Collision mortality for birds and bats.
- Habitat condition and restoration success.
- Net gain for critical habitat species (barbastelle bat, Schreiber's bent-winged bat, Geoffroy's bat, greater mouse-eared bat, lesser horseshoe bat, four-lined snake, European ratsnake, Hermann’s tortoise and Greek Tortoise / spur-thighed tortoise).

Apply adaptive management to respond to monitoring results and emerging risks.

8.9.2.3 Stakeholder Engagement

Continue engagement with national authorities, NGOs, and local communities throughout construction and operation as part of the SEP. Share monitoring results transparently and incorporate feedback into management actions.

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A. Species list (IBAT, literature review and field survey)

A.1 Species list (IBAT, literature review and field survey)

Table A.1: Plant species identified utilising desk-based studies and field surveys.

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
PLANTAE						
Polypodiopsida	*Pilularia minuta*	Dwarf Pillwort	EN		FALSE	IBAT
Magnoliopsida	*Rhododendron myrtifolium*		EN		FALSE	IBAT
Bryopsida	*Brachythecium geheebii*		VU		FALSE	IBAT
Pinopsida	*Pinus peuce*	Balkan Pine	NT		FALSE	IBAT
Magnoliopsida	*Elatine alsinastrum*	Elatine Faux Alsine	NT		FALSE	IBAT
Magnoliopsida	*Sideritis scardica*	Mountain Tea	NT		FALSE	IBAT
Magnoliopsida	*Fraxinus excelsior*	Common Ash	NT		FALSE	IBAT
Magnoliopsida	*Prunus cocomilia*	Italian Plum	LC		FALSE	IBAT
Pinopsida	*Abies alba*	Silver Fir	LC		FALSE	IBAT
Pinopsida	*Pinus mugo*	Dwarf Mountain Pine	LC		FALSE	IBAT
Magnoliopsida	*Quercus petraea*	Sessile Oak	LC		FALSE	IBAT
Magnoliopsida	*Sorbus austriaca*	Sorbus hazslinszkyana	LC		FALSE	IBAT
Magnoliopsida	*Vitis vinifera*	Wild Grape	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Liliopsida	*Cyperus flavescens*		LC		FALSE	IBAT
Liliopsida	*Eleocharis carniolica*		LC		FALSE	IBAT
Polypodiopsida	*Marsilea quadrifolia*	Water Shamrock	LC		FALSE	IBAT
Magnoliopsida	*Artemisia eriantha*	Genépi Laineux	LC		FALSE	IBAT
Magnoliopsida	*Lindernia procumbens*	Creeping lindernia	LC		FALSE	IBAT
Liliopsida	*Carex malato-belizii*		LC		FALSE	IBAT
Magnoliopsida	*Samolus valerandi*	Brookweed	LC		FALSE	IBAT
Magnoliopsida	*Lycopus europaeus*	Gypsywort	LC		FALSE	IBAT
Liliopsida	*Alisma lanceolatum*	Narrow-leaved Water-plantain	LC		FALSE	IBAT
Magnoliopsida	*Persicaria hydropiper*	Water-pepper	LC		FALSE	IBAT
Magnoliopsida	*Utricularia australis*	Bladderwort	LC		FALSE	IBAT
Liliopsida	*Potamogeton pusillus*	Lesser Pondweed	LC		FALSE	IBAT
Liliopsida	*Juncus articulatus*		LC		FALSE	IBAT
Liliopsida	*Eleocharis palustris*	Common Spike-rush	LC		FALSE	IBAT
Magnoliopsida	*Menyanthes trifoliata*	Bogbean	LC		FALSE	IBAT
Liliopsida	*Iris pseudacorus*	Yellow Iris	LC	Not a Migrant	FALSE	IBAT
Liliopsida	*Agrostis stolonifera*	Creeping Bent Grass	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Liliopsida	*Potamogeton coloratus*	Fen Pondweed	LC		FALSE	IBAT
Magnoliopsida	*Helosciadium nodiflorum*	Fool's-water-cress	LC		FALSE	IBAT
Magnoliopsida	*Veronica anagallis-aquatica*	Blue Water-speedwell	LC		FALSE	IBAT
Liliopsida	*Fimbristylis bisumbellata*		LC		FALSE	IBAT
Liliopsida	*Potamogeton lucens*	Shining Pondweed	LC		FALSE	IBAT
Liliopsida	*Schoenoplectus triqueter*	Triangular Club-rush	LC		FALSE	IBAT
Liliopsida	*Fuirena pubescens*	Hairy Sedge	LC		FALSE	IBAT
Liliopsida	*Juncus bufonius*	Toad Rush	LC		FALSE	IBAT
Liliopsida	*Lemna minor*	Common Duckweed	LC		FALSE	IBAT
Liliopsida	*Carex acutiformis*	Lesser Pond-Sedge	LC		FALSE	IBAT
Magnoliopsida	*Elatine macropoda*	Elatine à Longs Pédicelles	LC		FALSE	IBAT
Magnoliopsida	*Lythrum junceum*	False Grass-poly	LC	Not a Migrant	FALSE	IBAT
Liliopsida	*Phalaris arundinacea*	Reed Canary-grass	LC		FALSE	IBAT
Liliopsida	*Juncus tenageia*		LC		FALSE	IBAT
Liliopsida	*Cyperus fuscus*	Brown Galingale	LC		FALSE	IBAT
Magnoliopsida	*Lythrum hyssopifolia*	Grass-poly	LC		FALSE	IBAT
Magnoliopsida	*Rorippa amphibia*	Great Yellow-cress	LC		FALSE	IBAT
Magnoliopsida	*Limosella aquatica*	Mudwort	LC		FALSE	IBAT
Liliopsida	*Juncus subnodulosus*	Blunt-flowered Rush	LC		FALSE	IBAT
Liliopsida	*Lemna gibba*	Fat Duckweed	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Liliopsida	*Carex paniculata*	Greater Tussock-sedge	LC		FALSE	IBAT
Liliopsida	*Vallisneria spiralis*	Tapegrass	LC		FALSE	IBAT
Magnoliopsida	*Montia fontana*	Blinks	LC		FALSE	IBAT
Liliopsida	*Hydrocharis morsus-ranae*	Frogbit	LC		FALSE	IBAT
Liliopsida	*Alisma plantago-aquatica*	Common Water-plantain	LC		FALSE	IBAT
Liliopsida	*Zannichellia palustris*	Horned Pondweed	LC	Not a Migrant	FALSE	IBAT
Magnoliopsida	*Ranunculus trichophyllus*	Thread-leaved Water-crowfoot	LC		FALSE	IBAT
Liliopsida	*Sparganium erectum*	Branched Bur-reed	LC		FALSE	IBAT
Magnoliopsida	*Trapa natans*	Water Caltrop	LC		FALSE	IBAT
Magnoliopsida	*Lythrum portula*	Spatulaleaf Loosestrife	LC		FALSE	IBAT
Liliopsida	*Alopecurus aequalis*	Orange Foxtail	LC		FALSE	IBAT
Liliopsida	*Cladium mariscus*	Great Fen-Sedge	LC		FALSE	IBAT
Liliopsida	*Typha latifolia*	Bulrush	LC		FALSE	IBAT
Liliopsida	*Sparganium natans*	Least Bur-reed	LC		FALSE	IBAT
Liliopsida	*Brachiaria eruciformis*	Giavone sottile	LC		FALSE	IBAT
Magnoliopsida	*Utricularia minor*	Lesser Bladderwort	LC		FALSE	IBAT
Liliopsida	*Groenlandia densa*	Opposite-leaved Pondweed	LC		FALSE	IBAT
Magnoliopsida	*Utricularia vulgaris*	Greater Bladderwort	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Magnoliopsida	*Ranunculus aquatilis*	Common Water-crowfoot	LC		FALSE	IBAT
Liliopsida	*Potamogeton perfoliatus*	Perfoliate Pondweed	LC		FALSE	IBAT
Liliopsida	*Typha angustifolia*	Lesser Bulrush	LC		FALSE	IBAT
Magnoliopsida	*Hydrocotyle vulgaris*	Marsh Pennywort	LC		FALSE	IBAT
Magnoliopsida	*Apium graveolens*	Wild Celery	LC		FALSE	IBAT
Liliopsida	*Schoenoplectus lacustris*		LC		FALSE	IBAT
Liliopsida	*Typha domingensis*	Southern Cat-tail	LC		FALSE	IBAT
Magnoliopsida	*Lythrum tribracteatum*	Threebract Loosestrife	LC	Not a Migrant	FALSE	IBAT
Liliopsida	*Juncus effusus*	Soft Rush	LC		FALSE	IBAT
Liliopsida	*Potamogeton nodosus*	Loddon Pondweed	LC		FALSE	IBAT
Liliopsida	*Spirodela polyrhiza*	Greater Duckweed	LC		FALSE	IBAT
Magnoliopsida	*Nymphaea alba*	European White Waterlily	LC		FALSE	IBAT
Liliopsida	*Eleocharis uniglumis*	Slender Spike-rush	LC		FALSE	IBAT
Liliopsida	*Wolffia arrhiza*	Rootless Duckweed	LC		FALSE	IBAT
Liliopsida	*Eleocharis acicularis*		LC		FALSE	IBAT
Magnoliopsida	*Mentha pulegium*	Pennyroyal	LC		FALSE	IBAT
Liliopsida	*Carex riparia*	Greater Pond-Sedge	LC		FALSE	IBAT
Magnoliopsida	*Ranunculus peltatus*	Pond Water-crowfoot	LC		FALSE	IBAT
Magnoliopsida	*Ranunculus rionii*	Renoncule de Rion	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Liliopsida	*Bolboschoenus maritimus*	Sea Club-Rush	LC		FALSE	IBAT
Magnoliopsida	*Ranunculus flammula*		LC		FALSE	IBAT
Liliopsida	*Cyperus longus*	Sweet Cyperus	LC		FALSE	IBAT
Liliopsida	*Cyperus difformis*	Smallflower Umbrella Sedge	LC		FALSE	IBAT
Liliopsida	*Triglochin bulbosa*		LC	Not a Migrant	FALSE	IBAT
Liliopsida	*Glyceria fluitans*	Floating Sweet-grass	LC		FALSE	IBAT
Magnoliopsida	*Callitriche brutia*	Pedunculate Water-Starwort	LC		FALSE	IBAT
Magnoliopsida	*Nymphoides peltata*		LC		FALSE	IBAT
Magnoliopsida	*Lythrum thymifolia*		LC	Not a Migrant	FALSE	IBAT
Magnoliopsida	*Nuphar lutea*	Yellow Water-lily	LC		FALSE	IBAT
Liliopsida	*Najas marina*	Holly-leaved Naiad	LC		FALSE	IBAT
Magnoliopsida	*Lythrum salicaria*	Purple Loosestrife	LC	Not a Migrant	FALSE	IBAT
Liliopsida	*Juncus acutus*	Spiny Rush	LC		FALSE	IBAT
Magnoliopsida	*Myriophyllum verticillatum*	Whorled Leaf Water Milfoil	LC		FALSE	IBAT
Liliopsida	*Arundo donax*	Giant Reed	LC		FALSE	IBAT
Magnoliopsida	*Ludwigia palustris*		LC		FALSE	IBAT
Liliopsida	*Eleocharis quinqueflora*	Few-flowered Spike-rush	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Liliopsida	*Potamogeton trichoides*	Hairlike Pondweed	LC		FALSE	IBAT
Liliopsida	*Carex acuta*	Slender Tufted-sedge	LC		FALSE	IBAT
Liliopsida	*Juncus bulbosus*		LC		FALSE	IBAT
Magnoliopsida	*Callitriche stagnalis*	Common Water-Starwort	LC		FALSE	IBAT
Liliopsida	*Zannichellia peltata*		LC		FALSE	IBAT
Magnoliopsida	*Berula erecta*	Lesser Water-parsnip	LC		FALSE	IBAT
Liliopsida	*Carex pseudocyperus*	Cyperus Sedge	LC		FALSE	IBAT
Magnoliopsida	*Gratiola officinalis*	Hedge Hyssop	LC		FALSE	IBAT
Magnoliopsida	*Myosotis laxa*	Tufted Forget-Me-Not	LC		FALSE	IBAT
Liliopsida	*Juncus fontanesii*		LC		FALSE	IBAT
Magnoliopsida	*Persicaria lapathifolia*		LC		FALSE	IBAT
Magnoliopsida	Paeonia peregrina Mill.	Balkan Peony	LC (Europe); NE globally			Surveys May 2025, June 2025
Liliopsida	Anacamptis morio (L.) R.M.Bateman, Pridgeon & M.W.Chase	Green-winged Orchid	NT (Europe); NE globally			Surveys May 2025
Magnoliopsida	Astragalus onobrychis L.	Sainfoin Milk-vetch	LC			Surveys May 2025, June 2025

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Magnoliopsida	Astragalus parnasii Boiss.	Parnassus Milk-vetch	NE			Surveys May 2025
Magnoliopsida	Morina persica L.	Persian Morina	NE			Surveys May 2025, June 2025
Magnoliopsida	Orobanche amethystea Thuill.	Amethyst Broomrape	NE			Surveys May 2025, June 2025
Magnoliopsida	Orobanche reticulata subsp. pallidiflora (Wimm. & Grab.) Hayek	Pale-flowered Broomrape	NE			Surveys May 2025
Magnoliopsida	Dictamnus albus L.	Burning Bush	LC (Europe)			Surveys May 2025, June 2025
Magnoliopsida	Salvia ringens Sibth. & Sm.	Ringed Sage	NE			Surveys June 2025
Liliopsida	Alium spherocephalon L.	Round-headed Leek	NE			Surveys June 2025
Magnoliopsida	Campanula cervicaria L.	Bristly Bellflower	NE			Surveys June 2025
Magnoliopsida	Hippomarathrum cristatum (DC.) Boiss.	Crested Hippomarathrum	NE			Surveys June 2025
Liliopsida	Colchicum doerfleri	Meadow Saffron	LC (European)		Balkan endemic	Surveys May 2025
Magnoliopsida	Pulsatilla vernalis	Spring Pasque Flower	LC		FALSE	IBAT
Magnoliopsida	Syringa vulgaris	Common lilac	LC		FALSE	IBAT
Magnoliopsida	Sorbus aucuparia	Rowan	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Magnoliopsida	Sorbus torminalis	Wild Service Tree	LC		FALSE	IBAT
Magnoliopsida	Fagus sylvatica	European Beech	LC		FALSE	IBAT
Magnoliopsida	Quercus trojana	Macedonian Oak	LC		FALSE	IBAT
Magnoliopsida	Salix appendiculata		LC		FALSE	IBAT
Magnoliopsida	Celtis tournefortii		LC		FALSE	IBAT
Magnoliopsida	Laburnum alpinum		LC		FALSE	IBAT
Magnoliopsida	Sorbus domestica	True Service Tree	LC		FALSE	IBAT
Magnoliopsida	Tamarix smyrnensis		LC		FALSE	IBAT
Magnoliopsida	Crataegus heldreichii		LC		FALSE	IBAT
Magnoliopsida	Frangula rupestris		LC		FALSE	IBAT
Magnoliopsida	Lonicera nigra	Schwarze Heckenkirsche	LC		FALSE	IBAT
Magnoliopsida	Staphylea pinnata	European Bladdernut	LC		FALSE	IBAT
Bryopsida	Ptychostomum bornholmense	Potato Bryum	LC		FALSE	IBAT
Liliopsida	Calamagrostis varia		LC		FALSE	IBAT
Magnoliopsida	Crataegus rhipidophylla		LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Magnoliopsida	Lotus herbaceus		LC		FALSE	IBAT
Magnoliopsida	Onobrychis hypargyrea		LC		FALSE	IBAT
Liliopsida	Fritillaria gussichiae		DD		FALSE	IBAT
Liliopsida	Alisma gramineum	Ribbon-leaved Water-plantain	DD		FALSE	IBAT
Liliopsida	Galanthus gracilis	Snowdrop	DD		FALSE	IBAT
Magnoliopsida	Ranunculus fontanus		DD		FALSE	IBAT
Magnoliopsida	Galium rhodopeum		DD		FALSE	IBAT
Magnoliopsida	Prunus webbii	Wild Almond	DD		FALSE	IBAT
Magnoliopsida	Quercus dalechampii		DD		FALSE	IBAT
Magnoliopsida	Aquilegia nigricans	Bulgarian Columbine	DD		FALSE	IBAT
Magnoliopsida	Galeopsis segetum	Downy Hemp-nettle	DD		FALSE	IBAT
Magnoliopsida	Glechoma hirsuta		DD		FALSE	IBAT
Magnoliopsida	Ulmus minor	Field Elm	DD		FALSE	IBAT
Magnoliopsida	Genista nissana	Macedonian Broom	DD		TRUE	IBAT
Magnoliopsida	Veronica catenata	Pink Water-speedwell	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Liliopsida	Potamogeton crispus	Curled Pondweed	LC		FALSE	IBAT
Liliopsida	Butomus umbellatus	Flowering-rush	LC		FALSE	IBAT
Liliopsida	Cyperus michelianus	Souchet de Michel	LC		FALSE	IBAT
Liliopsida	Bolboschoenus glaucus	Tuberous Bulrush	LC		FALSE	IBAT
Liliopsida	Najas minor		LC		FALSE	IBAT
Liliopsida	Panicum repens	Millet Rampant	LC		FALSE	IBAT
Magnoliopsida	Lysimachia vulgaris		LC		FALSE	IBAT
Magnoliopsida	Mentha spicata	Spearmint	LC		FALSE	IBAT
Liliopsida	Lemna trisulca		LC		FALSE	IBAT
Liliopsida	Glyceria notata	Plicate Sweet-grass	LC		FALSE	IBAT
Magnoliopsida	Lythrum borysthenicum	Loosestrife	LC	Not a Migrant	FALSE	IBAT
Liliopsida	Potamogeton natans	Broad-leaved Pondweed	LC		FALSE	IBAT
Magnoliopsida	Myriophyllum spicatum	Spiked Water-milfoil	LC		FALSE	IBAT
Liliopsida	Phragmites australis	Common Reed	LC		FALSE	IBAT
Magnoliopsida	Ranunculus lateriflorus		LC		FALSE	IBAT
Magnoliopsida	Oenanthe fistulosa	Tubular Water-dropwort	LC		FALSE	IBAT
Magnoliopsida	Mentha aquatica	Water Mint	LC		FALSE	IBAT
Liliopsida	Catabrosa aquatica	Whorl-grass	LC		FALSE	IBAT
Magnoliopsida	Veronica anagalloides	Véronique Faux Mouron	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Magnoliopsida	Haberlea rhodopensis		LC		FALSE	IBAT
Liliopsida	Sagittaria sagittifolia	Arrowhead	LC		FALSE	IBAT
Magnoliopsida	Ceratophyllum submersum	Soft Hornwort	LC		FALSE	IBAT
Liliopsida	Carex appropinquata		LC		FALSE	IBAT
Liliopsida	Carex lasiocarpa		LC		FALSE	IBAT
Liliopsida	Carex limosa		LC		FALSE	IBAT
Liliopsida	Carex rostrata		LC		FALSE	IBAT
Liliopsida	Carex vesicaria		LC		FALSE	IBAT
Liliopsida	Eriophorum angustifolium		LC		FALSE	IBAT
Polypodiopsida	Equisetum arvense	Field Horsetail	LC		FALSE	IBAT
Polypodiopsida	Equisetum fluviatile	Water Horsetail	LC		FALSE	IBAT
Polypodiopsida	Equisetum palustre	Marsh Horsetail	LC		FALSE	IBAT
Liliopsida	Agrostis canina	Velvet bent	LC		FALSE	IBAT
Liliopsida	Glyceria maxima	Reed Sweet-grass	LC		FALSE	IBAT
Liliopsida	Glyceria nemoralis		LC	Not a Migrant	FALSE	IBAT
Magnoliopsida	Hippuris vulgaris	Mare's-tail	LC		FALSE	IBAT
Liliopsida	Stratiotes aloides	Water-soldier	LC		FALSE	IBAT
Magnoliopsida	Rumex hydrolapathum	Water Dock	LC		FALSE	IBAT
Liliopsida	Potamogeton berchtoldii	Small Pondweed	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Liliopsida	Potamogeton gramineus	Various-leaved Pondweed	LC		FALSE	IBAT
Liliopsida	Potamogeton obtusifolius	Blunt-leaved Pondweed	LC		FALSE	IBAT
Liliopsida	Potamogeton praelongus	Long-stalked Pondweed	LC		FALSE	IBAT
Magnoliopsida	Hottonia palustris		LC		FALSE	IBAT
Magnoliopsida	Lysimachia nummularia	Creeping-Jenny	LC		FALSE	IBAT
Magnoliopsida	Caltha palustris		LC		FALSE	IBAT
Magnoliopsida	Ranunculus fluitans	River Water-crowfoot	LC		FALSE	IBAT
Magnoliopsida	Veronica beccabunga	Brooklime	LC		FALSE	IBAT
Magnoliopsida	Veronica scutellata	Marsh Speedwell	LC		FALSE	IBAT
Liliopsida	Sparganium angustifolium	Floating Bur-reed	LC		FALSE	IBAT
Liliopsida	Sparganium emersum	Unbranched Bur-reed	LC		FALSE	IBAT
Magnoliopsida	Cicuta virosa	European Waterhemlock	LC		FALSE	IBAT
Magnoliopsida	Oenanthe aquatica	Fine-leaved Water-dropwort	LC		FALSE	IBAT
Liliopsida	Lemna perpusilla		LC		FALSE	IBAT
Magnoliopsida	Bidens tripartita	Trifid Bur-marigold	LC		FALSE	IBAT
Liliopsida	Stuckenia pectinata	Fennel Pondweed	LC		FALSE	IBAT
Magnoliopsida	Brassica elongata	Long-stalked Rape	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Liliopsida	Aegilops comosa		LC		FALSE	IBAT
Magnoliopsida	Prunus avium	Sweet Cherry	LC		FALSE	IBAT
Liliopsida	Aegilops tauschii	Rough-spike Hard Grass	LC		FALSE	IBAT
Magnoliopsida	Prunus padus	Bird Cherry	LC		FALSE	IBAT
Liliopsida	Allium melanantherum		LC		FALSE	IBAT
Liliopsida	Triticum monococcum	Einkorn	LC		FALSE	IBAT
Magnoliopsida	Prunus mahaleb	Mahaleb Cherry	LC		FALSE	IBAT
Liliopsida	Aegilops triuncialis	Jointed Goat Grass	LC		FALSE	IBAT
Magnoliopsida	Prunus fruticosa	European Dwarf Cherry	LC		FALSE	IBAT
Magnoliopsida	Lactuca aurea		LC		FALSE	IBAT
Magnoliopsida	Prunus spinosa	Blackthorn	LC		FALSE	IBAT
Liliopsida	Aegilops caudata	Cretan Hard-grass	LC		FALSE	IBAT
Liliopsida	Aegilops geniculata	Ovate Goat Grass	LC		FALSE	IBAT
Liliopsida	Aegilops speltoides	Tandat Bockvete	LC		FALSE	IBAT
Liliopsida	Aegilops cylindrica	Jointed Goat Grass	LC		FALSE	IBAT
Liliopsida	Aegilops neglecta	Three-awn Goat Grass	LC		FALSE	IBAT
Liliopsida	Aegilops biuncialis	Mediterranean Aegilops	LC		FALSE	IBAT
Magnoliopsida	Prunus prostrata	Mountain Cherry	LC		FALSE	IBAT
Magnoliopsida	Pyrus spinosa	Almond-leaf Pear	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Magnoliopsida	Medicago prostrata		LC		FALSE	IBAT
Magnoliopsida	Medicago sativa	Alfalfa	LC		FALSE	IBAT
Liliopsida	Tripidium ravennae	Ravenna Grass	LC		FALSE	IBAT
Magnoliopsida	Ranunculus lingua	Greater Spearwort	LC		FALSE	IBAT
Liliopsida	Schoenoplectus tabernaemontani	Grey Club-rush	LC		FALSE	IBAT
Magnoliopsida	Lysimachia dubia		LC	Not a Migrant	FALSE	IBAT
Liliopsida	Bolboschoenus laticarpus		LC		FALSE	IBAT
Magnoliopsida	Bidens cernua	Nodding Bur-marigold	LC		FALSE	IBAT
Liliopsida	Beckmannia eruciformis		LC		FALSE	IBAT
Liliopsida	Cyperus glomeratus	Gecebiten	LC	Not a Migrant	FALSE	IBAT
Liliopsida	Cyperus glaber		LC		FALSE	IBAT
Magnoliopsida	Persicaria maculosa	Redshank	LC		FALSE	IBAT
Liliopsida	Dactylorhiza cordigera	Heart Shaped Lip Dactylorhiza	LC		FALSE	IBAT
Liliopsida	Neottia cordata	Lesser Twayblade	LC		FALSE	IBAT
Liliopsida	Ophrys insectifera	Fly Orchid	LC		FALSE	IBAT
Liliopsida	Epipactis purpurata	Violet Helleborine	LC		FALSE	IBAT
Liliopsida	Dactylorhiza sambucina	Elder-flowered Orchid	LC		FALSE	IBAT
Liliopsida	Gymnadenia frivaldii	Frivald's Gymnadenia	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Magnoliopsida	Rorippa kerneri		LC		FALSE	IBAT
Magnoliopsida	Onobrychis viciifolia	Sainfoin	LC		FALSE	IBAT
Magnoliopsida	Rorippa lippizensis		LC		FALSE	IBAT
Magnoliopsida	Trifolium incarnatum	Crimson Clover	LC		FALSE	IBAT
Magnoliopsida	Medicago rigidula	Tifton Bur Clover	LC		FALSE	IBAT
Magnoliopsida	Medicago constricta		LC		FALSE	IBAT
Magnoliopsida	Medicago scutellata	Snail Medic	LC		FALSE	IBAT
Magnoliopsida	Medicago truncatula	Barrel Clover	LC		FALSE	IBAT
Magnoliopsida	Barbarea balcana	Balkan Yellow Rocket	LC		FALSE	IBAT
Magnoliopsida	Medicago doliata	Keg Medic	LC		FALSE	IBAT
Magnoliopsida	Medicago littoralis	Shore Medick	LC		FALSE	IBAT
Magnoliopsida	Medicago turbinata		LC		FALSE	IBAT
Magnoliopsida	Persicaria amphibia	Amphibious Bistort	LC		FALSE	IBAT
Liliopsida	Narcissus poeticus	Pheasant's-eye narcissus	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Magnoliopsida	Acer heldreichii	Mountain Maple	LC		FALSE	IBAT
Magnoliopsida	Acer monspessulanum	Montpellier Maple	LC		FALSE	IBAT
Magnoliopsida	Quercus cerris	Turkey Oak	LC	Unknown	FALSE	IBAT
Magnoliopsida	Quercus pubescens	Downy Oak	LC		FALSE	IBAT
Magnoliopsida	Achillea crithmifolia	Yarrow	LC		FALSE	IBAT
Magnoliopsida	Alchemilla xanthochlora	Lady's Mantle	LC	Not a Migrant	FALSE	IBAT
Magnoliopsida	Pulsatilla halleri	Haller's anemone	LC		FALSE	IBAT
Magnoliopsida	Artemisia umbelliformis	Alpine Wormwood	LC		FALSE	IBAT
Magnoliopsida	Castanea sativa	Sweet Chestnut	LC		FALSE	IBAT
Magnoliopsida	Cotinus coggygria	Smoke-bush	LC	Not a Migrant	FALSE	IBAT
Magnoliopsida	Sempervivum marmoreum	Houseleek	LC		FALSE	IBAT
Magnoliopsida	Gentiana punctata	Spotted Gentian	LC		FALSE	IBAT
Magnoliopsida	Tilia platyphyllos	Large-leaved Lime	LC		FALSE	IBAT
Magnoliopsida	Crataegus laevigata	Midland Hawthorn	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Magnoliopsida	Rosa pendulina	Alpen-Rose	LC		FALSE	IBAT
Magnoliopsida	Populus alba	White Poplar	LC		FALSE	IBAT
Magnoliopsida	Salix purpurea	Purple Willow	LC		FALSE	IBAT
Liliopsida	Lilium chalcedonicum		LC		FALSE	IBAT
Liliopsida	Sesleria autumnalis	Autumn Moor Grass	LC		FALSE	IBAT
Magnoliopsida	Silene vulgaris	Bladder Campion	LC		FALSE	IBAT
Magnoliopsida	Arbutus andrachne	Greek Strawberry Tree	LC		FALSE	IBAT
Magnoliopsida	Ferula communis	Giant Fennel	LC		FALSE	IBAT
Magnoliopsida	Pistacia terebinthus	Eastern Turpentine Tree	LC		FALSE	IBAT

Table A.2: Fungi species identified utilising desk-based studies and field surveys.

Class	Scientific name	Common name	IUCN Category	Movement pattern	Restricted range	Source
FUNGI						
Agaricomycetes	*Hyphoderma etruriae*	Етрурска коричка	EN	N/A	FALSE	IBAT
Agaricomycetes	*Hapalopilus croceus*	Orange Polypore	VU		FALSE	IBAT

Class	Scientific name	Common name	IUCN Category	Movement pattern	Restricted range	Source
Agaricomycetes	*Buglossoporus quercinus*	Oak Polypore	VU		FALSE	IBAT
Agaricomycetes	*Tricholoma acerbum*	bittermusseron	VU		FALSE	IBAT
Agaricomycetes	*Bovista paludosa*	Fen Puffball	VU		FALSE	IBAT
Agaricomycetes	*Arrhenia discorosea*	Kalichovka fialovoružová	VU		FALSE	IBAT
Agaricomycetes	*Alessioporus ichnusanus*	Boleto Sardo	VU		FALSE	IBAT
Agaricomycetes	*Hygrocybe ovina*	Blushing Waxcap	VU		FALSE	IBAT
Agaricomycetes	*Hygrocybe punicea*	Crimson Waxcap	VU		FALSE	IBAT
Agaricomycetes	*Xeromphalina junipericola*	Фоина труба	VU		FALSE	IBAT
Agaricomycetes	*Boletopsis grisea*	Grey Falsebolete	NT		FALSE	IBAT
Agaricomycetes	*Rhodotus palmatus*	Wrinkled Peach	NT		FALSE	IBAT
Agaricomycetes	*Rubroboletus dupainii*	Dupain’s Bolete	NT		FALSE	IBAT
Agaricomycetes	*Rubroboletus rhodoxanthus*	Ruddy Bolete	NT		FALSE	IBAT
Agaricomycetes	*Catathelasma imperiale*	Imperial Mushroom	NT		FALSE	IBAT
Sordariomycetes	*Poronia punctata*	Nail Fungus	LC		FALSE	IBAT

Class	Scientific name	Common name	IUCN Category	Movement pattern	Restricted range	Source
Agaricomycetes	*Hericium erinaceus*	Bearded Tooth	LC		FALSE	IBAT
Agaricomycetes	*Craterellus cornucopioides*	Horn of Plenty	LC		FALSE	IBAT
Agaricomycetes	*Craterellus tubaeformis*	Trumpet Chanterelle	LC		FALSE	IBAT
Agaricomycetes	*Montagnea radiosa*	Květka písečná	LC		FALSE	IBAT
Agaricomycetes	*Amanita caesarea*	Caesar's Amanita	LC		FALSE	IBAT
Lecanoromycetes	*Flavoparmelia caperata*	Common Green Shield	LC		FALSE	IBAT
Lecanoromycetes	*Parmelia saxatilis*	Salted Shield Lichen	LC		FALSE	IBAT
Lecanoromycetes	*Parmeliopsis ambigua*	Green Starburst Lichen	LC		FALSE	IBAT
Lecanoromycetes	*Parmeliopsis hyperopta*	Grey Starburst Lichen	LC		FALSE	IBAT

Table A.3: Fauna species identified utilising desk-based studies and field surveys.

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Mammalia	*Spermophilus citellus*	European Ground Squirrel	EN		FALSE	IBAT
Mammalia	*Dinaromys bogdanovi*	Balkan Snow Vole	VU		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Mammalia	*Myotis capaccinii*	Long-fingered Bat	VU		FALSE	IBAT, Myotis sp. recorded during surveys
Mammalia	*Rhinolophus mehelyi*	Mehely's Horseshoe Bat	VU		FALSE	IBAT
Mammalia	*Vormela peregusna*	Marbled Polecat	VU	Not a Migrant	FALSE	IBAT
Mammalia	*Miniopterus schreibersii*	Schreiber's Bent-winged Bat	VU	Full Migrant	FALSE	IBAT, Surveys 2024-2025
Mammalia	*Myotis blythii*	Lesser Mouse-eared Myotis	LC		FALSE	IBAT, Myotis sp. recorded during surveys
Mammalia	*Myotis emarginatus*	Geoffroy's Bat	LC		FALSE	IBAT, Myotis sp. recorded during surveys
Mammalia	*Myotis mystacinus*	Whiskered Bat	LC		FALSE	IBAT, Myotis sp. recorded during surveys
Mammalia	*Myotis aurascens*	Steppe Whiskered Bat	LC		FALSE	IBAT, Myotis sp. recorded during surveys
Mammalia	*Barbastella barbastellus*	Barbastelle Bat	NT		FALSE	IBAT, Surveys 2024-2025
Mammalia	*Lutra lutra*	Eurasian Otter	NT	Not a Migrant	FALSE	IBAT
Mammalia	*Rhinolophus euryale*	Mediterranean Horseshoe Bat	NT		FALSE	IBAT
Mammalia	*Plecotus austriacus*	Grey Long-eared Bat	NT		FALSE	IBAT, Surveys 2024-2025
Mammalia	*Apodemus agrarius*	Striped Field Mouse	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Mammalia	*Apodemus flavicollis*	Yellow-necked Field Mouse	LC		FALSE	IBAT
Mammalia	*Apodemus sylvaticus*	Long-tailed Field Mouse	LC		FALSE	IBAT
Mammalia	*Canis lupus*	Grey Wolf	LC		FALSE	IBAT
Mammalia	*Chionomys syriacus*	European Snow Vole	LC		FALSE	IBAT
Mammalia	*Clethrionomys glareolus*	Bank Vole	LC		FALSE	IBAT
Mammalia	*Dryomys nitedula*	Forest Dormouse	LC		FALSE	IBAT
Mammalia	*Lynx lynx*	Eurasian Lynx	LC		FALSE	IBAT
Mammalia	*Martes martes*	Pine Marten	LC	Not a Migrant	FALSE	IBAT
Mammalia	*Micromys minutus*	Eurasian Harvest Mouse	LC		FALSE	IBAT
Mammalia	*Microtus mystacinus*	East European Vole	LC		FALSE	IBAT
Mammalia	*Myotis myotis*	Greater Mouse-eared Bat	LC	Full Migrant	FALSE	IBAT, Myotis sp. recorded during surveys
Mammalia	*Microtus felteni*	Balkan Pine Vole	LC		FALSE	IBAT
Mammalia	*Nyctalus leisleri*	Leisler's Bat	LC	Full Migrant	FALSE	IBAT, Surveys 2024-2025
Mammalia	*Nyctalus noctula*	Common Noctule	LC	Full Migrant	FALSE	IBAT, Surveys 2024-2025
Mammalia	*Microtus arvalis*	Common Vole	LC		FALSE	IBAT
Mammalia	*Pipistrellus nathusii*	Nathusius' Pipistrelle	LC	Full Migrant	FALSE	IBAT, Surveys 2024-2025
Mammalia	*Microtus subterraneus*	European Pine Vole	LC		FALSE	IBAT
Mammalia	*Mus macedonicus*	Macedonian Mouse	LC		FALSE	IBAT
Mammalia	*Mus musculus*	House Mouse	LC		FALSE	IBAT
Mammalia	*Muscardinus avellanarius*	Hazel Dormouse	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Mammalia	*Pipistrellus kuhlii*	Kuhl's Pipistrelle	LC		FALSE	IBAT, Surveys 2024-2025
Mammalia	*Vespertilio murinus*	Parti-coloured Bat	LC	Full Migrant	FALSE	IBAT, Surveys 2024-2025
Mammalia	*Rattus norvegicus*	Brown Rat	LC		FALSE	IBAT
Mammalia	*Rhinolophus blasii*	Blasius's Horseshoe Bat	LC		FALSE	IBAT
Mammalia	*Rhinolophus ferrumequinum*	Greater Horseshoe Bat	LC		FALSE	IBAT
Mammalia	*Rhinolophus hipposideros*	Lesser Horseshoe Bat	LC		FALSE	IBAT, Surveys 2024-2025
Mammalia	*Tadarida teniotis*	European Free-tailed Bat	LC		FALSE	IBAT, Surveys 2024-2025
Mammalia	*Vulpes vulpes*	Red Fox	LC		FALSE	IBAT, surveys May, June and September 2025
Mammalia	*Crocidura leucodon*	Bicolored Shrew	LC		FALSE	IBAT
Mammalia	*Crocidura gueldenstaedtii*	GueldenstÃ¤dt's Shrew	LC		FALSE	IBAT
Mammalia	*Neomys anomalus*	Southern Water Shrew	LC		FALSE	IBAT
Mammalia	*Neomys fodiens*	Eurasian Water Shrew	LC		FALSE	IBAT
Mammalia	*Sorex araneus*		LC		FALSE	IBAT
Mammalia	*Sorex minutus*	Eurasian Pygmy Shrew	LC		FALSE	IBAT
Mammalia	*Martes foina*	Beech Marten	LC	Not a Migrant	FALSE	IBAT, surveys May, June and September 2025
Mammalia	*Meles meles*	Eurasian Badger	LC	Not a Migrant	FALSE	IBAT, surveys May, June and September 2025
Mammalia	*Glis glis*	Edible Dormouse	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Mammalia	*Lepus europaeus*	European Hare	LC	Not a Migrant	FALSE	IBAT, surveys May, June and September 2025
Mammalia	*Talpa caeca*	Mediterranean Mole	LC		FALSE	IBAT
Mammalia	*Talpa stankovici*	Balkan Mole	LC		FALSE	IBAT
Mammalia	*Mustela putorius*	Western Polecat	LC	Not a Migrant	FALSE	IBAT
Mammalia	*Ursus arctos*	Brown Bear	LC		FALSE	IBAT
Mammalia	*Sus scrofa*	Wild Boar	LC		FALSE	IBAT
Mammalia	*Dama dama*	Common Fallow Deer	LC		FALSE	IBAT
Mammalia	*Capreolus capreolus*	European Roe Deer	LC		FALSE	IBAT, Surveys June 2025
Mammalia	*Hypsugo savii*	Savi's Pipistrelle	LC		FALSE	IBAT, Surveys 2024-2025
Mammalia	*Erinaceus roumanicus*	Northern White-breasted Hedgehog	LC		FALSE	IBAT, Surveys June 2025
Mammalia	*Apodemus epimelas*	Western Broad-toothed Field Mouse	LC		FALSE	IBAT
Mammalia	*Cervus elaphus*	Red Deer	LC	Full Migrant	FALSE	IBAT
Mammalia	*Mustela nivalis*	Least Weasel	LC	Not a Migrant	FALSE	IBAT
Mammalia	*Eptesicus serotinus*	Serotine	LC	Full Migrant	FALSE	IBAT, Surveys 2024-2025
Mammalia	*Pipistrellus pipistrellus*	Common Pipistrelle	LC	Full Migrant	FALSE	IBAT, Surveys 2024-2025
Mammalia	*Myotis daubentonii*	Daubenton's Bat	LC	Full Migrant	FALSE	IBAT
Mammalia	*Plecotus auritus*	Brown Long-eared Bat	LC		FALSE	IBAT
Mammalia	*Myotis brandtii*	Brandt's Bat	LC	Full Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Mammalia	*Suncus etruscus*	Pygmy White-toothed Shrew	LC		FALSE	IBAT
Mammalia	*Canis aureus*	Golden Jackal	LC		FALSE	IBAT
Mammalia	*Felis silvestris*	European Wildcat	LC		FALSE	IBAT
Mammalia	*Myotis nattereri*	Natterer's Bat	LC		FALSE	IBAT
Mammalia	*Arvicola amphibius*	Eurasian Water Vole	LC		FALSE	IBAT
Mammalia	*Sciurus vulgaris*	Eurasian Red Squirrel	LC		FALSE	IBAT
Mammalia	*Neomys milleri*	Miller's Water Shrew	LC		FALSE	IBAT
Mammalia	*Talpa europaea*	European Mole	LC		FALSE	IBAT
Mammalia	*Nannospalax leucodon*	Lesser Blind Mole Rat	DD		FALSE	IBAT
Aves	*Oxyura leucocephala*	White-headed Duck	EN	Full Migrant	FALSE	IBAT
Aves	*Neophron percnopterus*	Egyptian Vulture	EN	Full Migrant	FALSE	IBAT
Aves	*Falco cherrug*	Saker Falcon	EN	Full Migrant	FALSE	IBAT
Aves	*Anser erythropus*	Lesser White-fronted Goose	VU	Full Migrant	FALSE	IBAT
Aves	*Streptopelia turtur*	European Turtle-dove	VU	Full Migrant	FALSE	IBAT
Aves	*Clanga clanga*	Greater Spotted Eagle	VU	Full Migrant	FALSE	IBAT
Aves	*Aquila heliaca*	Eastern Imperial Eagle	VU	Full Migrant	FALSE	IBAT
Aves	*Falco vespertinus*	Red-footed Falcon	VU	Full Migrant	FALSE	IBAT
Aves	*Alectoris graeca*	Rock Partridge	NT	Altitudinal Migrant	FALSE	IBAT
Aves	*Aythya nyroca*	Ferruginous Duck	NT	Full Migrant	FALSE	IBAT
Aves	*Gallinago media*	Great Snipe	NT	Full Migrant	FALSE	IBAT
Aves	*Limosa limosa*	Black-tailed Godwit	NT	Full Migrant	FALSE	IBAT
Aves	*Numenius arquata*	Eurasian Curlew	NT	Full Migrant	FALSE	IBAT
Aves	*Vanellus vanellus*	Northern Lapwing	NT	Full Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Aves	*Circus macrourus*	Pallid Harrier	NT	Full Migrant	FALSE	IBAT
Aves	*Pelecanus crispus*	Dalmatian Pelican	NT	Full Migrant	FALSE	IBAT
Aves	*Lanius senator*	Woodchat Shrike	NT	Full Migrant	FALSE	IBAT
Aves	*Turdus iliacus*	Redwing	NT	Full Migrant	FALSE	IBAT
Aves	*Accipiter gentilis*	Northern Goshawk	LC	Full Migrant	FALSE	IBAT
Aves	*Accipiter nisus*	Eurasian Sparrowhawk	LC	Full Migrant	FALSE	#N/A
Aves	*Aegithalos caudatus*	Long-tailed Tit	LC	Full Migrant	FALSE	IBAT
Aves	*Alauda arvensis*	Eurasian Skylark	LC	Full Migrant	FALSE	IBAT
Aves	*Anthus pratensis*	Meadow Pipit	LC	Full Migrant	FALSE	IBAT
Aves	*Anthus spinoletta*	Water Pipit	LC	Full Migrant	FALSE	IBAT
Aves	*Anthus trivialis*	Tree Pipit	LC	Full Migrant	FALSE	IBAT
Aves	*Buteo buteo*	Common Buzzard	LC	Full Migrant	FALSE	#N/A
Aves	*Buteo rufinus*	Long-legged Buzzard	LC	Full Migrant	FALSE	#N/A
Aves	*Calandrella brachydactyla*	Greater Short-toed Lark	LC	Full Migrant	FALSE	IBAT
Aves	*Carduelis carduelis*	European Goldfinch	LC	Full Migrant	FALSE	IBAT
Aves	*Carduelis spinus*	Eurasian Siskin	LC	Full Migrant	FALSE	IBAT
Aves	*Chloris chloris*	European Greenfinch	LC	Full Migrant	FALSE	IBAT
Aves	*Circus aeruginosus*	Western Marsh Harrier	LC	Full Migrant	FALSE	#N/A
Aves	*Circus cyaneus*	Hen Harrier	LC	Full Migrant	FALSE	#N/A
Aves	*Coccothraustes coccothraustes*	Hawfinch	LC	Full Migrant	FALSE	IBAT
Aves	*Columba livia domestica*	Rock Dove (Domestic Pigeon)	LC	Not a Migrant	FALSE	#N/A
Aves	*Columba oenas*	Stock Dove	LC	Full Migrant	FALSE	#N/A

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Aves	*Columba palumbus*	Common Wood Pigeon	LC	Full Migrant	FALSE	#N/A
Aves	*Corvus corax*	Common Raven	LC	Full Migrant	FALSE	#N/A
Aves	*Corvus cornix*	Hooded Crow	LC	Not a Migrant	FALSE	#N/A
Aves	*Cyanistes caeruleus*	Eurasian Blue Tit	LC	Not a Migrant	FALSE	IBAT
Aves	*Dendrocopos major*	Great Spotted Woodpecker	LC	Not a Migrant	FALSE	#N/A
Aves	*Dendrocopos minor*	Lesser Spotted Woodpecker	LC	Not a Migrant	FALSE	IBAT
Aves	*Dryocopus martius*	Black Woodpecker	LC	Not a Migrant	FALSE	IBAT
Aves	*Emberiza calandra*	Corn Bunting	LC	Not a Migrant	FALSE	#N/A
Aves	*Emberiza cia*	Rock Bunting	LC	Not a Migrant	FALSE	#N/A
Aves	*Emberiza cirlus*	Cirl Bunting	LC	Not a Migrant	FALSE	#N/A
Aves	*Emberiza citrinella*	Yellowhammer	LC	Not a Migrant	FALSE	#N/A
Aves	*Emberiza schoeniclus*	Reed Bunting	LC	Full Migrant	FALSE	IBAT
Aves	*Erithacus rubecula*	European Robin	LC	Not a Migrant	FALSE	IBAT
Aves	*Falco tinnunculus*	Common Kestrel	LC	Not a Migrant	FALSE	IBAT
Aves	*Fringilla coelebs*	Common Chaffinch	LC	Not a Migrant	FALSE	IBAT
Aves	*Fringilla montifringilla*	Brambling	LC	Full Migrant	FALSE	IBAT
Aves	*Galerida cristata*	Crested Lark	LC	Full Migrant	FALSE	IBAT
Aves	*Garrulus glandarius*	Eurasian Jay	LC	Not a Migrant	FALSE	IBAT, surveys 2024-2025
Aves	*Lanius excubitor*	Great Grey Shrike	LC	Full Migrant	FALSE	IBAT
Aves	*Linaria cannabina*	Common Linnet	LC	Not a Migrant	FALSE	IBAT
Aves	*Lullula arborea*	Woodlark	LC	Not a Migrant	FALSE	IBAT
Aves	*Melanocorypha calandra*	Calandra Lark	LC	Not a Migrant	FALSE	IBAT
Aves	*Parus major*	Great Tit	LC	Not a Migrant	FALSE	#N/A

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Aves	*Passer domesticus*	House Sparrow	LC	Not a Migrant	FALSE	IBAT
Aves	*Passer montanus*	Eurasian Tree Sparrow	LC	Not a Migrant	FALSE	IBAT
Aves	*Petronia petronia*	Rock Sparrow	LC	Not a Migrant	FALSE	IBAT
Aves	*Phasianus colchicus*	Common Pheasant	LC	Not a Migrant	FALSE	IBAT, surveys 2024-2025
Aves	*Phoenicurus ochruros*	Black Redstart	LC	Full Migrant	FALSE	IBAT
Aves	*Phylloscopus collybita*	Common Chiffchaff	LC	Full Migrant	FALSE	IBAT
Aves	*Phylloscopus trochilus*	Willow Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Pica pica*	Eurasian Magpie	LC	Not a Migrant	FALSE	IBAT
Aves	*Picus viridis*	European Green Woodpecker	LC	Not a Migrant	FALSE	IBAT
Aves	*Poecile lugubrus*	Sombre Tit	LC	Not a Migrant	FALSE	#N/A
Aves	*Poecile palustris*	Marsh Tit	LC	Not a Migrant	FALSE	#N/A
Aves	*Prunela modularis*	Dunnock	LC	Not a Migrant	FALSE	IBAT
Aves	*Pyrrhula pyrrhula*	Eurasian Bullfinch	LC	Not a Migrant	FALSE	IBAT
Aves	*Regulus ignicapilla*	Firecrest	LC	Full Migrant	FALSE	IBAT
Aves	*Regulus regulus*	Goldcrest	LC	Not a Migrant	FALSE	IBAT
Aves	*Saxicola rubicola*	European Stonechat	LC	Not a Migrant	FALSE	IBAT
Aves	*Sturnus vulgaris*	Common Starling	LC	Not a Migrant	FALSE	IBAT
Aves	*Sylvia atricapilla*	Eurasian Blackcap	LC	Full Migrant	FALSE	IBAT
Aves	*Troglodytes troglodytes*	Eurasian Wren	LC	Not a Migrant	FALSE	IBAT
Aves	*Turdus merula*	Common Blackbird	LC	Not a Migrant	FALSE	IBAT
Aves	*Turdus philomelos*	Song Thrush	LC	Full Migrant	FALSE	IBAT
Aves	*Turdus pilaris*	Fieldfare	LC	Full Migrant	FALSE	IBAT
Aves	*Turdus viscivorus*	Mistle Thrush	LC	Not a Migrant	FALSE	IBAT
Aves	*Gyps fulvus*	Griffon Vulture	LC	Full Migrant	FALSE	IBAT, GBIF

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Aves	*Coracias garrulus*	European Roller	LC	Full Migrant	FALSE	IBAT
Aves	*Lanius nubicus*	Masked shrike	LC	Full Migrant	FALSE	IBAT
Aves	*Burhinus oedicnemus*	Eurasian Thick-knee	LC	Not a Migrant	FALSE	IBAT, KBA
Aves	*Certhia familiaris*	Eurasian Treecreeper	LC	Not a Migrant	FALSE	IBAT
Aves	*Ixobrychus minutus*	Common Little Bittern	LC	Full Migrant	FALSE	IBAT
Aves	*Ficedula parva*	Red-breasted Flycatcher	LC	Full Migrant	FALSE	IBAT
Aves	*Periparus ater*	Coal Tit	LC	Not a Migrant	FALSE	IBAT
Aves	*Falco peregrinus*	Peregrine Falcon	LC	Not a Migrant	FALSE	IBAT
Aves	*Gallinula chloropus*	Common Moorhen	LC	Not a Migrant	FALSE	IBAT
Aves	*Egretta garzetta*	Little Egret	LC	Not a Migrant	FALSE	IBAT
Aves	*Oriolus oriolus*	Eurasian Golden Oriole	LC	Full Migrant	FALSE	IBAT
Aves	*Nucifraga caryocatactes*	Northern Nutcracker	LC	Not a Migrant	FALSE	IBAT
Aves	*Poecile lugubris*	Sombre Tit	LC	Not a Migrant	FALSE	IBAT
Aves	*Oenanthe oenanthe*	Northern Wheatear	LC	Full Migrant	FALSE	IBAT
Aves	*Delichon urbicum*	Northern House Martin	LC	Full Migrant	FALSE	IBAT
Aves	*Cecropis daurica*	Red-rumped Swallow	LC	Full Migrant	FALSE	IBAT
Aves	*Riparia riparia*	Collared Sand Martin	LC	Full Migrant	FALSE	IBAT
Aves	*Montifringilla nivalis*	White-winged Snowfinch	LC	Not a Migrant	FALSE	IBAT
Aves	*Motacilla flava*	Western Yellow Wagtail	LC	Full Migrant	FALSE	IBAT
Aves	*Curruca cantillans*	Subalpine Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Sitta europaea*	Eurasian Nuthatch	LC	Not a Migrant	FALSE	IBAT
Aves	*Acrocephalus arundinaceus*	Great Reed-warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Otus scops*	Eurasian Scops-owl	LC	Full Migrant	FALSE	IBAT
Aves	*Poecile montanus*	Willow Tit	LC	Altitudinal Migrant	FALSE	IBAT
Aves	*Remiz pendulinus*	Eurasian Penduline-tit	LC	Full Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Aves	*Milvus migrans*	Black Kite	LC	Full Migrant	FALSE	IBAT
Aves	*Coturnix coturnix*	Common Quail	LC	Full Migrant	FALSE	IBAT
Aves	*Tetrastes bonasia*	Hazel Grouse	LC	Not a Migrant	FALSE	IBAT
Aves	*Cygnus olor*	Mute Swan	LC	Full Migrant	FALSE	IBAT
Aves	*Anser fabalis*	Bean Goose	LC	Full Migrant	FALSE	IBAT
Aves	*Anser albifrons*	Greater White-fronted Goose	LC	Full Migrant	FALSE	IBAT
Aves	*Anser anser*	Greylag Goose	LC	Full Migrant	FALSE	IBAT
Aves	*Mareca strepera*	Gadwall	LC	Full Migrant	FALSE	IBAT
Aves	*Mareca penelope*	Eurasian Wigeon	LC	Full Migrant	FALSE	IBAT
Aves	*Anas platyrhynchos*	Mallard	LC	Full Migrant	FALSE	IBAT
Aves	*Spatula clypeata*	Northern Shoveler	LC	Full Migrant	FALSE	IBAT
Aves	*Anas acuta*	Northern Pintail	LC	Full Migrant	FALSE	IBAT
Aves	*Spatula querquedula*	Garganey	LC	Full Migrant	FALSE	IBAT
Aves	*Anas crecca*	Common Teal	LC	Full Migrant	FALSE	IBAT
Aves	*Jynx torquilla*	Eurasian Wryneck	LC	Full Migrant	FALSE	IBAT
Aves	*Dryobates minor*	Lesser Spotted Woodpecker	LC	Not a Migrant	FALSE	IBAT
Aves	*Leiopicus medius*	Middle Spotted Woodpecker	LC	Not a Migrant	FALSE	IBAT
Aves	*Dendrocopos syriacus*	Syrian Woodpecker	LC	Not a Migrant	FALSE	IBAT
Aves	*Upupa epops*	Common Hoopoe	LC	Full Migrant	FALSE	IBAT
Aves	*Alcedo atthis*	Common Kingfisher	LC	Not a Migrant	FALSE	IBAT
Aves	*Merops apiaster*	European Bee-eater	LC	Full Migrant	FALSE	IBAT
Aves	*Cuculus canorus*	Common Cuckoo	LC	Full Migrant	FALSE	IBAT
Aves	*Tachymarptis melba*	Alpine Swift	LC	Full Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Aves	*Apus apus*	Common Swift	LC	Full Migrant	FALSE	IBAT
Aves	*Apus pallidus*	Pallid Swift	LC	Full Migrant	FALSE	IBAT
Aves	*Tyto alba*	Common Barn-owl	LC	Not a Migrant	FALSE	IBAT
Aves	*Bubo bubo*	Eurasian Eagle-owl	LC	Not a Migrant	FALSE	IBAT
Aves	*Athene noctua*	Little Owl	LC	Not a Migrant	FALSE	IBAT
Aves	*Asio otus*	Northern Long-eared Owl	LC	Not a Migrant	FALSE	IBAT
Aves	*Asio flammeus*	Short-eared Owl	LC	Full Migrant	FALSE	IBAT
Aves	*Caprimulgus europaeus*	European Nightjar	LC	Full Migrant	FALSE	IBAT, SPA
Aves	*Columba livia*	Rock Dove	LC	Not a Migrant	FALSE	IBAT
Aves	*Crex crex*	Corncrake	LC	Full Migrant	FALSE	IBAT, SPA
Aves	*Zapornia pusilla*	Baillon's Crake	LC	Full Migrant	FALSE	IBAT
Aves	*Porzana porzana*	Spotted Crake	LC	Full Migrant	FALSE	IBAT
Aves	*Fulica atra*	Common Coot	LC	Full Migrant	FALSE	IBAT
Aves	*Scolopax rusticola*	Eurasian Woodcock	LC	Full Migrant	FALSE	IBAT
Aves	*Gallinago gallinago*	Common Snipe	LC	Full Migrant	FALSE	IBAT
Aves	*Lymnocryptes minimus*	Jack Snipe	LC	Full Migrant	FALSE	IBAT
Aves	*Tringa erythropus*	Spotted Redshank	LC	Full Migrant	FALSE	IBAT
Aves	*Tringa totanus*	Common Redshank	LC	Full Migrant	FALSE	IBAT
Aves	*Tringa ochropus*	Green Sandpiper	LC	Full Migrant	FALSE	IBAT
Aves	*Calidris alpina*	Dunlin	LC	Full Migrant	FALSE	IBAT
Aves	*Recurvirostra avosetta*	Pied Avocet	LC	Full Migrant	FALSE	IBAT
Aves	*Pluvialis apricaria*	Eurasian Golden Plover	LC	Full Migrant	FALSE	IBAT
Aves	*Charadrius dubius*	Little Ringed Plover	LC	Full Migrant	FALSE	IBAT
Aves	*Glareola pratincola*	Collared Pratincole	LC	Full Migrant	FALSE	IBAT
Aves	*Larus ridibundus*	Black-headed Gull	LC	Full Migrant	FALSE	IBAT
Aves	*Chlidonias hybrida*	Whiskered Tern	LC	Full Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Aves	*Chlidonias niger*	Black Tern	LC	Full Migrant	FALSE	IBAT
Aves	*Pandion haliaetus*	Osprey	LC	Full Migrant	FALSE	IBAT
Aves	*Pernis apivorus*	European Honey-buzzard	LC	Full Migrant	FALSE	IBAT, SPA
Aves	*Milvus milvus*	Red Kite	LC	Full Migrant	FALSE	IBAT
Aves	*Haliaeetus albicilla*	White-tailed Sea-eagle	LC	Full Migrant	FALSE	IBAT
Aves	*Circus pygargus*	Montagu's Harrier	LC	Full Migrant	FALSE	IBAT
Aves	*Accipiter brevipes*	Levant Sparrowhawk	LC	Full Migrant	FALSE	IBAT
Aves	*Buteo lagopus*	Rough-legged Buzzard	LC	Full Migrant	FALSE	IBAT
Aves	*Clanga pomarina*	Lesser Spotted Eagle	LC	Full Migrant	FALSE	IBAT
Aves	*Aquila chrysaetos*	Golden Eagle	LC	Full Migrant	FALSE	IBAT, SPA
Aves	*Aquila fasciata*	Bonelli's Eagle	LC	Not a Migrant	FALSE	
Aves	*Hieraaetus pennatus*	Booted Eagle	LC	Full Migrant	FALSE	IBAT
Aves	*Falco naumanni*	Lesser Kestrel	LC	Full Migrant	FALSE	IBAT
Aves	*Falco columbarius*	Merlin	LC	Full Migrant	FALSE	IBAT
Aves	*Falco subbuteo*	Eurasian Hobby	LC	Full Migrant	FALSE	IBAT
Aves	*Falco biarmicus*	Lanner Falcon	LC	Not a Migrant	FALSE	
Aves	*Tachybaptus ruficollis*	Little Grebe	LC	Full Migrant	FALSE	IBAT
Aves	*Podiceps grisegena*	Red-necked Grebe	LC	Full Migrant	FALSE	IBAT
Aves	*Podiceps cristatus*	Great Crested Grebe	LC	Full Migrant	FALSE	IBAT
Aves	*Podiceps nigricollis*	Black-necked Grebe	LC	Full Migrant	FALSE	IBAT
Aves	*Microcarbo pygmaeus*	Pygmy Cormorant	LC	Full Migrant	FALSE	IBAT
Aves	*Ardea cinerea*	Grey Heron	LC	Full Migrant	FALSE	IBAT
Aves	*Ardea purpurea*	Purple Heron	LC	Full Migrant	FALSE	IBAT
Aves	*Ardea alba*	Great White Egret	LC	Full Migrant	FALSE	IBAT
Aves	*Ardeola ralloides*	Squacco Heron	LC	Full Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Aves	*Nycticorax nycticorax*	Black-crowned Night-heron	LC	Full Migrant	FALSE	IBAT
Aves	*Botaurus stellaris*	Eurasian Bittern	LC	Full Migrant	FALSE	IBAT
Aves	*Plegadis falcinellus*	Glossy Ibis	LC	Full Migrant	FALSE	IBAT
Aves	*Platalea leucorodia*	Eurasian Spoonbill	LC	Full Migrant	FALSE	IBAT
Aves	*Ciconia nigra*	Black Stork	LC	Full Migrant	FALSE	IBAT, SPA
Aves	*Ciconia ciconia*	White Stork	LC	Full Migrant	FALSE	IBAT, SPA
Aves	*Lanius collurio*	Red-backed Shrike	LC	Full Migrant	FALSE	IBAT, SPA
Aves	*Lanius minor*	Lesser Grey Shrike	LC	Full Migrant	FALSE	IBAT
Aves	*Pyrrhocorax pyrrhocorax*	Red-billed Chough	LC	Not a Migrant	FALSE	IBAT
Aves	*Pyrrhocorax graculus*	Yellow-billed Chough	LC	Not a Migrant	FALSE	IBAT
Aves	*Corvus monedula*	Eurasian Jackdaw	LC	Not a Migrant	FALSE	IBAT
Aves	*Corvus frugilegus*	Rook	LC	Not a Migrant	FALSE	IBAT
Aves	*Corvus corone*	Carrion Crow	LC	Not a Migrant	FALSE	IBAT
Aves	*Cinclus cinclus*	White-throated Dipper	LC	Full Migrant	FALSE	IBAT
Aves	*Monticola saxatilis*	Rufous-tailed Rock-thrush	LC	Full Migrant	FALSE	IBAT
Aves	*Monticola solitarius*	Blue Rock-thrush	LC	Full Migrant	FALSE	IBAT
Aves	*Turdus torquatus*	Ring Ouzel	LC	Full Migrant	FALSE	IBAT
Aves	*Muscicapa striata*	Spotted Flycatcher	LC	Full Migrant	FALSE	IBAT
Aves	*Ficedula albicollis*	Collared Flycatcher	LC	Full Migrant	FALSE	IBAT
Aves	*Ficedula semitorquata*	Semi-collared Flycatcher	LC	Full Migrant	FALSE	IBAT
Aves	*Luscinia megarhynchos*	Common Nightingale	LC	Full Migrant	FALSE	IBAT
Aves	*Luscinia svecica*	Bluethroat	LC	Full Migrant	FALSE	IBAT
Aves	*Cercotrichas galactotes*	Rufous-tailed Scrub-robin	LC	Full Migrant	FALSE	IBAT
Aves	*Phoenicurus phoenicurus*	Common Redstart	LC	Full Migrant	FALSE	IBAT
Aves	*Saxicola rubetra*	Whinchat	LC	Full Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Aves	*Saxicola torquatus*	Common Stonechat	LC	Full Migrant	FALSE	IBAT
Aves	*Oenanthe hispanica*	Black-eared Wheatear	LC	Full Migrant	FALSE	IBAT
Aves	*Pastor roseus*	Rosy Starling	LC	Full Migrant	FALSE	IBAT
Aves	*Sitta neumayer*	Western Rock Nuthatch	LC	Altitudinal Migrant	FALSE	
Aves	*Tichodroma muraria*	Wallcreeper	LC	Full Migrant	FALSE	IBAT
Aves	*Certhia brachydactyla*	Short-toed Treecreeper	LC	Not a Migrant	FALSE	
Aves	*Lophophanes cristatus*	Crested Tit	LC	Nomadic	FALSE	
Aves	*Ptyonoprogne rupestris*	Eurasian Crag Martin	LC	Full Migrant	FALSE	IBAT
Aves	*Hirundo rustica*	Barn Swallow	LC	Full Migrant	FALSE	IBAT
Aves	*Cettia cetti*	Cetti's Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Locustella fluviatilis*	River Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Locustella luscinioides*	Savi's Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Acrocephalus melanopogon*	Moustached Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Acrocephalus schoenobaenus*	Sedge Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Acrocephalus scirpaceus*	Common Reed-warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Acrocephalus palustris*	Marsh Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Hippolais olivetorum*	Olive-tree Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Phylloscopus sibilatrix*	Wood Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Panurus biarmicus*	Bearded Reedling	LC	Not a Migrant	FALSE	
Aves	*Sylvia borin*	Garden Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Curruca communis*	Common Whitethroat	LC	Full Migrant	FALSE	IBAT
Aves	*Curruca nisoria*	Barred Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Curruca melanocephala*	Sardinian Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Eremophila alpestris*	Horned Lark	LC	Full Migrant	FALSE	IBAT
Aves	*Passer hispaniolensis*	Spanish Sparrow	LC	Not a Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Aves	*Motacilla alba*	White Wagtail	LC	Full Migrant	FALSE	IBAT
Aves	*Motacilla cinerea*	Grey Wagtail	LC	Full Migrant	FALSE	IBAT
Aves	*Anthus campestris*	Tawny Pipit	LC	Full Migrant	FALSE	IBAT
Aves	*Prunella collaris*	Alpine Accentor	LC	Full Migrant	FALSE	IBAT
Aves	*Serinus serinus*	European Serin	LC	Not a Migrant	FALSE	IBAT
Aves	*Spinus spinus*	Eurasian Siskin	LC	Not a Migrant	FALSE	IBAT
Aves	*Loxia curvirostra*	Red Crossbill	LC	Not a Migrant	FALSE	
Aves	*Emberiza hortulana*	Ortolan Bunting	LC	Full Migrant	FALSE	IBAT
Aves	*Emberiza melanocephala*	Black-headed Bunting	LC	Full Migrant	FALSE	IBAT
Aves	*Rallus aquaticus*	Western Water Rail	LC	Full Migrant	FALSE	IBAT
Aves	*Strix aluco*	Tawny Owl	LC	Not a Migrant	FALSE	IBAT
Aves	*Picus canus*	Grey-faced Woodpecker	LC	Not a Migrant	FALSE	IBAT
Aves	*Dendrocopos leucotos*	White-backed Woodpecker	LC	Not a Migrant	FALSE	IBAT
Aves	*Picoides tridactylus*	Three-toed Woodpecker	LC	Not a Migrant	FALSE	IBAT
Aves	*Streptopelia decaocto*	Eurasian Collared-dove	LC	Not a Migrant	FALSE	IBAT
Aves	*Himantopus himantopus*	Black-winged Stilt	LC	Full Migrant	FALSE	IBAT
Aves	*Phylloscopus orientalis*	Eastern Bonelli's Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Circaetus gallicus*	Short-toed Snake-eagle	LC	Full Migrant	FALSE	IBAT
Aves	*Iduna pallida*	Olivaceous Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Curruca crassirostris*	Eastern Orphean Warbler	LC	Full Migrant	FALSE	IBAT
Aves	*Curruca curruca*	Lesser Whitethroat	LC	Full Migrant	FALSE	IBAT
Amphibia	*Salamandra salamandra*	Common Fire Salamander	VU	Not a Migrant	FALSE	IBAT; Surveys (May 2025)
Amphibia	*Triturus macedonicus*	Macedonian Crested Newt	VU	Not a Migrant	FALSE	IBAT
Amphibia	*Triturus carnifex*	Italian Crested Newt	VU	Not a Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Amphibia	*Bombina variegata*	Yellow-bellied Toad	LC			Surveys May, June and September 2025
Amphibia	*Ichthyosaura alpestris*	Alpine Newt	LC	Not a Migrant	FALSE	IBAT
Amphibia	*Rana dalmatina*	Agile Frog	LC	Not a Migrant	FALSE	IBAT; Surveys (May 2025)
Amphibia	*Rana graeca*	Greek Stream Frog	LC	Not a Migrant	FALSE	IBAT, Surveys (May, June and September 2025)
Amphibia	*Pelophylax ridibundus*	Marsh Frog	LC	Not a Migrant	FALSE	IBAT, Surveys (May, June and September 2025)
Amphibia	*Bufo bufo*	Common Toad	LC			IBAT, Surveys May, June and September 2025
Amphibia	*Bufotes viridis*	European Green Toad	LC			IBAT, Surveys May, June and September 2025, GBIF
Amphibia	*Hyla arborea*	European Tree Frog	LC			IBAT, Surveys May and June 2025
Amphibia	*Triturus ivanbureschi*	Buresch's Crested New	LC	Not a Migrant	FALSE	IBAT
Amphibia	*Pelobates balcanicus*	Balkan Spadefoot	LC	Not a Migrant	FALSE	IBAT
Amphibia	*Rana temporaria*	European Common Frog	LC	Not a Migrant	FALSE	IBAT
Reptilia	*Testudo hermanni*	Hermann's Tortoise	VU	Not a Migrant	FALSE	IBAT, Surveys (May, June and September 2025)

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Reptilia	*Zamenis situla*	European ratsnake	LC		FALSE	IBAT; Surveys (May 2025)
Reptilia	*Elaphe quatuorlineata*	Four-lined Snake	LC		FALSE	IBAT, Surveys (May, June 2025)
Reptilia	*Testudo graeca*	Greek Tortoise / Spur-thighed Tortoise	VU (Europe)			Surveys May and June 2025
Reptilia	*Ablepharus kitaibelii*	Juniper Skink	LC		FALSE	IBAT
Reptilia	*Zootoca vivipara*	Viviparous Lizard	LC		FALSE	IBAT
Reptilia	*Lacerta viridis*	Green Lizard	LC		FALSE	IBAT, Surveys (May, June and September 2025)
Reptilia	*Podarcis muralis*	Common Wall Lizard	LC		FALSE	IBAT, Surveys (May, June and September 2025)
Reptilia	*Eryx jaculus*	Javelin Sand Boa	LC		FALSE	IBAT
Reptilia	*Vipera ammodytes*	Nose-horned Viper	LC		FALSE	IBAT, Surveys (May, June and September 2025)
Reptilia	*Malpolon insignitus*	Eastern Montpellier Snake	LC		FALSE	IBAT; Surveys (May 2025)
Reptilia	*Natrix tessellata*	Dice Snake	LC		FALSE	IBAT; Surveys (May 2025)
Reptilia	*Telescopus fallax*	Cat Snake	LC		FALSE	IBAT
Reptilia	*Pseudopus apodus*	Sheltopusik	LC		FALSE	IBAT
Reptilia	*Zamenis longissimus*	Aesculapian Ratsnake	LC		FALSE	IBAT
Reptilia	*Dolichophis caspius*	Large Whip Snake	LC		FALSE	IBAT; Surveys (May and June 2025)

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Reptilia	*Xerotyphlops vermicularis*	Eurasian Blind Snake	LC		FALSE	IBAT
Reptilia	*Lacerta agilis*	Sand Lizard	LC		FALSE	IBAT
Reptilia	*Platyceps najadum*	Dahl's Whip Snake	LC		FALSE	IBAT
Reptilia	*Coronella austriaca*	Smooth Snake	LC		FALSE	IBAT; Surveys (May 2025)
Reptilia	*Podarcis erhardii*	Erhard's Wall Lizard	LC			IBAT, Surveys May, June and September 2025
Reptilia	*Anguis fragilis*	Slow Worm	LC			IBAT, Surveys May, June and September 2025
Reptilia	*Lacerta trilineata*	Balkan Green Lizard	LC			IBAT, Surveys May, June and September 2025
Reptilia	*Natrix natrix*	Grass Snake	LC			IBAT, Surveys May 2025
Reptilia	*Telescopus falax*	European Cat Snake	LC			Surveys May 2025
Reptilia	*Zamenis longissimus*	Aesculapian Snake	LC			Surveys May 2025
Reptilia	*Vipera berus*	Adder	LC		FALSE	IBAT
Reptilia	*Mediodactylus kotschyi*	Kotschy's Gecko	LC		FALSE	IBAT
Reptilia	*Podarcis tauricus*	Balkan Wall Lizard	LC		FALSE	IBAT
Actinopterygii	*Anguilla anguilla*	European Eel	CR	Full Migrant	FALSE	IBAT
Actinopterygii	*Salmo pelagonicus*	Pelagonian Trout	VU		TRUE	IBAT
Actinopterygii	*Chondrostoma vardarense*	Vardar Nase	NT		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Actinopterygii	*Alburnus alburnus*	Common Bleak	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Aphanius fasciatus*	Mediterranean Killifish	LC		FALSE	IBAT
Actinopterygii	*Leuciscus aspius*	Eurasian Asp	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Barbus barbus*	Common Barbel	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Barbus cyclolepis*	Maritsa Barbel	LC		FALSE	IBAT
Actinopterygii	*Chondrostoma nasus*	Nase	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Cobitis elongata*	Balkan Spined Loach	LC		FALSE	IBAT
Actinopterygii	*Cobitis vardarensis*	Vardar Spined Loach	LC		FALSE	IBAT
Actinopterygii	*Cottus gobio*	European Bullhead	LC		FALSE	IBAT
Actinopterygii	*Romanogobio kesslerii*	Kessler's Gudgeon	LC		FALSE	IBAT
Actinopterygii	*Romanogobio uranoscopus*	Stone Gudgeon	LC		FALSE	IBAT
Actinopterygii	*Gymnocephalus cernua*	Eurasian Ruffe	LC		FALSE	IBAT
Actinopterygii	*Leucaspius delineatus*	Sunbleak	LC		FALSE	IBAT
Actinopterygii	*Leuciscus leuciscus*	Common Dace	LC	Full Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Actinopterygii	*Phoxinus phoxinus*	Channel Minnow	LC		FALSE	IBAT
Actinopterygii	*Pungitius platygaster*	Pontic Stickleback	LC		FALSE	IBAT
Actinopterygii	*Rutilus rutilus*	Common Roach	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Scardinius erythrophthalmus*	Eurasian Rudd	LC		FALSE	IBAT
Actinopterygii	*Sander lucioperca*	Eurasian Pikeperch	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Sander volgensis*	Volga Pikeperch	LC		FALSE	IBAT
Actinopterygii	*Thymallus thymallus*	European Grayling	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Vimba vimba*	Vimba Bream	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Zingel streber*	Danube Streber	LC		FALSE	IBAT
Actinopterygii	*Zingel zingel*	Zingel	LC		FALSE	IBAT
Actinopterygii	*Blicca bjoerkna*	White Bream	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Oxynoemacheilus bureschi*	Struma Stone Loach	LC		FALSE	IBAT
Actinopterygii	*Silurus glanis*	Wels Catfish	LC		FALSE	IBAT
Actinopterygii	*Salariopsis fluviatilis*	Freshwater Blenny	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Actinopterygii	*Squalius cephalus*	European Chub	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Romanogobio elimeius*	Greek Stone Gudgeon	LC		FALSE	IBAT
Actinopterygii	*Squalius vardarensis*	Vardar Chub	LC		FALSE	IBAT
Actinopterygii	*Barbus strumicae*	Struma Barbel	LC		FALSE	IBAT
Actinopterygii	*Rutilus heckelii*		LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Barbus balcanicus*	Large-Spot Barbel	LC		FALSE	IBAT
Actinopterygii	*Mugil cephalus*	Flathead Mullet	LC	Not a Migrant	FALSE	IBAT
Actinopterygii	*Gobio bulgaricus*	Aegean Gudgeon	LC		FALSE	IBAT
Actinopterygii	*Ballerus ballerus*	Blue Bream	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Cobitis elongatoides*		LC		FALSE	IBAT
Actinopterygii	*Rhodeus amarus*	European Bitterling	LC		FALSE	IBAT
Actinopterygii	*Squalius orpheus*	Thracian Chub	LC		FALSE	IBAT
Actinopterygii	*Ballerus sapa*	White-Eye Bream	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Gobio obtusirostris*	Danube Gudgeon	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Actinopterygii	*Romanogobio vladykovi*	Danube Whitefin Gudgeon	LC		FALSE	IBAT
Actinopterygii	*Salmo labrax*	Black Sea Trout	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Sabanejewia balcanica*	Balkan Golden Loach	LC		FALSE	IBAT
Actinopterygii	*Alburnus thessalicus*	Thessaly Bleak	LC		FALSE	IBAT
Actinopterygii	*Abramis brama*	Common Bream	LC	Full Migrant	FALSE	IBAT
Actinopterygii	*Rhodeus meridionalis*	Vardar Bitterling	LC		FALSE	IBAT
Actinopterygii	*Rutilus virgo*	Cactus Roach	LC		FALSE	IBAT
Actinopterygii	*Vimba melanops*	Macedonian Vimba	DD		FALSE	IBAT
Actinopterygii	*Pachychilon macedonicum*	Macedonian Roach	DD		FALSE	IBAT
Actinopterygii	*Zingel balcanicus*	Vardar Streber	DD		FALSE	IBAT
Actinopterygii	*Salmo macedonicus*	Macedonian Trout	DD		TRUE	IBAT
Actinopterygii	*Barbus macedonicus*	Macedonian Barbel	DD		FALSE	IBAT
Bivalvia	*Sphaerium rivicola*	River Orb Mussel	VU		FALSE	IBAT
Bivalvia	*Unio vicarius*		VU	Not a Migrant	FALSE	IBAT
Bivalvia	*Dreissena polymorpha*	Zebra Mussel	LC		FALSE	IBAT
Bivalvia	*Sphaerium corneum*	Horny Orb Mussel	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Bivalvia	*Unio pictorum*	Painter's Mussel	LC		FALSE	IBAT
Bivalvia	*Euglesa supina*	Hump-Backed Pea Mussel	LC		FALSE	IBAT
Bivalvia	*Musculium lacustre*	Lake Orb Mussel	LC		FALSE	IBAT
Bivalvia	*Euglesa henslowana*	Henslow's Pea Mussel	LC		FALSE	IBAT
Bivalvia	*Odhneripisidium annandalei*		LC		FALSE	IBAT
Bivalvia	*Euglesa obtusalis*	Porous Pea Mussel	LC		FALSE	IBAT
Bivalvia	*Dreissena carinata*		LC	Not a Migrant	FALSE	IBAT
Bivalvia	*Euglesa casertana*	Caserta Pea Mussel	LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Carinigera drenovoensis*		CR	Not a Migrant	TRUE	IBAT
Gastropoda	*Theodoxus transversalis*	Striped Nerite	EN		FALSE	IBAT
Gastropoda	*Carinigera lophauchena*		EN	Not a Migrant	FALSE	IBAT
Gastropoda	*Horatia macedonica*		VU		FALSE	IBAT
Gastropoda	*Plagigeyeria gladilini*		VU		FALSE	IBAT
Gastropoda	*Carinigera octava*		VU	Not a Migrant	TRUE	IBAT
Gastropoda	*Gyralina velkovrhi*		VU		TRUE	IBAT
Gastropoda	*Carinigera septima*		VU	Not a Migrant	TRUE	IBAT
Gastropoda	*Terranigra kosovica*		NT		FALSE	IBAT
Gastropoda	*Monacha oshanovae*		NT		FALSE	IBAT
Gastropoda	*Cattania sztolcmani*		NT		FALSE	IBAT
Gastropoda	*Orcula wagneri*		NT		FALSE	IBAT
Gastropoda	*Vitrea mikuskai*		NT	Not a Migrant	TRUE	IBAT
Gastropoda	*Viviparus acerosus*		LC		FALSE	IBAT
Gastropoda	*Stagnicola palustris*		LC		FALSE	IBAT
Gastropoda	*Viviparus viviparus*	Viviparus River Snail	LC		FALSE	IBAT
Gastropoda	*Stagnicola turricula*		LC		FALSE	IBAT
Gastropoda	*Lithoglyphus naticoides*	Flußsteinkleber	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Gastropoda	*Radix auricularia*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Stagnicola corvus*		LC		FALSE	IBAT
Gastropoda	*Ampullaceana balthica*		LC		FALSE	IBAT
Gastropoda	*Bithynia leachii*		LC		FALSE	IBAT
Gastropoda	*Viviparus contectus*	Lister's River Snail	LC		FALSE	IBAT
Gastropoda	*Anisus leucostoma*		LC		FALSE	IBAT
Gastropoda	*Gyraulus albus*		LC		FALSE	IBAT
Gastropoda	*Hydrobia acuta*		LC		FALSE	IBAT
Gastropoda	*Valvata macrostoma*	Large Mouthed Valve Snail	LC		FALSE	IBAT
Gastropoda	*Viviparus ater*	Italian River Snail	LC		FALSE	IBAT
Gastropoda	*Borysthenia naticina*	Fluss-Federkiemenschnecke	LC		FALSE	IBAT
Gastropoda	*Microcolpia daudebartii*		LC		FALSE	IBAT
Gastropoda	*Radomaniola curta*		LC		FALSE	IBAT
Gastropoda	*Holandriana holandrii*		LC		FALSE	IBAT
Gastropoda	*Planorbarius corneus*	Great Ram's Horn Snail	LC		FALSE	IBAT
Gastropoda	*Physa fontinalis*	Common Bladder Snail	LC		FALSE	IBAT
Gastropoda	*Planorbis planorbis*	Ram's Horn Snail	LC		FALSE	IBAT
Gastropoda	*Valvata piscinalis*	European Stream Valvata	LC		FALSE	IBAT
Gastropoda	*Helix philibinensis*		LC		FALSE	IBAT
Gastropoda	*Pupilla alpicola*		LC		FALSE	IBAT
Gastropoda	*Eucobresia diaphana*		LC		FALSE	IBAT
Gastropoda	*Helicodonta obvoluta*		LC		FALSE	IBAT
Gastropoda	*Helix dormitoris*		LC		FALSE	IBAT
Gastropoda	*Caucasotachea vindobonensis*		LC		FALSE	IBAT
Gastropoda	*Cernuella cisalpina*		LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Gastropoda	*Euomphalia strigella*		LC		FALSE	IBAT
Gastropoda	*Lindholmiola girva*		LC		FALSE	IBAT
Gastropoda	*Monacha dofleini*		LC		FALSE	IBAT
Gastropoda	*Josephinella phocaea*		LC		FALSE	IBAT
Gastropoda	*Jaminia quadridens*		LC		FALSE	IBAT
Gastropoda	*Arianta arbustorum*	Copse Snail	LC		FALSE	IBAT
Gastropoda	*Ena montana*		LC		FALSE	IBAT
Gastropoda	*Semilimacella bonellii*		LC		FALSE	IBAT
Gastropoda	*Helix secernenda*		LC		FALSE	IBAT
Gastropoda	*Helix pomatia*		LC		FALSE	IBAT
Gastropoda	*Agardhiella truncatella*		LC		FALSE	IBAT
Gastropoda	*Platyla polita*		LC		FALSE	IBAT
Gastropoda	*Platyla similis*		LC		FALSE	IBAT
Gastropoda	*Monacha claustralis*		LC		FALSE	IBAT
Gastropoda	*Dinarica pouzolzii*		LC		FALSE	IBAT
Gastropoda	*Monacha carascaloides*		LC		FALSE	IBAT
Gastropoda	*Mastus rossmaessleri*		LC		FALSE	IBAT
Gastropoda	*Pagodulina sparsa*		LC		FALSE	IBAT
Gastropoda	*Agardhiella parreyssii*		LC		FALSE	IBAT
Gastropoda	*Cattania haberhaueri*		LC		FALSE	IBAT
Gastropoda	*Xerocampylaea erjaveci*		LC		FALSE	IBAT
Gastropoda	*Pseudojaminia seductilis*		LC		FALSE	IBAT
Gastropoda	*Mastus etuberculatus*		LC		FALSE	IBAT
Gastropoda	*Fruticicola fruticum*		LC		FALSE	IBAT
Gastropoda	*Trochulus hispidus*	Hairy Snail	LC		FALSE	IBAT
Gastropoda	*Chondrula macedonica*		LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Gastropoda	*Granaria frumentum*		LC		FALSE	IBAT
Gastropoda	*Chondrula microtragus*		LC		FALSE	IBAT
Gastropoda	*Candidula rhabdotoides*		LC		FALSE	IBAT
Gastropoda	*Pupilla muscorum*	Moss Chrysalis Snail	LC		FALSE	IBAT
Gastropoda	*Sphyradium doliolum*		LC		FALSE	IBAT
Gastropoda	*Monachoides incarnatus*		LC		FALSE	IBAT
Gastropoda	*Xerolenta macedonica*		LC		FALSE	IBAT
Gastropoda	*Columella edentula*	Toothless chrysalis snail	LC		FALSE	IBAT
Gastropoda	*Cattania polinskii*		LC		FALSE	IBAT
Gastropoda	*Helix figulina*		LC		FALSE	IBAT
Gastropoda	*Helix vladica*		LC		FALSE	IBAT
Gastropoda	*Chondrus zebrulus*		LC		FALSE	IBAT
Gastropoda	*Lindholmiola corcyrensis*		LC		FALSE	IBAT
Gastropoda	*Lindholmiola pirinensis*		LC		FALSE	IBAT
Gastropoda	*Monacha cartusiana*		LC		FALSE	IBAT
Gastropoda	*Alinda biplicata*		LC		FALSE	IBAT
Gastropoda	*Vitrea erjaveci*		LC		FALSE	IBAT
Gastropoda	*Helix thessalica*		LC		FALSE	IBAT
Gastropoda	*Helicopsis striata*		LC		FALSE	IBAT
Gastropoda	*Anisus vorticulus*	Lesser Ramshorn Snail	DD		FALSE	IBAT
Gastropoda	*Viviparus mamillatus*		DD		FALSE	IBAT
Gastropoda	*Segmentina servaini*		DD		FALSE	IBAT
Gastropoda	*Lymnaea bakowskyana*		DD		FALSE	IBAT
Gastropoda	*Vitrea melovskii*		DD	Not a Migrant	FALSE	IBAT
Gastropoda	*Theodoxus danubialis*	Danubian Nerite	LC		FALSE	IBAT
Gastropoda	*Theodoxus fluviatilis*		LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Gastropoda	*Theodoxus varius*		LC		FALSE	IBAT
Gastropoda	*Deroceras sturanyi*		LC		FALSE	IBAT
Gastropoda	*Morlina glabra*		LC		FALSE	IBAT
Gastropoda	*Lehmannia brunneri*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Limax maximus*		LC		FALSE	IBAT
Gastropoda	*Vitrea subrimata*		LC		FALSE	IBAT
Gastropoda	*Arion circumscriptus*		LC		FALSE	IBAT
Gastropoda	*Vestia ranojevici*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Ambigolimax nyctelius*		LC		FALSE	IBAT
Gastropoda	*Strigillaria vetusta*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Arion fuscus*		LC		FALSE	IBAT
Gastropoda	*Carpathica stussineri*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Mediterranea inopinata*		LC		FALSE	IBAT
Gastropoda	*Tandonia serbica*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Arion silvaticus*		LC		FALSE	IBAT
Gastropoda	*Tandonia sowerbyi*		LC		FALSE	IBAT
Gastropoda	*Arion fasciatus*		LC		FALSE	IBAT
Gastropoda	*Mediterranea depressa*		LC		FALSE	IBAT
Gastropoda	*Limax graecus*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Tandonia kusceri*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Limacus flavus*		LC		FALSE	IBAT
Gastropoda	*Tandonia albanica*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Macrogastra ventricosa*		LC		FALSE	IBAT
Gastropoda	*Limax conemenosi*		LC		FALSE	IBAT
Gastropoda	*Laciniaria plicata*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Limax cinereoniger*		LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Gastropoda	*Vestia roschitzi*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Limax cephalonicus*		LC		FALSE	IBAT
Gastropoda	*Vitrea neglecta*		LC	Not a Migrant	FALSE	IBAT
Gastropoda	*Balea perversa*	Wall Snail	LC		FALSE	IBAT
Gastropoda	*Agardhiella macrodonta*		LC		FALSE	IBAT
Gastropoda	*Cattania rumelica*		LC		FALSE	IBAT
Gastropoda	*Segmentina distinguenda*		LC		FALSE	IBAT
Gastropoda	*Acroloxus rossicus*		LC		FALSE	IBAT
Gastropoda	*Segmentina molytes*		LC		FALSE	IBAT
Gastropoda	*Agardhiella armata*		LC		FALSE	IBAT
Insecta	*Ropalopus ungaricus*		VU		FALSE	IBAT
Insecta	*Dasypoda frieseana*		EN		FALSE	IBAT
Insecta	*Bradyporus macrogaster*	Big-Bellied Glandular Bush-Cricket	EN	Not a Migrant	FALSE	IBAT
Insecta	*Ammobates melectoides*		EN		FALSE	IBAT
Insecta	*Paragus majoranae*		EN	Not a Migrant	FALSE	IBAT
Insecta	*Merodon kozufensis*		EN	Not a Migrant	FALSE	IBAT
Insecta	*Cerophytum elateroides*		VU		FALSE	IBAT
Insecta	*Andreiniimon nuptialis*	Splendid Bush-cricket	VU		FALSE	IBAT
Insecta	*Asiotmethis limbatus*	Bordered Stone Grasshopper	VU		FALSE	IBAT
Insecta	*Montana macedonica*	Macedonian Steppe Bush-cricket	VU		FALSE	IBAT
Insecta	*Anisarthron barbipes*		VU		FALSE	IBAT
Insecta	*Merodon vladimiri*		VU	Not a Migrant	FALSE	IBAT
Insecta	*Cucujus cinnaberinus*	ScharlachkÃ¤fer	NT		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Insecta	*Hylis simonae*		NT		FALSE	IBAT
Insecta	*Crepidophorus mutilatus*		NT		FALSE	IBAT
Insecta	*Microrhagus pyrenaeus*		NT		FALSE	IBAT
Insecta	*Ropalopus insubricus*		NT		FALSE	IBAT
Insecta	*Ceruchus chrysomelinus*		NT		FALSE	IBAT
Insecta	*Pseudotriphyllus suturalis*		NT		FALSE	IBAT
Insecta	*Osmoderma barnabita*	lapkoku praulgrauzis	NT		FALSE	IBAT
Insecta	*Hipparchia fagi*	Woodland Grayling	NT		FALSE	IBAT
Insecta	*Bombus mucidus*	Musty Bumblebee	NT		FALSE	IBAT
Insecta	*Nomada armata*	Knautiawespbij	NT		FALSE	IBAT
Insecta	*Hylaeus crassanus*		NT		FALSE	IBAT
Insecta	*Hylaeus friesei*		NT		FALSE	IBAT
Insecta	*Glyphotmethis heldreichi*	Heldreich's Stone Grasshopper	NT		FALSE	IBAT
Insecta	*Psorodonotus fieberi*	Fieber's Walking Bush-cricket	NT		FALSE	IBAT
Insecta	*Psorodonotus macedonicus*	Macedonian Walking Bush-cricket	NT		FALSE	IBAT
Insecta	*Saga campbelli*	Lesser Predatory Bush-cricket	NT		FALSE	IBAT
Insecta	*Xylosteus bartoni*		NT		FALSE	IBAT
Insecta	*Merodon triangulum*	Hullámtéri nárciszlégy	NT	Not a Migrant	FALSE	IBAT
Insecta	*Lampyris noctiluca*	European glow-worm	NT	Not a Migrant	FALSE	IBAT
Insecta	*Ophiogomphus cecilia*	Green Snaketail	LC		FALSE	IBAT
Insecta	*Parnassius apollo*	Apollo	LC		FALSE	IBAT
Insecta	*Anax ephippiger*	Vagrant Emperor	LC	Full Migrant	FALSE	IBAT
Insecta	*Anax imperator*	Blue Emperor	LC	Nomadic	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Insecta	*Crocothemis erythraea*	Broad Scarlet	LC		FALSE	IBAT
Insecta	*Pantala flavescens*	Wandering Glider	LC	Full Migrant	FALSE	IBAT
Insecta	*Isorhipis marmottani*		LC		FALSE	IBAT
Insecta	*Purpuricenus desfontainii*		LC		FALSE	IBAT
Insecta	*Ampedus aethiops*		LC		FALSE	IBAT
Insecta	*Tritoma bipustulata*		LC		FALSE	IBAT
Insecta	*Clytus lama*		LC		FALSE	IBAT
Insecta	*Grynocharis oblonga*		LC		FALSE	IBAT
Insecta	*Xylophilus corticalis*		LC		FALSE	IBAT
Insecta	*Microrhagus pygmaeus*		LC		FALSE	IBAT
Insecta	*Clytus tropicus*		LC		FALSE	IBAT
Insecta	*Monochamus sartor*		LC		FALSE	IBAT
Insecta	*Stenagostus rufus*		LC		FALSE	IBAT
Insecta	*Microrhagus emyi*		LC		FALSE	IBAT
Insecta	*Ropalopus femoratus*		LC		FALSE	IBAT
Insecta	*Microrhagus lepidus*		LC		FALSE	IBAT
Insecta	*Orthetrum coerulescens*	Keeled Skimmer	LC		FALSE	IBAT
Insecta	*Leucorrhinia dubia*	Small Whiteface	LC		FALSE	IBAT
Insecta	*Lestes barbarus*	Migrant Spreadwing	LC		FALSE	IBAT
Insecta	*Sympetrum striolatum*	Common Darter	LC		FALSE	IBAT
Insecta	*Orthetrum albistylum*	White-tailed Skimmer	LC		FALSE	IBAT
Insecta	*Sympecma fusca*	Common Winter Damsel	LC		FALSE	IBAT
Insecta	*Sympetrum sanguineum*	Ruddy Darter	LC		FALSE	IBAT
Insecta	*Erythromma lindenii*	Blue-eye	LC		FALSE	IBAT
Insecta	*Orthetrum brunneum*	Southern Skimmer	LC		FALSE	IBAT
Insecta	*Cordulegaster heros*	Balkan Goldenring	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Insecta	*Calopteryx splendens*	Banded Demoiselle	LC		FALSE	IBAT
Insecta	*Cordulia aenea*	Downy Emerald	LC		FALSE	IBAT
Insecta	*Somatochlora metallica*	Brilliant Emerald	LC		FALSE	IBAT
Insecta	*Coenagrion puella*	Azure Bluet	LC		FALSE	IBAT
Insecta	*Platycnemis pennipes*	Blue Featherleg	LC		FALSE	IBAT
Insecta	*Erebia cassioides*	Common Brassy Ringlet	LC		FALSE	IBAT
Insecta	*Leptophyes punctatissima*	Common Speckled Bush-cricket	LC		FALSE	IBAT
Insecta	*Ancistrura nigrovittata*	Blackwinged Saw Bush-cricket	LC		FALSE	IBAT
Insecta	*Bradyporus dasypus*	Bronze Glandular Bush-cricket	LC		FALSE	IBAT
Insecta	*Bradyporus oniscus*	Wood-louse Glandular Bush-cricket	LC		FALSE	IBAT
Insecta	*Modestana ebneri*	Ebner's Modest Bush-cricket	LC		FALSE	IBAT
Insecta	*Iris oratoria*	Mediterranean Mantis	LC	Not a Migrant	FALSE	IBAT
Insecta	*Ameles heldreichi*	Heldreich's Dwarf Mantis	LC		FALSE	IBAT
Insecta	*Poecilimon affinis*	Balkan Bright Bush-cricket	LC		FALSE	IBAT
Insecta	*Poecilimon gracilis*	Slender Bright Bush-cricket	LC	Not a Migrant	FALSE	IBAT
Insecta	*Pholidoptera aptera*	Alpine Dark Bush-cricket	LC		FALSE	IBAT
Insecta	*Aphodius ghardimaouensis*		LC		FALSE	IBAT
Insecta	*Pholidoptera frivaldszkyi*	Green Dark Bush-cricket	LC		FALSE	IBAT
Insecta	*Barbitistes ocskayi*	Black Saw Bush-cricket	LC		FALSE	IBAT
Insecta	*Isophya andreevae*	Andreeva's Plump Bush-cricket	LC	Not a Migrant	TRUE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Insecta	*Isophya speciosa*	Showy Plump Bush-cricket	LC		FALSE	IBAT
Insecta	*Isophya tosevski*	Tosevsk's Plump Bush-cricket	LC		FALSE	IBAT
Insecta	*Ephippiger ephippiger*	Eastern Saddle Bush-cricket	LC		FALSE	IBAT
Insecta	*Eumodicogryllus bordigalensis*	Verge Cricket	LC		FALSE	IBAT
Insecta	*Eupholidoptera schmidti*	Schmidt's Marbled Bush-cricket	LC		FALSE	IBAT
Insecta	*Gampsocleis abbreviata*	Short-winged Spiny Bush-cricket	LC		FALSE	IBAT
Insecta	*Isophya modestior*	More-modest Plump Bush-cricket	LC		FALSE	IBAT
Insecta	*Meconema thalassinum*	Oak Bush-cricket	LC		FALSE	IBAT
Insecta	*Metaplastes ornatus*	Balkan Ornate Bush-cricket	LC		FALSE	IBAT
Insecta	*Metrioptera tsirojanni*	Olympus Meadow Bush-cricket	LC		FALSE	IBAT
Insecta	*Myrmecophilus hirticaudus*	Rough-tailed Ant-cricket	LC		FALSE	IBAT
Insecta	*Myrmecophilus nonveilleri*	Serbian Ant-cricket	LC		TRUE	IBAT
Insecta	*Pachytrachis gracilis*	Graceful Bush-cricket	LC		FALSE	IBAT
Insecta	*Phaneroptera nana*	Southern Sickle Bush-cricket	LC	Not a Migrant	FALSE	IBAT
Insecta	*Pholidoptera macedonica*	Macedonian Dark Bush-cricket	LC		FALSE	IBAT
Insecta	*Pholidoptera rhodopensis*	Rhodope Dark Bush-cricket	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Insecta	*Poecilimon brunneri*	Brunner's Bright Bush-cricket	LC		FALSE	IBAT
Insecta	*Poecilimon macedonicus*	Macedonian Bright Bush-cricket	LC		FALSE	IBAT
Insecta	*Poecilimon ornatus*	Ornate Bright Bush-cricket	LC		FALSE	IBAT
Insecta	*Poecilimon thoracicus*	Bellied Bright Bush-cricket	LC		FALSE	IBAT
Insecta	*Polysarcus denticauda*	Bull Bush-cricket	LC		FALSE	IBAT
Insecta	*Saga hellenica*	Greek Predatory Bush-cricket	LC		FALSE	IBAT
Insecta	*Saga rammei*	Ramme's Predatory Bush-cricket	LC		FALSE	IBAT
Insecta	*Tessellana carinata*	Keeled Slender Bush-cricket	LC		FALSE	IBAT
Insecta	*Troglophilus brevicauda*	Short-tailed Cave-cricket	LC		FALSE	IBAT
Insecta	*Troglophilus cavicola*	Common Cave-cricket	LC		FALSE	IBAT
Insecta	*Troglophilus neglectus*	Neglected Cave-cricket	LC		FALSE	IBAT
Insecta	*Vichetia oblongicollis*	Oblong Meadow Bush-cricket	LC		FALSE	IBAT
Insecta	*Myrmecophilus balcanicus*	Balkan Ant-cricket	LC		TRUE	IBAT
Insecta	*Tettigonia balcanica*	Balkan Green Bush-cricket	LC		FALSE	IBAT
Insecta	*Evodinus clathratus*		LC		FALSE	IBAT
Insecta	*Saphanus piceus*		LC		FALSE	IBAT
Insecta	*Xylosteus spinolae*		LC		FALSE	IBAT
Insecta	*Allecula morio*		LC		FALSE	IBAT
Insecta	*Isomira antennata*		LC		FALSE	IBAT
Insecta	*Anogcodes fulvicollis*		LC		FALSE	IBAT
Insecta	*Eumerus alpinus*		LC	Not a Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Insecta	*Pipiza noctiluca*		LC	Not a Migrant	FALSE	IBAT
Insecta	*Cheilosia rhynchops*		LC	Not a Migrant	FALSE	IBAT
Insecta	*Cheilosia ranunculi*		LC	Not a Migrant	FALSE	IBAT
Insecta	*Cheilosia pubera*		LC	Not a Migrant	FALSE	IBAT
Insecta	*Cheilosia pascuorum*		LC	Not a Migrant	FALSE	IBAT
Insecta	*Cheilosia orthotricha*		LC	Not a Migrant	FALSE	IBAT
Insecta	*Cheilosia himantopa*		LC		FALSE	IBAT
Insecta	*Cheilosia cynocephala*		LC		FALSE	IBAT
Insecta	*Cheilosia caerulescens*		LC		FALSE	IBAT
Insecta	*Cheilosia antiqua*		LC		FALSE	IBAT
Insecta	*Sphegina clavata*	Roodspriet-bronzweefvlieg	LC		FALSE	IBAT
Insecta	*Criorhina pachymera*	Populierenwoudzwever	LC		FALSE	IBAT
Insecta	*Sphaerophoria batava*	Nordwestliche Stiftschwebfliege	LC		FALSE	IBAT
Insecta	*Cheilosia lenis*		LC	Not a Migrant	FALSE	IBAT
Insecta	*Cheilosia frontalis*		LC		FALSE	IBAT
Insecta	*Eupeodes lucasi*		LC	Full Migrant	FALSE	IBAT
Insecta	*Merodon constans*		LC	Not a Migrant	FALSE	IBAT
Insecta	*Brachypalpus valgus*	Grootsprietmolmzweefvlieg	LC	Not a Migrant	FALSE	IBAT
Insecta	*Sphegina elegans*	Beekbronzweefvlieg	LC		FALSE	IBAT
Insecta	*Sphegina latifrons*	Sárgasörtéjű Karcsúlégy	LC		FALSE	IBAT
Insecta	*Eumerus uncipes*		LC	Not a Migrant	FALSE	IBAT
Insecta	*Pelecocera caledonica*	Verdwenen Heidedwerg	LC	Not a Migrant	FALSE	IBAT
Insecta	*Brachypalpus laphriformis*	Brun Mulmblomfluga	LC	Not a Migrant	FALSE	IBAT
Insecta	*Cheilosia fasciata*		LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Insecta	*Cheilosia semifasciata*	Varjúháj bronzlégy	LC	Not a Migrant	FALSE	IBAT
Insecta	*Sphiximorpha garibaldii*		LC		FALSE	IBAT
Insecta	*Psilota anthracina*	Anthracine Hoverfly	LC		FALSE	IBAT
Insecta	*Sericomyia bombiformis*	Grote Fophommel	LC	Not a Migrant	FALSE	IBAT
Insecta	*Sericomyia superbiens*	Gele Fophommel	LC	Not a Migrant	FALSE	IBAT
Insecta	*Criorhina asilica*	Pale-banded Bear Hoverfly	LC		FALSE	IBAT
Insecta	*Merodon calidus*		LC	Not a Migrant	FALSE	IBAT
Insecta	*Gomphus schneiderii*	Turkish Clubtail	LC	Not a Migrant	FALSE	IBAT
Insecta	*Enallagma cyathigerum*	Common Blue Damselfly	LC		FALSE	IBAT
Insecta	*Luciola lusitanica*	Lucciola Pedemontana	LC		FALSE	IBAT
Insecta	*Ampedus vandalitiae*		DD		FALSE	IBAT
Insecta	*Tenebroides fuscus*		DD		FALSE	IBAT
Insecta	*Lioderina linearis*		DD		FALSE	IBAT
Insecta	*Thambus friwaldszkyi*		DD		FALSE	IBAT
Insecta	*Chlorophorus aegyptiacus*		DD		FALSE	IBAT
Insecta	*Andrena curvana*		DD		FALSE	IBAT
Insecta	*Hylaeus pictus*		DD		FALSE	IBAT
Insecta	*Stelis franconica*		DD		FALSE	IBAT
Insecta	*Nomada corcyraea*		DD		FALSE	IBAT
Insecta	*Hylaeus alpinus*		DD		FALSE	IBAT
Insecta	*Andrena resoluta*		DD		FALSE	IBAT
Insecta	*Hylaeus hyperpunctatus*		DD		FALSE	IBAT
Insecta	*Lasioglossum eurasicum*		DD		FALSE	IBAT
Insecta	*Hylaeus adriaticus*		DD		FALSE	IBAT
Insecta	*Andrena fimbriata*		DD		FALSE	IBAT
Insecta	*Andrena graecella*		DD		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Insecta	*Rophites hellenicus*		DD		FALSE	IBAT
Insecta	*Empusa fasciata*	Devil's Mare	DD	Not a Migrant	FALSE	IBAT
Insecta	*Rivetina baetica*	Baetic Ground Mantis	DD	Not a Migrant	FALSE	IBAT
Insecta	*Rivetina baetica ssp. tenuidentata*	Delicate Teeth Baetic Ground Mantis	DD		FALSE	IBAT
Insecta	*Trypocopris amedei*		DD		FALSE	IBAT
Insecta	*Paracoptochirus singularis*		DD		FALSE	IBAT
Insecta	*Rhophitoides epiroticus*		DD		TRUE	IBAT
Insecta	*Pholidoptera stankoi*	Stanko's Dark Bush-cricket	DD		FALSE	IBAT
Insecta	*Roeseliana ambitiosa*	Ambitious Meadow Bush-cricket	DD		FALSE	IBAT
Insecta	*Troglophilus lazaropolensis*	Lazaropole Cave-cricket	DD		FALSE	IBAT
Insecta	*Vichetia knipperi*	Knipper's Meadow Bush-cricket	DD		TRUE	IBAT
Insecta	*Hymenalia obscuriceps*		DD		FALSE	IBAT
Insecta	*Leptorhabdium illyricum*		DD		FALSE	IBAT
Insecta	*Leptorhabdium nitidum*		DD		TRUE	IBAT
Insecta	*Ischnura elegans*	Common Bluetail	LC		FALSE	IBAT
Insecta	*Somatochlora arctica*	Northern Emerald	LC		FALSE	IBAT
Insecta	*Erythromma najas*	Large Redeye	LC		FALSE	IBAT
Insecta	*Cordulegaster bidentata*	Sombre Goldenring	LC		FALSE	IBAT
Insecta	*Calopteryx virgo*	Beautiful Demoiselle	LC	Not a Migrant	FALSE	IBAT
Insecta	*Sympetrum depressiusculum*	Spotted Darter	LC	Full Migrant	FALSE	IBAT
Insecta	*Orthetrum cancellatum*	Black-tailed Skimmer	LC		FALSE	IBAT
Insecta	*Chalcolestes viridis*	Western Willow Spreadwing	LC	Not a Migrant	FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Insecta	*Lysandra coridon*	Chalk-hill Blue	LC		FALSE	IBAT
Insecta	*Hipparchia volgensis*	Delattin's Grayling	LC		FALSE	IBAT
Insecta	*Erebia oeme*	Bright-eyed Ringlet	LC		FALSE	IBAT
Insecta	*Erebia pronoe*		LC		FALSE	IBAT
Insecta	*Erebia epiphron*	Mountain Ringlet	LC		FALSE	IBAT
Insecta	*Coenonympha rhodopensis*	Eastern Large Heath	LC		FALSE	IBAT
Insecta	*Pieris balcana*		LC		FALSE	IBAT
Insecta	*Erebia melas*	Black Ringlet	LC		FALSE	IBAT
Insecta	*Parnassius mnemosyne*	Clouded Apollo	LC		FALSE	IBAT
Insecta	*Vanessa atalanta*	Red Admiral	LC	Full Migrant	FALSE	IBAT
Insecta	*Vanessa cardui*	Painted Lady	LC	Full Migrant	FALSE	IBAT
Insecta	*Nymphalis antiopa*	Camberwell Beauty	LC	Full Migrant	FALSE	IBAT
Insecta	*Ceratina gravidula*	Cératine gravide	LC		FALSE	IBAT
Insecta	*Dasypoda pyriformis*		LC		FALSE	IBAT
Insecta	*Macropis europaea*	European Yellow Loosestrife Bee	LC		FALSE	IBAT
Insecta	*Acrida ungarica*	Cone-headed Grasshopper	LC		FALSE	IBAT
Insecta	*Acrotylus patruelis*	Slender Digging Grasshopper	LC	Not a Migrant	FALSE	IBAT
Insecta	*Euchorthippus declivus*	Common Straw Grasshopper	LC		FALSE	IBAT
Insecta	*Chorthippus brunneus*	Common Field Grasshopper	LC	Not a Migrant	FALSE	IBAT
Insecta	*Stenobothrus rubicundulus*	Wing-buzzing Toothed Grasshopper	LC		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Insecta	*Pseudopodisma fieberi*	Fieber's Mountain Grasshopper	LC		FALSE	IBAT
Insecta	*Chorthippus oschei*	Carpathian Dancing Grasshopper	LC		FALSE	IBAT
Insecta	*Odontopodisma decipiens*	Cheating Mountain Grasshopper	LC		FALSE	IBAT
Insecta	*Dolichopoda remyi*	Remy's Cave-cricket	LC		TRUE	IBAT
Insecta	*Poecilimon hoelzeli*	Macedonian Bright Bush-cricket	LC		FALSE	IBAT
Insecta	*Bombus pyrenaeus*	Pyrenean Bumblebee	LC		FALSE	IBAT
Insecta	*Hoplitis villosa*	Osmie velue	LC		FALSE	IBAT
Insecta	*Nomada atroscutellaris*		LC		FALSE	IBAT
Insecta	*Hoplitis ochraceicornis*		LC		FALSE	IBAT
Insecta	*Nomada bluethgeni*	NomÃ¡da BlÃ¼thgenova	LC		FALSE	IBAT
Insecta	*Nomada fabriciana*	Fabricius' Nomad Bee	LC		FALSE	IBAT
Insecta	*Nomada flava*	Gewone wespbij	LC		FALSE	IBAT
Insecta	*Nomada ferruginata*	Geelschouderwespbij	LC		FALSE	IBAT
Insecta	*Conocephalus conocephalus*	African Cone-head	LC	Not a Migrant	FALSE	IBAT
Insecta	*Phaneroptera sparsa*	Arabian Sickle Bush-cricket	LC	Not a Migrant	FALSE	IBAT
Malacostraca	*Astacus astacus*	Noble Crayfish	VU		FALSE	IBAT
Malacostraca	*Atyaephyra strymonensis*		VU	Full Migrant	FALSE	IBAT
Malacostraca	*Potamon fluviatile*		NT		FALSE	IBAT

Class	Scientific name	Common name	Category	Movement pattern	Restricted range	Source
Malacostraca	*Potamon ibericum*		NT		FALSE	IBAT
Malacostraca	*Pontastacus leptodactylus*		LC		FALSE	IBAT
Malacostraca	*Austropotamobius torrentium*	Stone Crayfish	DD		FALSE	IBAT
Malacostraca	*Palaemon antennarius*		LC	Not a Migrant	TRUE	IBAT
Petromyzonti	*Eudontomyzon mariae*	Ukrainian Brook Lamprey	LC		FALSE	IBAT

B. Survey reports

B.1 Habitats and flora

STIP WIND FARM

Biodiversity Baseline Survey

FIELD REPORT

Biodiversity Kingdom/Class: FLORA

Biodiversity Specialist: Prof. Mitko Karadelev

Reporting Period: May, 2025

Date:
June 2025

Mott MacDonald Restricted

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STIP WIND FARM, Biodiversity Baseline Survey

FIELD REPORT, Flora and Habitats

1 | INTRODUCTION

BACKGROUND

The construction of Stip Wind Farm has been planned in the region south of the city of Stip, in the area between the villages of Dolani and Bucim. In accordance with the location of individual wind turbines, the area to be covered by the Stip Wind Farm has been divided into three sectors for the purpose of the survey, for easier organization of field activities, and more appropriate processing, analysis and presentation of the obtained data. The current design includes up to 54 wind turbine generators (WTGs), each with a nominal capacity of 6-8 MW, for a total installed capacity of up to 400 MW.

PURPOSE OF THIS REPORT

The purpose of the flora and habitats survey is to identify if any species could be affected, which might be considered 'a priority biodiversity feature' in a national or international context.

SURVEY AREA

The area of the wind farm in Stip will occupy an area of approximately 400 ha. The focus of the plant survey and habitat mapping is about 1,000-m wide corridor on the central line of the proposed WF together with the related infrastructure (overhead lines and transformer station). The cited area is deemed appropriate for a survey, and it is sufficiently large to encompass most impacts on flora and habitats arising during the construction works and operational needs in the projected area.

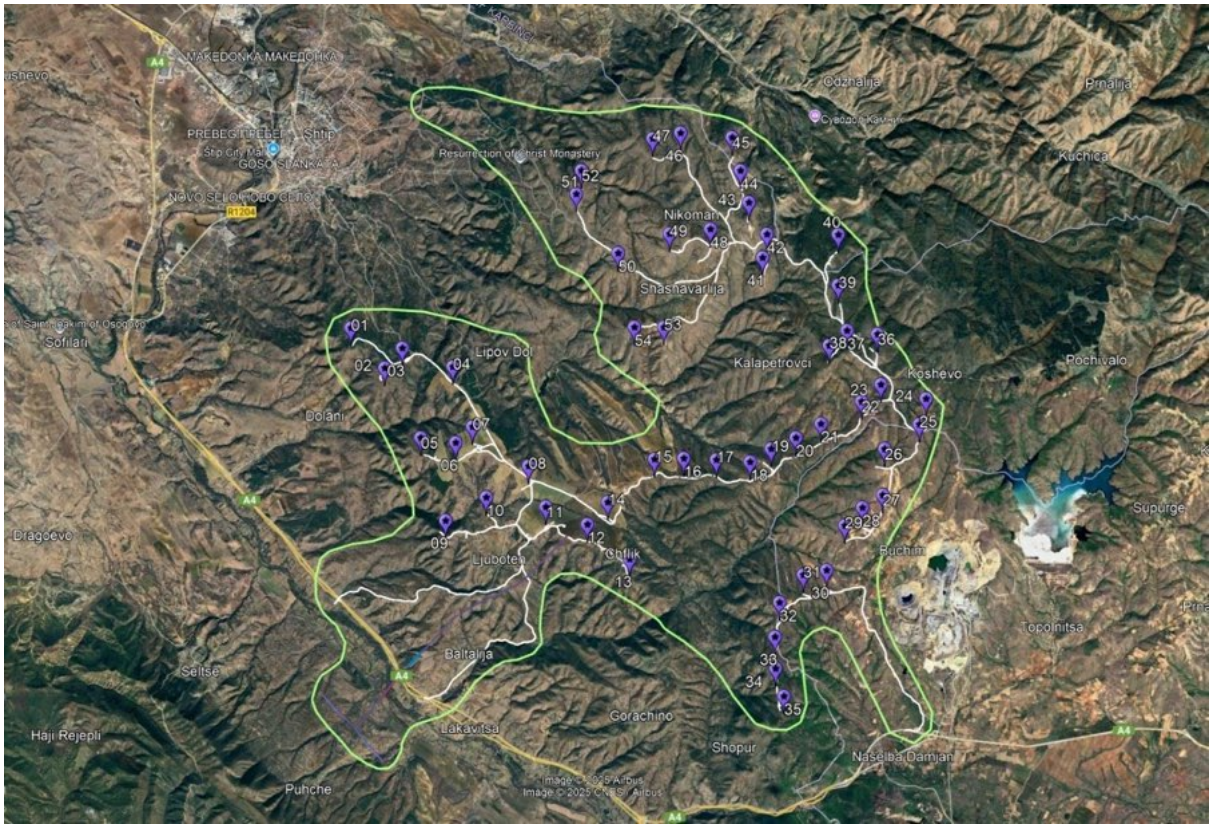

Figure 1 Survey Area

The project does not foresee blasting during the pre-construction / construction phase; therefore, there will be no airblast impact generated by the project. Air quality impact resulting from fugitive dust emissions is anticipated to be comparatively localised, and present within circa 5 m of the unsealed access roads. Dust deposition drop-out may also impact habitats in areas in close proximity to the source site during arid weather conditions.

SURVEY PERIOD

This report refers to the following survey period: May 2025.

Three field visits were organized to different locations in the survey area. The first was performed on 21 May, the second on 25 May, and the third on 27 May 2025.

SURVEY SPECIALIST

The survey was conducted by Prof. Mitko Karadelev.

2 | SCOPE OF WORK

Field survey is foreseen for the months of May, June and September of 2025.

The survey area is located in the oak belt of the Querco-Carpinetum orientalis community, which is the most degraded community due to intensive logging in the past. The rest are mountain pastures that are in varying degrees of succession due to the abandonment of agricultural properties, fields and acres, occasional watercourses and villages. The survey should define the habitats and significant flora elements in the area of construction of wind farms, access roads and transmission lines. Due to the impossibility of visiting all the locations of the wind turbines, access roads and transmission lines, survey points will first be defined depending on the present habitats, plant communities, accessibility to the site, altitude, and other differential factors that should ensure diversity of flora species. These locations will be visited in the forthcoming period in order to cover flora species in different time periods.

3 | METHODOLOGY

FIELD SURVEY

Field surveys will be conducted throughout the survey area in the spring and summer season (May, June and September). One of the goals outlined within the current project is identification of occurring types of habitats, especially grasslands, woodlands etc in the area. Following the revision of all available data, the Proposed National Reference List of Habitats, the distribution maps of individual habitats based on the desktop analysis, gaps in the knowledge of certain habitats will be identified, and field survey will be undertaken to complement the knowledge of present habitats.

The National Catalogue of Habitats of EU Importance as well as the Interpretation Manual of European Union Habitats EUR28 (2013) is consulted to interpret the habitat types included in Annex I. Identification of the habitats is performed based on phytocoenoses, dominant plant species and range-restricted species, accompanied by recognizing the characteristics of the geographical location, altitude, relief, substrate and soil. This means that the physiognomic, ecological and floristic approach is applied. The emphasis is laid on diagnostic and dominant species.

An input of the following field data will be made in the database: location coordinates, photography, observable species (characteristic, frequent, dominant, etc.), observations, but

also representativeness, degree of conservation, and degree of preserved functions. A map of habitats will be produced in GIS.

Plant species are evaluated according to IUCN's Red List of Species (global and national), annexes of the EU Habitats Directive, and national legislation, with the aim of assessing biodiversity values on the territory of the studied area.

LIMITATIONS

Hard-to-reach terrain, overgrown with bushes, difficult to pass, away from accessible roads even with an off-road vehicle.

4 | SURVEY RESULTS

SURVEY SITES

Survey was carried out at several locations, summarized in 12 points, based on the differences in the present habitats, distance to wind turbines, and altitude. Twenty-two locations of the wind turbines in total were visited in the stretch, starting from the town of Stip and the villages of Sasavarlija - Nikoman - Kalapetrovci, coupled with the wind turbines north of the village of Ljuboten, together with access roads and transmission lines. For the next field survey, the plan is to visit the rest of the locations in the stretch between the villages of Bucim and Kosevo, in addition to the surroundings of the village of Sopur.

Table 1 Survey sites/points/tranches for flora and habitats.

Site Reference	Location	Additional Details - Habitats
Point 1. WT **51, 52**, 42, 43, 44 and 45	41°43'54.03"N, 22°15'44.07"E; 41°44'9.29"N, 22°15'48.46"E	6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), with individual trees of *Quercus pubescens* and *Pyrus amygdaliformis* - 700 m alt.
Point 2. WT No. 48 and 50	41°43'30.84"N, 22°17'39.43"E; 41°43'15.82"N, 22°16'20.26"E	The ploughed fields surrounded by individual trees of *Quercus pubescens* and *Pyrus amygdaliformis,* at 730-830 m alt.
Point 3. WT No. 39, 40 and 41	41°43'12.46"N, 22°18'24.31"E	Degraded oak forest (*Quercus pubescens*) with hill pastures in the vicinity, 850 m alt.
Point 4. Power transmission line	Between 41°44'42.42"N, 22°14'52.94"E and 41°45'7.11"N, 22°13'27.53"E	Mixed conifer plantation of *Pinus nigra* and *Hesperocyparis arizonica*. It stretches from the town of Stip along the road to Sasavarlija village.
Point 5. Power transmission line (steppe vegetation)	41°45'17.52"N, 22°13'29.06"E	6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia). A minor area (approx. 12 m^2) along the road from the town of Stip to Sasavarlija vill. constitutes a typical steppe vegetation type.

Site Reference	Location	Additional Details - Habitats
Point 6. WT No. 10	41°40'38.16"N, 22°14'26.03"E 41°40'37.45"N, 22°14'28.62"E	1) FB.4 Vineyard and 2) E5.1 Abandoned arable land with ruderal vegetation, 600 m alt.
Point 7. WT No. 9	41°40'23.11"N, 22°13'50.93"E	6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), 610 m alt., encircled by degraded oak forest (*Quercus pubescens*).
Point 8. WT No. 6, 7, 8, 11 and 14	between 41°41'13.73"N, 22°13'59.65"E and 41°40'34.99"N, 22°16'11.23"E	Wheat fields, 630-650 m alt.
Point 9. WT No. 4	41°42'2.69"N, 22°13'57.34"E	E5.1 Abandoned arable land with ruderal vegetation, 670 m alt.
Point 10. WT No. 3	41°42'14.80"N, 22°13'13.67"E	E5.1 Abandoned vineyard with ruderal vegetation, 650 m alt.
Point 11. WT No. 2	41°42'1.90"N, 22°12'58.09"E	6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), 640 m alt., enclosed by degraded oak forest (*Quercus pubescens*).
Point 12. WT No. 1	41°42'27.82"N, 22°12'28.98"E	Mixed conifer plantation, 650 m alt.

HABITAT ASSESSMENT

During the survey, ten habitats overall - three natural habitats and seven anthropogenic habitats were recorded. All of the three natural habitats are cited in Annex I to the EU Habitats Directive, while one of them is of priority importance.

Table 2 Assessment of habitats in the survey area

[1]Habitat (EUNIS Classification)	[2]EU Habitats Directive (Annex I)	[3]European Red List of Habitats	Comments
E1.21 - Helleno-Balkanic [Satureja montana] steppes	6210: Semi-natural dry grasslands and scrubland facies on calcareous	VU	Wind turbines No. 2, 9, 51, 52, 42, 43, 44 and 45; transmission lines; access roads. The typical steppe

[1] http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm. Presence of Habitats Directive Annex 1 habitattypes is a prerequisite for consideration of a site for Special Area of Conservation (SAC) designation.
[2] https://eunis.eea.europa.eu/habitats.jsp The EUNIS habitat classification is a comprehensive pan-European system for habitat identification.
[3]https://www.researchgate.net/publication/312378307_European_Red_List_of_Habitats_Part_2_Terrestrial_and_freshwater_habitats

[1]Habitat (EUNIS Classification)	[2]EU Habitats Directive (Annex I)	[3]European Red List of Habitats	Comments
	substrates (Festuco Brometalia)		vegetation type is rare in the area. It is mostly represented by abandoned fields in various stages of succession to hill pastures.
G1.73 - Eastern Quercus pubescens woods.	*91AA: Eastern white oak woods.	LC	Mainly degraded oak forest at wind turbines No. 39, 40 and 41; transmission lines; access roads.
C2.5 - Temporary running waters	3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	DD	Transmission lines.
G3.F1 Native conifer plantations	/	/	Wind turbine No. 1; transmission lines; access roads.
G5.1 Lines of trees; Hedgerows	/	/	Transmission lines; access roads.
I1.3 Arable land	/	/	Wind turbines No. 6, 7, 8, 11, 14, 48 and 50; transmission lines; access roads.
G1.D4 Fruit orchards	/	/	Transmission lines; access roads.
FB.4 Vineyards	/	/	Wind turbine No. 10; transmission lines; access roads.
E5.1 Abandoned arable land with ruderal vegetation.	/	/	Wind turbines No. 3 and 4; transmission lines; access roads.
J Constructed, industrial and other artificial habitats.	/	/	/

FLORA ASSESSMENT

Valorisation of plants was conducted pursuant to the national and international conventions and legislation on protection of threatened species on a European or global level, as follows: species listed in the CORINE European List, CITES National List of Strictly Protected and Protected Wild Species, Global European and National Red Lists of Threatened Plants, along with rare or endemic species occurring in the area.

Table 3 Valorisation of plants in the wind farm corridor area.

Species	National Red List of Threatened Plants	Global IUCN Red List of Threatened Plants	IUCN European Red List	CORINE List	CITES Convention	Rare/ Endemic Species
Anacamptis morio		NT			Appendix II	
Silene vulgaris		LC		x		
Astragalus onobrychis						Rare species
Morina persica						Rare species
Astragalus parnasii						Rare species
Colchicum doerfleri			LC			Balkan endemic
Orobanche amethystea		NT				Rare species

Species	National Red List of Threatened Plants	Global IUCN Red List of Threatened Plants	IUCN European Red List	CORINE List	CITES Convention	Rare/ Endemic Species
Paeonia peregrina						Rare species
Orobanche reticulata						Rare species

FIELD SURVEY RESULTS

Point 1. Wind Turbines No. 51, 52, 42, 43, 44 and 45

Habitats: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), with individual trees of *Quercus pubescens* and *Pyrus amygdaliformis*, at 41°43'54.03"N, 22°15'44.07"E; 41°44'9.29"N, 22°15'48.46"E, 700 m alt. The most common plant species are the following:

Species	Cover
Achillea coarctata	1
Anacamptis morio	+
Anthemis arvensis	3
Anchusa officinalis	+
Astragalus onobrychis	4
Bromus racemosus	+
Campanula rapunculus	+
Campanula rotundifolia	+
Carduus crispus	+
Centaurea cyanus	+
Centaurea sp.	+
Crataegus monogyna	+
Crepis foetida	+
Dianthus cruentus	+
Erysimum diffusum	+
Euphorbia cyparissias	+
Euphorbia sequieriana	+
Erodium ciconium	+
Erodium cicutarium	+
Hordeum vulgare	3
Hordeum murinum	+
Hypericum olympicum	+
Avenula pubescens	+
Leontodon hispidus	1
Lamium purpureum	+
Lathyrus cicera	+
Linaria pelisseriana	+
Orobanche reticulata	+
Paeonia peregrina	+
Papaver rhoeas	+
Parentucellia latifolia	+
Poa pratensis	2
Potentilla argentea	2
Pyrus amygdaliformis	2
Quercus pubescens	+
Rosa gallica	+

Reseda lutea	+
Sanguisorba minor	4
Satureja hortensis	3
Sideritis montana	+
Silene conica	+
Silene italica	+
Sisymbrium altissimum	+
Scleranthus perennis	+
Senecio gallicus	+
Tragopogon dubius	+
Trifolium stellatum	+
Thymus sp.	+
Tuberaria guttata	+
Verbascum sp.	+

Figure 2 Hill pasture with grasses and annual plants. View of the WT 51 location.

Figure 3 Hill pasture with individual trees of Quercus pubescens and Pyrus amygdaliformis, WT 42 location.

Point 2. Wind Turbines No. 48 and 50.

Habitats: The ploughed fields encircled by individual trees of *Quercus pubescens* and *Pyrus amygdaliformis,* at 41°43'30.84"N, 22°17'39.43"E and 41°43'15.82"N, 22°16'20.26"E, 730-830 m alt.

Figure 4 Location of WT 48 in a ploughed field.

Figure 5Wind measurement tower near the WT 48 location.

Point 3. Wind Turbine No. 39, 40 and 41

Habitats: Degraded oak forest (*Quercus pubescens*) with adjacent hill pastures (at 41°43'12.46"N, 22°18'24.31"E, 850 m alt.).

Species	**Cover**
Quercus pubescens	3
Pyrus amygdaliformis	2
Quercus frainetto	2
Acer campestre	1
Crataegus monogyna	1
Fragaria vesca	+
Euphorbia cyparissias	+
Erodium cicutarium	+
Hordeum vulgare	+
Hypericum olympicum	+
Lamium purpureum	+
Linaria pelisseriana	+
Paeonia peregrina	+
Papaver rhoeas	+
Potentilla argentea	+
Rosa gallica	+
Sanguisorba minor	+
Satureja hortensis	+
Silene conica	+
Silene italica	+
Tragopogon dubius	+
Trifolium stellatum	+
Thymus sp.	+
Verbascum sp.	+

Figure 6 Location of WT 41 on the top of the hill in degraded oak forest with surrounding hill pastures.

Figure 7 Balkan peony (Paeonia peregrina) growing in an oak forest

Point 4. Power Transmission Line (Mixed Conifer Plantation)

Habitat: Mixed conifer plantation of *Pinus nigra* and *Hesperocyparis arizonica* (between 41°44'42.42"N, 22°14'52.94"E and 41°45'7.11"N, 22°13'27.53"E). It commences from the town of Stip, stretching along the road up to Sasavarlija village.

Figure 8 Mixed plantation of Pinus nigra and Hesperocyparis arizonica along the power transmission line.

Point 5. Power Transmission Line (Typical Steppe Vegetation)

Habitat: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia). A minor area (approx. 12 m^2) along the road from the town of Stip to Sasavarlija village constitutes a typical steppe vegetation type (41°45'17.52"N, 22°13'29.06"E). Important steppe species growing in the area are *Morina persica* and *Astragalus parnassi*. They belong to ass. Astragalo-Morinetum.

Species	**Cover**
Morina persica	1
Astragalus parnassi	3
Quercus pubescens	1
Carpinus orientalis	+
Crataegus monogyna	+
Cornus sanguinea	+
Paliurus spina-christi	+
Pyrus amygdaliformis	+
Hypericum olympicum	+
Astragalus onobrichis	+
Ornithogalum umbelatum	+
Scorzonera laciniata	+
Filipendula vulgaris	+
Linum usitatissimum	+

Figure 9 Astragalus parnassi is a spiny semi-shrub species with a steppe origin, distributed in Southern Europe.

Figure 10 Morina persica is a typical steppe-origin species in the region, and it is also found in the Near East.

Point 6. Wind Turbine No. 10

Habitats: FB.4 Vineyard (41°40'38.16"N, 22°14'26.03"E) and E5.1 Abandoned arable land with ruderal vegetation (41°40'37.45"N, 22°14'28.62"E), 600 m alt. The typical plant species in the abandoned arable land are as follows:

Species	**Cover**
Anthemis arvensis	3
Marubium perregrinum	2
Hordeum vulgare	1
Astragalus onobrichis	1
Verbascum sp.	+
Euphorbia cyparissias	+
Anchusa officinalis	+
Papaver rhoeas	+
Malva silvestris	1
Sisymbrium sp.	+
Carduus crispus	+
Lathyrus cicera	+
Hordeum vulgare	+
Xanthium spinosum	+
Sonchus asper	+
Tragopogon dubius	+
Lepidium draba	+
Centaurea cyanus	+
Campanula rapunculus	+
Lysimachia arvensis	+
Achillea coarctata	+
Euphorbia seguieriana	+
Potentila argentea	+
Stipa pennata	+
Bunias erucago	+

Figure 11 A vineyard and a neighbouring abandoned field with ruderal vegetation (right).

Figure 12 The most common ruderal plants in the abandoned fields - *Anthemis arvensis* (left) and *Marubium perregrinum* (right)

Point 7. Wind Turbines No. 9

Habitats: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (on 41°40'23.11"N, 22°13'50.93"E, 610 m alt.), enfolded by degraded oak forest (*Quercus pubescens*).

Species	**Cover**
Anchusa officinalis	3
Potentilla recta	3
Tragopogon dubius	+
Medicago falcata	3
Trifolium hirtum	1
Anchusa officinalis	+
Rumex acetosella	+
Galium aparine	+
Potentilla argentea	+
Agrostema githago	+
Euphorbia cyparissias	+
Lathyrus cicera	+
Astragalus onobrichis	+

Anthemis arvensis	+
Alissum montanum	+
Geranium pusillum	+
Alyssum alyssoides	+
Hordeum vulgare	+
Dasypyrum villosum	+
Achillea coarctata	+
Calamagrostis epigejos	+
Bromus racemosus	+
Stipellula capensis	+
Dianthus cruentus	+
Quercus pubescens	+
Pyrus amygdaliformis	+

Figure 13 Location of WT 9 in a hill pasture with adjoining oak forest.

Point 8. Wind Turbines No. 6, 7, 8, 11 and 14

Habitat: Wheat fields, between 41°41'13.73"N, 22°13'59.65"E and 41°40'34.99"N, 22°16'11.23"E, 630-650 m alt. The following species are found along the edges of the fields:

Species	**Cover**
Melilotus officinalis	+
Dianthus armeria	+
Evonimus europaeus	+
Trifolium incarnatum	+
Trifolium stellatum	+
Festuca sp.	+
Ulmus minor	+
Quercus pubescens	+
Evonymus europaeus	+

Lonicera etrusca	+
Colutea arborescens	+
Verbascum sp.	+
Malva silvestris	+
Daucus carota	+

Figure 14 Locations of WT 8 and WT 11 in a wheat field.

Point 9. Wind Turbine No. 4

Habitat: E5.1 Abandoned arable land with ruderal vegetation (41°42'2.69"N, 22°13'57.34"E), 670 m alt. Plant species distinctive of the abandoned arable land are as follows:

Species	**Cover**
Anthemis arvensis	3
Rumex acetosella	3
Centaurea cyanus	2
Marubium perregrinum	1
Bunias erucago	+
Trifolium campestre	+
Festuca sp.	+
Verbascum sp.	+
Malva silvestris	+
Daucus carota	+
Linaria genistifolia	+
Legousia speculum-veneris	+
Papaver rhoeas	+
Achillea coarctata	+

Figure 15 WT 4 location on abandoned arable land, with a measurement tower in the backdrop.

Point 10. Wind Turbine No. 3

Habitat: E5.1 Abandoned vineyard with ruderal vegetation (41°42'14.80"N, 22°13'13.67"E), 650 m alt.

Species	**Cover**
Vitis vinifera	3
Rubus fruticosus	2
Campanula rapunculus	2
Rumex acetosella	1
Papaver rhoeas	+
Centaurea cyanus	+
Achillea coarctata	+
Anthemis arvensis	+
Hordeum vulgare	+
Verbascum sp.	+
Sonchus asper	+
Carduus crispus	+

Figure 16 An abandoned vineyard with ruderal vegetation.

Point 11. Wind Turbine No. 2

Habitats: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (at 41°42'1.90"N, 22°12'58.09"E, 640 m alt.), encompassed by degraded oak forest (*Quercus pubescens*).

Species	**Cover**
Sideritis montana	3
Trifolium hirtum	1
Pyrus amygdaliformis	1
Dianthus armeria	+
Potentilla argentea	+
Thymus sp.	+
Stipa pennata	+
Coronilla varia	+
Potentilla hirta	+
Hordeum murinum	+
Achillea coarctata	+
Bromus racemosus	+
Crataegus monogyna	+
Quercus pubescens	+
Ulmus minor	+

Figure 17 WT 2 location in a hill pasture.

Point 12. Wind Turbine No. 1

Habitat: Mixed conifer plantation (41°42'27.82"N, 22°12'28.98"E), at 650 m alt.

Species	**Cover**
Pinus nigra	2
Hesperocyparis arizonica	5

Figure 18 WT 1 location in a conifer plantation.

Priority Biodiversity Features (PBF) and Critical Habitats (CH)

Critical Habitat and Priority Biodiversity Feature assessment is a process designed for identification of areas of the highest biodiversity value, considered especially sensitive to impact, and where particular attention must be paid. The CHA process comprises an initial project screening to identify potential CH/PBF trigger habitats or species present within the area affected by the project. Initial screening is conducted in order to establish trigger features, followed by analysis and verification.

Priority Biodiversity Features

According to PR6 paragraph 12-I criteria (a), Ecologically Appropriate Area of Analysis (EAAA) is a habitat type listed in Annex 1 to EU Habitats Directive or Resolution 4 of Bern Convention; the habitats 6210: Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia), and 3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion completely trigger PBF in the area. The grassland habitat is vulnerable according to the European Red List of Habitats. There are also 6 species of rare plants (one is a Balkan endemic) that trigger PBF.

Table 4 Habitats and Species that trigger PBF, occurring within the project area

Habitats - EUNIS	**Priority Features - Criteria**	
	[4]EU Habitats Directive (Annex I)	**[5]European Red List of Habitats**
E1.21 - Helleno-Balkanic [Satureja montana] steppes	6210: Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia)	VU
C2.5 - Temporary running waters	3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	DD

Species	**National Red List of Threatened Plants**	**Global IUCN Red List of Threatened Plants**	**IUCN European Red List**	**CITES Convention**	**Rare Species**
Astragalus onobrychis					x
Morina persica					x
Astragalus parnasii					x
Colchicum doerfleri		LC			Balkan endemic
Paeonia peregrina					x
Orobanche reticulata					x

[4]https://eunis.eea.europa.eu/habitats.jsp. The EUNIS habitat classification is a comprehensive pan-European system for habitat identification.
[3]https://www.researchgate.net/publication/312378307_European_Red_List_of_Habitats_Part_2_Terrestrial_and_freshwater_habitats

Critical Habitats

According to PR6 paragraph 14-I criteria (a), EAAA is a habitat type listed in Annex 1 to the EU Habitats Directive marked as priority habitat type; the habitat 91AA* Eastern white oak woods completely meets CH. The oak forest belt is characterised by a range of forest communities developing in the area. It is affiliated with the community of *Querco-Carpinetum orientalis*. This forest type in the area is primarily degraded due to extensive exploitation in the past. There aren't any plant species that trigger CH in the area.

Table 5 Habitats that trigger CH found within the project area.

Habitats - EUNIS	**Critical Habitats - Criteria**	
	EU Habitats Directive (Annex I - Priority Habitat Type)	**European Red List of Habitats**
G1.73 - Eastern Quercus pubescens woods.	91AA* Eastern white oak woods	LC

Invasive Species

No invasive species whatsoever have been detected in the project area.

CONCLUSION

On the basis of the aforementioned analysis, the following CH/PBF triggers in accordance with EBRD PR6 have been identified:

TRIGGER	HABITATS/SITES/SPECIES	STATUS
Habitats of significant importance	91AA* Eastern white oak woods; 6210: Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) 3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	**CH** **PBF** **PBF**
Plants of significant importance (rare, endemic or restricted range) species	*Astragalus onobrychis* *Astragalus parnasii* *Colchicum doerfleri* *Morina persica* *Paeonia peregrina* *Orobanche reticulata*	**PBF** **PBF** **PBF** **PBF** **PBF** **PBF**

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ANNEXES

ANNEX 1 - MONITORING LOCATIONS

Point 1. Wind turbines No. 51 and 52
Habitats: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), with individual trees of *Quercus pubescens* and *Pyrus amygdaliformis* - at 41°43'54.03"N, 22°15'44.07"E; 41°44'9.29"N, 22°15'48.46"E, 700 m alt.

Point 2. Wind turbines No. 48 and 50
Habitats: Ploughed fields surrounded by individual trees of *Quercus pubescens* and *Pyrus amygdaliformis,* at 41°43'30.84"N, 22°17'39.43"E and 41°43'15.82"N, 22°16'20.26"E, 730-830 m alt.

Point 3. Wind turbine No. 41
Habitats: Degraded oak forest (*Quercus pubescens*) with adjacent hill pastures, at 41°43'12.46"N, 22°18'24.31"E, 850 m alt.

Point 4. Power transmission line (mixed conifer plantation)
Habitat: Mixed conifer plantation of *Pinus nigra* and *Hesperocyparis arizonica* (between 41°44'42.42"N, 22°14'52.94"E and 41°45'7.11"N, 22°13'27.53"E). It begins from the town of Stip along the road to the Sasavarlija village.

Point 5. Power transmission line (typical steppe vegetation)
Habitat: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia). A small area (approx. 12 m^2) along the road from the town of Stip to Sasavalija vill. constitutes a typical steppe vegetation type (41°45'17.52"N, 22°13'29.06"E).

Point 6. Wind turbine No. 10
Habitats**:** FB.4 Vineyard (41°40'38.16"N, 22°14'26.03"E) and E5.1 Abandoned arable land with ruderal vegetation (41°40'37.45"N, 22°14'28.62"E), 600 m alt.

Point 7. Wind turbines No. 9
Habitats**:** 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), at 41°40'23.11"N, 22°13'50.93"E, 610 m alt., enclosed by degraded oak forest (*Quercus pubescens*).

Point 8. Wind turbines No. 6, 7, 8, 11 and 14
Habitat**:** Wheat fields, 650 m alt.

Point 9. Wind turbine No. 4
Habitat: E5.1 Abandoned arable land with ruderal vegetation (41°42'2.69"N, 22°13'57.34"E), 670 m.

Point 10. Wind turbine No. 3
Habitat**:** E5.1 Abandoned vineyard with ruderal vegetation (41°42'14.80"N, 22°13'13.67"E), 650 m.

Point 11. Wind turbine No. 2
Habitats**:** 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (at 41°42'1.90"N, 22°12'58.09"E, 640 m alt.), surrounded by degraded oak forest (*Quercus pubescens*).

Point 12. Wind turbine No. 1

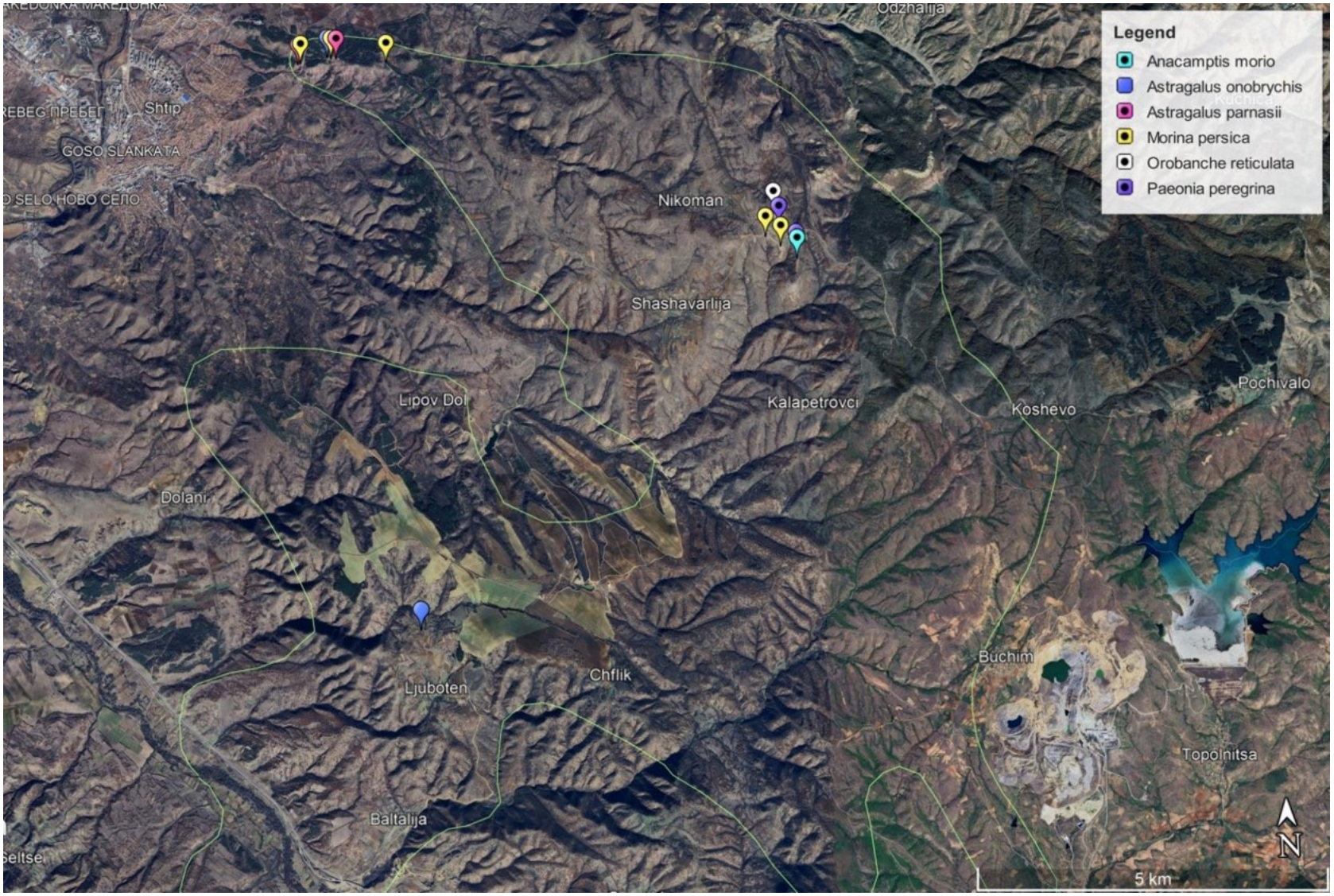
Habitat: Mixed conifer plantation (41°42'27.82"N, 22°12'28.98"E), 650 m alt.

ANNEX 2 - COMPLETE LIST OF IDENTIFIED FLORA SPECIES

1. *Acer campestre*
2. *Achillea coarctata*
3. *Agrostema githago*
4. *Alissum montanum*
5. *Alyssum alyssoides*
6. *Anacamptis morio*
7. *Anchusa officinalis*
8. *Anthemis arvensis*
9. *Armeria arenaria*
10. *Astragalus onobrychis*
11. *Astragalus parnasii*
12. *Avenula pubescens*
13. *Berberis vulgaris*
14. *Bromus racemosus*
15. *Bunias erucago*
16. *Calamagrostis epigejos*
17. *Campanula rapunculus*
18. *Campanula rotundifolia*
19. *Carduus crispus*
20. *Carpinus orientalis*
21. *Centaurea cyanus*
22. *Centaurea sp.*
23. *Clematis vitalba*
24. *Colutea arborescens*
25. *Coronilla varia*
26. *Crataegus monogyna*
27. *Crepis foetida*
28. *Crupina vulgaris*
29. *Dactylis glomerata*
30. *Dasypyrum villosum*
31. *Daucus carota*
32. *Dianthus armeria*
33. *Dianthus cruentus*
34. *Eringium campestre*
35. *Erodium ciconium*
36. *Erodium cicutarium*
37. *Erysimum diffusum*
38. *Euphorbia cyparissias*
39. *Euphorbia sequieriana*
40. *Evonimus europaeus*
41. *Festuca sp.*
42. *Filipendula vulgaris*
43. *Fragaria vesca*
44. *Fraxinus ornus*
45. *Galium aparine*
46. *Geranium pusillum*
47. *Geranium sanguineum*
48. *Hesperocyparis arizonica*
49. *Hordeum murinum*
50. *Hordeum vulgare*
51. *Hypericum olympicum*
52. *Inula helenium*
53. *Jurinea mollis*
54. *Lamium purpureum*
55. *Lathirus niger*
56. *Lathyrus cicera*
57. *Legousia speculum-veneris*
58. *Leontodon crispus*
59. *Leontodon hispidus*
60. *Lepidium draba*
61. *Ligustrum vulgare*
62. *Linaria genistifolia*
63. *Linaria pelisseriana*
64. *Linum tenuifolium*
65. *Lonicera etrusca*
66. *Lysimachia arvensis*
67. *Malva silvestris*
68. *Marrubium peregrinum*
69. *Medicago falcata*
70. *Melilotus officinalis*
71. *Morina persica*
72. *Nepeta nuda*
73. *Onobrychis arenaria*
74. *Ornithogalum umbelatum*
75. *Orobanche amethystea*
76. *Orobanche reticulata*
77. *Paeonia peregrina*
78. *Papaver rhoeas*
79. *Parentucellia latifolia*
80. *Phleum pratense*
81. *Pinus nigra*
82. *Plantago lanceolata*
83. *Poa pratensis*
84. *Polygala vulgaris*
85. *Potentilla argentea*
86. *Potentilla hirta*
87. *Potentilla recta*
88. *Pyrus amygdaliformis*
89. *Pyrus pyraster*
90. *Quercus frainetto*
91. *Quercus pubescens*
92. *Reseda lutea*
93. *Rhinanthus minor*
94. *Rosa canina*

95. *Rosa gallica*
96. *Rubus fruticosus*
97. *Rumex acetosella*
98. *Sanguisorba minor*
99. *Satureja hortensis*
100. *Scleranthus perennis*
101. *Senecio gallicus*
102. *Sideritis montana*
103. *Silene conica*
104. *Silene italica*
105. *Sisymbrium altissimum*
106. *Sisymbrium sp.*
107. *Sonchus asper*
108. *Sorbus aucuparia*
109. *Stipa pennata*
110. *Stipellula capensis*
111. *Thymus sp.*
112. *Tragopogon dubius*
113. *Trifolium angustifolium*
114. *Trifolium arvense*
115. *Trifolium campestre*
116. *Trifolium hirtum*
117. *Trifolium incarnatum*
118. *Trifolium pratense*
119. *Trifolium stellatum*
120. *Tuberaria guttata*
121. *Ulmus minor*
122. *Verbascum sp.*
123. *Vicia grandiflora*
124. *Vicia tenuifolia*
125. *Vicia vilosa*
126. *Viola tricolor*
127. *Vitis vinifera*
128. *Xanthium spinosum*

ANNEX 3 MAP OF IDENTIFIED IMPORTANT SPECIES



Legend
Anacamptis morio
Astragalus onobrychis
Astragalus parnasii
Morina persica
Orobanche reticulata
Paeonia peregrina
Nikoman
Shashavarlija

STIP WIND FARM

Baseline Survey of Species and Habitats

FIELD REPORT

Biodiversity Kingdom/Class: FLORA

Biodiversity Specialist: Prof. Mitko Karadelev

Reporting Period: June, 2025

Date:
July 2025

Mott MacDonald Restricted

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STIP WIND FARM, Biodiversity Baseline Survey

FIELD REPORT, Flora and Habitats

INTRODUCTION

BACKGROUND

The construction of Stip Wind Farm has been planned in the region south of the city of Stip, in the area between the villages of Dolani and Bucim. In accordance with the location of individual wind turbines, the area to be covered by the Stip Wind Farm has been divided into three sectors for the purpose of the survey, for easier organization of field activities, and more appropriate processing, analysis and presentation of the obtained data. The current design includes up to 54 wind turbine generators (WTGs), each with a nominal capacity of 6-8 MW, for a total installed capacity of up to 396 MW.

PURPOSE OF THIS REPORT

The purpose of the flora and habitats survey is to identify if any species could be affected, which might be considered 'a priority biodiversity feature' in a national or international context.

SURVEY AREA

The area of the wind farm in Stip will occupy an area of approximately 400 ha. The focus of the plant survey and habitat mapping is about 1,000-m wide corridor on the central line of the proposed WF together with the related infrastructure (overhead lines and transformer station). The cited area is deemed appropriate for a survey, and it is sufficiently large to encompass most impacts on flora and habitats arising during the construction works and operational needs in the projected area.

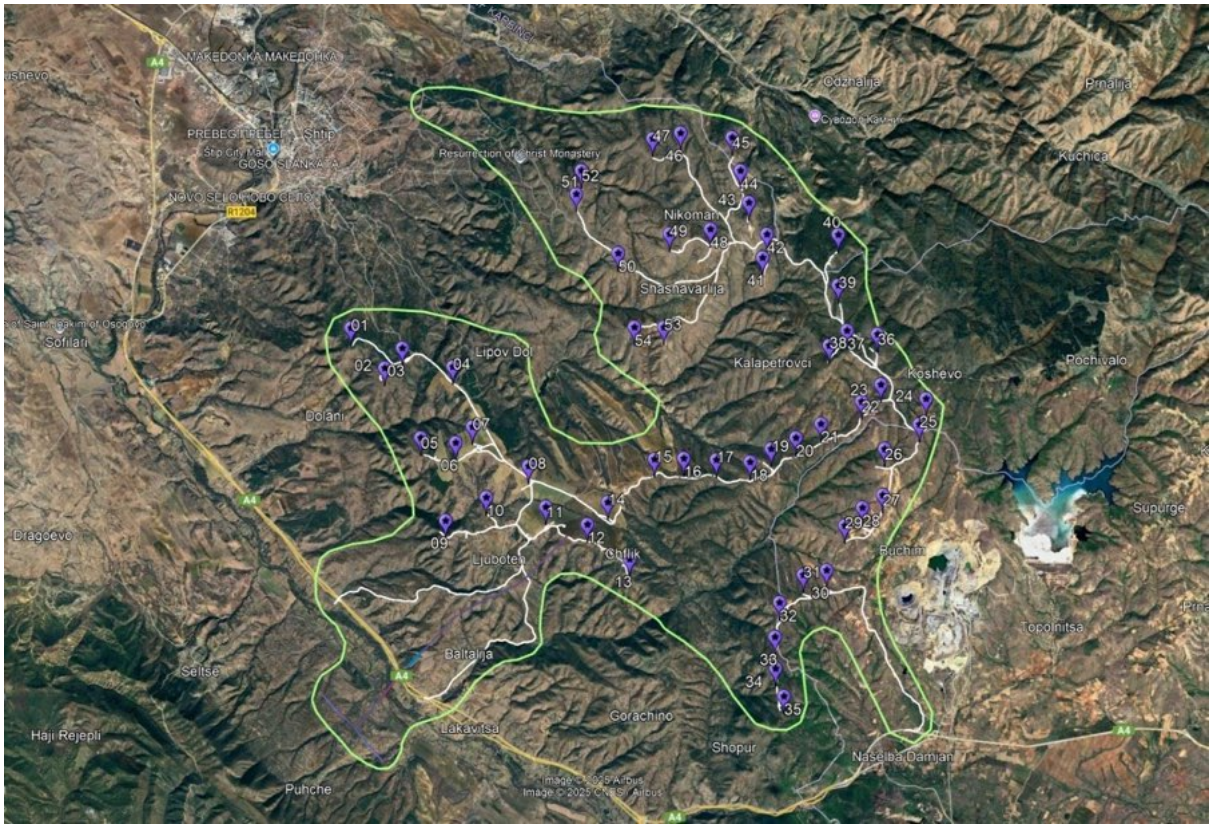

Figure 1 Survey Area

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The project does not foresee blasting during the pre-construction / construction phase; therefore, there will be no airblast impact generated by the project. Air quality impact resulting from fugitive dust emissions is anticipated to be comparatively localised, and present within circa 5 m of the unsealed access roads. Dust deposition drop-out may also impact habitats in areas in close proximity to the source site during arid weather conditions.

SURVEY PERIOD

This report refers to the following survey period: June 2025.

Three field visits were organized to different locations in the survey area. The first was performed on 8 June, the second on 11 June, and the third on 22 June 2025.

SURVEY SPECIALIST

The survey was conducted by Prof. Mitko Karadelev.

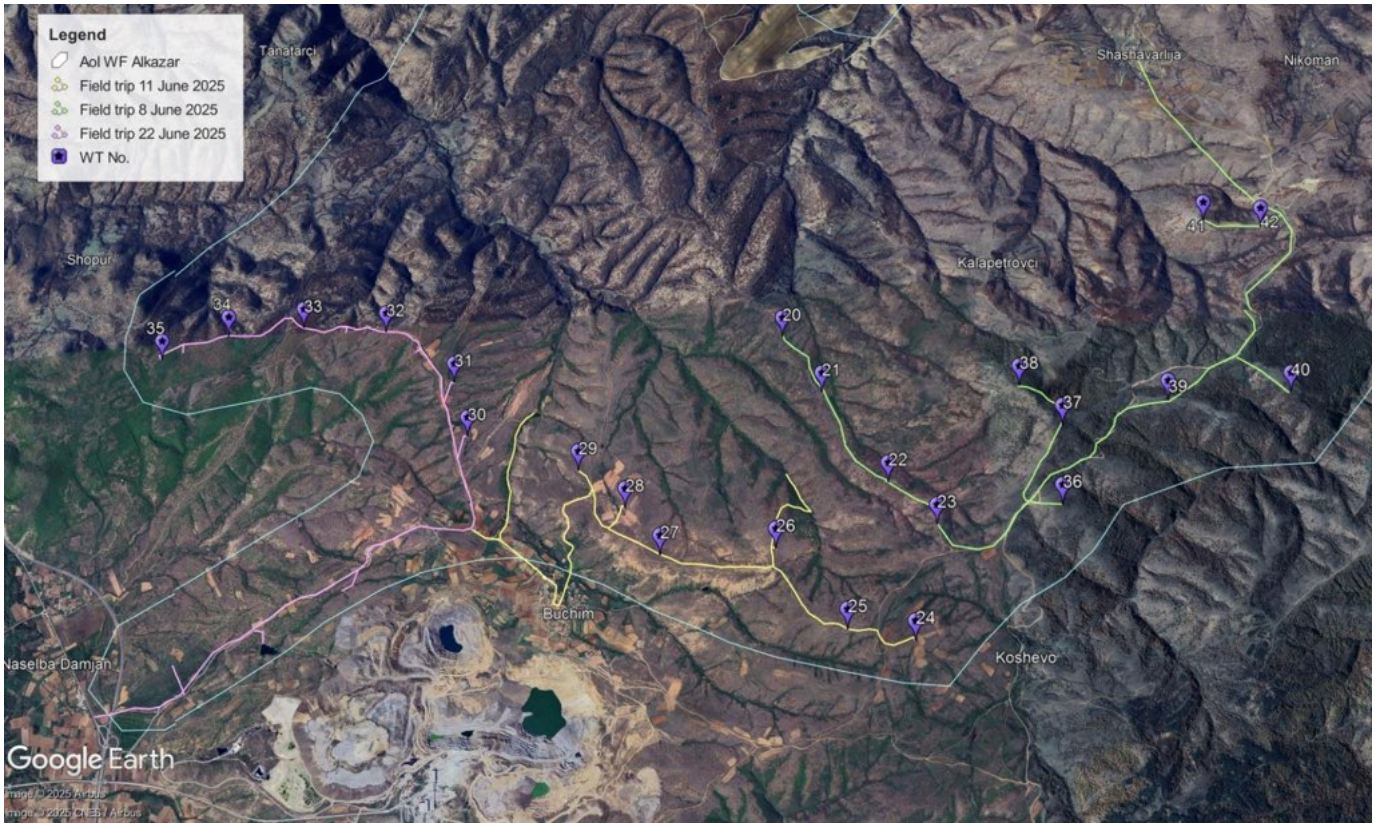

Figure 2 Field visits in different location in the area of interest.

SCOPE OF WORK

Field research is slated for the months of May, June and September of 2025. The survey area is located in the oak belt of the Querco-Carpinetum orientalis community, which is the most degraded community due to intensive logging in the past. The rest are mountain pastures that are in varying degrees of succession due to the abandonment of agricultural properties, fields and acres, occasional watercourses and villages. The research should define the habitats and significant flora elements in the area of construction of wind farms, access roads and transmission lines. Due to the impossibility of visiting all the locations of the wind turbines, access roads and transmission lines, research points will first be defined depending on the present habitats, plant communities, accessibility to the site, altitude, and

other differential factors that should ensure diversity of flora species. These locations will be visited in the forthcoming period in order to cover flora species in different time periods.

METHODOLOGY

FIELD SURVEY

Field surveys are conducted throughout the survey area in the spring and summer season (May, June and September). One of the goals outlined within the current project is identification of occurring types of habitats, especially grasslands, woodlands etc in the area. Following the revision of all available data, the Proposed National Reference List of Habitats, the distribution maps of individual habitats based on the desktop analysis, gaps in the knowledge of certain habitats will be identified, and field research will be undertaken to complement the knowledge of present habitats.

The National Catalogue of Habitats of EU Importance as well as the Interpretation Manual of European Union Habitats EUR28 (2013) will be consulted to interpret the habitat types included in Annex I. Identification of the habitats will be performed based on phytocoenoses, dominant plant species and range-restricted species, accompanied by recognizing the characteristics of the geographical location, altitude, relief, substrate and soil. This means that the physiognomic, ecological and floristic approach will be applied. The emphasis will be laid on diagnostic and dominant species.

An input of the following field data will be made in the database: location coordinates, photography, observable species (characteristic, frequent, dominant, etc.), observations, but also representativeness, degree of conservation, and degree of preserved functions. A map of habitats will be produced in GIS.

Plant species will be evaluated according to IUCN's Red List of Species (global and national), annexes of the EU Habitats Directive, and national legislation, with the aim of assessing biodiversity values on the territory of the studied area.

LIMITATIONS

Hard-to-reach terrain, overgrown with bushes, difficult to pass, away from accessible roads even with an off-road vehicle.

SURVEY RESULTS

SURVEY SITES

Research was carried out at several locations, summarized in 11 points, based on the differences in the present habitats, distance to wind turbines, and altitude. A total of 22 locations of wind turbines were visited, starting from the villages of Sasavarlija - Nikoman - Kalapetrovci, then continuing to the village of Koshevo. Floristic material was also collected and habitats were analyzed in the wind turbine areas between the villages of Buchim and Shopur, along with access roads and transmission lines.

Table 1 Survey sites/points/tranches for flora and habitats.

Site Reference	Location	Additional Details - Habitats
Point 1. Access road between wind turbines	41°44'34.48"N,	6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-

Site Reference	Location	Additional Details - Habitats
No. 39 and 42	22°18'8.38"E	Brometalia). A minor area (approx. 5 ha) along the access road between wind turbine No. 39 and 42 and a transmission line, constitutes a typical steppe vegetation type which belong to ass. Astragalo-Morinetum. Important steppe species growing in the area is *Morina persica.*
Point 2. WT No. 39, 40, and 42	41°42'54.35"N, 22°19'29.12"E	6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), with individual trees of Quercus pubescens and Pyrus amygdaliformis, at 870 m alt
Point 3. WT No. 37	41°42'25.10"N, 22°19'35.74"E	Mainly oak forest with clearings overgrown with grasses, at 970 m alt.
Point 4. WT No. 20, 21, 22, 38 and 41	41°42'15.80"N, 22°19'20.58"E	Degraded oak forest (Quercus pubescens) with adjacent hill pastures (700-960 m alt.)
Point 5. WT 23, 24, 25, 26, 27, 28 and 29.	41°41'50.93"N, 22°20'5.83"E; 41°41'41.77"N, 22°20'44.16"E; 41°41'25.30"N, 22°20'38.47"E; 41°41'9.47"N, 22°20'9.37"E; 41°40'39.80"N, 22°20'8.18"E; 41°40'31.58"N, 22°19'51.01"E and 41°40'19.85"N, 22°19'35.96"E	6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), 660-890 m alt.
Point 6. WT No. 21	41°41'14.36"N 22°19'14.95"E	3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion, 720 m alt.)
Point 7. Access road (on the way to Buchim village)	41°38'32.50"N, 22°20'39.56"E; 41°38'27.77"N, 22°20'42.55"E 41°38'47.87"N, 22°20'24.33"E 41°39'2.78"N, 22°20'12.60"E	91AA Eastern white oak woods, degraded formation of Quercus pubescens, 460 m alt.; Almond orchards, 460 m alt.; E5.1 Abandoned arable land with ruderal vegetation, 500 m alt.; Tobacco field, 550 m alt.
Point 8. WT No. 30 and 31	41°39'50.97"N, 22°19'20.60"E and 41°39'48.04"N, 22°19'0.36"E	Abandoned arable land with ruderal vegetation, 640 m alt.
Point 9. WT No. 32	41°39'30.27"N, 22°18'39.75"E	Degraded oak forest (Quercus frainetto) with hill pasture around, 650 m alt.
Point 10. WT No. 33 and	41°39'7.98"N,	Good developed oak forest (Quercus frainetto),

Site Reference	Location	Additional Details - Habitats
34.	22°18'35.76"E and 41°38'47.43"N, 22°18'36.44"E	640-650 m alt.
Point 11. WT No. 35	41°38'29.55"N, 22°18'43.64"E	91AA Eastern white oak woods, ass Querco-Carpinetum orienatlis , 640 m alt

HABITAT ASSESSMENT

During the survey, ten habitats overall - three natural habitats and seven anthropogenic habitats were recorded. All of the three natural habitats are cited in Annex I to the EU Habitats Directive, while one of them is of priority importance.

Table 2 Assessment of habitats in the wind farm corridor area.

[1]Habitat (EUNIS Classification)	[2]EU Habitats Directive (Annex I)	[3]European Red List of Habitats	Comments
E1.21 - Helleno-Balkanic [Satureja montana] steppes	6210: Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia)	VU	Wind turbines No. 23, 24, 25, 26, 27, 28, 29, 39, 40 and 42; transmission lines; access roads. The typical steppe vegetation type is rare in the area, but it is well developed along the access road between wind turbine No. 39 and 42. It is mostly represented by abandoned fields in various stages of succession to hill pastures.
G1.73 - Eastern Quercus pubescens woods.	*91AA: Eastern white oak woods.	LC	Mainly degraded oak forest at wind turbines No. 20, 21, 22, 32, 33, 34, 35, 37, 38 and 41; transmission lines; access roads.
C2.5 - Temporary running waters	3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	DD	In the gully near wind turbine No. 21
G5.1 Lines of trees; Hedgerows	/	/	Transmission lines; access roads.
I1.3 Arable land	/	/	Transmission lines; access roads.
G1.D4 Fruit orchards	/	/	Transmission lines; access roads.
E5.1 Abandoned arable land with ruderal	/	/	Wind turbines No. 30 and 31; transmission lines; access roads.

[1] http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm. Presence of Habitats Directive Annex 1 habitattypes is a prerequisite for consideration of a site for Special Area of Conservation (SAC) designation.

[2] https://eunis.eea.europa.eu/habitats.jsp The EUNIS habitat classification is a comprehensive pan-European system for habitat identification.

[3] https://www.researchgate.net/publication/312378307_European_Red_List_of_Habitats_Part_2_Terrestrial_and_freshwater_habitats

[1]Habitat (EUNIS Classification)	[2]EU Habitats Directive (Annex I)	[3]European Red List of Habitats	Comments
vegetation.			
J Constructed, industrial and other artificial habitats.	/	/	/

FLORA ASSESSMENT

Valorisation of plants was conducted pursuant to the national and international conventions and legislation on protection of threatened species on a European or global level, as follows: species listed in the CORINE European List, CITES National List of Strictly Protected and Protected Wild Species, Global European and National Red Lists of Threatened Plants, along with rare or endemic species occurring in the area.

Table 3 Valorisation of plants in the wind farm corridor area.

Species	National Red List of Threatened Plants	Global IUCN Red List of Threatened Plants	IUCN European Red List	CORINE List	Rare/ Endemic Species
Silene vulgaris		LC		x	
Astragalus onobrychis					Rare species
Hippomarathrum cristatum					Rare species
Morina persica					Rare species
Campanula cervicaria					Rare species
Alium spherocephalon					Rare species
Paeonia peregrina					Rare species
Orobanche amethistea		NT			Rare species

FIELD SURVEY RESULTS

Point 1. Access road between wind turbines No. 39 and 42

Habitat: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia). A minor area (approx. 5 ha) along the access road between wind turbine No. 39 and 42 and a transmission line, constitutes a typical steppe vegetation type which belong to ass. Astragalo-Morinetum. (41°44'34.48"N, 22°18'8.38"E). Important steppe species growing in the area is *Morina persica.*

Species	Cover
Morina persica	5
Astragalus parnassi	1
Pyrus amygdaliformis	1
Quercus pubescens	+
Hypericum olympicum	+

Figure 3 Typical steppe vegetation with Morina persica.

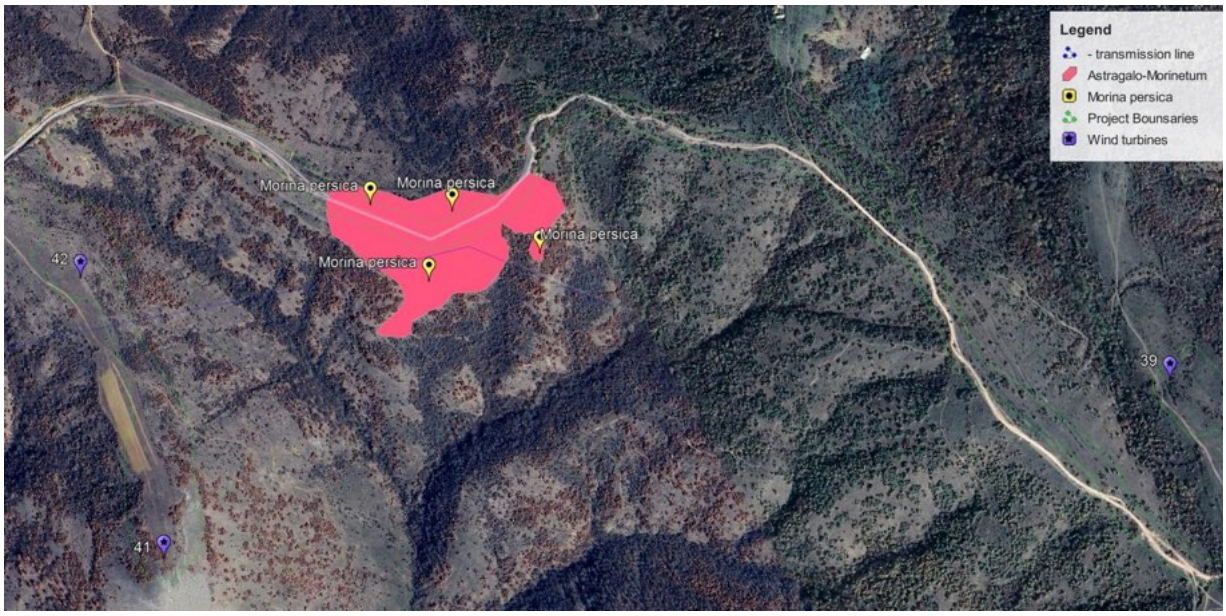

Figure 4 *Location of the ass. Astragalo-Morinetum on the road between the villages Shashavarlija and Koshevo.*

Point 2. Wind turbines No. 39, 40, and 42

Habitat: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), with individual trees of Quercus pubescens and Pyrus amygdaliformis, at 41°42'54.35"N, 22°19'29.12"E, 870 m alt. The most common plant species are:

Species	Cover
Quercus pubescens	3
Quercus frainetto	2
Prunus amygdaliformis	2
Acer campestre	1
Achillea coarctata	+
Anchusa officinalis	+
Anthemis arvensis	+
Astragalus onobrychis	+
Bromus racemosus	+
Campanula rapunculus	+
Campanula rotundifolia	+
Carduus crispus	+
Centaurea cyanus	+
Centaurea sp.	+
Crataegus monogyna	+
Crepis foetida	+
Dianthus cruentus	+
Erodium ciconium	+
Erodium cicutarium	+
Erysimum diffusum	+
Euphorbia cyparissias	+
Filipendula vulgaris	+
Fragaria vesca	+
Geranium sanguineum	+
Hordeum murinum	+
Hypericum olympicum	+
Jurinea mollis	+
Lamium purpureum	+
Ligustrum vulgare	+
Linaria pelisseriana	+
Linum tenuifolium	+
Paeonia peregrina	+
Rosa canina	+
Verbascum sp.	+

Figure 5 Hill pastures with grasses and annual plants, with individual trees of Quercus pubescens and Pyrus amygdaliformis. Viev of the location of WT 39 (left).

Point 3. Wind turbine No. 37

Habitat: Mainly oak forest with clearings overgrown with grasses, at 41°42'25.10"N, 22°19'35.74"E, 970 m alt. The typical plant species are:

Species	Cover
Quercus pubescens	3
Pyrus amygdaliformis	2
Viola tricolor	2
Quercus frainetto	1
Acer campestre	1
Ulmus minor	+
Crataegus monogyna	+
Fragaria vesca	+
Leontodon crispus	+
Euphorbia cyparissias	+
Trifolium angustifolium	+
Paeonia peregrina	+
Trifolium arvense	+
Trifolium campestre	+
Crupina vulgaris	+
Crepis foetida	+
Dianthus armeria	+
Vicia vilosa	+
Polygala vulgaris	+
Armeria arenaria	+
Ornithogalum umbelatum	+
Eringium campestre	+
Vicia tenuifolia	+
Calamagrostis epigejos	+
Hypericum olympicum	+
Plantago lanceolata	+
Pyrus pyraster	+
Clematis vitalba	+
Orobanche amethistea	+

Figure 6 Location of WT 37 (left) and burned forest around the site (right).

Point 4. Wind turbines No. 20, 21, 22, 38 and 41

Habitat: Degraded oak forest (Quercus pubescens) with adjacent hill pastures (at 41°42'15.80"N, 22°19'20.58"E, 700-960 m alt.)

Species	Cover
Quercus pubescens	3
Pyrus amygdaliformis	3
Carpinus orientalis	2
Quercus frainetto	1
Acer campestre	1
Achillea coarctata	+
Bromus racemosus	+
Centaurea cyanus	+
Coronilla varia	+
Crataegus monogyna	+
Dianthus armeria	+
Dianthus cruentus	+
Hordeum murinum	+
Hypericum olympicum	+
Nepeta nuda	+
Onobrichis arenaria	+
Paeonia peregrina	+
Potentila argentea	+
Potentilla hirta	+
Rosa gallica	+
Sideritis montana	+
Stipa pennata	+
Thymus sp.	+
Trifolium arvense	+
Trifolium hirtum	+
Ulmus minor	+
Verbascum sp.	+

Figure 7 Location of WT 38 in degraded oak forest with hill pastures around.

Figure 8 Balkan peony (Paeonia peregrina) grows in oak forest.

Point 5. Wind turbines No. 23, 24, 25, 26, 27, 28 and 29.

Habitat: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (on 41°41'50.93"N, 22°20'5.83"E; 41°41'41.77"N, 22°20'44.16"E; 41°41'25.30"N, 22°20'38.47"E; 41°41'9.47"N, 22°20'9.37"E; 41°40'39.80"N, 22°20'8.18"E; 41°40'31.58"N, 22°19'51.01"E and 41°40'19.85"N, 22°19'35.96"E (660-890 m alt.).

Species	Cover
Anthemis arvensis	2
Centaurea cyanus	2
Achillea coarctata	+
Bromus racemosus	+
Campanula rotundifolia	+
Crataegus monogyna	+
Crepis foetida	+
Dactylis glomerata	+
Dasypyrum villosum	+
Dianthus armeria	+
Dianthus cruentus	+
Hypericum olympicum	+
Inula helenium	+
Lathirus niger	+
Leontodon hispidus	+
Linum usitatissimim	+
Marrubium peregrinum	+
Nepeta nuda	+
Onobrichis arenaria	+
Phleum pratense	+
Potentila argentea	+
Potentilla argentea	+
Pyrus amygdaliformis	+
Quercus pubescens	+
Reseda lutea	+
Rhinanthus minor	+
Sanguisorba minor	+
Silene italica	+
Stipa pennata	+
Trifolium arvense	+
Trifolium pratense	+
Verbascum sp.	+
Vicia grandiflora	+

Figure 9 Location of WT 23 (top left), WT 26 (top right), WT 27 with the measuring tower (bottom left) and WT 28 (bottom right), all located on hill pastures, or the gradual succession over a long period of abandoned fields into hill pastures.

Point 6. Wind turbine No. 21

Habitat: 3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion (at 41°41'14.36"N, 22°19'14.95"E, 720 m alt.)

Species	Cover
Quercus pubescens	2
Pyrus amygdaliformis	2
Carpinus orientalis	2
Fraxinus ornus	2
Cornus mas	1
Quercus frainetto	1
Corylus avellana	+
Acer campestre	+
Crataegus monogyna	+
Rosa gallica	+
Ulmus minor	+

Figure 10 Forest vegetation in the ravine near WT 21.

Figure 11 The temporary stream in the ravine near WT 21.

Point 7. Access road (on the way to Buchim village)

Habitats: 91AA Eastern white oak woods, degraded formation of Quercus pubescens, (41°38'32.50"N, 22°20'39.56"E), 460 m alt.; Almond orchards (41°38'27.77"N, 22°20'42.55"E, 460 m alt.); E5.1 Abandoned arable land with ruderal vegetation (41°38'47.87"N, 22°20'24.33"E), 500 m alt. Tobacco field (41°39'2.78"N, 22°20'12.60"E), 550 m alt. The most common plant species are:

Species	Cover
Achillea coarctata	1
Achillea milefolium	+
Aegilops geniculata	+
Agrostema githago	+
Anthemis arvensis	1
Campanula cervicaria	+
Carpinus orientalis	1
Centaurea cyanus	+
Centaurea paniculata	+
Convolvulus arvensis	+
Cornus mas	+
Crataegus monogyna	+
Crepis foetida	+
Daucus carota	2
Deshampsia cespitosa	+
Dianthus armeria	+
Echium italicum	+
Eryngium campestre	+
Euphorbia cyparissias	+
Fraxinus ornus	1
Hypericum olympicum	+
Hypericum perforatum	2
Jasione montana	+
Lotus herbaceous	+
Marrubium peregrinum	+

Nepeta nuda	+
Odontarrhena muralis	+
Onopordum acanthium	+
Paliurus spina-christi	+
Pentanema oculus-christi	+
Poa bulbosa	+
Prunella laciniata	+
Pyrus amygdaliformis	2
Pyrus communis	+
Quercus frainetto	2
Quercus pubescens	3
Rosa canina	1
Sedum acre	+
Sedum rubens	+
Stachis germanica	+
Taeniatherum caput-medusae	+
Trifolium angustifolium	+
Trifolium campestre	+
Trifolium purpureum	+
Verbascum baldaccii	+

Figure 12 Eastern white oak woods (left) and temporary water flow with a high degree of contamination with heavy metals (right).

Figure 13 Abandoned arable land with ruderal vegetation (left) and tobacco field (right).

Point 8. Wind turbines No. 30 and 31

Habitat: Abandoned arable land with ruderal vegetation (41°39'50.97"N, 22°19'20.60"E and 41°39'48.04"N, 22°19'0.36"E), 640 m alt. The typical plant species are:

Species	Cover
Achillea coarctata	+
Achillea milefolium	+
Agrimonia eupatoria	+
Ajuga laxmanii	+
Anthemis arvensis	+
Armeria arenaria	+
Betonica officinalis	+
Centaurea cyanus	+
Convolvulus arvensis	+
Cota tinctoria	+
Daucus carota	1
Deshampsia cespitosa	+
Dianthus armeria	2
Eryngium campestre	+
Euphorbia cyparissias	+
Gallium verum	+
Hypericum perforatum	2
Ligustrum vulgare	+
Marrubium peregrinum	+
Onosma heterophylla	+
Plantago lanceolata	+
Hieracium piloselloides	+
Potentilla hirta	+
Prunus spinosa	+
Pyrus amygdaliformis	+
Koeleria pyramidata	5
Quercus frainetto	+
Rubus idaeus	+
Salvia nemorosa	+
Salvia verticillata	+
Sanguisorba minor	1
Stachis germanica	+
Taeniatherum caput-medusae	+
Teucrium chamaedrus	+
Trifolium purpureum	2
Verbascum baldaccii	+
Vicia cracca	2

Mott MacDonald Restricted

Figure 14 Abandoned arable land with ruderal vegetation. Locations of WT 30 (left) and WT 31 (right).

Point 9. Wind turbine No. 32

Habitat: Degraded oak forest (Quercus frainetto) with hill pasture around, (on 41°39'30.27"N, 22°18'39.75"E, 650 m alt.)

Species	Cover
Asparagus officinalis	+
Campanula cervicaria	+
Carpinus orientalis	+
Chrysopogon gryllus	2
Dictamnus albus	3
Genista tinctoria	+
Pyrus amygdaliformis	+
Pyrus communis	+
Quercus frainetto	5
Sorbus aucuparia	+

Figure 15 Location of WT 32 in degraded oak forest with hill pastures around.

Figure 16 Burning bush (Dictamnus albus) grows in the area.

Point 10. Wind turbines No. 33 and 34.

Habitat: Good developed oak forest (Quercus frainetto), 41°39'7.98"N, 22°18'35.76"E and 41°38'47.43"N, 22°18'36.44"E, 640-650 m alt.

Species	Cover
Quercus frainetto	3
Quercus pubescens	2
Campanula cervicaria	1
Salvia ringens	+
Jurinea mollis	+
Leopoldia comosa	+
Odontarrhena muralis	+
Trifolium ochroleucum	+

Figure 17 Oak forest (Quercus frainetto). Location of WT 33 (left) and WT 34 (right) inside in oak forest

Figure 18 Rare plant species from the area, Campanula cervicaria (left) and Salvia ringens (right).

Point 11. Wind turbine No. 35

Habitat: 91AA Eastern white oak woods, ass Querco-Carpinetum orienatlis (41°38'29.55"N, 22°18'43.64"E), 640 m alt.

Species	Cover
Carpinus orientalis	4
Quercus pubescens	3
Quercus frainetto	2
Fraxinus ornus	2
Colutea arborescens	+
Pyrus communis	+
Euphorbia cyparissias	+
Marrubium peregrinum	+
Daucus carota	+
Galium album	+
Stachis germanica	+
Odontarrhena muralis	+
Allium spherocephalon	+
Hippomarathrum cristatum	+

Figure 19 Location of WT 35. Oriental hornbeam and downi oak forest (ass. Querco-Carpinetum orientalis) with Alium spherocephalon (right).

Figure 20 Allium spherocephalon, a rare species in the area.

Figure 21 Hyppomarathrum cristatum, a rare species known from small number of localities in the country.

Priority Biodiversity Features (PBF) and Critical Habitats (CH)

Critical Habitat and Priority Biodiversity Feature assessment is a process designed for identification of the areas of the highest biodiversity value, considered especially sensitive to impact, and where particular attention must be paid. The CHA process comprises an initial project screening to identify potential CH/PBF trigger habitats or species present within the area affected by the project. Initial screening is conducted in order to establish trigger features, followed by analysis and verification.

Priority Biodiversity Features

According to PR6 paragraph 12-I criteria (a), Ecologically Appropriate Area of Analysis (EAAA) is a habitat type listed in Annex 1 to EU Habitats Directive or Resolution 4 of Bern Convention; the habitats 6210: Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia), and 3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion completely trigger PBF in the area. The grassland habitat is vulnerable according to the European Red List of Habitats. There are also 6 species of rare plants (one is a Balkan endemic) that trigger PBF.

Table 4 Species that trigger PBF, occurring within the project area.

Habitats - EUNIS	Priority Features - Criteria	
	[4]EU Habitats Directive (Annex I)	[5]European Red List of Habitats
E1.21 - Helleno-Balkanic [Satureja montana] steppes	6210: Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia)	VU
C2.5 - Temporary running waters	3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	DD

Species	National Red List of Threatened Plants	Global IUCN Red List of Threatened Plants	IUCN European Red List	CITES Convention	Rare Species
Astragalus onobrychis					x
Allium spherocephalon					x
Hippomarathrum cristatum					x
Morina persica					x
Campanula cervicaria					x
Paeonia peregrina					x
Orobanche amethistea		NT			x

Critical Habitats

According to PR6 paragraph 14-I criteria (a), EAAA is a habitat type listed in Annex 1 to the EU Habitats Directive marked as priority habitat type; the habitat 91AA* Eastern white oak woods completely meets CH. The oak forest belt is characterised by a range of forest communities developing in the area. It is affiliated with the community of *Querco-Carpinetum orientalis*. This forest type in the area is primarily degraded due to extensive exploitation in the past. There aren't any plant species that trigger CH in the area.

[4]https://eunis.eea.europa.eu/habitats.jsp. The EUNIS habitat classification is a comprehensive pan-European system for habitat identification.
[3]https://www.researchgate.net/publication/312378307_European_Red_List_of_Habitats_Part_2_Terrestrial_and_freshwater_habitats

Table 5 Habitats that trigger CH found within the project area.

Habitats - EUNIS	Critical Habitats - Criteria	
	EU Habitats Directive (Annex I - Priority Habitat Type)	European Red List of Habitats
G1.73 - Eastern Quercus pubescens woods.	91AA* Eastern white oak woods	LC

Invasive Species

No invasive species whatsoever have been detected in the project area.

CONCLUSION

On the basis of the aforementioned analysis, the following CH/PBF triggers have been identified:

TRIGGER	HABITATS/SITES/SPECIES	STATUS
Habitats of significant importance to notable (rare, endemic or restricted range) species	91AA* Eastern white oak woods;	**CH**
	6210: Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia)	**PBF**
	3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	**PBF**
Plants	*Allium spherocephalon*	**PBF**
	Astragalus onobrychis	**PBF**
	Campanula cervicaria	**PBF**
	Hippomarathrum cristatum	**PBF**
	Orobanche amethistea	**PBF**
	Paeonia peregrina	**PBF**
	Morina persica	**PBF**

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ANNEXES

ANNEX 1 - MONITORING LOCATIONS

Point 1. Access road between wind turbines No. 39 and 42
Habitat: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia). A minor area (approx. 5 ha) along the access road between wind turbine No. 39 and 42 and a transmission line, constitutes a typical steppe vegetation type which belong to ass. Astragalo-Morinetum. (41°44'34.48"N, 22°18'8.38"E). Important steppe species growing in the area is *Morina persica.*

Point 2. Wind turbines No. 39, 40, and 42
Habitat**:** 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), with individual trees of Quercus pubescens and Pyrus amygdaliformis, at 41°42'54.35"N, 22°19'29.12"E, 870 m alt

Point 3. Wind turbine No. 37
Habitat**:** Mainly oak forest with clearings overgrown with grasses, at 41°42'25.10"N, 22°19'35.74"E, 970 m alt.

Point 4. Wind turbines No. 20, 21, 22, 38 and 41
Habitat**:** Degraded oak forest (Quercus pubescens) with adjacent hill pastures (at 41°42'15.80"N, 22°19'20.58"E, 700-960 m alt.)

Point 5. Wind turbines No. 23, 24, 25, 26, 27, 28 and 29.
Habitat**:** 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (on 41°41'50.93"N, 22°20'5.83"E; 41°41'41.77"N, 22°20'44.16"E; 41°41'25.30"N, 22°20'38.47"E; 41°41'9.47"N, 22°20'9.37"E; 41°40'39.80"N, 22°20'8.18"E; 41°40'31.58"N, 22°19'51.01"E and 41°40'19.85"N, 22°19'35.96"E (660-890 m alt.).

Point 6. Wind turbine No. 21
Habitat**:** 3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion (at 22.321674, 22.320923, 720 m alt.)

Point 7. Access road (on the way to Buchim village)
Habitats**:** 91AA Eastern white oak woods, degraded formation of Quercus pubescens, (41°38'32.50"N, 22°20'39.56"E), 460 m alt.; Almond orchards (41°38'27.77"N, 22°20'42.55"E, 460 m alt.); E5.1 Abandoned arable land with ruderal vegetation (41°38'47.87"N, 22°20'24.33"E), 500 m alt. Tobacco field (41°39'2.78"N, 22°20'12.60"E), 550 m alt.

Point 8. Wind turbines No. 30 and 31
Habitat**:** Abandoned arable land with ruderal vegetation (41°39'50.97"N, 22°19'20.60"E and 41°39'48.04"N, 22°19'0.36"E), 640 m alt.

Point 9. Wind turbine No. 32
Habitat**:** Degraded oak forest (Quercus frainetto) with hill pasture around, (on 41°39'30.27"N, 22°18'39.75"E, 650 m alt.)

Point 10. Wind turbines No. 33 and 34.

Habitat**:** Good developed oak forest (Quercus frainetto), 41°39'7.98"N, 22°18'35.76"E and 41°38'47.43"N, 22°18'36.44"E, 640-650 m alt.

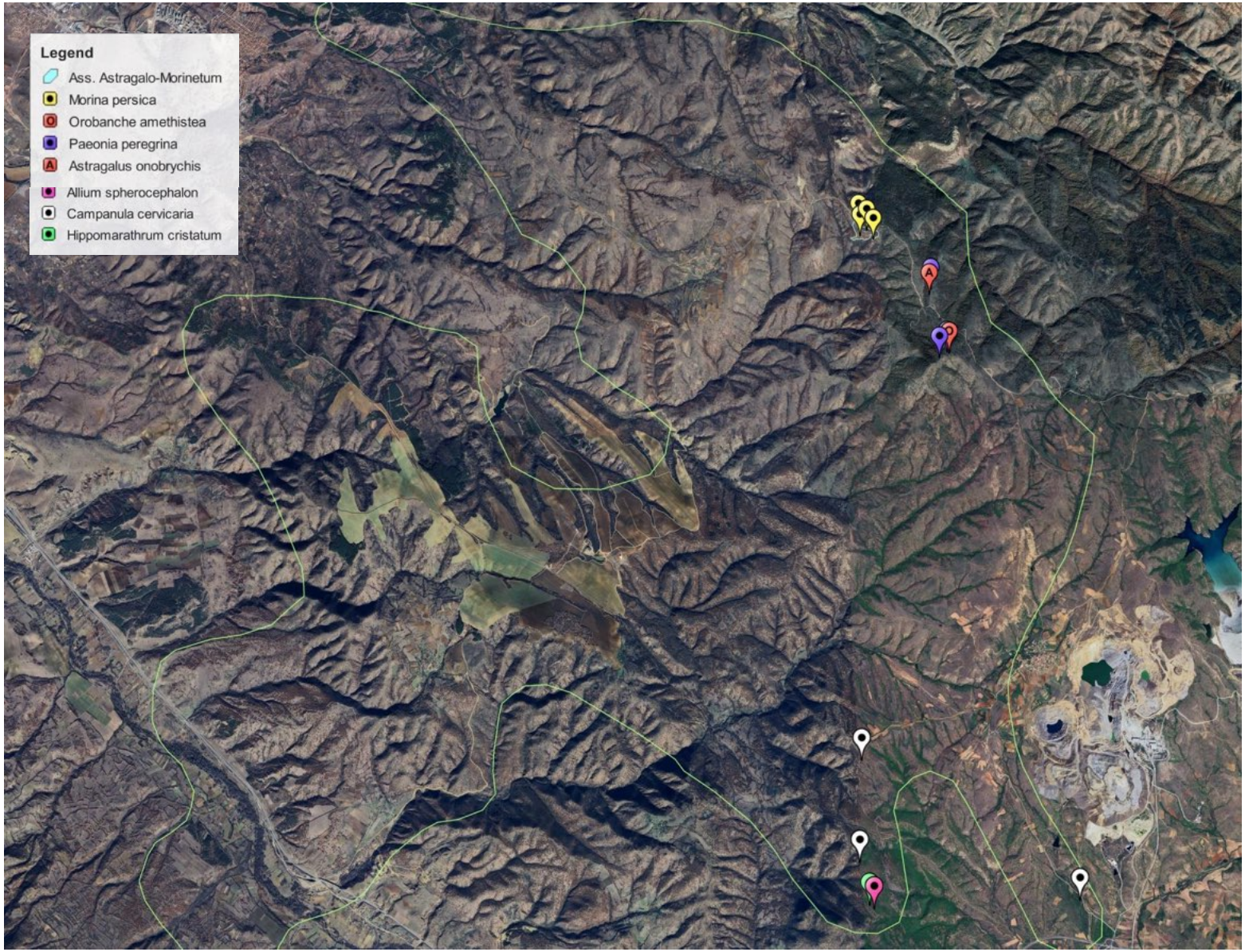
Point 11. Wind turbine No. 35
Habitat: 91AA Eastern white oak woods, ass Querco-Carpinetum orienatlis (41°38'29.55"N, 22°18'43.64"E), 640 m alt

ANNEX 2 - COMPLETE LIST OF IDENTIFIED SPECIES

1. Acer campestre
2. Achillea coarctata
3. Achillea milefolium
4. Aegilops geniculata
5. Agrimonia eupatoria
6. Agrostema githago
7. Ajuga laxmanii
8. Alium sphaerocephalon
9. Anchusa officinalis
10. Anthemis arvensis
11. Armeria arenaria
12. Asparagus officinalis
13. Astragalus onobrychis
14. Betonica officinalis
15. Bromus racemosus
16. Calamagrostis epigejos
17. Campanula cervicaria
18. Campanula rapunculus
19. Campanula rotundifolia
20. Carduus crispus
21. Carpinus orientalis
22. Centaurea cyanus
23. Centaurea paniculata
24. Centaurea sp.
25. Chrysopogon gryllus
26. Clematis vitalba
27. Colutea arborescens
28. Convolvulus arvensis
29. Cornus mas
30. Coronilla varia
31. Corylus avellana
32. Cota tinctoria
33. Crataegus monogyna
34. Crepis foetida
35. Crepis foetida
36. Crupina vulgaris
37. Dactylis glomerata
38. Dasypyrum villosum
39. Daucus carota
40. Deshampsia cespitosa
41. Dianthus armeria
42. Dianthus cruentus
43. Dictamnus albus
44. Echium italicum
45. Eringium campestre
46. Erodium ciconium
47. Erodium cicutarium
48. Eryngium campestre
49. Erysimum diffusum
50. Euphorbia cyparissias
51. Filipendula vulgaris
52. Fragaria vesca
53. Fraxinus ornus
54. Galium album
55. Gallium verum
56. Genista tinctoria
57. Geranium sanguineum
58. Hieracium piloselloides
59. Hippomarathrum cristatum
60. Hordeum murinum
61. Hypericum olympicum
62. Hypericum perforatum
63. Inula helenium
64. Jasione montana
65. Jurinea mollis
66. Koeleria pyramidata
67. Lamium purpureum
68. Lathirus niger
69. Leontodon crispus
70. Leontodon hispidus
71. Leopoldia comosa
72. Ligustrum vulgare
73. Linaria pelisseriana
74. Linum tenuifolium
75. Linum usitatissimim
76. Lotus herbaceous
77. Marrubium peregrinum
78. Morina persica
79. Nepeta nuda
80. Odontarrhena muralis
81. Onobrichis arenaria
82. Onopordum acanthium
83. Onosma heterophylla
84. Orobanche amethistea
85. Paeonia peregrina
86. Paliurus spina-christi
87. Pentanema oculus-christi
88. Phleum pratense
89. Plantago lanceolata
90. Poa bulbosa
91. Polygala vulgaris
92. Potentila argentea
93. Potentilla hirta
94. Prunella laciniata
95. Prunus spinosa
96. Pyrus pyraster
97. Pyrus amygdaliformis
98. Pyrus communis
99. Pyrus communis
100. Quercus frainetto

101. Quercus pubescens
102. Reseda lutea
103. Rhinanthus minor
104. Rosa canina
105. Rosa gallica
106. Rubus idaeus
107. Salvia nemorosa
108. Salvia ringens
109. Salvia verticillata
110. Sanguisorba minor
111. Sedum acre
112. Sedum rubens
113. Sideritis montana
114. Silene italica
115. Sorbus aucuparia
116. Stachis germanica
117. Stipa pennata
118. Stipellula capensis
119. Taeniatherum caput-medusae
120. Teucrium chamaedrus
121. Thymus sp.
122. Trifolium angustifolium
123. Trifolium arvense
124. Trifolium campestre
125. Trifolium hirtum
126. Trifolium ochroleucum
127. Trifolium pratense
128. Trifolium purpureum
129. Ulmus minor
130. Verbascum baldaccii
131. Verbascum sp.
132. Vicia cracca
133. Vicia grandiflora
134. Vicia tenuifolia
135. Vicia vilosa
136. Viola tricolor

Mott MacDonald Restricted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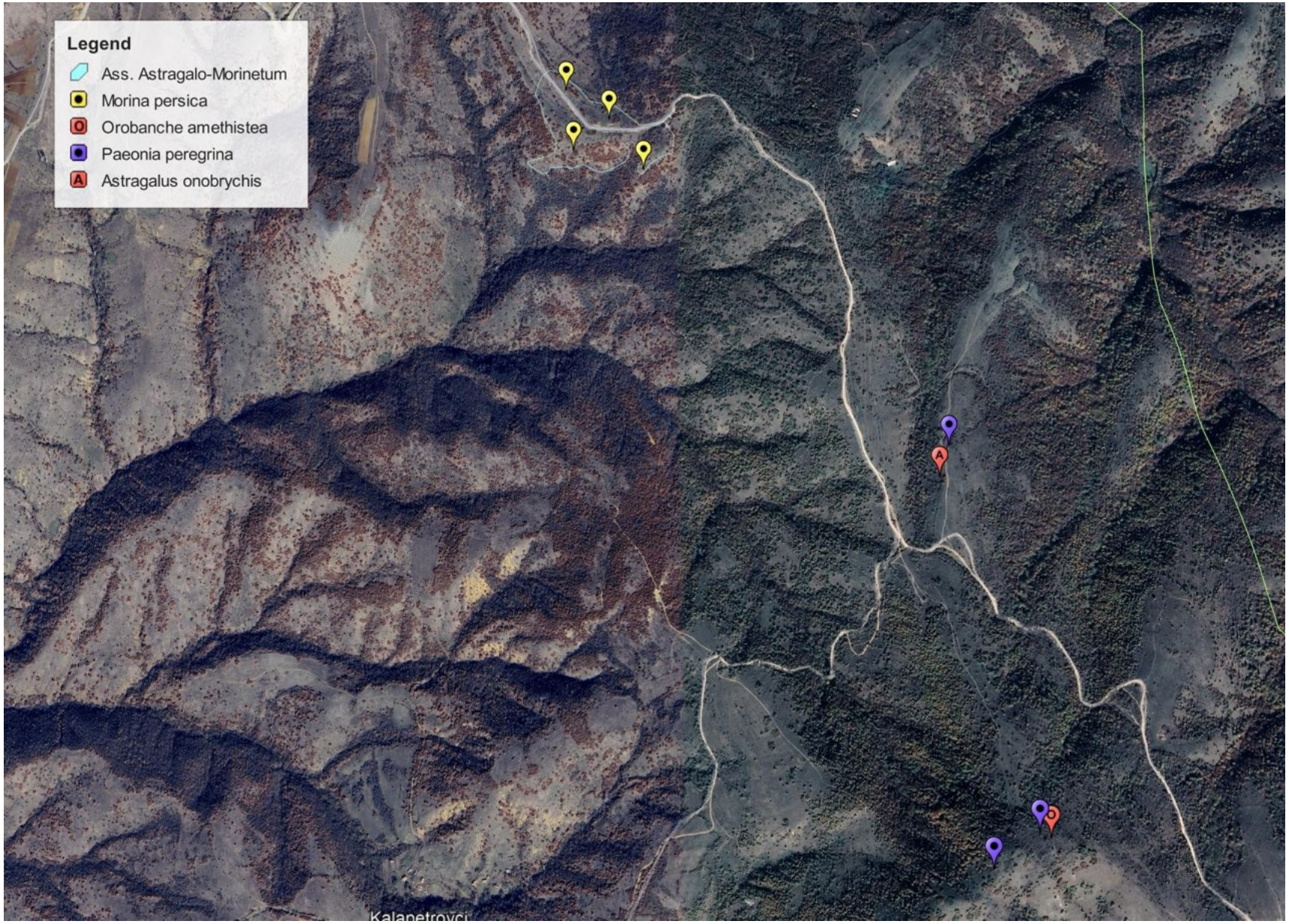
Orobanche amethistea
Paeonia peregrina
Astragalus onobrychis
Allium spherocephalon
Campanula cervicaria
Hippomarathrum cristatum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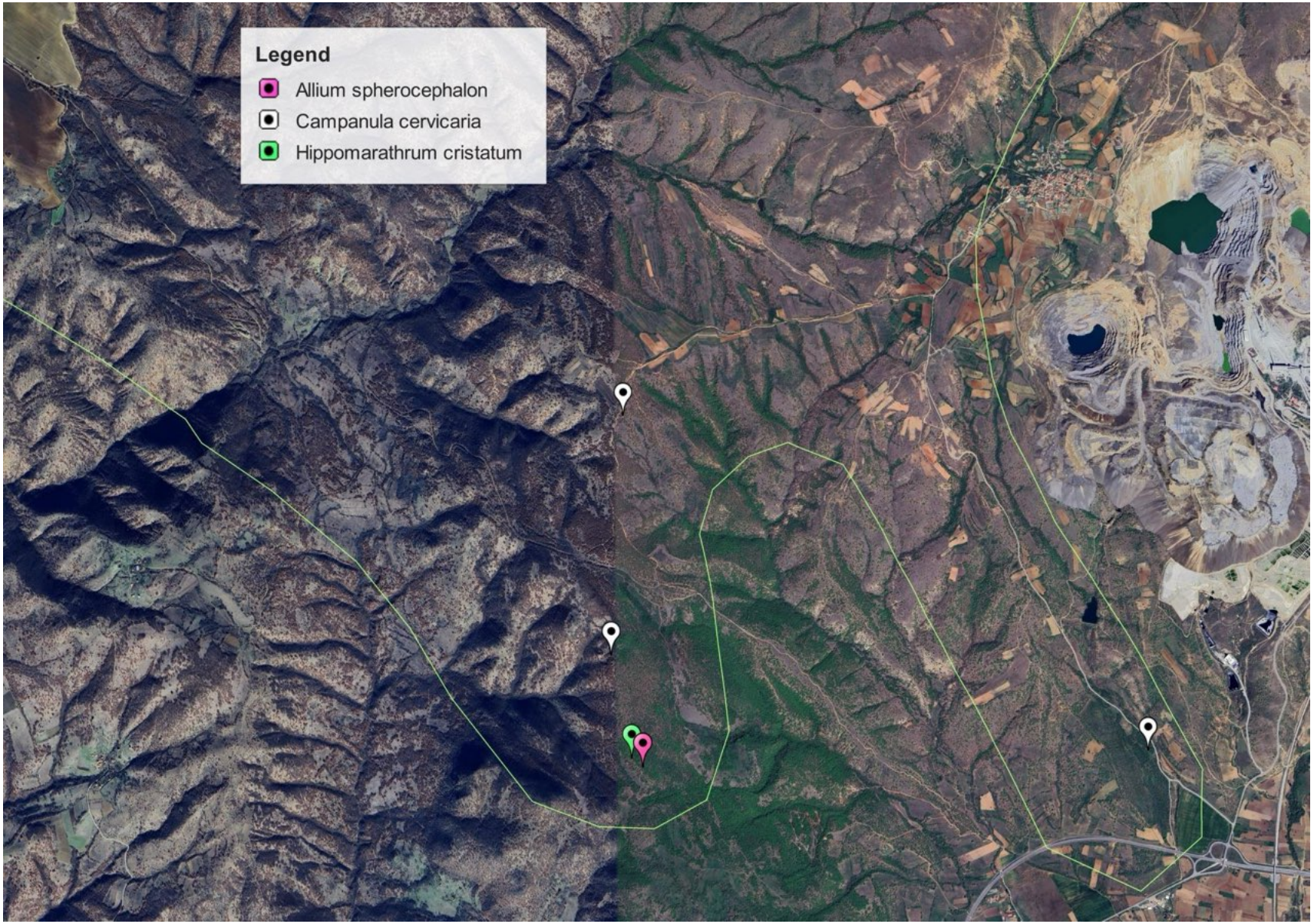
Legend
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Campanula cervicaria
Hippomarathrum cristatum

STIP WIND FARM

Baseline Survey of Species and Habitats

FIELD REPORT

Biodiversity Kingdom/Class: FLORA

Biodiversity Specialist: Prof. Mitko Karadelev

Reporting Period: September, 2025

Date:
October 2025

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Mott MacDonald Restricted

STIP WIND FARM, Biodiversity Baseline Survey

SUMMER FIELD REPORT, Flora and Habitats

INTRODUCTION

BACKGROUND

The construction of Stip Wind Farm has been planned in the region south of the city of Stip, in the area between the villages of Dolani and Bucim. In accordance with the location of individual wind turbines, the area to be covered by the Stip Wind Farm has been divided into three sectors for the purpose of the survey, for easier organization of field activities, and more appropriate processing, analysis and presentation of the obtained data. The current design includes up to 54 wind turbine generators (WTGs), each with a nominal capacity of 6-8 MW, for a total installed capacity of up to 396 MW.

PURPOSE OF THIS REPORT

The purpose of the flora and habitats survey is to identify if any species could be affected, which might be considered 'a priority biodiversity feature' in a national or EU context.

SURVEY AREA

The area of the wind farm in Stip will occupy an area of approximately 400 ha. The focus of the plant survey and habitat mapping is about 1,000-m wide corridor on the central line of the proposed WF together with the related infrastructure (overhead lines and transformer station). The cited area is deemed appropriate for a survey, and it is sufficiently large to encompass most impacts on flora and habitats arising during the construction works and operational needs in the projected area.

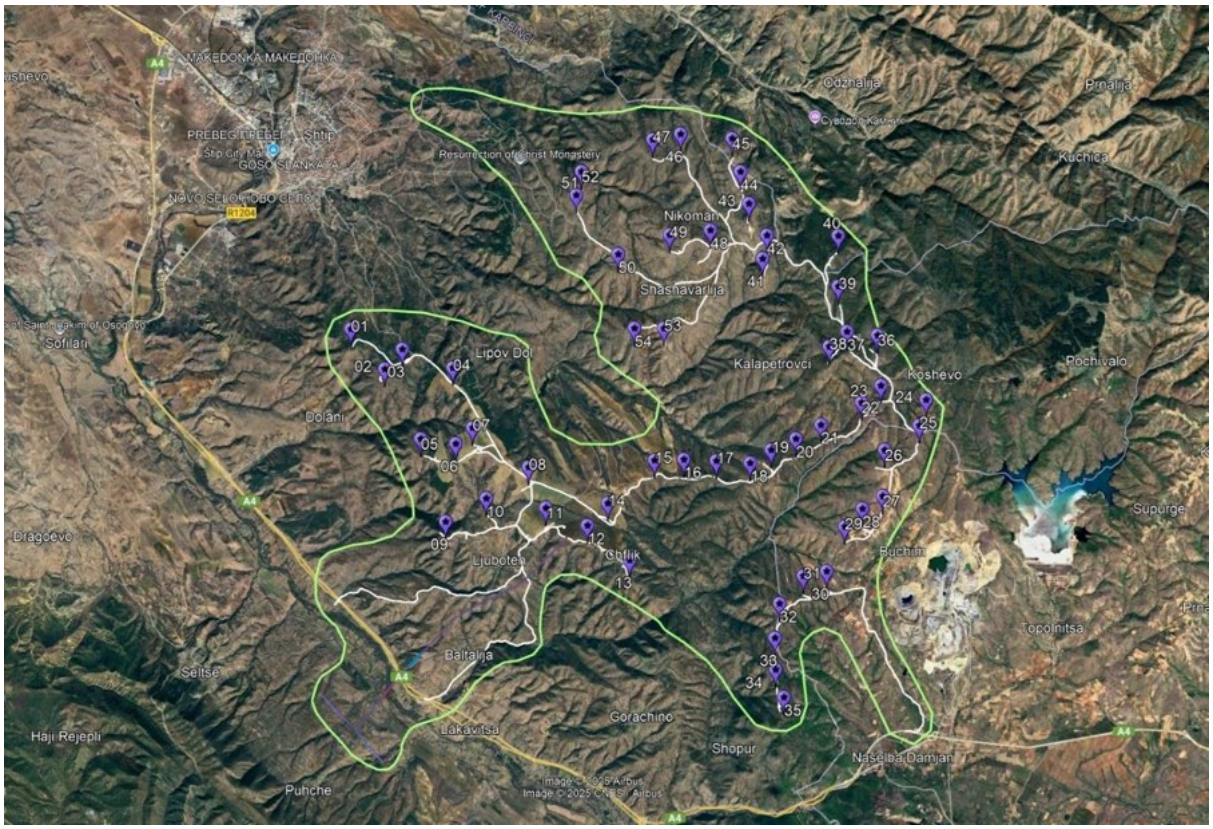

Figure 1 Survey Area

Mott MacDonald Restricted

The project does not foresee blasting during the pre-construction / construction phase; therefore, there will be no airblast impact generated by the project. Air quality impact resulting from fugitive dust emissions is anticipated to be comparatively localised, and present within circa 5 m of the unsealed access roads. Dust deposition drop-out may also impact habitats in areas in close proximity to the source site during arid weather conditions.

SURVEY PERIOD

This report refers to the following survey period: September 2025.

Surveys were undertaken in different locations in the area of influence. The first was performed on 24 September, the second on 25 September, and the third on 26 September 2025.

SURVEY SPECIALIST

The survey was conducted by Prof. Mitko Karadelev.

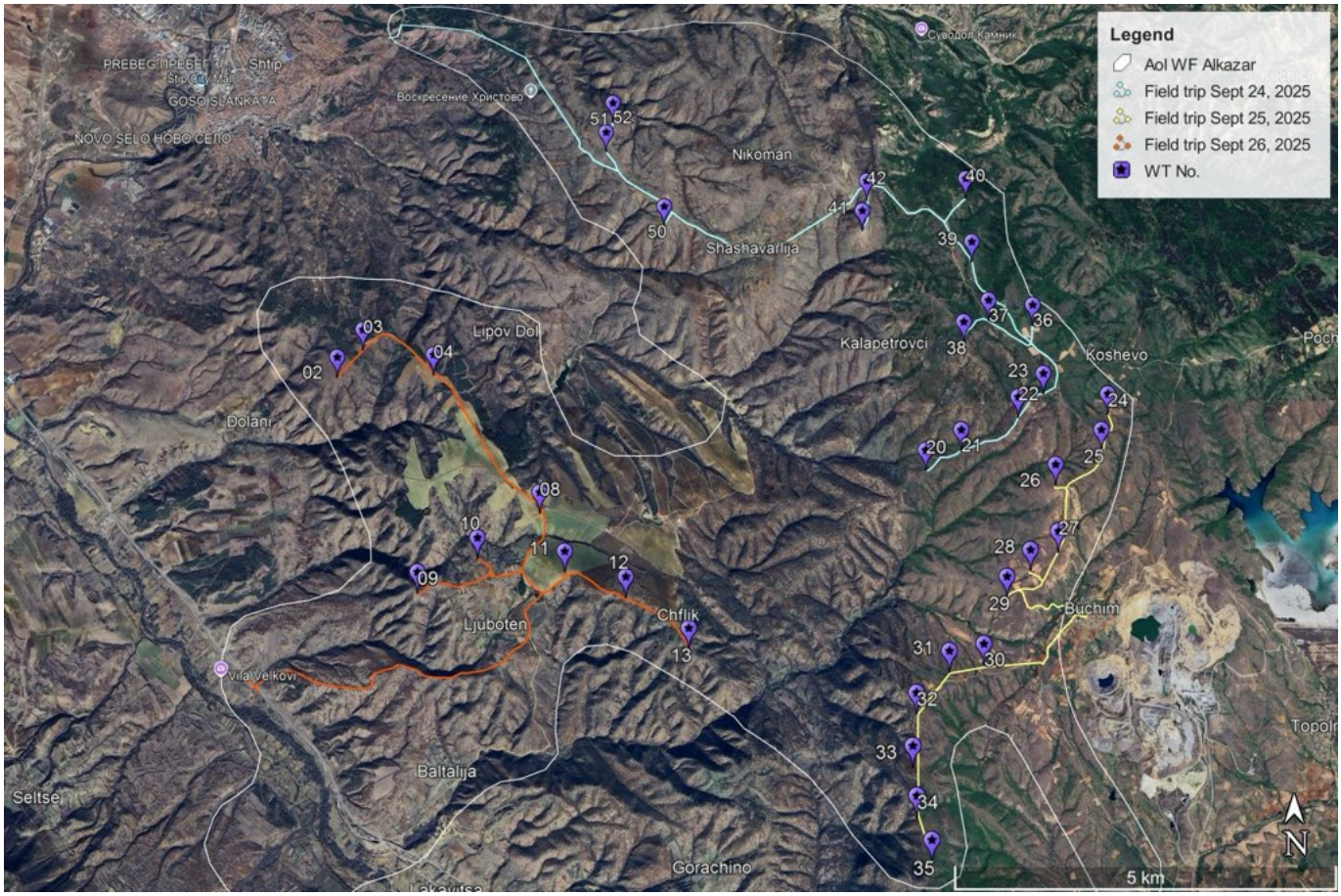

Fig. 2: Field visits in different location in the area of interest.

SURVEY SITES

Research was carried out at several locations (refer to Fig. 1 above) , based on the differences in the present habitats, distance to wind turbines, and altitude. A total of 35 locations of wind turbines were visited, starting from the town of Stip, then the villages of Sasavarlija - Nikoman - Kalapetrovci, and continuing to the village of

Koshevo. Floristic material was also collected and habitats were analyzed in the wind turbine areas between the villages of Ljuboten, Buchim and Shopur, along with access roads and transmission lines. Short visits were made to several locations, mostly easily accessible by vehicle.

FIELD SURVEY RESULTS

First day of the visit (September 24th)

On 24 September, a total of 14 wind turbine sites were visited, namely turbines nos. 20, 21, 22, 23, 36, 37, 38, 39, 40, 41, 42, 50, 51 and 52, all located on the route between Shtip, Sasavarlija, Kalapetrovci and Koshevo. Due to the dry weather, no new plant species were recorded. Of the herbaceous plants in flower, only Cichorium intybus and Dianthus armeria were found, while of the woody species, representatives of the oak forest communities were present, such as: Quercus frainetto, Quercus pubescens, Carpinus orientalis, Acer campestre, Ulmus minor and Fraxinus ornus. The following species of shrubs were present: *Crataegus monogyna, Cornus mas, Prunus spinosa, Pyrus amygdaliformis, Rosa canina and Rubus fruticosus*. Of the autumn plant species, only 2 specimens of *Colchicum autumnale* (only in the area of WT 37) were found, which indicates that it is still early for the appearance of autumn floral elements.

Fig. 2: Locations of WT 51 (left) and the location with measuring tower close to the village of Sasavarlija (right)

Fig. 3: Locations of WT 37: the dog rose (Rosa canina) with fruits (left) and the autumn crocus (Colchicum autumnale) in the flowering stage (right).

Second day of the visit (September 25th)

On September 25, a total of 12 wind turbine locations were visited, namely turbines number 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34 and 35, all in the vicinity of the villages of Buchim and on the way to the abandoned village of Shopur. Due to the dry weather, new plant species were not registered. Of the herbaceous plants, only the species *Lotus corniculatus, Cichorium intybus, and Daucus carota* were found in flower. Among the tree species, representatives of oak forest communities are present, such as: *Quercus frainetto, Quercus pubescens, Carpinus orientalis, Acer campestre, Corylus avellana and Fraxinus ornus*. The following species were found among the shrubs: *Crataegus monogyna, Prunus spinosa, Pyrus amygdaliformis, Rosa canina, Rosa gallica and Rubus fruticosus*. No representatives of autumn flora were found in this part of the study area.

Fig. 4: Locations of WT 26 (left) and WT 27 (right) with dry hill pastures and degraded oak forest around.

Fig. 5: Rubus fruticosus with fruits

3rd day of the visit (September 26th)

On September 26, a total of 9 wind turbine locations were visited, namely turbines number 2, 3, 4, 8, 9, 10, 11, 12 and 13, all in the vicinity of the village of Ljuboten. Due to the dry weather, new plant species were not registered. Of the herbaceous plants in flower, only the species *Verbascum baldaccii, Crepis foetida, Centaurea cyanus* and *Daucus carota* were found, while of the woody species representatives of the oak forest communities such as: *Quercus frainetto, Quercus pubescens, Carpinus orientalis, Acer campestre, Pyrus pyraster, Corylus avellana* and *Fraxinus ornus* are present. The following species were found among the shrubs: *Crataegus monogyna, Clematis vitalba, Prunus spinosa, Pyrus amygdaliformis, Rosa canina, Rosa gallica и Rubus fruticosus*. No representatives of autumn flora were found in this part of the study area.

Fig. 6: Locations of WT 10 (left) and WT 3 (right) with dry hill pastures and degraded oak forest around.

Fig. 7: The only representatives of the flora that are still in the flowering phase: Verbascum baldaccii (upper left) Centaurea sp. (bottom left) and the common hawthorn (Crataegus monogyna) with fruits (right).

List of identified plant species (September 2025)

Acer campestre
Carpinus orientalis
Centaurea cyanus
Centaurea sp.
Cichorium intybus
Daucus carota
Clematis vitalba
Cornus mas
Corylus avellana
Crepis foetida
Dianthus armeria
Fraxinus ornus
Lotus corniculatus
Prunus spinosa
Pyrus amygdaliformis
Pyrus pyraster
Quercus frainetto
Quercus pubescens
Rosa canina
Rosa gallica
Rubus fruticosus
Ulmus minor

An assessment of plant species was not carried out due to the absence of significant species. Of the autumn flower species, only Colchicum autumnale was found, which is very common and widespread throughout the country. Species listed in national and international conventions and legislation for the protection of endangered species at European or global level, as well as rare or endemic species found in this area, were not found during the surveys in September 2025.

No invasive species whatsoever have been detected in the project area.

CONCLUSION

The very hot and dry summer is not conducive to plant development. The study area is quite dry, with extremely high summer temperatures and a long dry period, which causes the plants to wither. Due to this, it seems that September was not the best time suitable for floristic studies. Only a few of the herbaceous species were in bloom, while the rest were mainly perennial trees and shrubs that are constantly present in this area. Individual specimens of autumn crocus (Colchicum autumnale) were present from the autumn flora.

B.2 Terrestrial mammals

MANEKO Solutions

STIP WIND FARM

Biodiversity Baseline Survey

FIELD REPORT

Biodiversity kingdom/class: Mammalia

Biodiversity specialist: Aleksandar Stojanov

Reporting period: May 2025

Date:
June, 2025

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TABLE 1 TRANSECTS CONDUCTED DURING THE MAMMAL'S FIELD SURVEY 5

STIP WIND FARM, Biodiversity Baseline Survey

FIELD REPORT, Mammals

1 | INTRODUCTION

BACKGROUND

The construction of Stip Wind Farm has been planned in the region south of the city of Stip, in the area between the villages of Dolani and Bucim. In accordance with the location of individual wind turbines, the area to be covered by the Stip Wind Farm has been divided into three sectors for the purpose of the survey, for easier organization of field activities, and more appropriate processing, analysis and presentation of the obtained data. The current design includes up to 54 wind turbine generators (WTGs), each with a nominal capacity of 6-8 MW, for a total installed capacity of up to 400 MW.

PURPOSE OF THIS REPORT

The purpose of this document is to report on conducted surveys of mammals identified in the surveyed area throughout the first survey period. In particular: List species and habitats potentially found within the project area, with defined protection category, and map of their potential distribution (in .shp format), and List identified PBFs and CHs.

SURVEY AREA

The area of the wind farm in Stip will occupy an area of approximately 400 ha. The focus of the flora, habitat and fauna survey mapping is about 1,000-m wide corridor on the central line of the proposed WF together with the related infrastructure (overhead lines and transformer station). The cited area is deemed appropriate for a survey, and it is sufficiently large to encompass most impacts on mammals arising during the construction works and operational needs in the projected area.

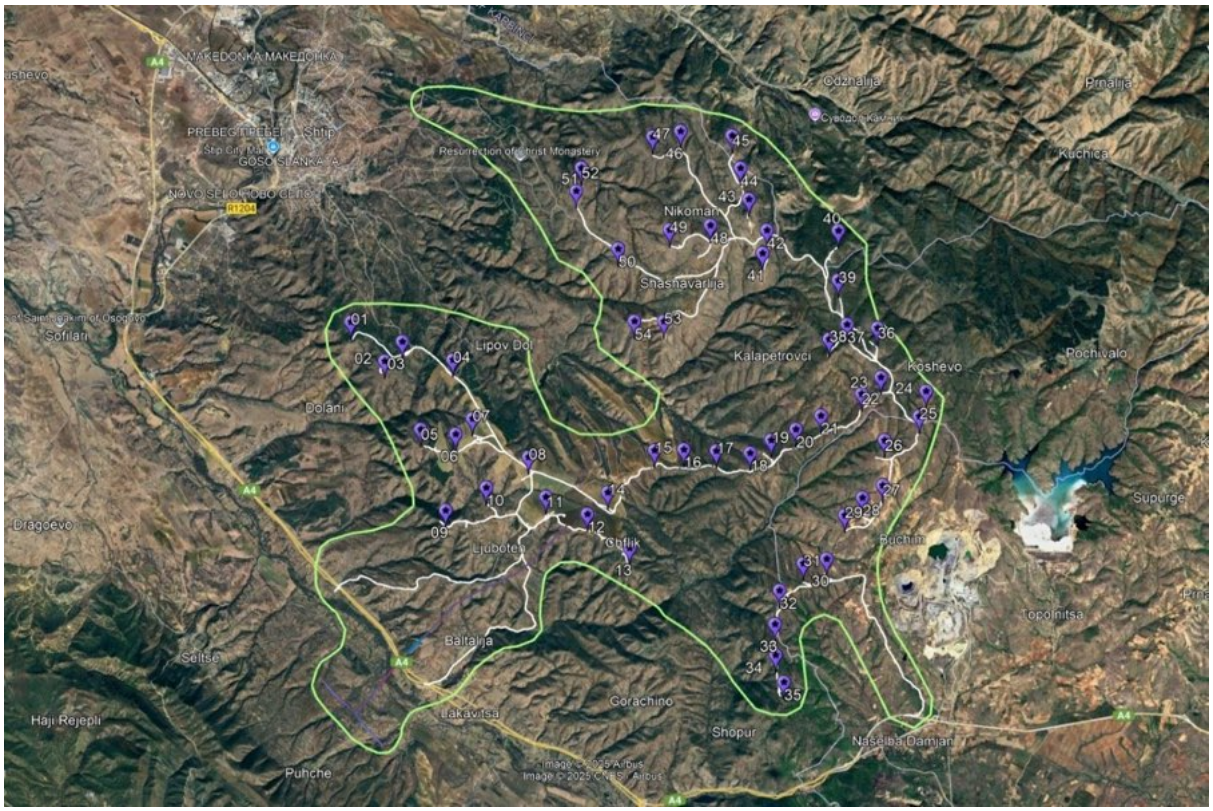


Figure 1 Survey Area

SURVEY PERIOD

This report refers to the following survey period: May 2025.

The first spring season survey on mammalian fauna was conducted during 21, 27 and 30 May 2025.

SURVEY SPECIALIST

The survey was conducted by: Aleksandar Stojanov.

2 | SCOPE OF WORK

Field survey is foreseen for the months of May, June and September of 2025.

The first seasonal survey (spring season) on mammalian fauna was done throughout the area of the planned Wind Park Stip.

The aim of the survey was to collect field data on species presence and distribution. According to the IBAT report, focus was also to see possible presence of species that are of national/international importance: European Ground Squirrel (*Spermophilus citellus*), Balkan Snow Vole (*Dinaromys bogdanovi*) and Marbled Polecat (*Vormela peregusna*).

3 | METHODOLOGY

FIELD SURVEY

The first spring season survey on mammalian fauna was conducted during May 2025 (21, 27 and 30 May). During the field survey, data of the presence of mammals within the survey area was obtained using the method of sign (transect) surveys (Linnel et al. 1998; Long et al. 2008; Suárez-Tangil 2021).

Transects were carried out in different habitats and searched for footprints, scats, hairs and other signs of presence of mammal species. When found, all signs were photographed and data on identified species, date, location, habitat and type of data were recorded.

LIMITATIONS

Hard-to-reach terrain, away from accessible roads even with an off-road vehicle.

4 | SURVEY RESULTS

SURVEY SITES

The field survey was conducted in parts of the project area between v. Lipov Dol and v. Dolani, near v. Ljuboten, v. Nikoman and v. Shashavarlija. Five transects were conducted in total (Map provided in Annex 1):

- Transect 1: Walked transect in the area Lipov Dol – Dolani, along the proposed locations for wind turbines 2, 3 and 4;
- Transect 2: Walked transect in the area of v. Ljuboten, along the proposed locations for wind turbines 8, 10, 11 and 14;
- Transect 3: Walked transect in the area of v. Shashavarlija, along the proposed locations for wind turbines 48, 50, 51 and 52;

- Transect 4: Walked transect in the area of v. Shashavarlija, along the proposed locations for wind turbines 40, 41 and 42;
- Transect 5: Walked transect in the area of v. Nikoman, along the proposed locations for wind turbines 43, 44 and 45;
- Transect 6: Walked transect in the area of v. Buchim and v. Shopur along the proposed locations for wind turbines 30 - 35.

Table 1 Transects conducted during the mammal's field survey

Site reference	Location	Additional details
Transect 1	41.706044 / 22.222864	Abandoned arable land, grassland and scrubland
Transect 2	41.680180 / 22.251523	Arable land, vineyards
Transect 3	41.718461 / 22.283013	Arable land, grassland and scrubland
Transect 4	41.726395 / 22.307359	Degraded oak forest, grassland and scrubland
Transect 5	41.735035 / 22.301508	Grassland and scrubland
Transect 6	41.661161 / 22.313667	Arable land, grassland and scrubland, oak forest

HABITAT ASSESSMENT

Following habitats were observed during the field visits in the project area: abandoned arable land, arable land, grasslands and scrublands, and degraded oak forest. However, all these habitats are not crucial for the presence of any notable mammal species.

FIELD SURVEY RESULTS

During the field survey, the presence of 4 species of mammals was recorded. Also, burrows of rodents from the genus Microtus (possibly from the species *Microtus hartingi*) were found at several locations. All of the recorded species are common and widespread in N. Macedonia and are found in all habitat types in the area with different species composition. All mammal species are not considered as species of special conservation interest. European ground squirrel and Balkan vole are not present in the project area. The marbled polecat in North Macedonia is mainly distributed in the lowlands and plains, so it is not expected to occur in the project area. The complete list of all mammal species found during the winter field surveys is presented in Annex 2.

Figure 2 Brown hare droppings near WT 03

Figure 3 Stone marten feces near WT 10

Figure 4 Microtus sp. burrows near WT 2

Figure 5 Badger digging near WT 10

Figure 6 Red fox footprints near WT 10

Priority Biodiversity Features (PBF) and critical habitats (CH)

Priority Biodiversity Features

No PBF mammal species were found.

Species	Priority features - criteria			
	(i)	(ii)	(iii)	(iv)

Critical habitats

No mammal species that trigger CH were found.

Species	Critical Habitats - criteria				
	Criterion (i)	Criterion (ii)	Criterion (iii)	Criterion (iv)	Criterion (v)

Invasive species

No invasive mammal species were found.

CONCLUSION

The spring monitoring season in the project area of the planned Wind Park Stip resulted with records of 5 mammal species, which are common and widely distributed in Macedonia and have no important conservation status.

Based on the identification and evaluation, no invasive species, PBF species or species that trigger CH habitats were encountered.

The habitats found in the project area are not crucial or important for any notable mammal species recorded in the project area.

RECOMMENDATIONS

No specific recommendation.

REFERENCES

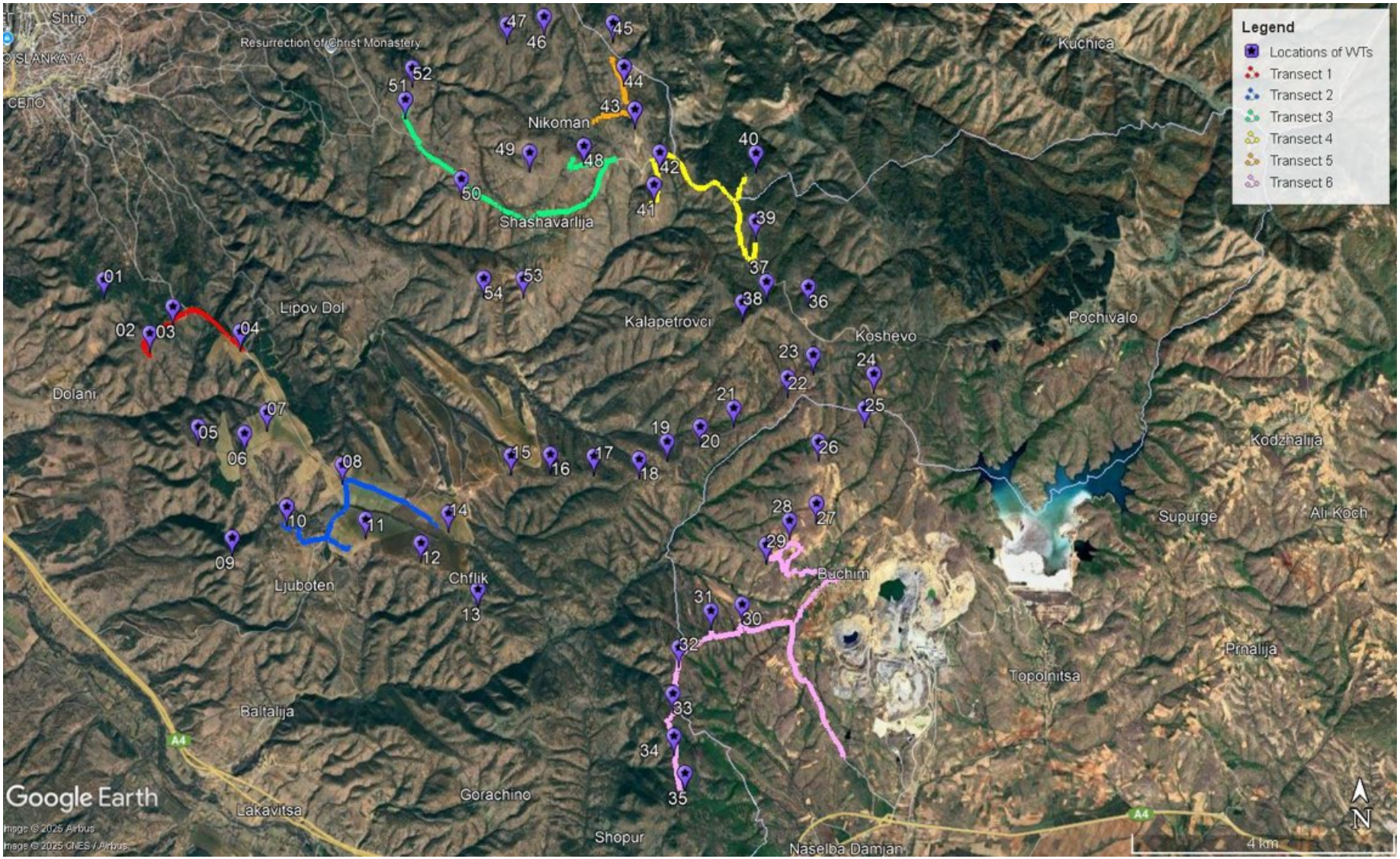
Long, R., MacKay, P., Ray, J & Zielinski, W. (2008). Noninvasive Survey Methods for Carnivores. Bibliovault OAI Repository, the University of Chicago Press.

Linnell, J.D.C., Swenson, J.E., Landa, A. & Kvam, T. (1998). Methods for monitoring European large carnivores- A worldwide review of relevant experience. – NINA Oppdragsmelding 549: 1-38.

Suárez-Tangil, B.D. and Rodríguez, A. (2021). Integral assessment of active and passive survey methods for large-scale monitoring of mammal occurrence in Mediterranean landscapes. Ecological Indicators, Volume 125, 107553, ISSN 1470-160X,https://doi.org/10.1016/j.ecolind.2021.107553.

ANNEXES

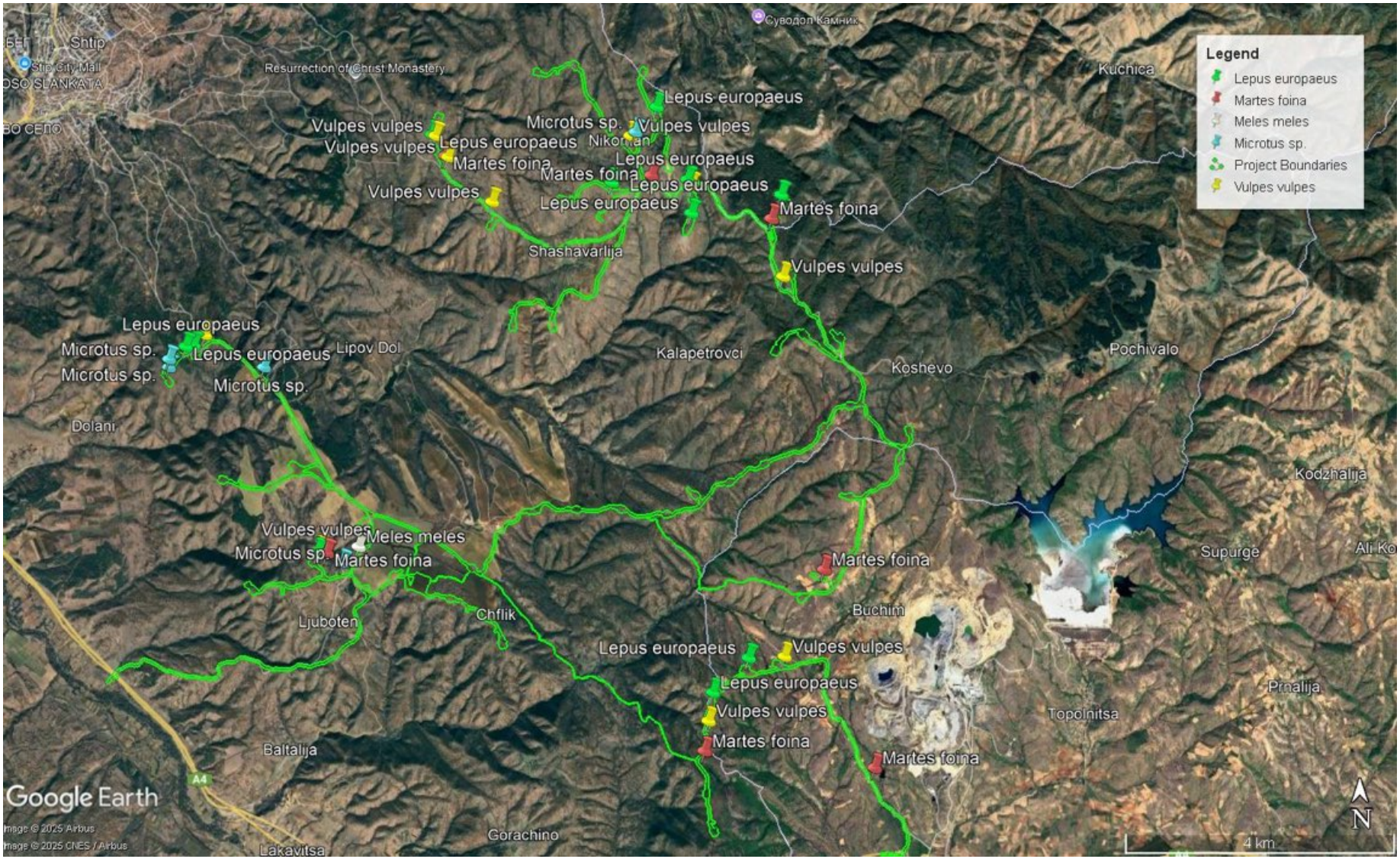
ANNEX 1 MONITORING LOCATIONS (TRANSECTS)



ANNEX 2 COMPLETE LIST OF IDENTIFIED SPECIES AND RELEVANT STATUS

№	English name	Latin name	IUCN Global Red List	European Red List	National Red List	Habitats Directive	Law on hunting	Law on Nature
1	Brown hare	*Lepus europaeus*	LC	LC			Seasonal protection	
2	Red fox	*Vulpes vulpes*	LC	LC			Without protection	
3	Stone marten	*Martes foina*	LC	LC			Without protection	
4	Badger	*Meles meles*	LC	LC			Seasonal protection	Protected species
5	Vole	*Microtus sp.*	LC	LC				

ANNEX 3 DISTRIBUTIONS MAPS



MANEKO Solutions

STIP WIND FARM

Biodiversity Baseline Survey

FIELD REPORT

Biodiversity kingdom/class: Mammalia

Biodiversity specialist: Aleksandar Stojanov

Reporting period: June 2025

Date:
July, 2025

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TABLE 1 TRANSECTS CONDUCTED DURING THE MAMMAL'S FIELD SURVEY 5

STIP WIND FARM, Biodiversity Baseline Survey

FIELD REPORT, Mammals

1 | INTRODUCTION

BACKGROUND

The construction of Stip Wind Farm has been planned in the region south of the city of Stip, in the area between the villages of Dolani and Bucim. In accordance with the location of individual wind turbines, the area to be covered by the Stip Wind Farm has been divided into three sectors for the purpose of the survey, for easier organization of field activities, and more appropriate processing, analysis and presentation of the obtained data. The current design includes up to 54 wind turbine generators (WTGs), each with a nominal capacity of 6-8 MW, for a total installed capacity of up to 396 MW.

PURPOSE OF THIS REPORT

The purpose of this document is to report on conducted surveys of mammals identified in the surveyed area throughout the first survey period. In particular: List species and habitats potentially found within the project area, with defined protection category, and map of their potential distribution (in .shp format), and List identified PBFs and CHs.

SURVEY AREA

The area of the wind farm in Stip will occupy an area of approximately 400 ha. The focus of the flora, habitat and fauna survey mapping is about 1,000-m wide corridor on the central line of the proposed WF together with the related infrastructure (overhead lines and transformer station). The cited area is deemed appropriate for a survey, and it is sufficiently large to encompass most impacts on mammals arising during the construction works and operational needs in the projected area.

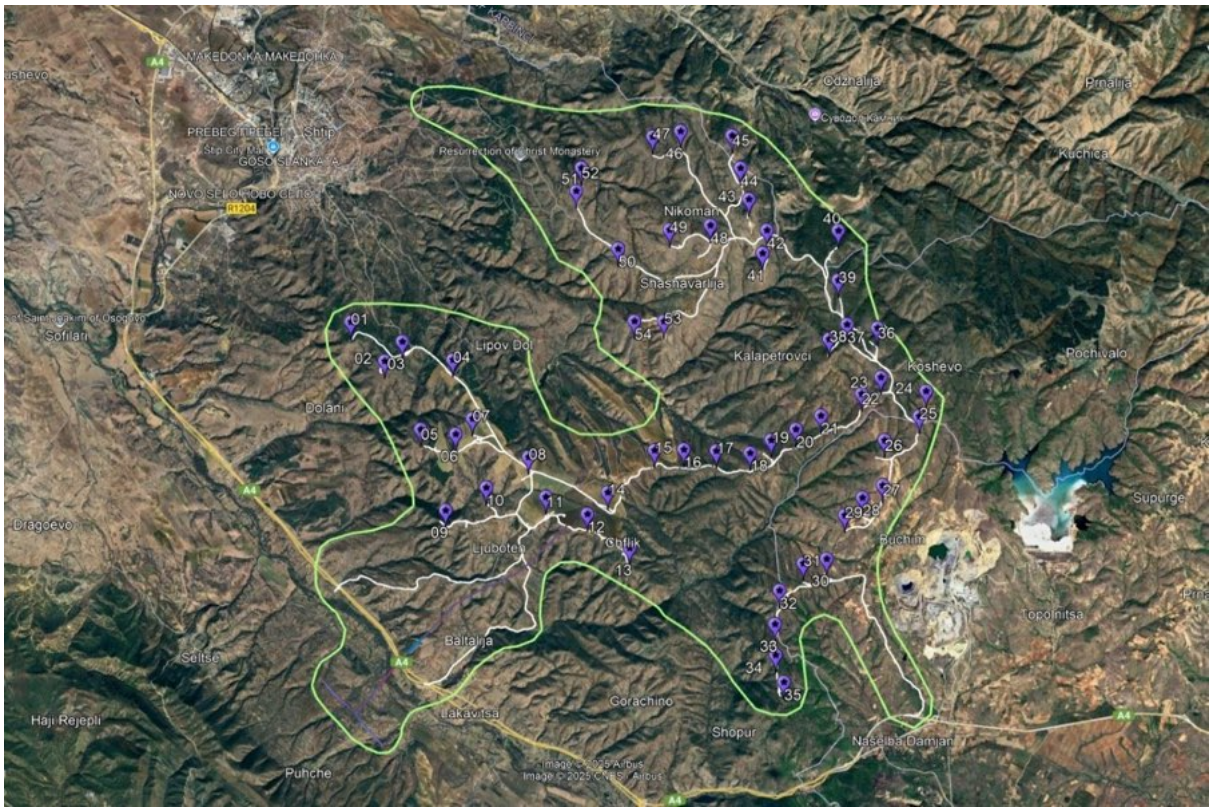

Figure 1 Survey Area

SURVEY PERIOD

This report refers to the following survey period: June 2025.

The second (summer) season survey on mammalian fauna was conducted during 8, 14 and 22 June 2025.

SURVEY SPECIALIST

The survey was conducted by: Aleksandar Stojanov.

2 | SCOPE OF WORK

Field survey is foreseen for the months of May, June and September of 2025.

The second seasonal survey (summer season) on mammalian fauna was done throughout the area of the planned Wind Park Stip.

The aim of the survey was to collect field data on species presence and distribution throughout the project area.

3 | METHODOLOGY

FIELD SURVEY

The second (summer) season survey on mammalian fauna was conducted during June 2025 (08, 14 and 22 June). During the field survey, data of the presence of mammals within the survey area was obtained using the method of sign (transect) surveys (Linnel et al. 1998; Long et al. 2008; Suárez-Tangil 2021).

Transects were carried out in different habitats and searched for footprints, scats, hairs and other signs of presence of mammal species. When found, all signs were photographed and data on identified species, date, location, habitat and type of data were recorded.

LIMITATIONS

Hard-to-reach terrain, overgrown with bushes, difficult to pass, away from accessible roads even with an off-road vehicle.

4 | SURVEY RESULTS

SURVEY SITES

The field survey was conducted in parts of the project area around villages Lipov Dol, Ljuboten, Nikoman, Shashavarlija, Koshevo, Buchim and Shopur. Six transects were conducted in total (Map provided in Annex 1):

- Transect 1: Transect in the area Shashavarlija - Nikoman, along the proposed locations for wind turbines 41, 42, 43, 48, 50 and 51;
- Transect 2: Transect in the area of v. Koshevo, along the proposed locations for wind turbines 36-40;
- Transect 3: Transect in the area of v. Koshevo, along the proposed locations for wind turbines 21-23;

- Transect 4: Transect in the area between v. Koshevo and v. Buchim, along the proposed locations for wind turbines 24-29;
- Transect 5: Transect in the area along the access road to v. Buchim and towards v. Shopur, along the proposed locations for wind turbines 30-35;
- Transect 6: Transect in the area between v. Lipov Dol and v. Ljuboten, along the proposed locations for wind turbines 3, 4, 8, 10, 11 and 14.

Table 1 Transects conducted during the mammal's field survey

Site reference	Location	Additional details
Transect 1	41.718641 / 22.282460	Degraded oak forest, arable land, grassland and scrubland
Transect 2	41.712146 / 22.325236	Degraded oak forest, grassland and scrubland
Transect 3	41.694195 / 22.330168	Degraded oak forest, hill pastures
Transect 4	41.685663 / 22.337717	Degraded oak forest, grassland and scrubland
Transect 5	41.664212 / 22.328378	Grassland and scrubland
Transect 6	41.689557 / 22.243340	Oak forest, degraded oak forest, grassland, arable land, abandoned arable land

HABITAT ASSESSMENT

Following habitats were observed during the field visits in the project area: abandoned arable land, arable land, grasslands and scrublands, oak forest and degraded oak forest. However, all these habitats are not crucial for presence of any notable mammal species.

FIELD SURVEY RESULTS

During the field survey, the presence of 8 species of mammals was recorded, including a species from the genus Microtus (possibly from the species *Microtus hartingi*). All of the recorded species are common and widespread in N. Macedonia and are found in all habitat types in the area with different species composition. All mammal species are not considered as species of special conservation interest. The complete list of all mammal species found during the summer field surveys is presented in Annex 2.

Figure 2 Hedgehog footprints in the area of the access road (Buchim)

Figure 3 Badger footprints in the area of the access road (Buchim)

Figure 4 Microtus sp. burrows near WT7

Figure 5 Brown hare droppings near WT3

Figure 6 Red fox footprints near WT 30

Figure 7 Stone marten droppings near WT51

Figure 8 Weasel droppings near WT 33

Figure 9 Roe deer footprints near WT 32

Priority Biodiversity Features (PBF) and critical habitats (CH)

Priority Biodiversity Features

No PBF mammal species were found.

Species	Priority features - criteria			
	(i)	(ii)	(iii)	(iv)

Critical habitats

No mammal species that trigger CH were found.

Species	Critical Habitats - criteria				
	Criterion (i)	Criterion (ii)	Criterion (iii)	Criterion (iv)	Criterion (v)

Invasive species

No invasive mammal species were found.

CONCLUSION

The summer monitoring season in the project area of the planned Wind Park Shtip resulted with records of 8 mammal species, which are common and widely distributed in Macedonia and have no important conservation status.

Based on the identification and evaluation, no invasive species, PBF species or species that trigger CH habitats were encountered.

The habitats found in the project area are not crucial or important for any notable mammal species recorded in the project area.

RECOMMENDATIONS

No specific recommendation.

REFERENCES

Long, R., MacKay, P., Ray, J & Zielinski, W. (2008). Noninvasive Survey Methods for Carnivores. Bibliovault OAI Repository, the University of Chicago Press.

Linnell, J.D.C., Swenson, J.E., Landa, A. & Kvam, T. (1998). Methods for monitoring European large carnivores- A worldwide review of relevant experience. – NINA Oppdragsmelding 549: 1-38.

Suárez-Tangil, B.D. and Rodríguez, A. (2021). Integral assessment of active and passive survey methods for large-scale monitoring of mammal occurrence in Mediterranean landscapes. Ecological Indicators, Volume 125, 107553, ISSN 1470-160X,https://doi.org/10.1016/j.ecolind.2021.107553.

ANNEXES

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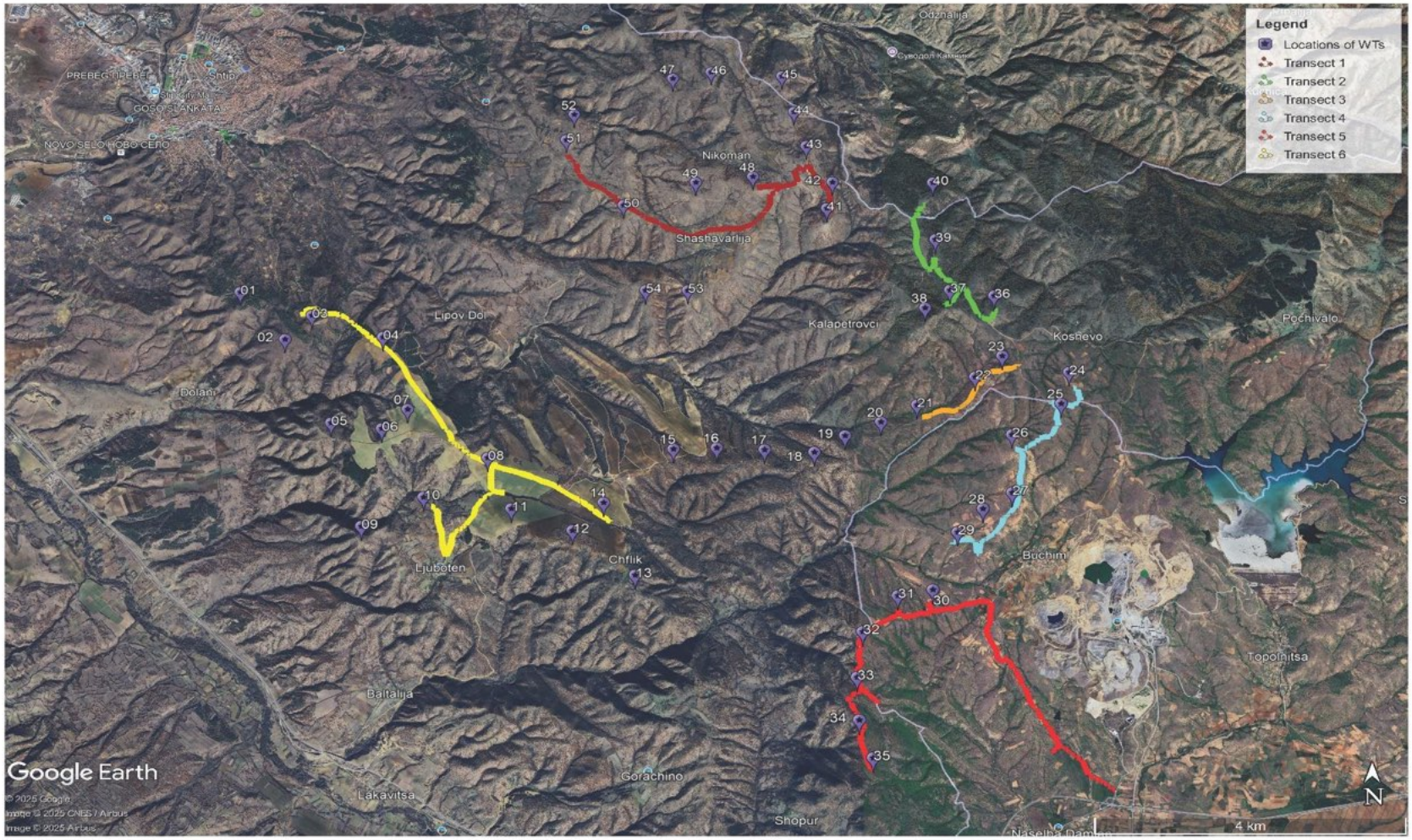
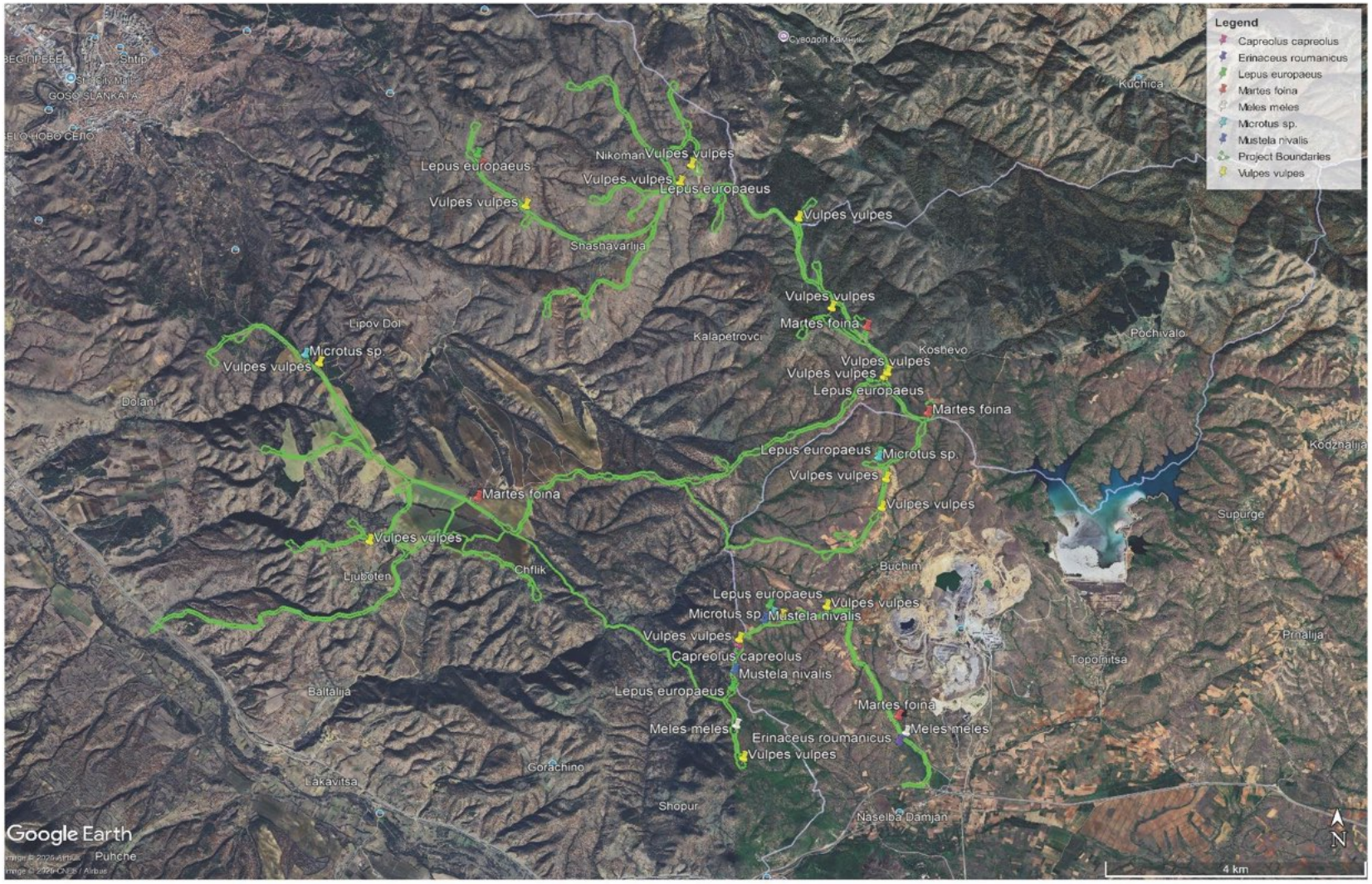
ANNEX 1 MONITORING LOCATIONS (TRANSECTS)



ANNEX 2 COMPLETE LIST OF IDENTIFIED SPECIES AND RELEVANT STATUS

№	English name	Latin name	IUCN Global Red List	European Red List	National Red List	Habitats Directive	Law on game species and hunting	Law on Nature Protection
1	Northern White-breasted Hedgehog	*Erinaceus roumanicus*	LC	LC				
2	Brown hare	*Lepus europaeus*	LC	LC			Seasonal protection	
3	Red fox	*Vulpes vulpes*	LC	LC			Without protection	
4	Stone marten	*Martes foina*	LC	LC			Without protection	
5	Least weasel	*Mustela nivalis*	LC	LC			Without protection	
6	Badger	*Meles meles*	LC	LC			Seasonal protection	Protected species
7	Roe deer	*Capreolus capreolus*	LC	LC			Seasonal protection	
8	Vole	*Microtus sp.*	LC	LC				

ANNEX 3 DISTRIBUTIONS MAPS



MANEKO Solutions

STIP WIND FARM

Biodiversity Baseline Survey

FIELD REPORT

Biodiversity kingdom/class: Mammalia

Biodiversity specialist: Aleksandar Stojanov

Reporting period: September 2025

Date:
October, 2025

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TABLE 1 TRANSECTS CONDUCTED DURING THE MAMMAL'S FIELD SURVEY 5

STIP WIND FARM, Biodiversity Baseline Survey

FIELD REPORT, Mammals

1 | INTRODUCTION

BACKGROUND

The construction of Stip Wind Farm has been planned in the region south of the city of Stip, in the area between the villages of Dolani and Bucim. In accordance with the location of individual wind turbines, the area to be covered by the Stip Wind Farm has been divided into three sectors for the purpose of the survey, for easier organization of field activities, and more appropriate processing, analysis and presentation of the obtained data. The current design includes up to 54 wind turbine generators (WTGs), each with a nominal capacity of 6-8 MW, for a total installed capacity of up to 396 MW.

PURPOSE OF THIS REPORT

The purpose of this document is to report on conducted surveys of mammals identified in the surveyed area throughout the first survey period. In particular: List species and habitats potentially found within the project area, with defined protection category, map of their potential distribution (in .shp format), List identified of species of conservation concern that qualify as primary biodiversity features (PBF) and/or trigger critical habitat (CH) in accordance with the updated EBRD Performance Requirement 6 and IFC Performance Standard 6 (European Bank for Reconstruction and Development 2024; International Finance Corporation 2019).

SURVEY AREA

The area of the wind farm in Stip will occupy an area of approximately 400 ha. The focus of the mammal survey mapping is about 1,000-m wide corridor on the central line of the proposed WF together with the related infrastructure (overhead lines and transformer station). The cited area is deemed appropriate for a survey, and it is sufficiently large to encompass most impacts on mammals arising during the construction works and operational needs in the projected area. Some small parts of the area of influence are not surveyed due to certain limitations (inaccessible terrain etc.), however this not affects the results as there are same habitats as in the surveyed area, and thus same species composition.

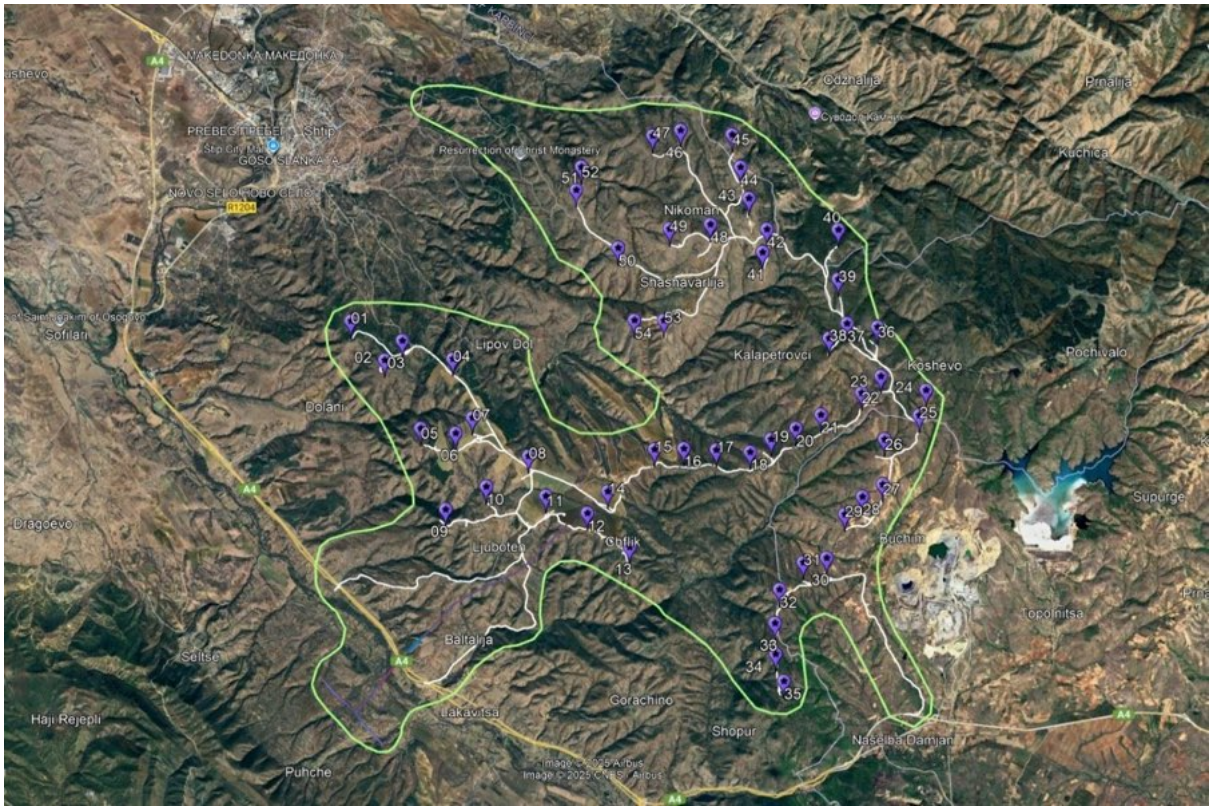

Figure 1 Survey Area

SURVEY PERIOD

This report refers to the following survey period: September 2025.

The third (autumn) season survey on mammalian fauna was conducted during 24-26 September 2025.

SURVEY SPECIALIST

The survey was conducted by: Aleksandar Stojanov.

2 | SCOPE OF WORK

Field survey is foreseen for the months of May, June and September of 2025.

The third seasonal survey (autumn season) on mammalian fauna was done throughout the area of the planned Wind Park Stip.

The aim of the survey was to collect field data on species presence and distribution throughout the project area.

3 | METHODOLOGY

FIELD SURVEY

The third (autumn) season survey on mammalian fauna was conducted during September 2025 (24, 25 and 26 September). During the field survey, data of the presence of mammals

within the survey area was obtained using the method of sign (transect) surveys (Linnel et al. 1998; Long et al. 2008; Suárez-Tangil 2021).

Transects were carried out in different habitats and searched for footprints, scats, hairs and other signs of presence of mammal species. When found, all signs were photographed and data on identified species, date, location, habitat and type of data were recorded.

LIMITATIONS

Hard-to-reach terrain, overgrown with bushes, difficult to pass, away from accessible roads even with an off-road vehicle.

4 | SURVEY RESULTS

SURVEY SITES

The field survey was conducted in parts of the project area around villages Lipov Dol, Ljuboten, Nikoman, Shashavarlija, Koshevo, Buchim and Shopur. Three transects were conducted in total (Map provided in Annex 1):

- Transect 1: Transect in the area of v. Shahavarlija, Nikoman and Koshevo, along the proposed locations for wind turbines 20, 21, 22, 23, 36, 37, 38, 39, 40, 41, 42, 50, 51 and 52;
- Transect 2: Transect in the area of v. Koshevo towards v. Buchim and v. Shopur, along the proposed locations for wind turbines 24-35;
- Transect 3: Transect in the area between v. Lipov Dol, Ljuboten and Chiflik, along the proposed locations for wind turbines 2, 3, 4, 8, 9, 10, 11, 12 and 13.

Table 1 Transects conducted during the mammal's field survey

Site reference	Location	Additional details
Transect 1	41.73058 / 22.26040 41.68807 / 22.31552	Degraded oak forest, arable land, grassland and scrubland
Transect 2	41.69440 / 22.34539 41.64150 / 22.31226	Oak forest, degraded oak forest, arable land, abandoned arable land grassland and scrubland
Transect 3	41.70074 / 22.21644 41.66646 / 22.27460	Arable land, abandoned arable land grassland and scrubland

HABITAT ASSESSMENT

Following habitats were observed during the field visits in the project area: abandoned arable land, arable land, grasslands and scrublands, oak forest and degraded oak forest. However, all these habitats are not crucial for presence of any notable mammal species.

FIELD SURVEY RESULTS

During the field survey, the presence of 5 species of mammals was recorded, including a species from the genus Microtus (possibly from the species *Microtus hartingi*). All of the recorded species were recorded with the previous field surveys. They are common and widespread in N. Macedonia and are found in all habitat types in the area with different species composition. All mammal species are not considered as species of special conservation

interest. The complete list of all mammal species found during the summer field surveys is presented in Annex 2.

Figure 1 Stone marten droppings near WT39

Figure 2 Badger diggings near WT33

Figure 3 Microtus sp. burrows near WT51

Figure 4 Brown hare droppings near WT26

Figure 5 Red fox footprints near WT31

Priority Biodiversity Features (PBF) and critical habitats (CH)

Priority Biodiversity Features

No PBF mammal species were found.

Species	Priority features - criteria			
	(i)	(ii)	(iii)	(iv)

Critical habitats

No mammal species that trigger CH were found.

Species	Critical Habitats - criteria				
	Criterion (i)	Criterion (ii)	Criterion (iii)	Criterion (iv)	Criterion (v)

Invasive species

No invasive mammal species were found.

Conclusion

The summer monitoring season in the project area of the planned Wind Park Shtip resulted with records of 5 mammal species. All of them were recorded during the previous seasonal surveys, and they are common and widely distributed in Macedonia, with no special conservation status.

Based on the identification and evaluation, no invasive species, PBF species or species that trigger CH habitat in accordance with EBRD PR6 and IFC PS6 requirements were encountered.

The habitats found in the project area are not crucial or important for any notable mammal species recorded in the project area.

Recommendations

No specific recommendation.

REFERENCES

European Bank for Reconstruction and Development (2024). Environmental and Social Policy.

International Finance Corporation (2019). Performance Standard 6: Biodiversity Conservation and the Sustainable Management of Living Natural Resources.

Long, R., MacKay, P., Ray, J & Zielinski, W. (2008). Noninvasive Survey Methods for Carnivores. Bibliovault OAI Repository, the University of Chicago Press.

Linnell, J.D.C., Swenson, J.E., Landa, A. & Kvam, T. (1998). Methods for monitoring European large carnivores- A worldwide review of relevant experience. – NINA Oppdragsmelding 549: 1-38.

Suárez-Tangil, B.D. and Rodríguez, A. (2021). Integral assessment of active and passive survey methods for large-scale monitoring of mammal occurrence in Mediterranean landscapes. Ecological Indicators, Volume 125, 107553, ISSN 1470-160X,https://doi.org/10.1016/j.ecolind.2021.107553.

ANNEXES

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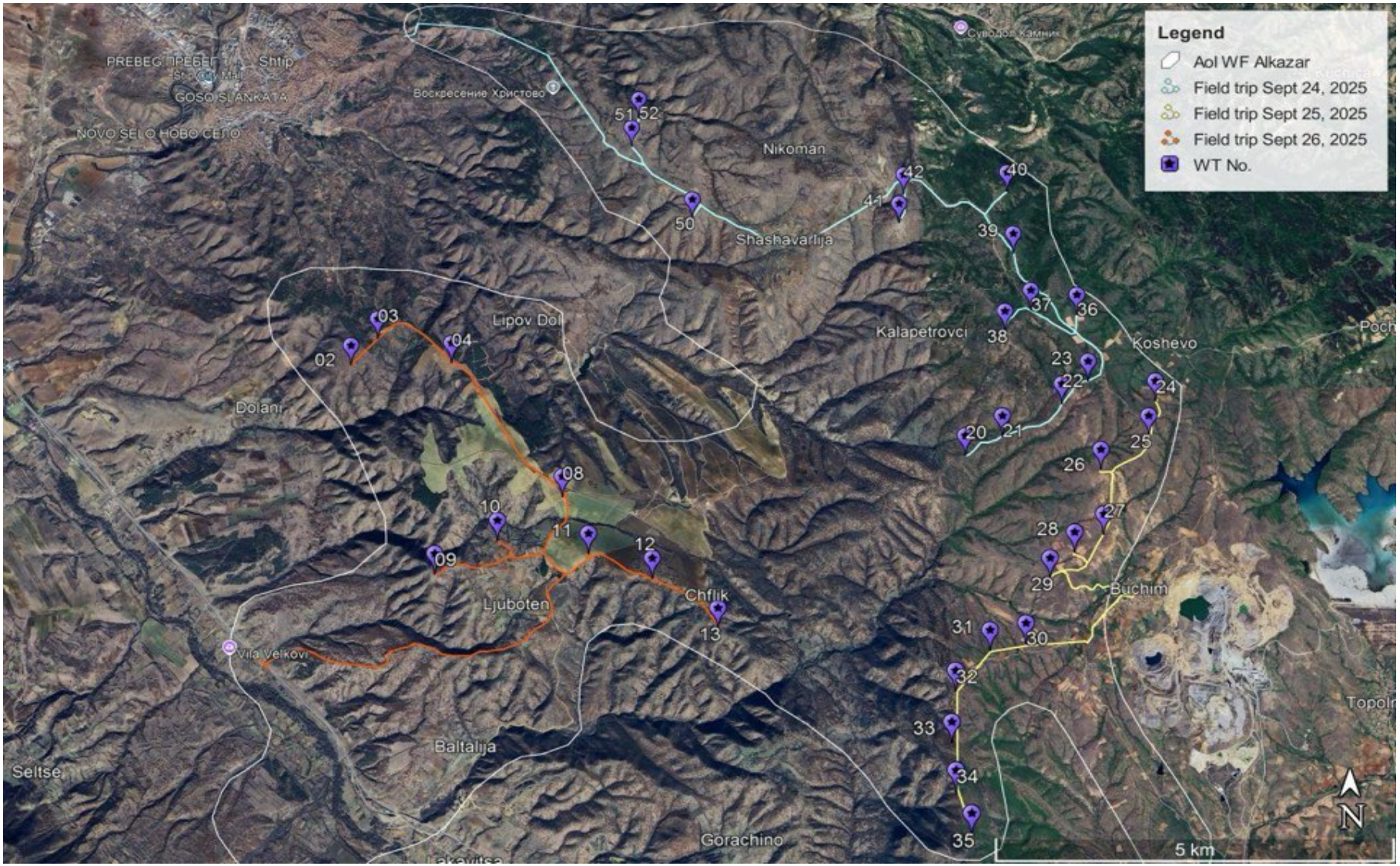
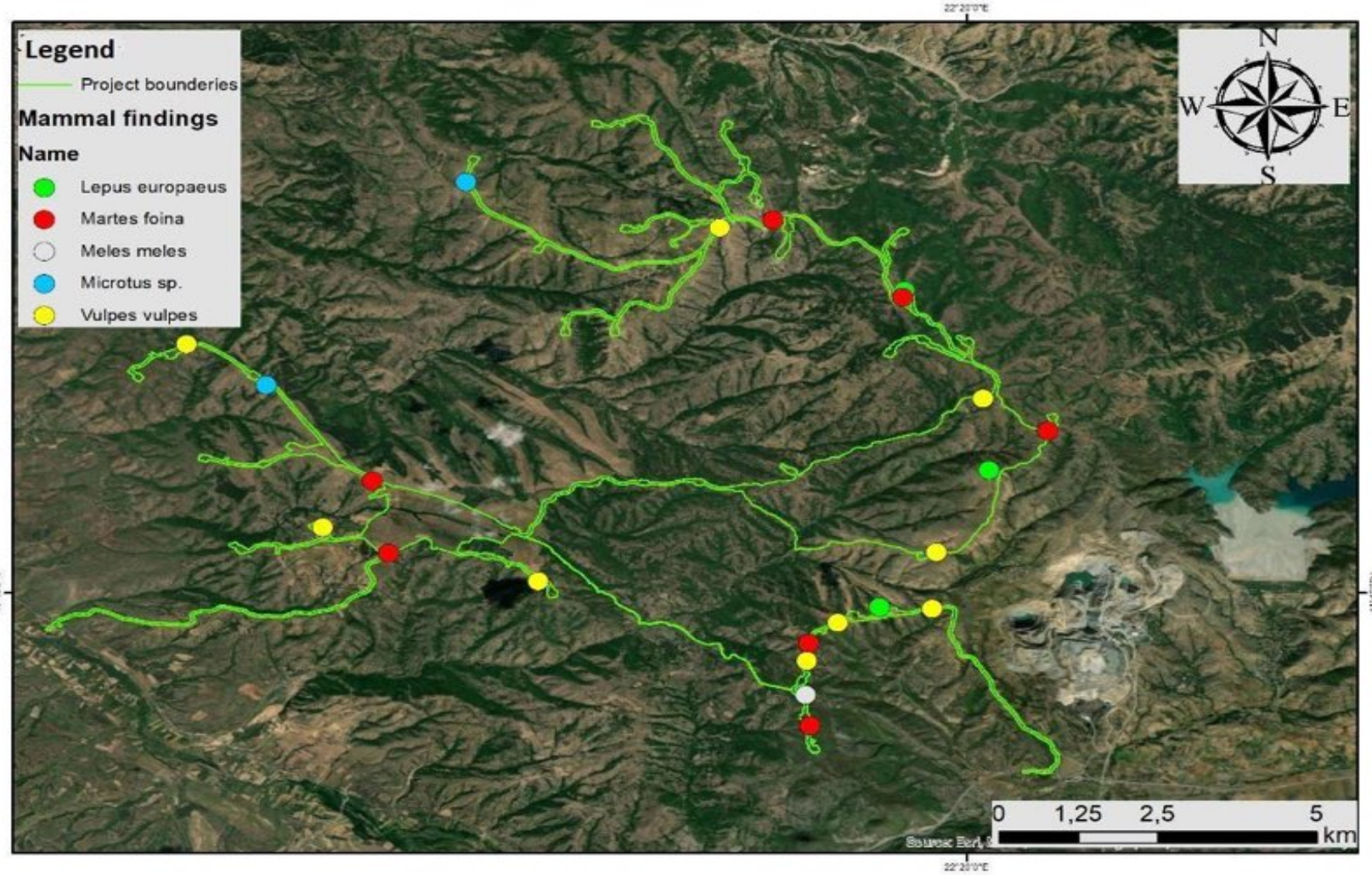
ANNEX 1 MONITORING LOCATIONS (TRANSECTS)



ANNEX 2 COMPLETE LIST OF IDENTIFIED SPECIES AND RELEVANT STATUS

№	English name	Latin name	IUCN Global Red List	European Red List	National Red List	Habitats Directive	Law on game species and hunting	Law on Nature Protection
1	Brown hare	*Lepus europaeus*	LC	LC			Seasonal protection	
2	Red fox	*Vulpes vulpes*	LC	LC			Without protection	
3	Stone marten	*Martes foina*	LC	LC			Without protection	
4	Badger	*Meles meles*	LC	LC			Seasonal protection	Protected species
5	Vole	*Microtus sp.*	LC	LC				

ANNEX 3 DISTRIBUTIONS MAPS



B.3 Bats

Bat Survey Methods

Overview

This section describes the approach to bat surveys. Firstly, the criteria used to identify target species for survey are identified. The surveys for the target species comprises of three methodologies; two for bat flight activity (manual and automated bat detector surveys) and one for bat roost activity.

Target species

All bat species are protected in Europe by the EU Habitats Directive. The following high to medium collision risk species are likely to be present in the project area and will form the primary focus of the surveys:. These species will be treated as primary target species and all others as secondary target species

The first group of species includes:

High Risk

Species of the genus Nyctalus (*Nyctalus noctula, Nyctalus lasiopterus*, *Nyctalus leisleri*
Species of the genus Pipistrellus (*Pipistrellus pipistrellus*, *Pipistrellus nathusii*, *Pipistrellus pygmaeus*, *Pipistrellus kuhlii*)
Savi's pipistrelle (*Hypsugo savii*),
Common bent-wing bat (*Miniopterus schreibersii*),
Parti-coloured bat (*Vespertilio murinus*) and
European free-tailed bat (*Tadarida teniotis*).

Medium Risk

Species of the genus Eptesicus (*Eptesicus serotinus*, *E. isabellinus*, *E. nilssonii*),
Western barbastelle *Barbastella barbastellus* and
Pond bat *Myotis dasycneme* (in water bodies rich areas).

Secondary target species will include all other bat species (i.e. those at low risk of harm).
In the vicinity of Wind Park area there are no published surveys of bats, so we propose that all recorded bat species is treated as target species.

3.3 Bat survey methodology

Surveys will follow three methodologies. Manual and automated bat detector surveys on the ground will be conducted. The surveys will result in a bat activity index for the site: this is the number of bat contacts per hour (Rodrigues 2015). In addition, surveys for bat roost activity will be undertaken. Section 4 sets out details of the proposed survey calendar.

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3.3.1 Manual bat detector surveys on the ground

Manual bat detector surveys on the ground will be conducted by vehicle driven transects based on Bat Conservation Trust guidelines (Hundt, 2012).

Transects (Figure 2) will be driven with the vehicle headlight dipped and at a consistent speed of 15 mph (24 km/h). Echolocation calls will be continually recorded by a detector mounted to point out of the window or sunroof at a 45 degree angle to the direction of travel. A time expansion, full spectrum or frequency division detector will be used for the recording, and the data subsequently analysed so that bat calls can be identified. The location at which bat passes are recorded will also be recorded with a Global Positioning System (GPS) reference. Manual survey effort (to determine a site specific bat activity index (number of bat contacts per hour)) will be as follows:

- One survey visit every 10 days, two whole nights in September/October 2024, first half of night from sunset for 4 hours
- One survey visit every 10 days (if weather conditions are appropriate), first half of night from half an hour before dusk for two hours (November-December 2024).
- One survey visit every 10 days, first half of the night from sunset for four hours (February-March 2025);
- One survey visit every 10 days, i.e. two times for the first half of the night (from sunset for four hours) and one whole night in May (March-May 2025); and
- One survey every second week, always a whole night (June-July 2025).

Manual bat detectors Petersson 240x and Song Meter Mini Bat2 were used in survey.

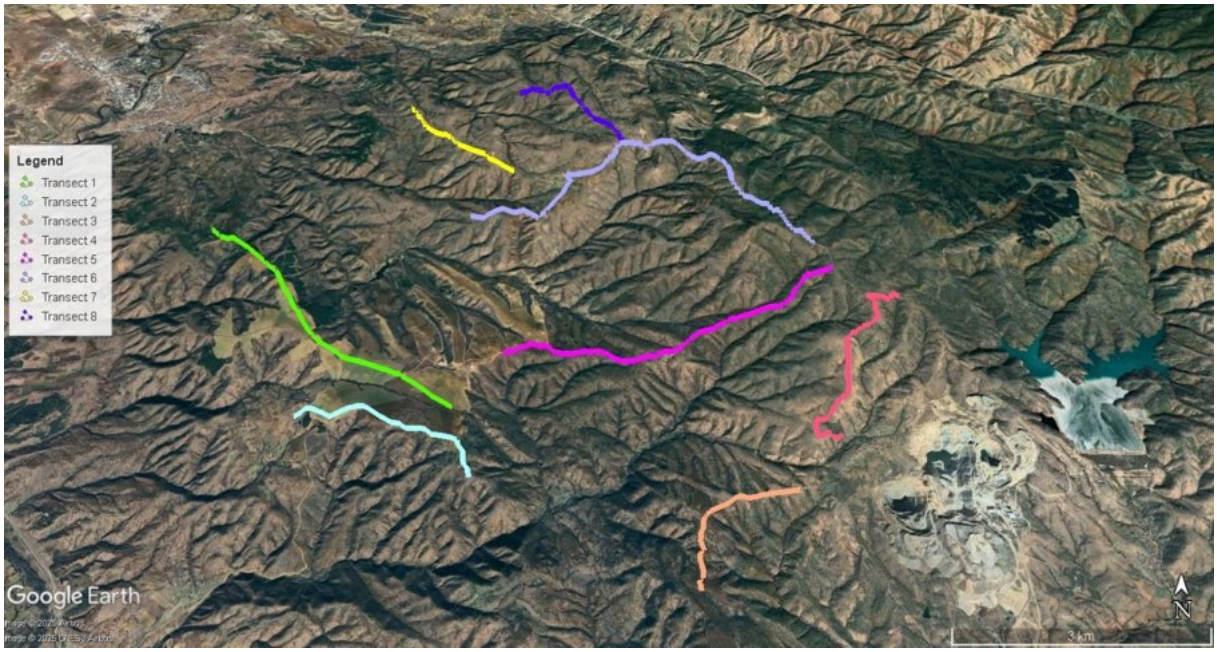

Figure 2. Transects for bat monitoring on "Štip" Wind Park area.

Automated bat detector surveys on the ground

In accordance with the terms of reference, one automated bat detector will be installed in each of the four wind park claster (Figure 3). Automated survey effort (to determine a site specific bat activity index (number of bat contacts per hour)) will be at least one

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night during each manual detector survey visit (located at a representative number of turbine sites in each type of habitat, relief and topography present). Note that one "survey visit" can consist of several nights that are needed to cover the whole project study area.

The time for which the detectors recorded the activity of the bats was used to calculate the bat activity index (number of contacts per hour). Automated bat detectors (SongMeter4BAT FS) were used in survey. This type of detector has been specifically designed for long-term surveys. It features HD-sound, external microphones and the stereo/dual option. It has the extended frequency range from 15 to 130 kHz and it is able to record all bat sounds in clear audio. These are stationary automatic detectors. Recorded bat calls were analysed using Cleidoscope PRO software. Specific bat activity index was calculated as number of bat contacts per hour. Recorded bats are grouped according to the level of collision risk with wind turbines (Table 1). The used criteria to estimate the bat activity indexes are shown in Table 2.

Table 1 - Level of collision risk with wind turbines (not micro- and small-wind turbines) for European and Mediterranean bat species to which EUROBATS applies (state of knowledge: September 2014) (Rodrigues et al., 2015)

High risk	Medium risk	Low risk	Unknown
Nyctalus spp.	*Eptesicus* spp.	*Myotis* spp.**	*Rousettus aegyptiacus*
Pipistrellus spp.	*Barbastella* spp.	*Plecotus* spp.	*Taphozous nudiventris*
Vespertilio murinus	*Myotis dasycneme**	*Rhinolophus* spp.	*Otonycteris hemprichii*
Hypsugo savii			*Miniopterus pallidus*
Miniopterus schreibersi			
Tadarida teniotis			

* in water rich area, ** exclusive *Myotisdasycneme*in water rich area

Table 2 - Criteria of bat activity indexes to study impact of wind turbines (Dürr 2007)

Bat activity index	Assessment of activity
<1,6	Low activity
1,6-3,5	Medium activity
3,6-5,9	High activity
>6,0	Very high activity

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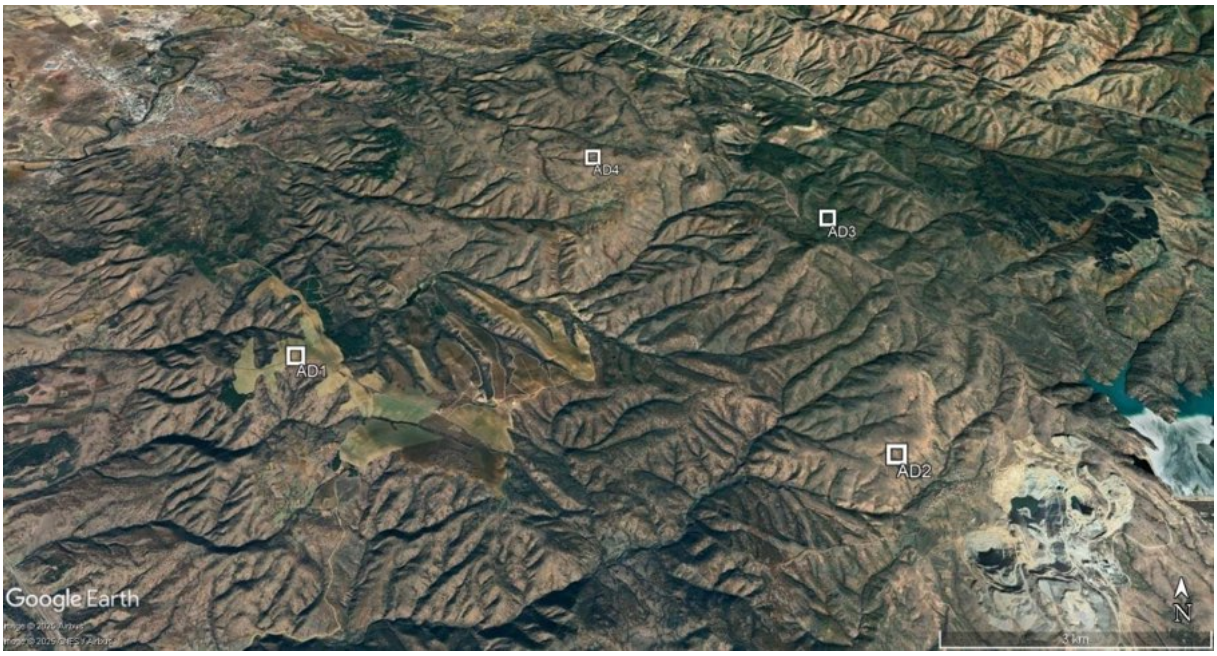

Figure 3. Automated detectors position for bat monitoring on "Štip" Wind Park area.

In accordance with the intended research methodology, Tables 3 and 4 show the date when the monitoring was carried out.

Table 3. Dates of bat monitoring using manual detector and weather data.

Date	Surveyor	Transect	Begin	End	Visibility	Clouds	Temp	Wind		Rain
			(hh:mm)	(hh:mm)	(m)	(%)	(°C)	speed	direction	(% of time)
25.10.2024.	Stefan Skorić	1	19:21	19:38		0 %	13	7 km/h	SE	
25.10.2024.	Stefan Skorić	2	19:53	20:04		0	12	7	SE	
25.10.2024.	Stefan Skorić	3	20:26	20:34		0	12	7	SE	
25.10.2024.	Stefan Skorić	4	20:49	21:01		0	12	7	SE	
26.10.2024.	Stefan Skorić	6	19:23	19:48		0	14	9	ESE	
26.10.2024.	Stefan Skorić	5	19:52	20:19		0	13	9	ESE	
26.10.2024.	Stefan Skorić	7	20:36	20:53		0	13	8	ESE	
26.10.2024.	Stefan Skorić	8	21:13	21:26		0	12	8	ESE	
06.11.2024.	Stefan Skorić	1	16:05	16:23		0	13	6	SW	
06.11.2024.	Stefan Skorić	2	16:35	16:47		0	13	6	SW	
06.11.2024.	Stefan Skorić	3	17:05	17:21		0	13	6	W	
06.11.2024.	Stefan Skorić	4	17:33	17:49		0	13	7	W	
07.11.2024.	Stefan Skorić	5	15:55	16:22		0	13	3	E	
07.11.2024.	Stefan Skorić	6	16:25	16:52		0	13	3	E	

07.11.2024.	Stefan Skorić	7	17:00	17:11		0	13	3	E	
07.11.2024.	Stefan Skorić	8	17:24	17:38		0	13	3	E	
12.11.2024.	Stefan Skorić	5	15:50	16:12		70	6	4	W	
12.11.2024.	Stefan Skorić	6	16:17	16:44		70	6	4	W	
12.11.2024.	Stefan Skorić	7	16:58	17:13		70	6	4	W	
12.11.2024.	Stefan Skorić	8	17:29	17:42		70	6	4	W	
13.11.2024.	Stefan Skorić	1	15:56	16:17		100	5	4	W	
13.11.2024.	Stefan Skorić	2	16:30	16:45		100	5	4	W	
13.11.2024.	Stefan Skorić	3	16:58	17:09		100	5	4	W	
13.11.2024.	Stefan Skorić	4	17:17	17:31		100	5	4	W	
8.2.2025.	Stefan Skorić	1	16:35	16:53		0	0	7	NE	
8.2.2025.	Stefan Skorić	2	17:08	17:19		0	0	7	NE	
8.2.2025.	Stefan Skorić	3	17:35	17:44		0	0	7	NE	
8.2.2025.	Stefan Skorić	4	17:51	18:06		0	0	7	NE	
9.2.2025.	Stefan Skorić	5	16:40	17:02		0	-1	4	NE	
9.2.2025.	Stefan Skorić	6	17:07	17:33		0	-1	4	NE	
9.2.2025.	Stefan Skorić	7	17:49	18:06		0	-1	4	NE	
9.2.2025.	Stefan Skorić	8	18:18	18:31		0	-1	4	NE	
21.2.2025.	Stefan Skorić	1	16:55	17:14		0	3	3	E	
21.2.2025.	Stefan Skorić	2	17:22	17:35		0	3	3	E	
21.2.2025.	Stefan Skorić	3	17:52	18:03		0	2	3	E	
21.2.2025.	Stefan Skorić	4	18:11	18:26		0	2	3	E	
21.2.2025.	Stefan Skorić	5	18::30	18:48		0	2	3	E	
21.2.2025.	Stefan Skorić	6	19:04	19:31		0	1	3	E	
21.2.2025.	Stefan Skorić	7	19:43	19:56		0	1	1	E	
21.2.2025.	Stefan Skorić	8	20:10	20:21		0	1	1	E	
8.3.2025.	Stefan Skorić	6	17:15	17:42		0	18	9	SE	
8.3.2025.	Stefan Skorić	5	17:45	18:06		0	18	9	SE	
8.3.2025.	Stefan Skorić	7	18::21	17:33		0	18	9	SE	
8.3.2025.	Stefan Skorić	8	17:51	18:05		0	17	9	SE	
9.3.2025.	Stefan Skorić	1	17:20	17:39		0	16	10	SE	
9.3.2025.	Stefan Skorić	2	17:52	18:04		0	16	10	SE	
9.3.2025.	Stefan Skorić	3	18::23	18:37		0	15	10	SE	
9.3.2025.	Stefan Skorić	4	18:47	19:03		0	15	10	SE	
25.3.2025.	Stefan Skorić	1	17:40	18:02		100	13	18	SE	

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25.3.2025.	Stefan Skorić	2	18:15	18:28		100	13	18	SE	
25.3.2025.	Stefan Skorić	3	18:46	18:59		100	13	18	SE	
25.3.2025.	Stefan Skorić	4	19:10	19:26		100	12	18	SE	
26.3.2025.	Stefan Skorić	5	17:34	17:57		80	14	13	SE	
26.3.2025.	Stefan Skorić	6	18:00	18:21		80	14	13	SE	
26.3.2025.	Stefan Skorić	7	18:32	18:49		80	14	13	SE	
26.3.2025.	Stefan Skorić	8	19:05	19:26		80	13	13	SE	
5.4.2025.	Stefan Skorić	1	18:55	19:18		0	11	2	S	
5.4.2025.	Stefan Skorić	2	19:26	19:50		0	11	2	S	
5.4.2025.	Stefan Skorić	3	19:58	20:16		0	11	2	S	
5.4.2025.	Stefan Skorić	4	20:23	20:46		0	11	2	S	
6.4.2025.	Stefan Skorić	5	18:51	19:18		100	2	18	NW	
6.4.2025.	Stefan Skorić	6	19:25	19:49		100	2	18	NW	
6.4.2025.	Stefan Skorić	7	20:04	20:23		100	2	18	NW	
6.4.2025.	Stefan Skorić	8	20:33	20:57		100	2	18	NW	
18.4.2025.	Stefan Skorić	8	19:05	19:27		20	17	6	NW	
18.4.2025.	Stefan Skorić	7	19:50	20:14		20	17	6	NW	
18.4.2025.	Stefan Skorić	6	20:25	20:47		20	17	6	NW	
18.4.2025.	Stefan Skorić	5	21:05	21:33		20	17	6	NW	
19.4.2025.	Stefan Skorić	4	19:10	19:36		0	16	6	NW	
19.4.2025.	Stefan Skorić	3	19:55	20:12		0	16	6	NW	
19.4.2025.	Stefan Skorić	2	20:27	20:51		0	16	6	NW	
19.4.2025.	Stefan Skorić	1	21:10	21:33		0	16	6	NW	
26.4.2025.	Stefan Skorić	8	19:15	19:38		0	15	5	E	
26.4.2025.	Stefan Skorić	5	20:05	20:29		0	15	5	E	
26.4.2025.	Stefan Skorić	7	20:43	21:07		0	15	5	E	
26.4.2025.	Stefan Skorić	6	21:20	21:44		0	15	5	E	
27.4.2025.	Stefan Skorić	1	19:18	19:45		100	13	1	W	
27.4.2025.	Stefan Skorić	2	20:00	20:19		100	13	1	W	
27.4.2025.	Stefan Skorić	3	20:37	20:56		100	13	1	W	
27.4.2025.	Stefan Skorić	4	21:15	21:42		100	13	1	W	
2.5.2025.	Stefan Skorić	5	19:20	19:47		0	18	7	ENE	
2.5.2025.	Stefan Skorić	6	20:03	20:31		0	18	7	ENE	
2.5.2025.	Stefan Skorić	7	20:50	21:14		0	18	7	ENE	
2.5.2025.	Stefan Skorić	8	21:30	21:51		0	18	7	ENE	

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3.5.2025.	Stefan Skorić	1	19:30	19:55		20	19	10	SSE	
3.5.2025.	Stefan Skorić	2	20:11	20:35		20	19	10	SSE	
3.5.2025.	Stefan Skorić	3	20:52	21:16		20	19	10	SSE	
3.5.2025.	Stefan Skorić	4	21:35	22:04		20	19	10	SSE	
18.5.2025.	Stefan Skorić	5	19:35	20:06		10	14	5	S	
18.5.2025.	Stefan Skorić	7	20:15	20:42		10	14	5	S	
18.5.2025.	Stefan Skorić	6	21:02	21:38		10	14	5	S	
18.5.2025.	Stefan Skorić	8	21:52	22:16		10	14	5	S	
18.5.2025.	Stefan Skorić	4	22:55	23:19		20	12	5	S	
19.5.2025.	Stefan Skorić	3	23:40	00:06		20	12	5	S	
19.5.2025.	Stefan Skorić	2	00:25	00:51		20	10	5	S	
19.5.2025.	Stefan Skorić	1	01:14	01:37		20	10	5	S	
20.5.2025.	Stefan Skorić	5	19:35	20:03		70	17	5	E	
20.5.2025.	Stefan Skorić	6	20:25	20:57		70	17	5	E	
20.5.2025.	Stefan Skorić	8	21:15	21:41		70	17	5	E	
20.5.2025.	Stefan Skorić	7	22:00	22:27		70	17	5	E	
21.5.2025.	Stefan Skorić	1	19:40	20:09		20	16	13	ESE	
21.5.2025.	Stefan Skorić	2	20:20	20:44		20	16	13	ESE	
21.5.2025.	Stefan Skorić	3	21:05	21:28		20	16	13	ESE	
21.5.2025.	Stefan Skorić	4	21:47	22:19		20	16	13	ESE	
4.6.2025.	Stefan Skorić	5	19:55	20:27		0	24	6	ESE	
4.6.2025.	Stefan Skorić	6	20:40	21:08		0	24	6	ESE	
4.6.2025.	Stefan Skorić	7	21:25	21:51		0	24	6	ESE	
4.6.2025.	Stefan Skorić	8	22:07	22:37		0	24	6	ESE	
4.6.2025.	Stefan Skorić	4	23:45	00:09		70	24	9	SSE	
5.6.2025.	Stefan Skorić	3	00:23	00:48		70	24	9	SSE	
5.6.2025.	Stefan Skorić	2	01:00	01:22		70	24	9	SSE	
5.6.2025.	Stefan Skorić	1	01:37	02:06		70	24	9	SSE	
21.6.2025.	Stefan Skorić	1	20:10	20:33		60	23	9	N	
21.6.2025.	Stefan Skorić	2	20:45	21:11		60	23	9	N	
21.6.2025.	Stefan Skorić	3	21:25	21:53		60	23	9	N	
21.6.2025.	Stefan Skorić	4	22:15	22:37		60	23	9	N	
21.6.2025.	Stefan Skorić	7	23:50	00:14		0	24	3	N	
22.6.2025.	Stefan Skorić	6	00:33	00:58		0	24	3	N	
22.6.2025.	Stefan Skorić	5	01:10	01:43		0	24	3	N	

22.6.2025.	Stefan Skorić	8	02:10	02:38		0	24	3	N	
2.7.2025.	Stefan Skorić	1	20:05	20:33		0	26	5	E	
2.7.2025.	Stefan Skorić	2	20:45	21:11		0	26	5	E	
2.7.2025.	Stefan Skorić	3	21:24	21:47		0	26	5	E	
2.7.2025.	Stefan Skorić	4	22:00	22:26		0	26	5	E	
2.7.2025.	Stefan Skorić	5	22:45	23:19		0	27	7	ESE	
2.7.2025.	Stefan Skorić	6	23:47	00:21		0	27	7	ESE	
3.7.2025.	Stefan Skorić	7	00:35	00:58		0	27	7	ESE	
3.7.2025.	Stefan Skorić	8	01:20	01:44		0	27	7	ESE	
26.7.2025.	Stefan Skorić	7	19:50	20:17		0	30	23	ESE	
26.7.2025.	Stefan Skorić	8	20:35	21:07		0	30	23	ESE	
26.7.2025.	Stefan Skorić	6	21:20	21:53		0	30	23	ESE	
26.7.2025.	Stefan Skorić	5	22:12	22:53		0	30	23	ESE	
27.7.2025.	Stefan Skorić	4	19:45	20:18		20	27	10	W	
27.7.2025.	Stefan Skorić	3	20:27	20:59		20	27	10	W	
27.7.2025.	Stefan Skorić	2	21:15	21:42		20	27	10	W	
27.7.2025.	Stefan Skorić	1	21:55	22:26		20	27	10	W	
8.8.2025.	Stefan Skorić	1	19:45	20:08		0	26	7	ENE	
8.8.2025.	Stefan Skorić	2	20:24	20:51		0	26	7	ENE	
8.8.2025.	Stefan Skorić	3	21:12	21:39		0	26	7	ENE	
8.8.2025.	Stefan Skorić	4	22:00	22:28		0	26	7	ENE	
9.8.2025.	Stefan Skorić	5	19:52	20:34		0	26	7	ENE	
9.8.2025.	Stefan Skorić	6	21:03	21:46		0	26	7	ENE	
9.8.2025.	Stefan Skorić	7	22:05	22:31		0	26	7	ENE	
9.8.2025.	Stefan Skorić	8	22:47	23:16		0	26	7	ENE	
10.8.2025.	Stefan Skorić	4	19:35	19:57		0	27	11	E	
10.8.2025.	Stefan Skorić	3	20:20	20:53		0	27	11	E	
10.8.2025.	Stefan Skorić	2	21:15	21:44		0	27	11	E	
10.8.2025.	Stefan Skorić	1	22:03	22:39		0	27	11	E	
11.8.2025.	Stefan Skorić	7	19:42	20:14		0	28	10	E	
11.8.2025.	Stefan Skorić	6	20:30	21:08		0	28	10	E	
11.8.2025.	Stefan Skorić	5	21:22	22:07		0	28	10	E	
11.8.2025.	Stefan Skorić	8	22:43	23:19		0	28	10	E	
28.8.2025.	Stefan Skorić	5	19:17	19:54		0	23	14	ESE	
28.8.2025.	Stefan Skorić	6	20:10	20:46		0	23	14	ESE	

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28.8.2025.	Stefan Skorić	7	21:07	21:33		0	23	14	ESE	
28.8.2025.	Stefan Skorić	8	21:52	22:25		0	23	14	ESE	
29.8.2025.	Stefan Skorić	4	19:15	19:41		0	23	19	ESE	
29.8.2025.	Stefan Skorić	3	19:58	20:29		0	23	19	ESE	
29.8.2025.	Stefan Skorić	2	20:48	21:22		0	23	19	ESE	
29.8.2025.	Stefan Skorić	1	21:40	22:09		0	23	19	ESE	
1.9.2025.	Stefan Skorić	5	19:10	19:48		0	20	8	NNE	
1.9.2025.	Stefan Skorić	6	20:03	20:37		0	20	8	NNE	
1.9.2025.	Stefan Skorić	7	20:55	21:24		0	20	8	NNE	
1.9.2025.	Stefan Skorić	8	21:42	22:08		0	20	8	NNE	
2.9.2025.	Stefan Skorić	1	19:15	19:42		0	22	7	ESE	
2.9.2025.	Stefan Skorić	2	19:55	20:18		0	22	7	ESE	
2.9.2025.	Stefan Skorić	3	20:40	21:07		0	22	7	ESE	
2.9.2025.	Stefan Skorić	4	21:24	21:51		0	22	7	ESE	
12.9.2025.	Stefan Skorić	4	19:00	19:28		0	21	4	NW	
12.9.2025.	Stefan Skorić	3	19:43	20:09		0	21	4	NW	
12.9.2025.	Stefan Skorić	2	20:27	20:54		0	21	4	NW	
12.9.2025.	Stefan Skorić	1	21:10	21:33		0	21	4	NW	
13.9.2025.	Stefan Skorić	5	18:55	19:42		0	22	12	SSE	
13.9.2025.	Stefan Skorić	6	20:00	20:37		0	22	12	SSE	
13.9.2025.	Stefan Skorić	8	20:45	21:11		0	22	12	SSE	
13.9.2025.	Stefan Skorić	7	21:30	21:57		0	22	12	SSE	
25.9.2025.	Stefan Skorić	5	18:30	19:18		50	19	14	ESE	
25.9.2025.	Stefan Skorić	6	19:35	20:16		50	19	14	ESE	
25.9.2025.	Stefan Skorić	7	20:30	20:53		50	19	14	ESE	
25.9.2025.	Stefan Skorić	8	21:18	21:47		50	19	14	ESE	
26.9.2025.	Stefan Skorić	4	18:25	18:54		100	16	9	ESE	
26.9.2025.	Stefan Skorić	3	19:10	19:36		100	16	9	ESE	
26.9.2025.	Stefan Skorić	2	20:07	20:41		100	16	9	ESE	
26.9.2025.	Stefan Skorić	1	20:54	21:23		100	16	9	ESE	
3.10.2025.	Stefan Skorić	8	18:10	18:33		90	4	10	WNW	
3.10.2025.	Stefan Skorić	5	19:15	19:58		90	4	10	WNW	
3.10.2025.	Stefan Skorić	6	20:15	20:49		90	4	10	WNW	
3.10.2025.	Stefan Skorić	7	21:03	21:27		90	4	10	WNW	
4.10.2025.	Stefan Skorić	4	18:17	18:44		10	7	4	E	

4.10.2025.	Stefan Skorić	3	19:02	19:31		10	7	4	E	
4.10.2025.	Stefan Skorić	2	19:48	20:19		10	7	4	E	
4.10.2025.	Stefan Skorić	1	20:35	21:06		10	7	4	E	

Table 4. Dates of bat monitoring using automated detector.

Date	AD	Start time	End time	Duration
27.10.2024.	1	16:00	6:30	whole night
27.10.2024.	2	16:00	6:30	whole night
28.10.2024.	3	16:00	6:30	whole night
28.10.2024.	4	16:00	6:30	whole night
6.11.2024.	3	15:45	6:45	whole night
6.11.2024.	4	15:45	6:45	whole night
7.11.2024.	1	15:50	6:40	whole night
7.11.2024.	2	15:50	6:40	whole night
12.11.2024.	1	15:40	6:50	whole night
12.11.2024.	4	15:40	6:50	whole night
13.11.2024.	2	15:40	6:50	whole night
13.11.2024.	3	15:40	6:50	whole night
6.02.2025.	1	15:40	6:10	whole night
6.02.2025.	2	15:40	6:10	whole night
8.02.2025.	3	15:40	6:10	whole night
8.02.2025.	4	15:40	6:10	whole night
21.02.2025.	2	16:40	6:45	whole night
21.02.2025.	3	16:40	6:45	whole night
22.02.2025.	1	16:40	6:45	whole night
22.02.2025.	4	16:40	6:45	whole night
8.03.2025.	1	17:00	6:20	whole night
8.03.2025.	3	17:00	6:20	whole night
9.03.2025.	2	17:00	6:20	whole night
9.03.2025.	4	17:00	6:20	whole night
24.03.2025.	1	17:15	5:00	whole night
24.03.2025.	2	17:15	5:00	whole night
26.03.2025.	3	17:15	5:00	whole night
26.03.2025.	4	17:15	5:00	whole night
5.04.2025.	1	19:00	6:04	whole night
5.04.2025.	2	19:00	6:04	whole night
6.04.2025.	3	19:00	6:04	whole night
6.04.2025.	4	19:00	6:04	whole night
18.04.2025.	1	19:15	5:43	whole night
18.04.2025.	2	19:15	5:43	whole night
19.04.2025.	3	19:15	5:43	whole night
19.04.2025.	4	19:15	5:43	whole night
26.04.2025.	1	19:23	5:31	whole night
26.04.2025.	2	19:23	5:31	whole night

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26.04.2025.	3	19:23	5:31	whole night
26.04.2025.	4	19:23	5:31	whole night
02.05.2025.	1	19:30	5:23	whole night
02.05.2025.	3	19:30	5:23	whole night
03.05.2025.	2	19:30	5:23	whole night
03.05.2025.	4	19:30	5:23	whole night
18.05.2025.	2	19:46	5:07	whole night
18.05.2025.	3	19:46	5:07	whole night
19.05.2025.	1	19:46	5:07	whole night
19.05.2025.	4	19:46	5:07	whole night
20.05.2025.	1	19:49	5:03	whole night
20.05.2025.	2	19:49	5:03	whole night
21.05.2025.	3	19:49	5:03	whole night
21.05.2025.	4	19:49	5:03	whole night
04.06.2025.	1	20:01	4:56	whole night
04.06.2025.	2	20:01	4:56	whole night
04.06.2025.	3	20:01	4:56	whole night
04.06.2025.	4	20:01	4:56	whole night
21.06.2025.	1	20:09	4:55	whole night
21.06.2025.	3	20:09	4:55	whole night
21.06.2025.	2	20:09	4:55	whole night
21.06.2025.	4	20:09	4:55	whole night
02.07.2025.	1	20:09	4:59	whole night
02.07.2025.	2	20:09	4:59	whole night
03.07.2025.	3	20:09	4:59	whole night
03.07.2025.	4	20:09	4:59	whole night
26.07.2025.	1	19:54	5:18	whole night
26.07.2025.	2	19:54	5:18	whole night
27.07.2025.	3	19:54	5:18	whole night
27.07.2025.	4	19:54	5:18	whole night
08.08.2025.	1	19:10	6:02	whole night
08.08.2025.	2	19:10	6:02	whole night
09.08.2025.	3	19:10	6:02	whole night
09.08.2025.	4	19:10	6:02	whole night
10.08.2025.	1	19:07	6:04	whole night
10.08.2025.	2	19:07	6:04	whole night
11.08.2025.	3	19:07	6:04	whole night
11.08.2025.	4	19:07	6:04	whole night
28.08.2025.	1	18:40	6:23	whole night
28.08.2025.	2	18:40	6:23	whole night
29.08.2025.	3	18:40	6:23	whole night
29.08.2025.	4	18:40	6:23	whole night
03.09.2025.	1	18:33	6:27	whole night
03.09.2025.	2	18:33	6:27	whole night
04.09.2025.	3	18:33	6:27	whole night
04.09.2025.	4	18:33	6:27	whole night

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12.09.2025.	1	18:14	6:38	whole night
12.09.2025.	2	18:14	6:38	whole night
12.09.2025.	3	18:14	6:38	whole night
12.09.2025.	4	18:14	6:38	whole night
25.09.2025.	1	17:57	6:52	whole night
25.09.2025.	2	17:57	6:52	whole night
25.09.2025.	3	17:57	6:52	whole night
25.09.2025.	4	17:57	6:52	whole night
03.10.2025.	1	17:38	7:00	whole night
03.10.2025.	2	17:38	7:00	whole night
03.10.2025.	3	17:38	7:00	whole night
03.10.2025.	4	17:38	7:00	whole night

Bat roost surveys

As well as the houses and barns in the settlements of Buchim, Shashavarlija and surroundings there are numerous anthropogenic structures of varying states of dilapidation within the wider landscape including weekend houses and cottages that may be suitable roost sites for bats.

Results of bat monitoring

During full year monitoring of bats at the area of wind park "Štip" in period (October 2024 - October 2025.) using manual and automatic bat detectors, fifteen bat speecies and genera Myotis (identification of species in this genus is difficult, so they are left at the genus level) were registered. A list of recorded species with conservation status (national and global) and population trends is given in Table 5.

Table 5. Protection level, status and population trends of recorded bat species.

Species	Bern convention	Bonn convention	Habitat directive 92/43/CEE	Europe IUCN status and population trend	Strictli protected/Protected wild species	Rare/Endengere species at national level
		International status			National status	
Barbastella barbastellus	II	II	II/IV	VU,decreasing	P	Yes
Eptesicus serotinus	II	II	IV	LC, decreasing		No
Hypsugo savii	II	II	IV	LC, Increasing		No
Miniopterus schreibersii	II	II	II/IV	VU,decreasing		Yes
Myotis sp.						
Nyctalus leisleri	II	II	IV	LC, unknown		No
Nyctalus noctula	II	II	IV	LC, unknown		No
Pipistrellus kuhlii	II	II	IV	LC, Increasing		No
Pipistrellus nathusii	II	II	IV	LC, unknown		No
Pipistrellus pipistrellus	III	II	IV	LC, stable		No
Pipistrellus pygmaeus	II	II	IV	LC, stable		No
Plecotus austriacus	II	II	IV	NT, decreasing		No
Rhinolophus hipposideros	II	II	IV	LC, increasing		No
Rhinolophus ferumequinum	II	II	IV	LC, increasing		No
Vespertilio murinus	II	II	IV	LC, increasing		No
Tadarida teniotis	II	II	IV	LC, stable		No

IUCN status - LC: least concern, **NT**: near thretened, **VU**: vulnarable, **DD**: data deficient

P – Protected wild species

- species with a high collision risk with operational wind turbines are marked in bold

Of all the bat species recorded on wind park area, two species is classified in one of the categories of threat at European levels (CR – Critically Endangered, EN – Endangered, VU – Vulnerable), *Barbastella barbastellus* and *Miniopterus schreibersii*. One species is categorized as Near Threatened (NT) at European levels (Plecotus austriacus).

Manual Bat Detector Surveys on the Ground

Ten bat species and genera Myotis were registered during annually monitoring using manual detector. Details about presence of bats registered by manual bat detector are presented in Table 6. Additionally details of number of bat passes and values of Bat Activity Index (BAI) during autumn season are given in Table 7.

Table 6 - Presence of bat species registered using manual detector on transect lines

Species / Months	T 1										
	O	N	F	M	A	M	J	J	A	S	O
Eptesicus serotinus										X	
Hypsugo savii						X	X	X	X	X	
Nyctalus leislerii					X					X	X
Nyctalus noctula	X			X				X	X	X	X
Pipistrellus kuhlii				X	X	X	X	X	X	X	
Pipistrellus nathusii					X	X		X	X	X	
Pipistrellus pipistrellus							X		X		
Pipistrellus pygmaeus							X				
Tadarida teniotis	X							X	X	X	
Species / Months	T 2										
	O	N	F	M	A	M	J	J	A	S	O
Hypsugo savii						X	X		X		
Nyctalus leislerii								X		X	
Nyctalus noctula									X	X	X
Pipistrellus kuhlii					X	X	X	X	X	X	
Pipistrellus natussi	X				X			X	X	X	
Pipistrellus pipistrellus								X	X		
Tadarida teniotis		X					X		X		
Species / Months	T 3										
	O	N	F	M	A	M	J	J	A	S	O
Hypsugo savii						X	X	X		X	
Nyctalus leislerii								X	X		
Nyctalus noctula				X		X			X	X	
Pipistrellus kuhlii					X	X	X	X	X	X	
Pipistrellus nathusii					X	X	X	X	X		
Tadarida teniotis								X	X	X	
Vespertilio murinus		X								X	
Species / Months	T 4										
	O	N	F	M	A	M	J	J	A	S	O
Hypsugo savii						X		X	X		
Miniopterus schreibersii										X	
Nyctalus leislerii						X	X		X		
Nyctalus noctula				X	X		X	X		X	X
Pipistrellus kuhlii	X				X	X	X	X	X	X	
Pipistrellus natussi						X		X	X		
Tadarida teniotis									X	X	
Species / Months	T 5										
	O	N	F	M	A	M	J	J	A	S	O
Eptesicus serotinus						X					
Hypsugo savii						X	X				
Myotis sp.									X		
Nyctalus leislerii					X	X					X
Nyctalus noctula	X			X	X	X				X	
Pipistrellus kuhlii					X	X	X	X	X	X	
Pipistrellus natussi	X				X				X	X	
Pipistrellus pipistrellus								X	X	X	

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Tadarida teniotis										X	
Vespertilio murinus		X									
Species / Months	T 6										
	O	N	F	M	A	M	J	J	A	S	O
Hypsugo savii						X	X		X	X	
Myotis sp.									X		
Nyctalus leislerii						X			X		
Nyctalus noctula				X	X			X		X	
Pipistrellus kuhlii	X				X	X	X	X	X	X	
Pipistrellus natussi								X	X	X	
Pipistrellus pipistrellus								X	X		
Tadarida teniotis		X								X	
Species / Months	T 7										
	O	N	F	M	A	M	J	J	A	S	O
Hypsugo savii						X	X	X			
Nyctalus leislerii						X					
Nyctalus noctula					X					X	
Pipistrellus kuhlii					X	X	X	X	X	X	
Pipistrellus nathusii				X	X	X		X	X		
Pipistrellus pipistrellus							X		X	X	
Tadarida teniotis									X	X	
Vespertilio murinus	X									X	
Species / Months	T 8										
	O	N	F	M	A	M	J	J	A	S	O
Hypsugo savii						X	X	X	X	X	
Miniopterus schreibersii						X					
Nyctalus leislerii					X	X					
Nyctalus noctula	X				X	X		X		X	
Pipistrellus kuhlii				X	X	X	X	X	X	X	
Pipistrellus natussi					X	X		X	X	X	
Pipistrellus pipistrellus						X	X	X	X	X	
Pipistrellus pygmaeus						X	X				
Tadarida teniotis										X	
Vespertilio murinus										X	

Table 7 -Number of bat passes and Bat Activity Index on transect lines obtained by using manual bat detector surveys from ground.

Date	Param.	T1	T2	T3	T4	T5	T6	T7	T8
October (25.10.)	Nt (BAI)	2 (3.33)	1 (5.55)	/	1 (5.00)				
October (26.10.)						2 (4.44)	1 (2.38)	1 (3.57)	1 (4.55)
November (06.11.)	Nt (BAI)	/	/	1 (3.7)	/				
November (07.11.)						/	/	/	/
November (12.11.)						/	1 (2.22)	/	/
November (13.11.)		/	1 (4.00)	/	/				
February (08.02.)	Nt (BAI)	/	/	/	/				
February (09.02.)						/	/	/	/
February (21.02.)		/	/	/	/	/	/	/	/
March (08.03.)	Nt (BAI)					/	/	/	/
March (09.03)		1 (3.13)	/	/	/				

March (25.03)		1 (2.7)	/	1 (4.55)	1 (3.7)				
March (26.03)						1 (2.63)	1 (2.85)	1 (3.57)	1 (2.86)
April (05.04)		1 (2.6)	0 (0.00)	2 (6.64)	2 (5.21)	/	/	/	/
April (06.04)		/	/	/	/	2 (4.43)	2 (4.99)	0 (0.00)	1 (2.49)
April (18.04)	Nt (BAI)	/	/	/	/	2 (4.43)	1 (2.7)	1 (2.5)	2 (5.41)
April (19.04)		1 (2.63)	2 (4.98)	1 (3.57)	0 (0.00)	/	/	/	/
April (26.04)		/	/	/	/	2 (4.98)	2 (4.98)	1 (2.49)	2 (5.22)
April (27.04)		2 (4.44)	1 (3.13)	1 (3.13)	1 (2.22)	/	/	/	/
May (02.05)		/	/	/	/	2 (4.44)	3 (6.38)	2 (5.00)	2 (5.71)
May (03.05)		3 (7.14)	2 (5.00)	2 (5.00)	1 (2.08)	/	/	/	/
May (18.05)	Nt (BAI)	/	/	2 (4.65)	1 (2.5)	3 (5.77)	2 (3.33)	2 (4.44)	3 (7.5)
May (19.05)		1 (2.63)	1 (2.32)			/	/	/	/
May (20.05)		/	/	/	/	3 (6.38)	2 (4.44)	1 (2.08)	2 (4.17)
May (21.05)		2 (4.16)	0 (0.00)	2 (5.26)	2 (3.7)	/	/	/	/
June (04.06.)		/	/	/	2 (5.00)	3 (5.55)	2 (4.25)	1 (2.32)	2 (3.92)
June (05.06.)	Nt (BAI)	1 (2.08)	1 (2.7)	2 (4.76)	/	/	/	/	/
June (21.06.)		2 (4.65)	1 (2.33)	1 (2.13)	1 (2.7)	/	/	/	/
June (22.06.)		/	/	/	/	2 (3.63)	2 (4.76)	0 (0.00)	1 (2.13)
July (02.07.)		2 (4.26)	2 (4.65)	1 (2.63)	0 (0.00)	3 (5.26)	2 (3.51)		
July (03.07.)	Nt (BAI)							1 (2.63)	2 (5.00)
July (26.07.)		/	/	/	/	3 (4.35)	1 (1.82)	1 (2.22)	2 (3.77)
July (27.07.)		1 (1.92)	2 (4.44)	1 (1.89)	1 (1.82)	/	/	/	/
August (08.08.)		2 (5.26)	1 (2.22)	1 (2.22)	1 (2.13)	/	/	/	/
August (09.08.)		/	/	/	/	2 (2.85)	2 (2.78)	1 (2.33)	0 (0.00)
August (10.08.)	Nt (BAI)	1 (1.67)	1 (2.08)	2 (3.64)	1 (2.7)	/	/	/	/
August (11.08.)		/	/	/	/	4 (5.33)	2 (3.13)	1 (1.89)	3 (5.00)
August (28.08.)		/	/	/	/	3 (4.84)	2 (3.33)	0 (0.00)	2 (3.64)
August (29.08.)		2 (4.17)	2 (3.51)	3 (5.77)	1 (2.33)	/	/	/	/
September (03.09.)		/	/	/	/	3 (4.69)	2 (3.51)	1 (2.08)	2 (4.65)
September (04.09.)		1 (2.22)	1 (2.63)	2 (4.44)	0 (0.00)	/	/	/	/
September (13.09.)	Nt (BAI)	1 (2.63)	1 (2.22)	1 (2.33)	2 (4.26)	/	/	/	/
September (14.09.)		/	/	/	/	3 (3.79)	2 (3.23)	1 (2.22)	0 (0.00)
September (25.09.)		/	/	/	/	3 (3.75)	4 (5.88)	1 (2.63)	2 (4.17)
September (26.09.)		1 (2.08)	0 (0.00)	1 (2.33)	1(2.08)	/	/	/	/
October (03.10)	Nt (BAI)	/	/	/	/	1 (1.34)	0 (0.00)	0 (0.00)	0 (0.00)
October (04.10.)		2 (3.85)	1 (1.92)	0 (0.00)	1 (2.22)	/	/	/	/

Nt: 'total number of registered bats'

Bat activity indexes obtained using manual bat detector from the ground varied from 2.22 – 5.77 during months with bat activity. Bat activity index during annually monitoring corresponding with a low to very high activity. However, the high BAI values are mostly recorded on short transects and do not represent wind farm areas with really higher activity than the others, but are a consequence of the established work methodology.

Automated Bat Detector Surveys on the Ground

Fifteen bat species were registered during annually monitoring using automated detector. Details about presence of bats species registered by automated bat detector are presented in Table 8. Additionally details of number of bat passes,

values of BAI and recorded bat species during this six months period (October 2024 – March 2025) are given in Table 9.

Table 8 -Presence of bat species registered using automated (static) detectors

Species / Months	AD1										
	O	N	F	M	A	M	J	J	A	S	O
Barbastella barbastellus					X	X					
Eptesicus serotinus					X	X			X	X	X
Hypsugo savii					X	X	X	X	X	X	
Miniopterus schreibersii	X	X				X	X	X		X	
Myotis sp.					X	X	X			X	
Nyctalus leisleri					X	X	X		X	X	X
Nyctalus noctula	X	X			X	X		X	X	X	X
Pipistrellus kuhlii	X			X	X	X	X	X	X	X	
Pipistrellus natussi		X			X	X		X	X	X	
Pipistrellus pipistrellus					X	X	X	X	X	X	
Pipistrellus pygmaeus					X	X	X	X		X	
Plecotus austriacus				X	X	X		X			
Rhinolophus ferrumequinum					X						
Rhinolophus hipposideros							X				
Tadarida teniotis	X						X			X	
Vespertilio murinus						X			X	X	
Species / Months	AD2										
	O	N	F	M	A	M	J	J	A	S	O
Barbastella barbastellus											
Eptesicus serotinus				X		X			X	X	
Hypsugo savii					X	X	X	X	X	X	
Miniopterus schreibersii	X				X		X	X		X	X
Nyctalus leisleri					X	X	X			X	X
Nyctalus noctula	X	X			X	X		X	X	X	
Pipistrellus kuhlii	X				X	X	X	X	X	X	
Pipistrellus natussi	X				X	X	X	X	X	X	
Pipistrellus pipistrellus						X			X	X	
Pipistrellus pygmaeus									X	X	
Plecotus austriacus	X				X	X		X	X	X	
Tadarida teniotis		X							X	X	
Vespertilio murinus				X		X				X	
Species / Months	AD3										
	O	N	F	M	A	M	J	J	A	S	O
Barbastella barbastellus	X					X			X	X	
Eptesicus serotinus						X	X	X	X	X	
Hypsugo savii						X	X	X	X	X	
Miniopterus schreibersii	X						X	X	X	X	
Myotis sp.					X	X		X	X	X	

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Nyctalus leisleri	X				X	X			X	X	
Nyctalus noctula	X	X			X		X	X	X	X	X
Pipistrellus kuhlii	X				X	X	X	X	X	X	
Pipistrellus natussi	X				X		X	X	X	X	
Pipistrellus pipistrellus	X				X			X	X	X	
Pipistrellus pygmaeus									X	X	
Plecotus austriacus					X			X	X	X	
Rhinolophus hipposideros								X	X		
Tadarida teniotis		X				X	X		X	X	
Vespertilio murinus	X						X		X	X	
Species / Months	**AD4**										
	O	N	F	M	A	M	J	J	A	S	O
Barbastella barbastellus					X	X				X	
Eptesicus serotinus					X	X	X			X	
Hypsugo savii					X	X	X	X	X	X	
Miniopterus schreibersii	X	X			X	X			X	X	X
Myotis sp.					X		X			X	X
Nyctalus leisleri					X	X	X		X	X	
Nyctalus noctula	X	X						X	X	X	
Pipistrellus kuhlii	X	X			X	X	X	X	X	X	
Pipistrellus natussi					X	X		X	X	X	
Pipistrellus pipistrellus	X				X	X	X	X	X	X	
Pipistrellus pygmaeus						X	X	X	X	X	
Plecotus austriacus					X	X				X	X
Tadarida teniotis	X				X			X	X	X	
Vespertilio murinus						X				X	

Table 9 - Number of bat passes and Bat Activity Index obtained by using static detector surveys from ground

Date	Param.	1	2	3	4
October (27.10.)	Nt (BAI)	11 (0.82)	13 (0.97)		
October (28.10.)				18 (1.33)	14 (1.04)
November (06.11.)	Nt (BAI)			1 (0.07)	4 (0.29)
November (07.11.)		3 (0.21)	1 (0.07)		
November (12.11.)		3 (0.21)			2 (0.14)
November (13.11.)			2 (0.14)	1 (0.07)	
February (06.02.)	Nt (BAI)	/	/		
February (08.02.)				/	/
February (21.02.)			/	/	
February (22.02.)		/			/
March (08.03.)	Nt (BAI)	5 (0.4)		1 (0.08)	
March (09.03)			/		/
March (24.03)		10 (0.86)	2 (0.17)		
March (26.03)				/	/
April (05.04)		9 (0,81)	3 (0.27)		
April (06.04)				22 (1.99)	3 (0.27)
April (18.04)		54 (5.15)	37 (3.53)		

April (19.04)				29 (2.76)	48 (4.58)
April (26.04)		40 (3.94)			35 (3.46)
April (27.04)			0 (0.00)	15 (1.48)	
May (02.05)		48 (4.85)		7 (0.71)	
May (03.05)			22 (2.22)		43 (4.34)
May (18.05)			46 (5.04)	29 (3.17)	
May (19.05)		64 (7.01)			27 (2.96)
May (20.05)		1 (0.11)	3 (0.33)		
May (21.05)				5 (0.55)	12 (1.32)
June (04.06.)				41 (4.6)	45 (5.04)
June (05.06.)		5 (0.56)	21 (2.35)		
June (21.06.)		51 (6.42)		44 (5.54)	
June (22.06.)			30 (3.78)		54 (6.8)
July (02.07.)		39 (4.41)	41 (4.64)		
July (03.07.)				12 (1.36)	52 (5.88)
July (26.07.)		52 (5.52)	39 (4.14)		
July (27.07.)				63 (6.69)	41 (4.35)
August (08.08.)		57 (5.79)	53 (5.38)		
August (09.08.)				43 (4.37)	57 (5.79)
August (10.08.)		49 (4.95)	37 (3.74)		
August (11.08.)				60 (6.07)	45 (4.55)
August (28.08.)				54 (5.06)	31 (2.9)
August (29.08.)		11 (1.03)	42 (3.93)		
September (03.09.)		56 (5.1)	43 (3.91)		
September (04.09.)				46 (4.19)	51 (4.64)
September (13.09.)		41 (3.58)	44 (3.85)		
September (14.09.)				36 (3.15)	49 (4.29)
September (25.09.)		39 (3.25)	31 (2.58)		
September (26.09.)				35 (2.92)	50 (4.17)
October (03.10)		11 (0.89)	24 (1.94)		
October (04.10.)				19 (1.54)	16 (1.3)

Nt: total number of registered bats.

Bat activity indexes obtained using automated (static) bat detector from the ground varied from 0.07- 7.01 during the survey period. These values are corresponding with low to very high activity of bats in surveyed areas.

The most frequently recorded species of bat is *Pipistrellus kuhlii* with 30.29%, followed by *Pipistrellus nathusii* with 15.27% and *Pipistrellus pipistrellus* with 12.2%. Populations of these species have stable or increasing populations at the European level.

Two species classified as vulnerable (*Barbastella barbastellus* and *Miniopterus schreibersii*) according by IUCN classification are represented with 1,54% and 5,02% respectively.

5.3. Bat Roost Survey

During monitoring, no natural shelters or shelters in human settlements were found in the research area. A small number of buildings were available for inventory considering that most of the buildings are in use during the warmer period of the year. Due to the superstitions of the local population, some abandoned buildings in the villages have not been visited due to the negative

connotation towards bats. The wind park area lacks forest stands with old trees, which are essential for providing suitable roosting conditions for bats.

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1. Bat activity index per species and per month

Month	Decade	**Barbar**	**Eptser**	**Hypsav**	**Minsch**	**Myosp.**	**Nyclei**	**Nycnoc**	**Pipkuh**	**Pipnat**	**Pippip**	**Pippyg**	**Pleaus**	**Rhifer**	**Rhihip**	**Tadten**	**Vesmur**
Oct.	1		0.04		2.23	0.2	0.16	0.24					0.04			0.08	0.04
	3	0.04	0.07	0.11	0.15	0.04		0.19	1.15	0.52	0.04					0.07	0.04
Nov.	1		0.04	0.07		0.04		0.07	0.07	0.04						0.04	
	2		0.14					0.11		0.04						0.04	
Feb.	1																
	3																
Mar.	1							0.16	0.08				0.04				
	3		0.04	0.09			0.04	0.13	0.13	0.3			0.04				0.04
Apr.	1					0.09		0.32	0.9	0.23	0.09	0.04		0.04			
	2	0.05	0.33	0.29	0.05	0.14	0.91	0.24	2.53	2.77	0.43	0.05	0.67				0.05
	3	0.1	0.15	0.25			0.2		2.07	1.68	0.44		0.14				
May	1	0.25	0.3	0.86	0.3	0.05	0.25		3.44	0.86	0.2	0.15	0.15				
	2	0.16	0.11	1.82	0.05	0.11	0.32	0.27	5.31	1.13	0.16	0.05	0.05				0.11
	3	0.05	0.05	0.38		0.05	0.11		0.81	0.27	0.16						
Jun.	1		0.11	1.85	0.11	0.06		0.06	2.97		1.35	0.11				0.39	0.06
	3		0.11	1.2	0.11	0.17	0.17	0.06	3.31	0.29	2.34	2.91			0.06	0.06	
Jul.	1	0.06	0.11	1.19	0.11	0.17		1.36	2.82	0.85	1.53	0.34	0.28			0.06	
	3		0.05	0.8		1.38		0.37	1.96	0.27	6		0.11			0.05	
Aug.	1	0.41	0.35	1.17	0.61	0.96		0.15	2.53	3.24	1.06	0.35				0.3	
	2	0.1	0.2	0.59	0.29	1.67	0.05		2.55	2.9	1.47	0.25	0.05				
	3	0.14	0.23	0.19	0.51	0.84	0.09	0.14	1.91	1.68	0.19	0.98	0.23				
Sep.	1	0.18	0.41	0.59	0.41	0.45	0.18	1.32	2.5	1.64	0.05	0.77	0.09			0.64	
	2	0.26	0.35	1.01	0.04	0.22	0.13	1.09	1.36	0.96	1.62	0.61	0.17		0.09		
	3	0.04	0.08	0.08	2.66	0.17	0.04	1.42	1.08	0.79		0.13	0.21			0.04	0.25

Table 1. Overview of Bat activity index per species and per months

Table 2. Representation (%) of high/ medium/ low risk bat species in the study area

Month	Decade	High collision risk	Medium collision risk	Low collision risk
Oct.	1	90.67	1.33	8.00
	3	93.85	4.62	1.54

Nov.	1	80.00	10.00	10.00
	2	100.00	0.00	0.00
Feb.	1	0.00	0.00	0.00
	3	0.00	0.00	0.00
Mar.	1	85.71	0.00	14.29
	3	89.47	5.26	5.26
Apr.	1	92.11	0.00	7.89
	2	85.96	4.49	9.55
	3	92.16	4.90	2.94
May	1	88.89	8.15	2.96
	2	95.56	2.78	1.67
	3	91.43	5.71	2.86
Jun.	1	97.62	1.59	0.79
	3	96.83	1.06	2.12
Jul.	1	92.99	1.91	5.10
	3	85.99	0.48	13.53
Aug.	1	84.55	6.82	8.64
	2	80.10	2.91	16.99
	3	79.74	5.23	15.03
Sep.	1	87.68	6.40	5.91
	2	86.19	7.73	6.08
	3	92.86	1.79	5.36

2. % of activity per species from the total number of calls.

Table 3. Percentage share of species by month with recorded bat activity.

Month	Decade	**Barbar**	**Eptser**	**Hypsav**	**Minsch**	**Myosp.**	**Nyclei**	**Nycnoc**	**Pipkuh**	**Pipnat**	**Pippip**	**Pippyg**	**Pleaus**	**Rhifer**	**Rhihip**	**Tadten**	**Vesmur**
Oct.	1	0.00	1.33	0.00	73.33	6.67	5.33	8.00	0.00	0.00	0.00	0.00	1.33	0.00	0.00	2.67	1.33
	3	1.54	3.08	4.62	6.15	1.54	0.00	7.69	47.69	21.54	1.54	0.00	0.00	0.00	0.00	3.08	1.54
Nov.	1	0.00	10.00	20.00	0.00	10.00	0.00	20.00	20.00	10.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00
	2	0.00	0.00	0.00	44.44	0.00	0.00	33.33	0.00	11.11	0.00	0.00	0.00	0.00	0.00	11.11	0.00
Feb.	1																
	3																
Mar.	1	0.00	0.00	0.00	0.00	0.00	0.00	57.14	28.57	0.00	0.00	0.00	14.29	0.00	0.00	0.00	0.00
	3	0.00	5.26	10.53	0.00	0.00	5.26	15.79	15.79	36.84	0.00	0.00	5.26	0.00	0.00	0.00	5.26
Apr.	1	0.00	0.00	0.00	0.00	5.26	0.00	18.42	52.63	13.16	5.26	2.63	0.00	2.63	0.00	0.00	0.00
	2	0.56	3.93	3.37	0.56	1.69	10.67	2.81	29.78	32.58	5.06	0.56	7.87	0.00	0.00	0.00	0.56
	3	1.96	2.94	4.90	0.00	0.00	3.92	0.00	41.18	33.33	8.82	0.00	2.94	0.00	0.00	0.00	0.00
May	1	3.70	4.44	12.59	4.44	0.74	3.70	0.00	50.37	12.59	2.96	2.22	2.22	0.00	0.00	0.00	0.00
	2	1.67	1.11	18.89	0.56	1.11	3.33	2.78	55.00	11.67	1.67	0.56	0.56	0.00	0.00	0.00	1.11
	3	2.86	2.86	20.00	0.00	2.86	5.71	0.00	42.86	14.29	8.57	0.00	0.00	0.00	0.00	0.00	0.00
Jun.	1	0.00	1.59	26.19	1.59	0.79	0.00	0.79	42.06	0.00	19.05	1.59	0.00	0.00	0.00	5.56	0.79
	3	0.00	1.06	11.11	1.06	1.59	1.59	0.53	30.69	2.65	21.69	26.98	0.00	0.00	0.53	0.53	0.00
Jul.	1	0.64	1.27	13.38	1.27	1.91	0.00	15.29	31.85	9.55	17.20	3.82	3.18	0.00	0.00	0.64	0.00
	3	0.00	0.48	7.25	0.00	12.56	0.00	3.38	17.87	2.42	54.59	0.00	0.97	0.00	0.00	0.48	0.00
Aug.	1	3.64	3.18	10.45	5.45	8.64	0.00	1.36	22.73	29.09	9.55	3.18	0.00	0.00	0.00	2.73	0.00
	2	0.97	1.94	5.83	2.91	16.50	0.49	0.00	25.24	28.64	14.56	2.43	0.49	0.00	0.00	0.00	0.00
	3	1.96	3.27	2.61	7.19	11.76	1.31	1.96	26.80	23.53	2.61	13.73	3.27	0.00	0.00	0.00	0.00
Sep.	1	1.97	4.43	6.40	4.43	4.93	1.97	14.29	27.09	17.73	0.49	8.37	0.99	0.00	0.00	6.90	0.00
	2	3.31	4.42	12.71	0.55	2.76	1.66	13.81	17.13	12.15	20.44	7.73	2.21	0.00	1.10	0.00	0.00
	3	0.60	1.19	1.19	38.10	2.38	0.60	20.24	15.48	11.31	0.00	1.79	2.98	0.00	0.00	0.60	3.57

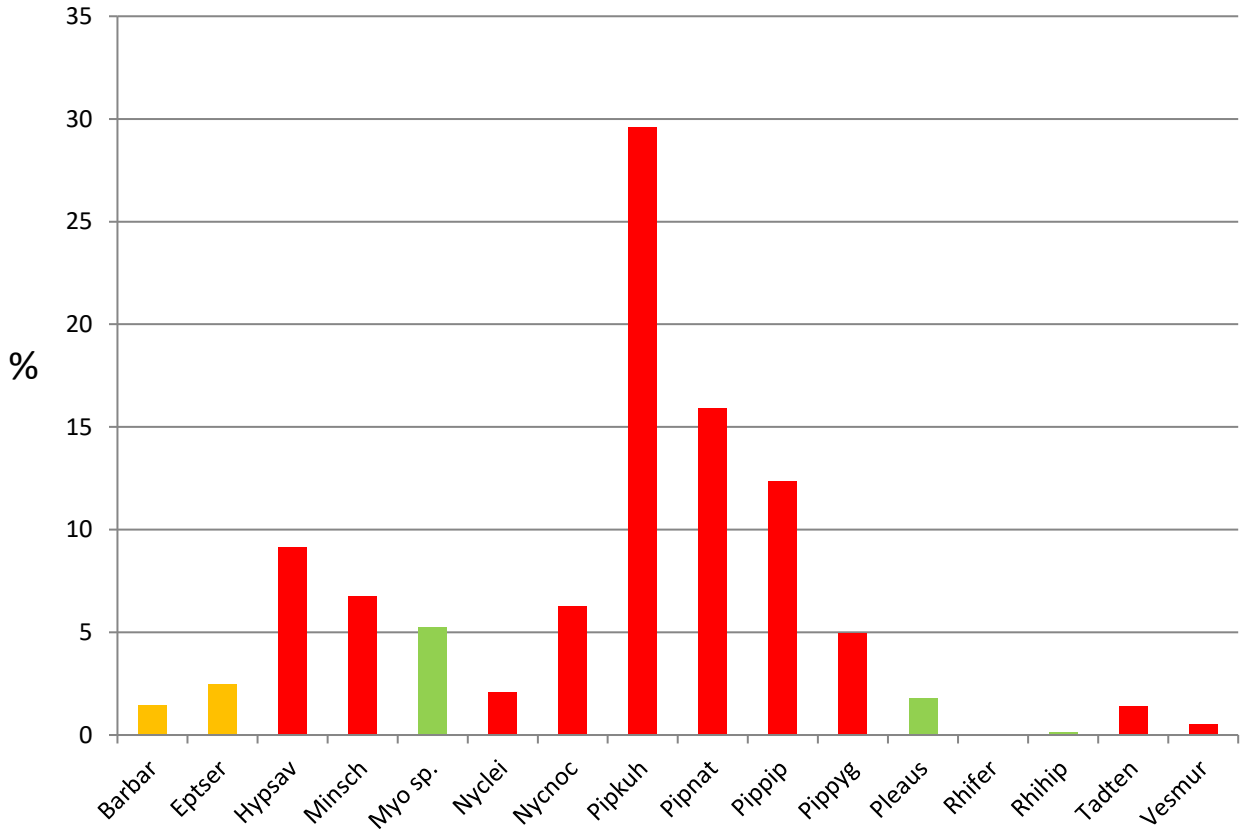

Figure 1. Percentage share of bat species in total number of recorded calls. (red bars – high collide risk species; orange bars - moderate collide risk species; green bars - low collide risk species).

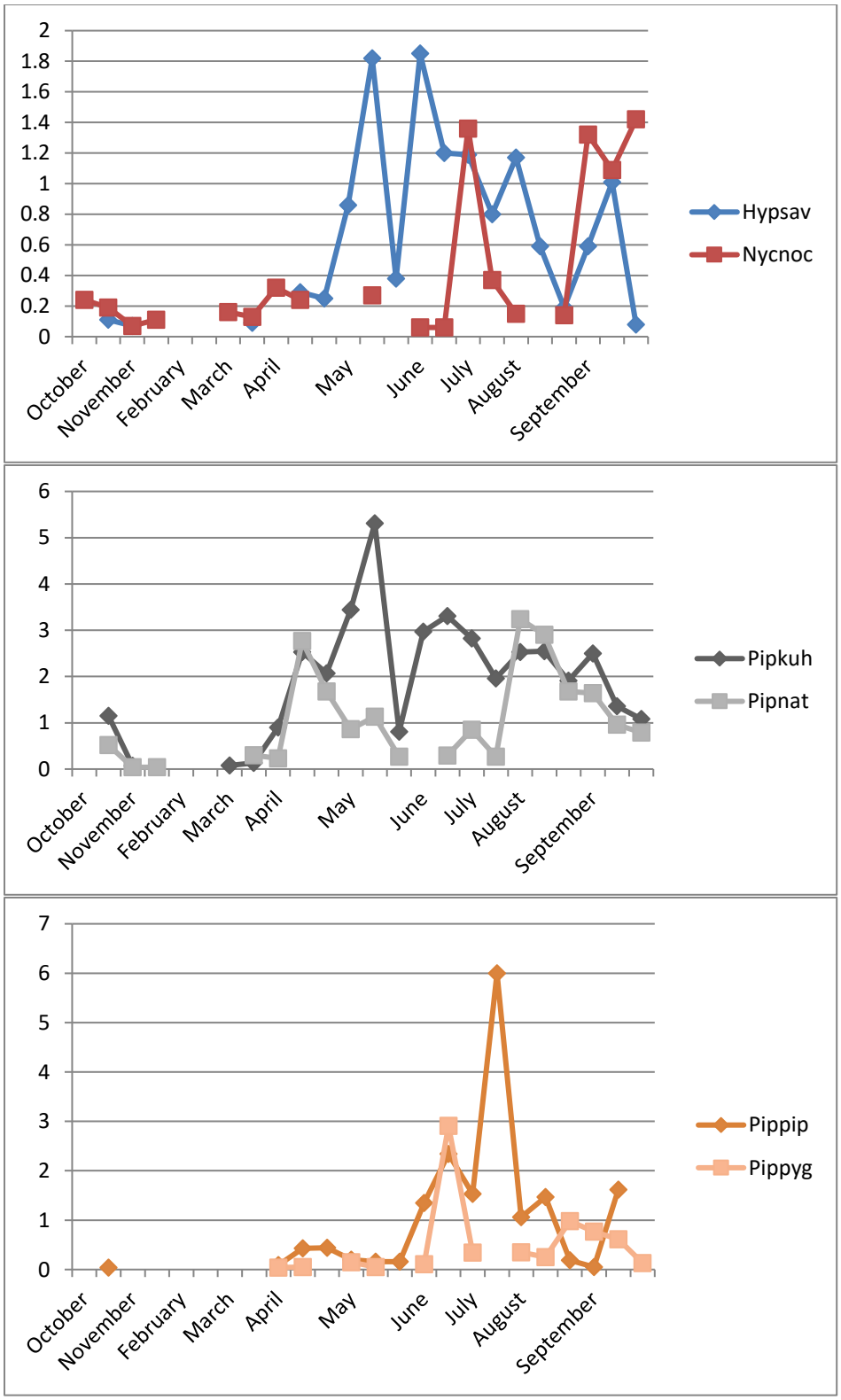

Figure 2. Bat activity index for the most commonly recorded species in the study area.

3. Automated bat detectors

Two automatic detectors were used. They were placed at the designated locations two or three nights per month (see Table 4. Dates of bat monitoring using automated detector). SongMeter4BAT FS detectors were used.

4. Bat activity per month and trends in species recorded

Bat activity in the study area showed a clear seasonal pattern, with very low activity recorded during winter months (February and March), a gradual increase in spring (April–May), and peak activity during summer (June–August). Activity then gradually declined in September and dropped sharply by October and November.

During **spring months (April–May)**, species richness and activity started to increase, dominated mainly by *Pipistrellus kuhlii*, *P. pipistrellus*, *Hypsugo savii* and *Miniopterus schreibersii*. These species were also the most frequently detected throughout the active season.

Summer months (June–August) represented the period of highest overall bat activity, with the largest number of calls and the broadest species composition. In this period, high-activity peaks were associated mainly with *Pipistrellus kuhlii*, *P. nathusii*, *Hypsugo savii*, and *Miniopterus schreibersii*, while *Nyctalus leisleri* and *Tadarida teniotis* were also regularly detected. The dominance of these species suggests intense foraging and commuting activity during the reproductive season.

Autumn months (September–October) showed a gradual decrease in total activity but still relatively high diversity, with *Pipistrellus kuhlii* and *Nyctalus noctula* being the most frequent species. Migration-related activity likely contributed to higher detections in September.

Winter (November–February) recordings indicated minimal activity, restricted to occasional passes of *Nyctalus noctula* and *Pipistrellus kuhlii*, reflecting their tolerance to lower temperatures and potential winter activity in milder periods.

Overall, the recorded pattern corresponds to the typical temperate-zone bat phenology — low winter activity, progressive spring increase, a summer peak dominated by *Pipistrellus* and *Hypsugo* species, followed by gradual decline in autumn. The most abundant and consistent species across all active months were *Pipistrellus kuhlii* and *Miniopterus schreibersii*, while *Myotis* and *Rhinolophus* species were rarely detected, suggesting that their activity in the area is limited or occasional.

5. Discussion on the bat populations in the area, projects areas importance for roosts, commuting and foraging and assemblages of bat species

Ecological Importance of the Project Area for Bats

Overview of Bat Populations and Assemblages

During the full-year monitoring campaign (October 2024 – October 2025), fifteen bat species and the genus *Myotis* were recorded within the Štip Wind Park area, representing a diverse but regionally typical bat assemblage. The community is dominated by widespread, open-air foraging species such as *Pipistrellus kuhlii*, *P. nathusii*, *P. pipistrellus*, *Hypsugo savii*, *Miniopterus schreibersii*, *Nyctalus leisleri*, *Nyctalus noctula* and *Tadarida teniotis*, which together comprised more than 80% of all registered bat passes. These species are generalists, tolerant of modified habitats, and commonly associated with open and semi-open landscapes. The presence of clutter-adapted taxa (*Myotis* spp., *Rhinolophus* spp., *Plecotus austriacus*) was sporadic, confirming the limited suitability of the area for forest or cave-dwelling bats.

Roosting Importance

The bat roost survey undertaken in 2025 did not reveal any confirmed natural or anthropogenic roosts within the project boundaries.

The project landscape is predominantly composed of agricultural and shrub habitats with scattered settlements and limited forest cover. There is a general absence of mature trees or rocky formations that could provide potential roosting features. Only a few anthropogenic structures (abandoned or partially used rural houses) were identified as potentially suitable, but none were confirmed as active roosts. Consequently, the area holds **low importance for roosting** populations.

Foraging and Commuting Importance

Monitoring data indicate that bat activity was strongly seasonal, commencing in March and peaking between May and August, corresponding with the reproductive and foraging period. High Bat Activity Index (BAI) values, ranging up to 7.01, were recorded in June–August, primarily associated with *Pipistrellus kuhlii*, *Hypsugo savii* and *Miniopterus schreibersii*, confirming **intense foraging and commuting behaviour** along open habitats and linear structures such as roads, hedgerows.

The activity of large aerial-hawking species (*Nyctalus*, *Tadarida*, *Vespertilio*) suggests that the area functions primarily as a **secondary foraging and commuting zone**, rather than as a key breeding or roosting area. Bat activity in autumn (September–October) likely reflects post-breeding dispersal and migratory movements.

Conservation Value and Compliance Context

Of all recorded species, two are listed as *Vulnerable* (*Barbastella barbastellus*, *Miniopterus schreibersii*) and one as *Near Threatened* (*Plecotus austriacus*) according to the European Red List. However, their occurrence within the project footprint was low and limited to isolated detections, indicating that these species are not resident or dependent on the area for critical life-cycle stages.

Under the **EU Habitats Directive (92/43/EEC, Annex IV)** and **and Conservation of Populations of European Bats (EUROBATS)**, all recorded species are protected, and their

ecological requirements must be considered during planning and operation of wind energy facilities. The present survey indicates that the Štip Wind Park area does not host any roosts or colonies of high conservation importance, and that **no evidence of significant population centres or key functional habitats** (e.g. breeding roosts, swarming sites) exists within the project boundaries.

Summary Assessment

Based on the recorded data and ecological context, the following assessment of the project area's importance for bats can be made:

Ecological Function	Importance Level	Remarks
Roosting	**Low**	No confirmed roosts; unsuitable habitat structure
Foraging	**Moderate**	Regular nightly activity of widespread aerial species
Commuting	**Moderate**	Activity concentrated along linear open habitats
Assemblage Value	**Typical**	Dominated by generalist species; limited presence of threatened taxa

In conclusion, the bat populations within the Štip Wind Park area are **widespread and regionally representative**, dominated by common and adaptable species. The project site plays a **moderate role for foraging and commuting activity**, but holds **low significance for roosting or reproduction**. The absence of key roosts suggests that the wind park area is of **limited ecological sensitivity** within the wider bat landscape context.

B.4 Birds

WIND FARM “ŠTIP”

Bird and Bat survey final report

(October 2024. – October 2025.)

October 2025.

Mott MacDonald Restricted

Wind Park “Štip”

Bird and bat survey – final report (October 2024. – October 2025.)

October 2025.

Report made by:

Marko Raković

Mott MacDonald Restricted

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EXECUTIVE SUMMARY

Stefan Skorić and Marko Raković were commissioned to undertake bird and bat surveys (pre-construction monitoring) for 12 months in wind park "Štip". Following are the results of bird surveys from the whole period of monitoring.

The scoping phase of the assignment has identified:

- Twenty-four species considered to be vulnerable to the impacts of collisions with operational wind turbines as a result of their high risk and adverse conservation status; and

Bird surveys for monitoring for the one year period were undertaken following the terms of reference and included:

- Vantage Point (VP) surveys;
- Breeding bird surveys;
- Breeding raptor surveys;
- Nocturnal species surveys.

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1. INTRODUCTION

Mott MacDonald has contracted Maneko Solutions to conduct bird and bat surveys (pre-construction monitoring) for a period of 12 months and for the purposes of the Wind Park "Štip". In the behalf of Maneko Solutions, biodiversity specialist Stefan Skorić, bat specialist and Marko Raković, bird specialist, conducted the surveys. Additionally, Nikola Stanojević and Ivan Medenica, bird specialists were involved in collecting bird data.

1.1 Project description

The Project is located within the eastern area of North Macedonia about 7 km southeast from Štip. It comprises the installation of 54 wind turbine generators with a total nominal power of 432 MW over three phases as well as the construction of a new substation.

1.2 Scope of this report

This is an interim report providing results of one year of surveys carried out as a baseline prior to construction work, which occured from late October 2024 till early October 2025.

Using monitoring methods described in this report we collected data such as:

- the occurrence and use of the wind farm area of bird species that have the potential to collide with the operational WTGs. These data were collected by bird surveys in vantage points distributed over the wind park area;
- breeding bird assemblages (surveys including breeding passerines, raptors and nocturnal birds.

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2. BIRD SURVEY METHODOLOGY

2.1 Overview

This section describes the approach to bird surveys. Firstly, the criteria used to identify target species for survey are identified. The surveys for the target species comprise of four methodologies; one for bird flight activity to inform a collision risk assessment, three for abundance and distribution (nocturnal species, breeding birds and breeding raptors surveys), and one for collision victims (search for dead carcasses).

The overall methodology for the surveys is based on guidance for bird surveys methods for wind farms developed by Scottish National Heritage (2025) complemented by specialist knowledge of the site conditions and species.

2.2 Target Species

The following criteria were used to select the target species:

- Species with a known risk of collision with wind turbines;
- Species listed on the European Red List as Near Threatened, Vulnerable, Endangered or Critically Endangered (BirdLife International, 2015a);
- Species with an uncertain or negative short-term and/or long-term trend in North Macedonia (BirdLife International, 2015a).

Target species include:

1. Red kite, *Milvus milvus*
2. Egyptian vulture, *Neophron percnopterus**
3. Eurasian griffon, *Gyps fulvus**
4. Northern goshawk, *Accipiter gentilis*
5. Sparrowhawk, *Accipiter nisus*
6. Short-toed snake eagle, *Circaetus gallicus**

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7. Marsh harrier, *Circus aeruginosus*
8. Hen harrier, *Circus cyaneus*
9. Pallid harrier, *Circus macrourus*
10. Montagu's harrier, *Circus pygargus*
11. Eurasian buzzard, *Buteo buteo*
12. Long-legged buzzard, *Buteo rufinus**
13. Lesser spotted eagle, *Clanga pomarina*
14. Greater spotted eagle, *Clanga clanga*
15. Eastern imperial eagle, *Aquila heliaca**
16. Golden eagle, *Aquila chrysaetos*
17. Lesser kestrel, *Falco naumanni**
18. Kestrel, *Falco tinnunculus*
19. Red-footed falcon, *Falco vespertinus*
20. Saker falcon, *Falco cherrug**
21. Lanner, *Falco biarmicus*
22. Peregrine falcon, *Falco peregrinus*
23. Eurasian eagle-owl, *Bubo bubo*
24. Roller, *Coracias garrulus**

*Species important for Ovče Pole IBA area (Velevski et al. 2010).

Other species of birds not already included in the list of target species above will be noted in separate files.

2.3 Vantage point surveys

The survey methodologies were based on national guidance Prakljačić et al. (2011) and international best practices (Scottish Natural Heritage, 2025).

The primary purpose of the surveys is to provide input data for the Updated Collision Risk Model (Band, 2012; Masden 2015), which predicts mortalities from collision with turbines. Vantage Point surveys are designed to quantify the level of flight activity and its

distribution over the survey area. Eight vantage point (VP) watches (Figure 1) were conducted within the wind farm project site.

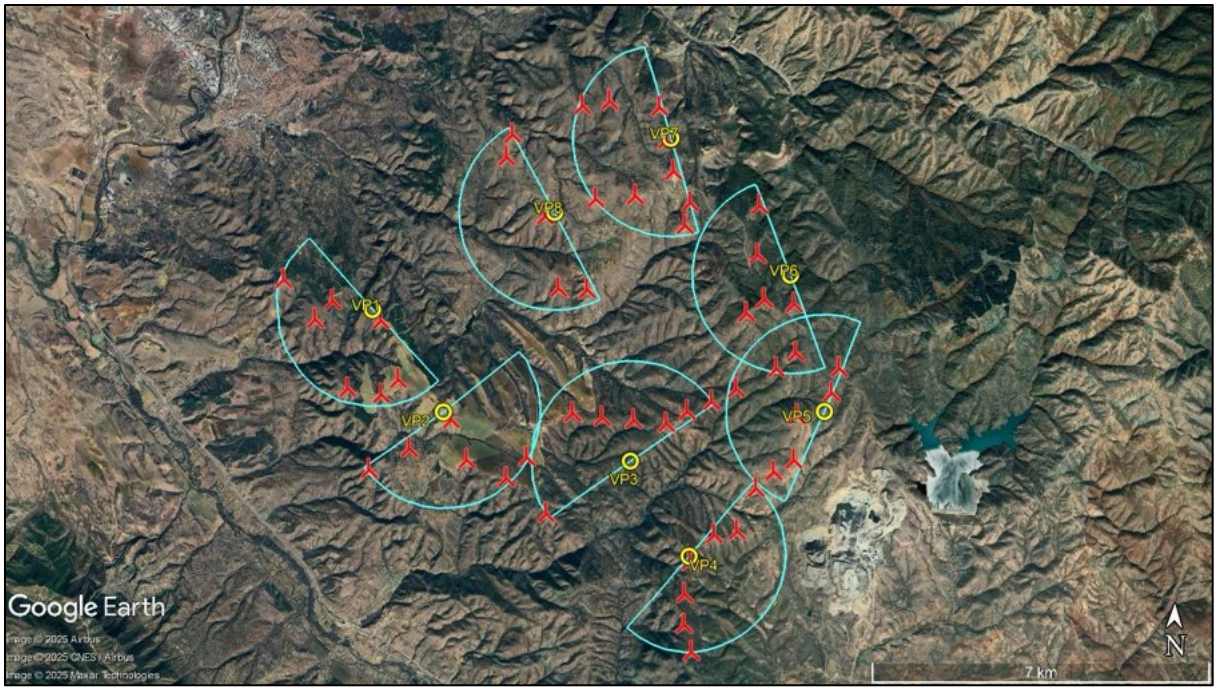

Figure 1. Vantage points (yellow circles) with view sheds that were used for bird monitoring on “Štip” Wind Park.

Based on SNH guidance (2025), VP watches from each location lasted from 2 to 3 hours (Table 1), with a gap of at least half an hour between each survey. Surveys were undertaken in a range of weather conditions as birds alter their behavior and flight patterns. Start times varied, ensuring that VP watches are undertaken throughout the day, between dawn and dusk for each VP in each month. This resulted in a total of 72 hours for one year (Band et al. 2007, 2012; see Douglas et al. 2012).

During the VP watches, details of all target species (i.e. those identified in scoping assessment as vulnerable to collision) seen or heard were recorded. Information included species, sex (where possible), number, flight direction, location, flight duration, and flight height for every 15-second period of flight. Flight heights were recorded as three different height categories (<30m, 30m-210m, >210m), with the minimum, maximum, and average height recorded.

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For the duration of a target species flight, the flight height was recorded every 15 seconds to enable the amount of time spent within the potential collision risk height (approximately 30m-210m) to be established for each target species: an essential statistics for collision risk analysis. All target species flights were hand drawn on a map within the 2km view shed and the timing of bird flights were recorded only within the collision risk window (i.e. the area of the view shed delineated by the outmost turbines) within the view shed. A different map will be used for each VP watch, and a clear target note allowed each hand-drawn flight to be associated with the correct flight details.

During the survey, information on all species were collected, and summarized at ten-minute intervals. Species not included on the target species list, but due to their flight patterns and behavior are still considered to be of some risk from a wind turbine development, are noted. For these species, the number of individuals, flight direction and general flight height was recorded during the VP watch.

Table 1. Dates of monitoring and weather data.

Date	Surveyor	VP	Begin	End	Visibility	Clouds	Temp	Wind		Rain
			(hh:mm)	(hh:mm)	(m)	(%)	(°C)	speed	direction	(% of time)
25.10.2024.	Marko Rakovic	1	06:30	09:00	2000	10%	5	2	nw	
25.10.2024.	Marko Rakovic	2	09:30	12:00	2000	0%	9	3	w	
25.10.2024.	Marko Rakovic	3	12:30	15:00	2000	10%	15	2	w	
25.10.2024.	Marko Rakovic	4	15:30	18:00	2000	10%	14	2	w	
26.10.2024.	Marko Rakovic	5	06:30	09:00	2000	10%	5	2	e	
26.10.2024.	Marko Rakovic	6	09:30	12:00	2000	10%	13	2	s	
26.10.2024.	Marko Rakovic	7	12:30	15:00	2000	10%	22	1	e	
26.10.2024.	Marko Rakovic	8	15:30	18:00	2000	10%	19	2	se	
27.10.2024.	Marko Rakovic	1	14:30	17:00	2000	0%	22	1	all	
27.10.2024.	Marko Rakovic	2	05:30	08:00	2000	0%	5	1	all	
27.10.2024.	Marko Rakovic	3	08:30	11:00	2000	10%	10	3	e	
27.10.2024.	Marko Rakovic	4	11:30	14:00	2000	10%	20	2	all	
28.10.2024.	Marko Rakovic	5	14:30	17:00	2000	0%	23	1	e	
28.10.2024.	Marko Rakovic	6	05:30	08:00	2000	0%	6	2	se	
28.10.2024.	Marko Rakovic	7	08:30	11:00	2000	0%	12	1	w	
28.10.2024.	Marko Rakovic	8	11:30	14:00	2000	0%	21	1	s	
12.11.2024.	Marko Rakovic	1	11:00	13:00	2000	70%	10	2	se	

12.11.2024.	Marko Rakovic	2	13:30	15:30	2000	60%	11	3	s	
12.11.2024.	Marko Rakovic	3	06:00	08:00	2000	60%	6	2	s	
12.11.2024.	Marko Rakovic	4	08:30	10:30	2000	80%	8	1	s	
13.11.2024.	Marko Rakovic	5	11:00	13:00	2000	90%	9	5	sw	
13.11.2024.	Marko Rakovic	6	13:30	15:30	2000	100%	11	4	s	
13.11.2024.	Marko Rakovic	7	06:00	08:00	2000	80%	5	6	s	
13.11.2024.	Marko Rakovic	8	08:30	10:30	2000	90%	7	3	sw	
14.11.2024.	Marko Rakovic	1	13:30	15:30	2000	100%	11	2	s	
14.11.2024.	Marko Rakovic	2	06:00	08:00	2000	100%	6	2	sw	5%
14.11.2024.	Marko Rakovic	3	08:30	10:30	2000	90%	8	1	s	
14.11.2024.	Marko Rakovic	4	11:00	13:00	2000	100%	9	2	s	5%
15.11.2024.	Marko Rakovic	5	13:30	15:30	2000	100%	6	3	e	
15.11.2024.	Marko Rakovic	6	06:00	08:00	2000	100%	4	3	e	5%
15.11.2024.	Marko Rakovic	7	08:30	10:30	2000	100%	4	4	se	
15.11.2024.	Marko Rakovic	8	11:00	13:00	2000	100%	5	3	e	10%
27.12.2024.	Marko Rakovic	1	06:00	08:00	2000	20%	1	4	sw	
27.12.2024.	Marko Rakovic	2	08:30	10:30	2000	10%	3	3	sw	
27.12.2024.	Marko Rakovic	3	11:00	13:00	2000	30%	6	6	s	
27.12.2024.	Marko Rakovic	4	13:30	15:30	2000	40%	7	7	s	
28.12.2024.	Marko Rakovic	5	06:00	08:00	2000	10%	2	5	s	
28.12.2024.	Marko Rakovic	6	08:30	10:30	2000	0%	6	2	se	
28.12.2024.	Marko Rakovic	7	11:00	13:00	2000	0%	9	4	se	
28.12.2024.	Marko Rakovic	8	13:30	15:30	2000	10%	10	6	se	
29.12.2024.	Marko Rakovic	1	08:30	10:30	2000	10%	2	2	se	
29.12.2024.	Marko Rakovic	2	11:00	13:00	2000	0%	7	2	w	
29.12.2024.	Marko Rakovic	3	13:30	15:30	2000	10%	9	4	n	
29.12.2024.	Marko Rakovic	4	06:00	08:00	2000	20%	-4	1	e	
30.12.2024.	Marko Rakovic	5	08:30	10:30	2000	0%	2	1	nw	
30.12.2024.	Marko Rakovic	6	11:00	13:00	2000	0%	6	2	all	
30.12.2024.	Marko Rakovic	7	13:30	15:30	2000	10%	9	3	all	
30.12.2024.	Marko Rakovic	8	06:00	08:00	2000	0%	-4	1	nw	
31.12.2024	Marko Rakovic	1	11:00	13:00	2000	0%	4	3	s	
31.12.2024	Marko Rakovic	2	13:30	15:30	2000	0%	8	3	ne	
31.12.2024	Marko Rakovic	3	06:00	08:00	2000	10%	-4	2	all	
31.12.2024	Marko Rakovic	4	08:30	10:30	2000	0%	2	1	all	

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17.1.2025.	Marko Rakovic	5	11:30	13:30	2000	10%	7	1	nw	
17.1.2025.	Marko Rakovic	6	14:00	16:00	2000	0%	9	3	sw	
17.1.2025.	Marko Rakovic	7	06:30	08:30	2000	30%	-2	3	s	
17.1.2025.	Marko Rakovic	8	09:00	11:00	2000	10%	2	2	sw	
18.1.2025.	Marko Rakovic	1	14:00	16:00	2000	100%	2	3	s	
18.1.2025.	Marko Rakovic	2	06:30	08:30	2000	100%	0	4	s	
18.1.2025.	Marko Rakovic	3	09:00	11:00	2000	100%	1	6	sw	
18.1.2025.	Marko Rakovic	4	11:30	13:30	2000	100%	2	3	sw	
19.1.2025.	Marko Rakovic	5	14:00	16:00	2000	100%	1	2	w	
19.1.2025.	Marko Rakovic	6	06:30	08:30	2000	100%	-1	5	sw	
19.1.2025.	Marko Rakovic	7	09:00	11:00	2000	100%	0	3	sw	
19.1.2025.	Marko Rakovic	8	11:30	13:30	2000	100%	1	2	s	
20.1.2025.	Marko Rakovic	1	06:30	08:30	2000	100%	-1	4	sw	
20.1.2025.	Marko Rakovic	2	09:00	11:00	2000	100%	-1	3	sw	
20.1.2025.	Marko Rakovic	3	11:30	13:30	2000	100%	0	3	sw	
20.1.2025.	Marko Rakovic	4	14:00	16:00	2000	100%	0	1	sw	
21.1.2025	Marko Rakovic	5	06:30	08:30	2000	100%	0	2	nw	
21.1.2025	Marko Rakovic	6	09:00	11:00	2000	100%	1	1	sw	5%
21.1.2025	Marko Rakovic	7	11:30	13:30	2000	100%	2	2	all	5%
21.1.2025	Marko Rakovic	8	14:00	16:00	2000	100%	3	2	all	
6.2.2025.	Marko Rakovic	1	09:00	11:00	2000	10%	4	1	s	
6.2.2025.	Marko Rakovic	2	11:30	13:30	2000	10%	8	5	se	
6.2.2025.	Marko Rakovic	3	14:00	16:00	2000	30%	9	6	e	
6.2.2025.	Marko Rakovic	4	06:30	08:30	2000	0%	-4	2	n	
7.2.2025.	Marko Rakovic	5	09:00	11:00	2000	80%	7	2	e	
7.2.2025.	Marko Rakovic	6	11:30	13:30	2000	60%	10	3	e	
7.2.2025.	Marko Rakovic	7	14:00	16:00	2000	40%	12	3	all	
7.2.2025.	Marko Rakovic	8	06:30	08:30	2000	100%	3	2	s	
8.2.2025.	Marko Rakovic	1	11:30	13:30	2000	10%	7	2	all	
8.2.2025.	Marko Rakovic	2	14:00	16:00	2000	0%	12	1	all	
8.2.2025.	Marko Rakovic	3	06:30	08:30	2000	0%	-4	1	s	
8.2.2025.	Marko Rakovic	4	09:00	11:00	2000	10%	2	4	sw	
9.2.2025.	Marko Rakovic	5	11:30	13:30	2000	10%	8	2	w	
9.2.2025.	Marko Rakovic	6	14:00	16:00	2000	0%	10	3	w	
9.2.2025.	Marko Rakovic	7	06:30	08:30	2000	0%	-7	3	nw	

9.2.2025.	Marko Rakovic	8	09:00	11:00	2000	0%	1	4	all	
8.3.2025.	Marko Rakovic	1	14:30	17:00	2000	0%	20	1	n	
8.3.2025.	Marko Rakovic	2	05:30	08:00	2000	0%	-2	1	w	
8.3.2025.	Marko Rakovic	3	08:30	11:00	2000	0%	10	2	all	
8.3.2025.	Marko Rakovic	4	11:30	14:00	2000	0%	18	1	nw	
9.3.2025.	Marko Rakovic	5	14:30	17:00	2000	0%	19	2	all	
9.3.2025.	Marko Rakovic	6	05:30	08:00	2000	0%	-1	2	all	
9.3.2025.	Marko Rakovic	7	08:30	11:00	2000	0%	10	1	e	
9.3.2025.	Marko Rakovic	8	11:30	14:00	2000	0%	16	2	ne	
10.3.2025.	Marko Rakovic	1	05:30	08:00	2000	10%	1	2	nw	
10.3.2025.	Marko Rakovic	2	08:30	11:00	2000	10%	7	3	all	
10.3.2025.	Marko Rakovic	3	11:30	14:00	2000	0%	18	5	w	
10.3.2025.	Marko Rakovic	4	14:30	17:00	2000	0%	22	7	n	
11.3.2025.	Marko Rakovic	5	05:30	08:00	2000	0%	4	2	nw	
11.3.2025.	Marko Rakovic	6	08:30	11:00	2000	10%	11	3	e	
11.3.2025.	Marko Rakovic	7	11:30	14:00	2000	40%	18	4	s	
11.3.2025.	Marko Rakovic	8	14:30	17:00	2000	80%	20	7	sw	
24.3.2025.	Marko Rakovic	1	08:30	11:00	2000	90%	14	2	nw	
24.3.2025.	Marko Rakovic	2	11:30	14:00	2000	70%	16	6	n	
24.3.2025.	Marko Rakovic	3	14:30	17:00	2000	50%	19	4	e	
24.3.2025.	Marko Rakovic	4	05:30	08:00	2000	100%	10	2	all	10%
25.3.2025.	Marko Rakovic	5	08:30	11:00	2000	60%	15	5	nw	
25.3.2025.	Marko Rakovic	6	11:30	14:00	2000	50%	18	5	nw	
25.3.2025.	Marko Rakovic	7	14:30	17:00	2000	40%	20	6	nw	
25.3.2025.	Marko Rakovic	8	05:30	08:00	2000	60%	12	3	sw	
26.3.2025.	Marko Rakovic	1	11:30	14:00	2000	80%	12	3	s	
26.3.2025.	Marko Rakovic	2	14:30	17:00	2000	60%	13	2	e	
26.3.2025.	Marko Rakovic	3	05:30	08:00	2000	90%	10	4	w	
26.3.2025.	Marko Rakovic	4	08:30	11:00	2000	90%	11	4	w	
27.3.2025.	Marko Rakovic	5	11:30	14:00	2000	100%	14	7	nw	
27.3.2025.	Marko Rakovic	6	14:30	17:00	2000	60%	19	6	nw	
27.3.2025.	Marko Rakovic	7	05:30	08:00	2000	70%	9	2	s	
27.3.2025.	Marko Rakovic	8	08:30	11:00	2000	80%	11	3	e	5%
6.4.2025	Nikola Stanojevic	1	5:30	8:30	2000	90%	7	1	se	
6.4.2025	Nikola Stanojevic	2	9:00	12:00	2000	100%	9	6	se	

6.4.2025	Marko Rakovic	3	12:30	15:30	2000	90%	9	6	s	5%
7.4.2025	Nikola Stanojevic	4	5:30	8:30	2000	10%	0	4	se	
7.4.2025	Nikola Stanojevic	5	9:00	12:00	2000	100%	5	3	s	
7.4.2025	Marko Rakovic	6	12:30	15:30	2000	80%	4	4	se	
8.4.2025	Nikola Stanojevic	7	5:30	8:30	2000	0%	0	2	e	
8.4.2025	Nikola Stanojevic	8	9:00	12:00	2000	0%	4	4	se	
21.4.2025	Nikola Stanojevic	1	9:00	12:00	2000	10%	15	2	ne	
21.4.2025	Marko Rakovic	2	12:30	15:30	2000	10%	22	2	ne	
21.4.2025	Nikola Stanojevic	3	5:30	8:30	2000	50%	11	1	ne	
22.4.2025	Nikola Stanojevic	4	9:00	12:00	2000	30%	19	2	ne	
22.4.2025	Marko Rakovic	5	12:30	15:30	2000	30%	22	2	ne	
22.4.2025	Nikola Stanojevic	6	5:30	8:30	2000	10%	12	2	sw	
23.4.2025	Nikola Stanojevic	7	9:00	12:00	2000	10%	17	2	ne	
23.4.2025	Marko Rakovic	8	12:30	15:30	2000	20%	21	2	e	
1.5.2025	Nikola Stanojevic	1	9:30	12:30	2000	0%	14	2	s	
1.5.2025	Marko Rakovic	2	13:00	16:00	2000	10%	22	5	sw	
1.5.2025	Nikola Stanojevic	3	6:00	9:00	2000	0%	9	2	s	
2.5.2025	Nikola Stanojevic	4	9:30	12:30	2000	0%	18	2	sw	
2.5.2025	Marko Rakovic	5	13:00	16:00	2000	10%	21	4	e	
2.5.2025	Nikola Stanojevic	6	6:00	9:00	2000	10%	12	1	sw	
3.5.2025	Nikola Stanojevic	7	9:30	12:30	2000	10%	20	2	nw	
3.5.2025	Marko Rakovic	8	13:00	16:00	2000	20%	24	2	n	
29.5.2025	Nikola Stanojevic	1	6:00	9:00	2000	10%	14	1	w	
29.5.2025	Nikola Stanojevic	2	9:30	12:30	2000	40%	19	2	e	
29.5.2025	Marko Rakovic	3	13:00	16:00	2000	90%	18	4	se	
30.5.2025	Nikola Stanojevic	4	6:00	9:00	2000	80%	13	3	s	
30.5.2025	Nikola Stanojevic	5	9:30	12:30	2000	80%	15	5	s	
30.5.2025	Marko Rakovic	6	13:00	16:00	2000	90%	16	3	se	
31.5.2025	Nikola Stanojevic	7	6:00	9:00	2000	10%	11	1	n	
31.5.2025	Nikola Stanojevic	8	9:30	12:30	2000	30%	12	2	e	
4.6.2025	Nikola Stanojevic	1	9:30	12:30	2000	0%	25	1	ne	
4.6.2025	Marko Rakovic	2	13:00	16:00	2000	0%	28	2	e	
4.6.2025	Nikola Stanojevic	3	6:00	9:00	2000	10%	20	1	sw	
5.6.2025	Nikola Stanojevic	4	9:30	12:30	2000	70%	26	2	ne	
5.6.2025	Marko Rakovic	5	13:00	16:00	2000	30%	30	3	n	

5.6.2025	Nikola Stanojevic	6	6:00	9:00	2000	0%	18	1	w	
6.6.2025	Nikola Stanojevic	7	9:30	12:30	2000	10%	22	2	e	
6.6.2025	Marko Rakovic	8	13:00	16:00	2000	60%	27	2	e	
22.6.2025	Marko Rakovic	1	13:00	16:00	2000	20%	25	2	e	
22.6.2025	Nikola Stanojevic	2	6:00	9:00	2000	10%	19	1	nw	
22.6.2025	Nikola Stanojevic	3	9:30	12:30	2000	10%	24	2	ne	
23.6.2025	Marko Rakovic	4	13:00	16:00	2000	0%	28	3	se	
23.6.2025	Nikola Stanojevic	5	6:00	9:00	2000	0%	18	2	e	
23.6.2025	Nikola Stanojevic	6	9:30	12:30	2000	0%	23	2	e	
24.6.2025	Marko Rakovic	7	13:00	16:00	2000	0%	31	4	se	
24.6.2025	Nikola Stanojevic	8	6:00	9:00	2000	0%	23	2	e	
2.7.2025	Nikola Stanojevic	1	6:00	9:00	2000	0%	23	2	ne	
2.7.2025	Nikola Stanojevic	2	9:30	12:30	2000	0%	27	3	ne	
2.7.2025	Marko Rakovic	3	13:00	16:00	2000	10%	30	4	se	
3.7.2025	Nikola Stanojevic	4	6:00	9:00	2000	0%	22	1	s	
3.7.2025	Nikola Stanojevic	5	9:30	12:30	2000	0%	28	2	ne	
3.7.2025	Marko Rakovic	6	13:00	16:00	2000	0%	31	3	ne	
4.7.2025	Nikola Stanojevic	7	6:00	9:00	2000	0%	25	1	s	
4.7.2025	Nikola Stanojevic	8	9:30	12:30	2000	0%	29	2	ne	
27.7.2025	Nikola Stanojevic	1	9:30	12:30	2000	10%	32	7	nw	
27.7.2025	Marko Rakovic	2	13:00	16:00	2000	0%	34	7	n	
27.7.2025	Nikola Stanojevic	3	6:00	9:00	2000	30%	27	6	nw	
28.7.2025	Nikola Stanojevic	4	9:30	12:30	2000	10%	27	5	se	
28.7.2025	Marko Rakovic	5	13:00	16:00	2000	30%	29	4	se	
28.7.2025	Nikola Stanojevic	6	6:00	9:00	2000	0%	21	4	se	
29.7.2025	Nikola Stanojevic	7	9:30	12:30	2000	20%	25	4	se	
29.7.2025	Marko Rakovic	8	13:00	16:00	2000	20%	29	5	se	
8.8.2025	Marko Rakovic	1	13:00	16:00	2000	10%	30	2	se	
8.8.2025	Nikola Stanojevic	2	6:00	9:00	2000	10%	23	2	e	
8.8.2025	Nikola Stanojevic	3	9:30	12:30	2000	0%	26	3	se	
9.8.2025	Marko Rakovic	4	13:00	16:00	2000	0%	30	3	se	
9.8.2025	Nikola Stanojevic	5	6:00	9:00	2000	0%	21	1	sw	
9.8.2025	Nikola Stanojevic	6	9:30	12:30	2000	0%	27	2	e	
10.8.2025	Marko Rakovic	7	13:00	16:00	2000	10%	33	2	e	
10.8.2025	Nikola Stanojevic	8	6:00	9:00	2000	0%	24	1	sw	

28.8.2025	Marko Rakovic	1	6:00	9:00	2000	0%	18	2	w	
28.8.2025	Marko Rakovic	2	9:30	12:30	2000	0%	24	3	n	
28.8.2025	Nikola Stanojevic	3	13:00	16:00	2000	0%	29	2	ne	
29.8.2025	Nikola Stanojevic	4	6:00	9:00	2000	0%	22	3	nw	
29.8.2025	Nikola Stanojevic	5	9:30	12:30	2000	0%	25	4	n	
29.8.2025	Marko Rakovic	6	13:00	16:00	2000	0%	29	3	n	
30.8.2025	Nikola Stanojevic	7	6:00	9:00	2000	0%	20	3	nw	
30.8.2025	Nikola Stanojevic	8	9:30	12:30	2000	0%	27	6	n	
2.9.2025	Nikola Stanojevic	1	9:30	12:30	2000	0%	24	3	e	
2.9.2025	Marko Rakovic	2	13:00	16:00	2000	0%	27	3	e	
2.9.2025	Nikola Stanojevic	3	6:00	9:00	2000	0%	19	1	e	
3.9.2025	Nikola Stanojevic	4	9:30	12:30	2000	0%	28	2	ne	
3.9.2025	Marko Rakovic	5	13:00	16:00	2000	0%	31	3	ne	
3.9.2025	Nikola Stanojevic	6	6:00	9:00	2000	0%	20	1	n	
4.9.2025	Nikola Stanojevic	7	9:30	12:30	2000	80%	20	4	e	
4.9.2025	Marko Rakovic	8	13:00	16:00	2000	80%	25	4	e	
24.9.2025	Marko Rakovic	1	13:00	16:00	2000	10%	27	4	n	
24.9.2025	Nikola Stanojevic	2	6:00	9:00	2000	0%	17	2	s	
24.9.2025	Nikola Stanojevic	3	9:30	12:30	2000	0%	24	4	ne	
25.9.2025	Marko Rakovic	4	13:00	16:00	2000	30%	25	5	n	
25.9.2025	Nikola Stanojevic	5	6:00	9:00	2000	40%	19	2	nw	
25.9.2025	Nikola Stanojevic	6	9:30	12:30	2000	30%	23	4	n	
26.9.2025	Marko Rakovic	7	13:00	16:00	2000	100%	16	6	nw	
26.9.2025	Nikola Stanojevic	8	6:00	9:00	2000	70%	18	4	nw	
3.10.2025	Marko Rakovic	1	6:00	9:00	2000	100%	2	4	se	
3.10.2025	Marko Rakovic	2	9:30	12:30	2000	100%	3	4	se	
3.10.2025	Marko Rakovic	3	13:00	16:00	2000	100%	4	5	se	
4.10.2025	Marko Rakovic	4	6:00	9:00	2000	30%	3	3	e	
4.10.2025	Marko Rakovic	5	9:30	12:30	2000	20%	7	5	e	
4.10.2025	Marko Rakovic	6	13:00	16:00	2000	20%	10	4	e	
5.10.2025	Marko Rakovic	7	6:00	9:00	2000	50%	7	1	n	
5.10.2025	Marko Rakovic	8	9:30	12:30	2000	30%	12	2	e	

2.4 Breeding bird surveys

Breeding bird surveys involved walking 13 transect routes (Figure 2) three times, with each visit to a specific transect spaced evenly across the breeding season in the period April to June aiming to record mainly passerines and other small birds breeding in the area.

Surveys started at sunrise, and the starting point and direction of the transect route varied each time to ensure that there is no tendency for any part of the survey area to be visited earlier or later in the day. Surveys were undertaken in fair weather conditions (i.e. not in heavy rain, poor visibility or strong wind).

All birds identified by sight and sound were recorded, and GPS coordinate of every bird was noted. The length and start/finish times were recorded for each transect survey (Table 2).

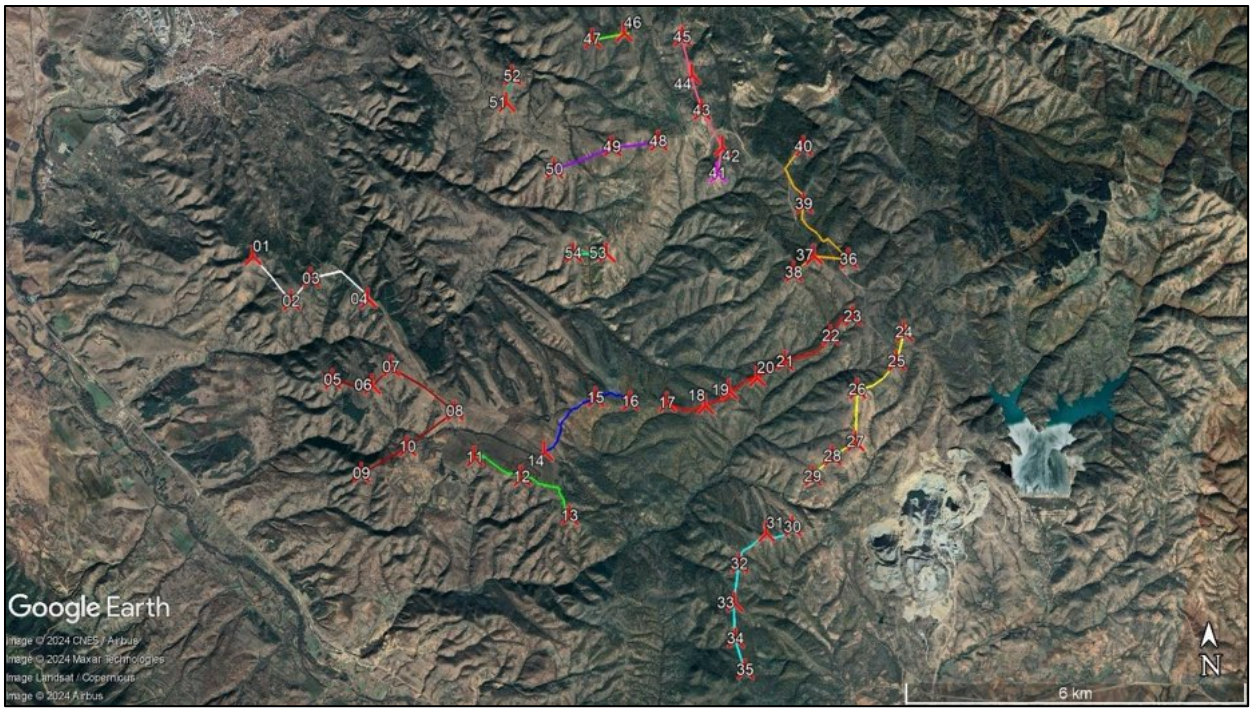

Figure 2. Transects routes in Wind Park area for monitoring breeding birds.

Table 2. Transects details.

Transect	Lenght (m)	Date	Time	Surveyor
Transect 1	2947	21.4.2025	05:22-07:01	Marko Rakovic
Transect 2	4952	21.4.2025	08:05-10:18	Marko Rakovic
Transect 3	2464	22.4.2025	05:19-06:58	Marko Rakovic
Transect 4	2248	22.4.2025	07:31-08:42	Marko Rakovic
Transect 5	4084	22.4.2025	09:13-11:18	Marko Rakovic
Transect 6	3440	23.4.2025	05:23-07:15	Marko Rakovic
Transect 7	3557	23.4.2025	05:42-07:31	Nikola Stanojevic
Transect 8	3951	24.4.2025	05:12-07:03	Marko Rakovic

Transect 9	2869	24.4.2025	05:28-06:42	Nikola Stanojevic
Transect 10	2206	24.4.2025	07:38-08:45	Marko Rakovic
Transect 11	785	24.4.2025	07:29-08:02	Nikola Stanojevic
Transect 12	774	24.4.2025	09:30-10:02	Marko Rakovic
Transect 13	796	24.4.2025	08:42-09:15	Nikola Stanojevic
Transect 1	2947	1.5.2025	07:47-09:27	Marko Rakovic
Transect 2	4952	1.5.2025	05:13-06:57	Marko Rakovic
Transect 3	2464	2.5.2025	09:16-11:00	Marko Rakovic
Transect 4	2248	2.5.2025	07:35-08:47	Marko Rakovic
Transect 5	4084	2.5.2025	05:10-07:08	Marko Rakovic
Transect 6	3440	3.5.2025	05:21-07:10	Marko Rakovic
Transect 7	3557	3.5.2025	05:40-07:42	Nikola Stanojevic
Transect 8	3951	4.5.2025	08:21-10:23	Marko Rakovic
Transect 9	2869	4.5.2025	07:31-08:56	Nikola Stanojevic
Transect 10	2206	4.5.2025	06:35-07:50	Marko Rakovic
Transect 11	785	4.5.2025	06:24-06:57	Nikola Stanojevic
Transect 12	774	4.5.2025	05:34-06:03	Marko Rakovic
Transect 13	796	4.5.2025	05:18-05:50	Nikola Stanojevic
Transect 1	2947	4.6.2025	04:51-06:31	Marko Rakovic
Transect 2	4952	4.6.2025	07:02-09:24	Marko Rakovic
Transect 3	2464	5.6.2025	04:53-05:28	Marko Rakovic
Transect 4	2248	5.6.2025	06:00-07:05	Marko Rakovic
Transect 5	4084	5.6.2025	07:37-09:30	Marko Rakovic
Transect 6	3440	6.6.2025	04:50-06:24	Marko Rakovic
Transect 7	3557	6.6.2025	05:13-07:55	Nikola Stanojevic
Transect 8	3951	7.6.2025	04:55-06:51	Marko Rakovic
Transect 9	2869	7.6.2025	05:12-06:45	Nikola Stanojevic
Transect 10	2206	7.6.2025	07:23-08:31	Marko Rakovic
Transect 11	785	7.6.2025	07:14-07:49	Nikola Stanojevic
Transect 12	774	7.6.2025	09:02-09:35	Marko Rakovic
Transect 13	796	7.6.2025	08:24-08:59	Nikola Stanojevic

2.5 Breeding raptor surveys

Breeding raptor species vulnerable to collision with wind turbines can have breeding territories much larger than the extent of the wind farm. For these reasons and in accordance with SNH (2025) species-specific surveys were undertaken to identify breeding locations in the wider landscape. Two survey visits for any of the target raptor species were undertaken in the relevant months where evidence of territory occupation (Visit 1) and location of active nests (Visit 2) (Table 3).

In accordance with (Prakljačić et al, 2011), the survey area extended from 2 km up to 6 km from the turbine clusters depending on the species (Figure 3).

In addition to census of widespread and numerous raptor species we conducted more detailed searches for any large raptors in the wider area, targeting Imperial Eagle nests which were present in previous years in Ovče Pole.

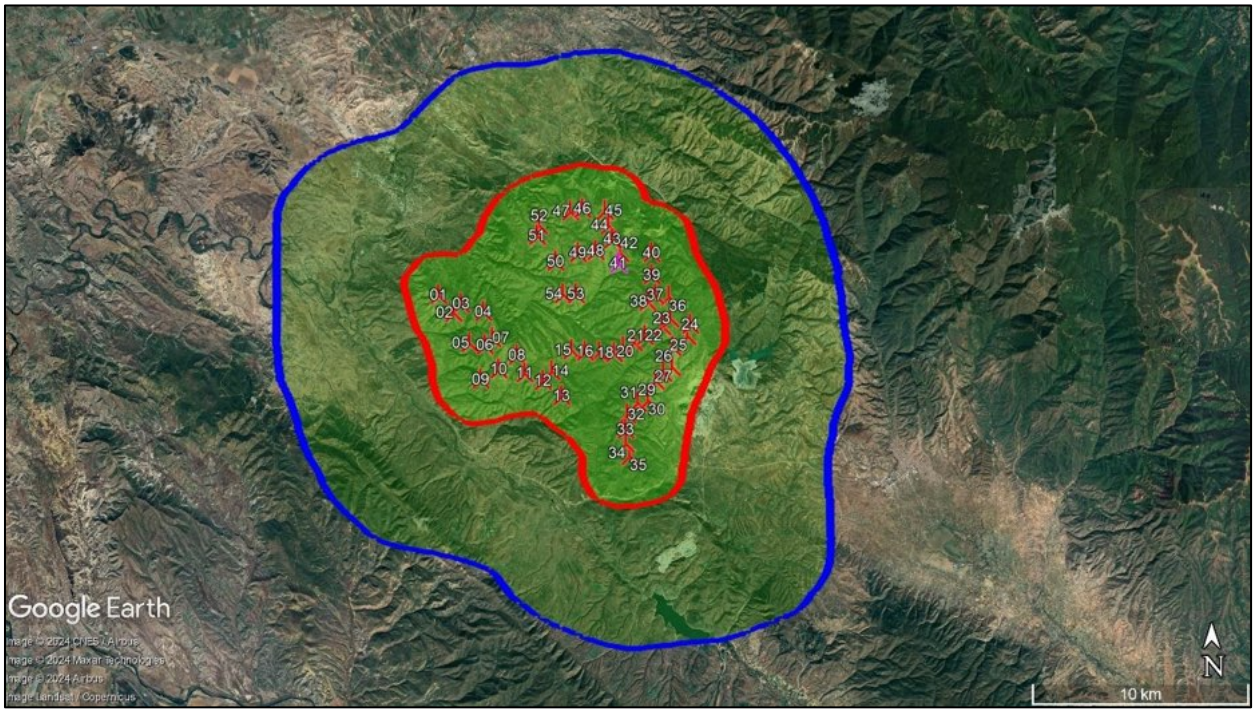

Figure 3. Shaded area for breeding raptor research. The first circle for small raptor species is around 2 km from Wind Park, and for larger species (eg. Imperial Eagle) is a 6 km radius.

Table 3. Raptor search dates and times.

Date	Time	Surveyor
28.3.2025	06:34-17:32	Nikola Stanojevic
29.3.2025	06:26-18:06	Nikola Stanojevic
19.4.2025	06:13-17:32	Nikola Stanojevic
20.4.2025	06:47-18:11	Nikola Stanojevic
10.5.2025	06:03-18:54	Nikola Stanojevic
11.5.2025	05:58-17:34	Nikola Stanojevic
11.6.2025	06:15-19:31	Nikola Stanojevic
12.6.2025	06:26-18:21	Nikola Stanojevic

2.6 Nocturnal species

In accordance with the terms of reference, species specific surveys were undertaken for nocturnal bird species. Nocturnal species probably breeding in the vicinity of project area include:

- Eurasian eagle owl *Bubo bubo*;
- Little owl *Athene noctua*;
- Scops owl *Otus scops*;
- Tawny owl *Strix aluco*;
- Common quail *Coturnix coturnix*; and
- European nightjar *Caprimulgus europaeus*.

Playback surveys, i.e. the broadcast of recordings of target species calls using audio equipment to illicit a response from birds present in the study area, were conducted at 24 locations (Figure 4) within 500m of the turbine clusters (Prakljačić et al, 2011). Surveys were conducted on field visits in October (for owl species) and in April and May for all target nocturnal species (Table 4).

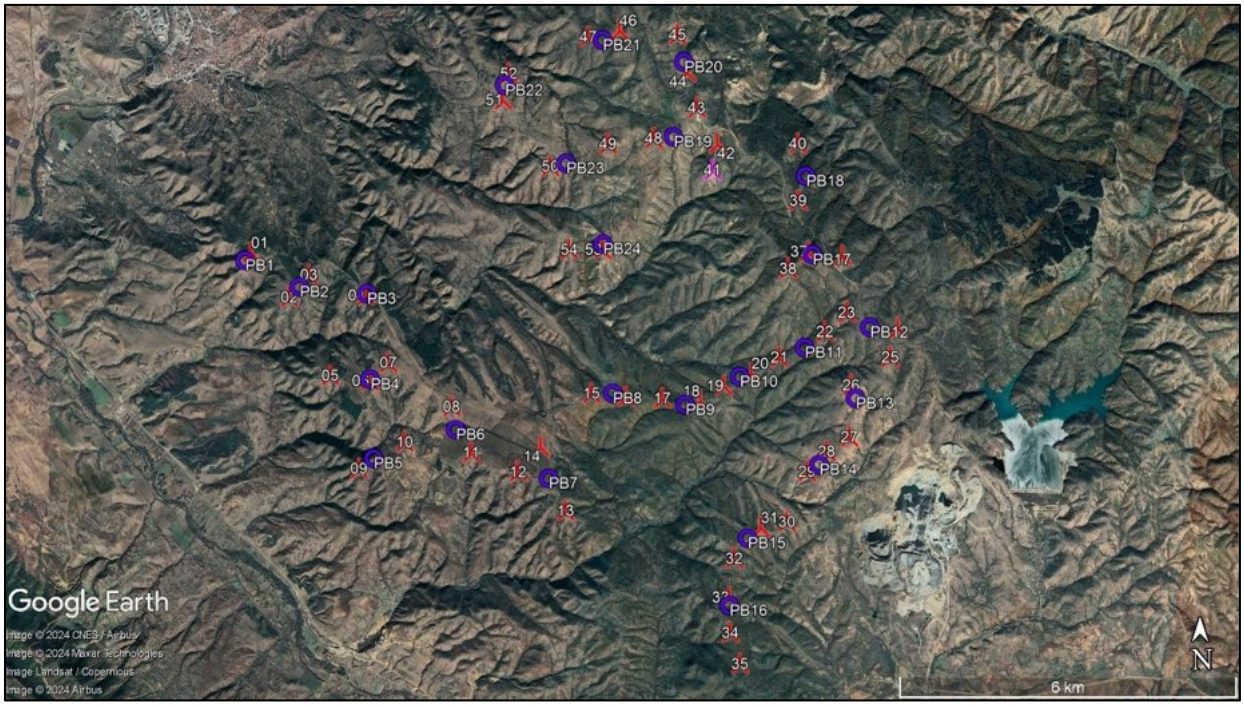

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Figure 4. Playback points to survey nocturnal species within the borders of Wind Farm area

Table 4. Data on playback point surveys.

Date	Time	Surveyor
27.10.2024	18:12-23:45	Ivan Medenica
28.10.2024	18:05-00:27	Ivan Medenica
19.4.2025	20:13-00:32	Ivan Medenica
20.4.2025	20:03-23:51	Ivan Medenica
10.5.2025	20:55-00:54	Ivan Medenica
11.5.2025	20:38-23:41	Ivan Medenica

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3. Results of bird monitoring and conclusions

All results collected during VP watches are given in an Excel file which is part of the final report. Additionally, we are attaching target species flights in a Google Earth file (KML format).

The proposed methodologies and surveys are based on national and international good practices complemented by specialist knowledge of the site conditions and species.

As agreed in the draft methodology, one of the deliverables included in the final report are breeding bird results and we attached excel file.

Also, there are two excel files covering raptors and nocturnal species.

4. References

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B.5 Herpetofauna

MANEKO Solutions

STIP WIND FARM

Biodiversity Baseline Survey

FIELD REPORT

Biodiversity Kingdom/Class: HERPETOFAUNA

Biodiversity Specialist: Bogoljub Sterijovski

Reporting Period: May, 2025

Date:
June 2025

Mott MacDonald Restricted

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STIP WIND FARM, Biodiversity Baseline Survey

FIELD REPORT, Herpetofauna

1 | INTRODUCTION

BACKGROUND

The construction of Stip Wind Farm has been planned in the region south of the city of Stip, in the area between the villages of Dolani and Bucim. In accordance with the location of individual wind turbines, the area to be covered by the Stip Wind Farm has been divided into three sectors for the purpose of the survey, for easier organization of field activities, and more appropriate processing, analysis and presentation of the obtained data. The current design includes up to 54 wind turbine generators (WTGs), each with a nominal capacity of 6-8 MW, for a total installed capacity of up to 400 MW.

PURPOSE OF THIS REPORT

The purpose of the herpetofauna survey is to identify if any species could be affected, which might be considered 'a priority biodiversity feature' in a national or international context.

SURVEY AREA

The area of the wind farm in Stip will occupy an area of approximately 400 ha. The focus of the plant survey and habitat mapping is about 1,000-m wide corridor on the central line of the proposed WF together with the related infrastructure (overhead lines and transformer station). The cited area is deemed appropriate for a survey, and it is sufficiently large to encompass most impacts on herpetofauna arising during the construction works and operational needs in the projected area.

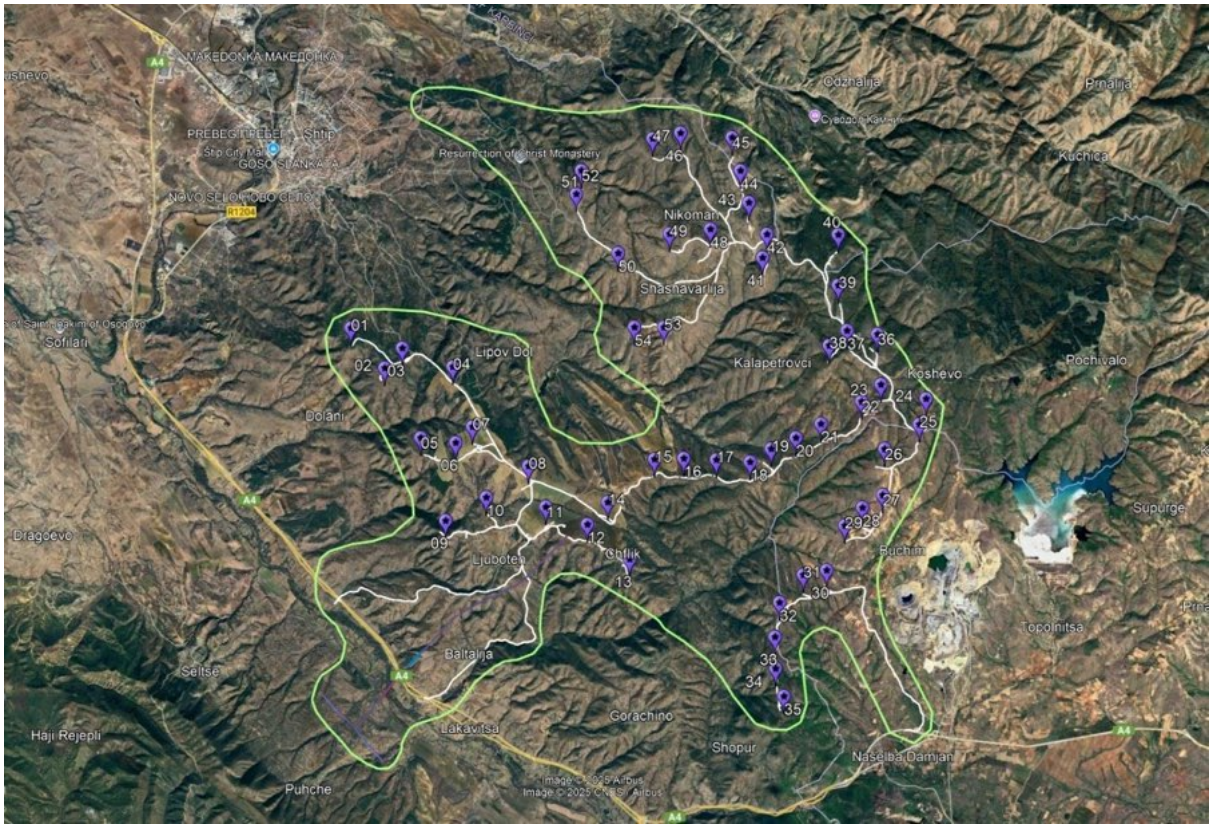

Figure 1 Survey Area

SURVEY PERIOD

This report refers to the following survey period: May 2025.

The field visits were organized to transect locations in the survey area between 15 and 17 and 23 – 25 May 2025.

SURVEY SPECIALIST

The survey was conducted by Bogoljub Sterijovski.

2 | SCOPE OF WORK

Field survey is foreseen for the months of May, June and September of 2025.

Subject of survey is seasonal research in all habitats and valorisation of herpetofauna.

3 | METHODOLOGY

FIELD SURVEY

The specimens observed in the field were determined according to the field guides of Radovanović (1951)[1] and Arnold & Owenden (2002)[2]. The methodology for determining the specimens of reptiles in their natural habitats was different in terms of the biology and ecology of each species separately in the morning and night hours.
Survey methodologies

"Search-and-seize" method

Determining the presence / distribution of species with the "catch-and-release" method, i.e., "search-and-seize" (Vogt 1982)[3] is likely the most basic and often-used approach. The researcher carefully walks through the natural habitat observing the activity. At a suitable moment the observer tries to catch an individual using gloves, nets or hooks. Following capture, the species can be determined in situ, and all additional data collected according to the monitoring protocol (sex, size, GPS coordinates, etc.). This method is suitable for searching species in their preferable habitats.

Field surveys are conducted throughout the survey area in the spring and summer season (May, June and September, 2025) to determine the presence / distribution of species with the search and capture method, i.e. "Search-and-seize" (Vogt 1982).

Line transects - in order to determine the average number of individuals in the amphibian and reptile classes, the line transect sampling method is used (Buckland et al., 1993, Everitt 2002). These methods is used to determine biodiversity richness, density, and population size of amphibians and reptiles for a simple reason characteristic of low-mobility animals (McDiarmid et al., 2012).

[1] Radovanović, M. (1951): Vodozemci i gmizavci naše zemlje. Naučna knjiga, Beograd.

[2] Arnold, N., Ovenden, D. (2002): Reptiles and Amphibians of Britain and Europe. Collins, London.

[3] Vogt, R.C. and Hine, R.L. (1982): Evaluation of techniques for assessment of amphibian and reptile populations in Wisconsin. Herpetological communities. Wildlife Res. Report. Fish and wildlife service, U.S. Dept. of Interior. Pp. 201-217

Field research takes place in the most active period of these two classes, from May to September. The scope of the research is to determine the qualitative composition of the diversity of amphibians and reptiles in the researched area. Additionally, by using the proposed methodologies, basic quantitative parameters are acquired to primarily show the frequency of the species of these two classes and their abundance. This approach can determine the state of diversity of amphibians and reptiles in the surveyed area. In addition to all the above, the dynamics of continuous surveying in the active period of these two taxonomic groups (from May to September) is essential in order to cover the reproductive period of amphibians and reptiles where a higher frequency of occurrence is expected and the period in which these animals are preparing for hibernation (September).

Given the large size of the project area and the diversity of habitats, the qualitative and quantitative composition of amphibians and reptiles is assessed in a systematic and uniform manner, ensuring equal representation of habitat types within the transects to be established and surveyed at the same time periods and at the same times. Transects are set up in such a way that they are evenly dispersed throughout the sub-area, so that the data obtained on species composition and abundance of both classes are sufficiently representative of the micro-region surrounding the transect: Bucim transect [1], Ljuboten – Ciflik transect [2], Koshevo transect [3], Shashavarlija – Nikoman trasect [4] and Dolani – Lipov dol transect [5]), and one control transect that has the same habitat types and ecological conditions and traits outside the surveyed area but in near vicinity (Gorachino transect [C]).

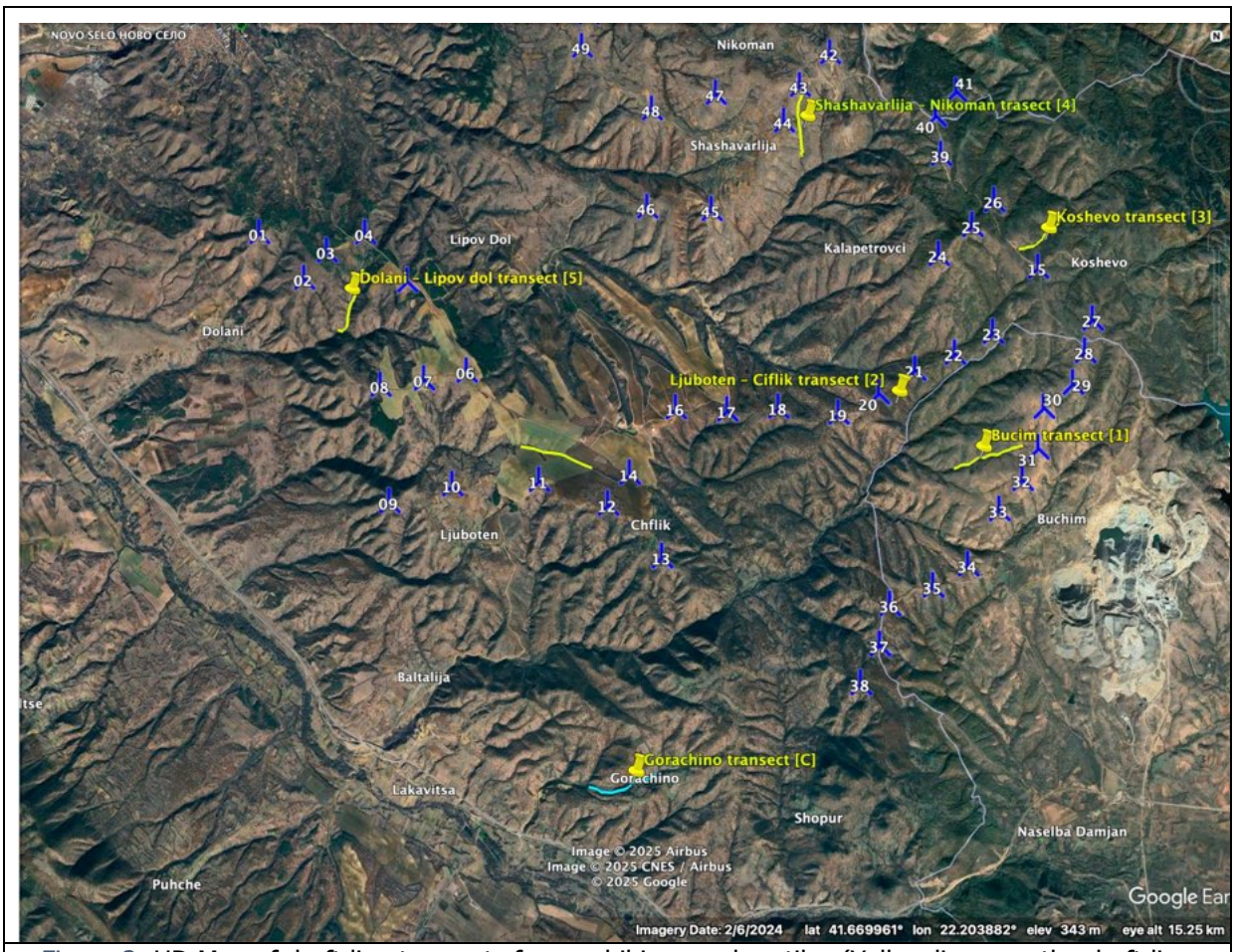

Figure 2 HD Map of draft line transects for amphibians and reptiles (Yellow lines are the draft line transects within the project area - from point 1 to 5, and turquoise line is Gorachino control transect-

point C). Source: Bogoljub Sterijovski

The surveys are conducted in the morning hours when the frequencies of occurrence of these two classes of animals are higher. The work on one transect with a time interval is on average about 4-6 hours, depending on the population's density of the amphibians and reptiles as well as the quantity of ecological data that is collected for a particular field research day.

BRIEF LITERATURE OVERVIEW RELEVANT TO THE TAXONOMIC GROUP

This area was systematically investigated for amphibians and reptiles within the Nature Conservation Programme Phase I. For the wider area of the Stip – Radovis windmill project scope, systematic research has not been conducted. From the literature published for this region regarding the amphibian's distribution there are 8 species (*Salamandra salamandra, Bombina variegata, Bufo bufo, Bufotes viridis, Hyla arborea, Pelophylax ridibundus, Rana dalmatina* and *Rana graeca*). These species are mentioned from Uzunova et al. 2015[4] and Sterijovski & Arsovski 2020a[5].

Same is for the reptiles where in the above-mentioned references where for the targeted prjvet area there are 17 taxa are mentioned (*Testudo graeca, Testudo hermanni, Anguis fragilis, Lacerta trilineata, Lacerta viridis, Podarcis erhardi, Podarcis muralis, Coronella austriaca, Dolichophis caspius, Elaphe quatuorlineata, Malpolon insignitus, Telescopus fallax, Natrix natrix, Natrix tessellata, Zamenis longissimus, Zamenis situla* and *Vipera ammodytes*).

LIMITATIONS

For the amphibia and reptiles class there are no limitations in terms of research.

4 | SURVEY RESULTS

SURVEY SITES

Survey was carried out at several locations, summarized in 6 transects, based on the differences in the present habitats, distance to wind turbines, and altitude…

Table 1 Survey sites/points/tranches for flora and habitats.

Site Reference	Location	Additional Details - Habitats
Transect 1	Buchim	Bucim transect is consist of hilly pastures intersected with temporary water flows and small ponds. This is typical habitat opposite of the village Bucim. Due to the low altitude (between 639 and 718 meters of altitude) it is preferred habitat for many reptilian

[4] Uzunova, D., Kitanova, D., Spirovska, M., Hristovski, S. 2015. Integral Report for the Project implementation. Final report of the project "Ecological data gap analysis and ecological sensitivity map development for the Bregalnica river watershed". In: Dekons - Ema (ed.). Skopje.

[5] Sterijovski, B. & Arsovski, D. 2020a. National red list of amphibians. https://redlist.moepp.gov.mk/pregled-na-vidovi/#amphibians

Site Reference	Location	Additional Details - Habitats
		species. However, due to lack of water courses the populations of the amphibian species are low.
Transect 2	Ljuboten – Ciflik	Ljuboten – Ciflik transect is situated on the boundary of two agricultural blocks. Theses boundary belts are often preferred habitat for many reptile species and some of the amphibian species se well. It is on a low altitude between 610 and 633 meters.
Transect 3	Koshevo	Koshevo transect is on the highest altitude of all transects, between 773 and 883 meters. This is hilly pasture habitat with shrubs and low vegetation as a preferred habitat by the reptilian species mainly. Also it is a suitable home for the "terrestrial toads" such as the *Bufo bufo* and *Bufotes viridis* from the amphibian species.
Transect 4	Shashavarlija – Nikoman	Shashavarlija – Nikoman is hilly pasture transect situated in the small valley between two hills. Preferred habitat for the reptile's class but also there are some temporary water bodies that are small safe haven for the amphibian's species for a short period in a springtime. The altitude is between 713 and 820 meters.
Transect 5	Dolani – Lipov dol	This is most various transect in terms of habitat types. It is consisting of riparian belt vegetation with meadows on the side of the Cengica spring. Habitats found here are suitable for the species of both classes. The altitude is between 505 and 601 meters.
Transect 6	Gorachno	Goracino transect is chosen to be referent transect that will have no effect of the installation of wind park in the project area. This transect area is situated within the valley below the Goracino village. Within the transect there are suitable habitats for all species of amphibians and reptiles that can be found within the wider region of and around the project area.

Transect surveys

Line transects (Buckland et al., 1993[6]; Everitt 2002[7]) can be used to determine the richness of biodiversity, the density and size of populations of amphibians and reptiles characterized with low-mobility (McDiarmid et al., 2012[8]). This technique can be easily conducted, on a shorter monitoring period (two active seasons minimum) and with small capacity in terms of

[6] Buckland, S. T., Anderson, D. R., Burnham, K. P. and Laake, J. L. (1993): *Distance Sampling: Estimating Abundance of Biological Populations*. London: Chapman and Hall

[7] Everitt, B. S. (2002): *The Cambridge Dictionary of Statistics*, 2nd Edition.

[8] McDiarmid et al. (2012): Reptile Biodiversity: Standard Methods for Inventory and Monitoring. University of California Press Ltd. London. 424 pp.

human resources. The transect survey technique is used to measure the relative abundance of selected species and known sub-populations. Regular surveys are the basis for assessing the impact of threats to amphibian populations. A transect consists of a person walking from point A to point B along a defined path. A person counts the number of individuals seen and/or heard within approximately 1 m distance from the path. Surveying relies upon detecting amphibians and reptiles with the naked eye or with the aid of binoculars. If identification from the distance is not possible, a simple hand net can be used to catch and identify specimens, and to release them again. The transect length can vary from 50 m up to 1000 meters depending on the geographical relief and habitat types (Dodd 2010[9]). The number of transects also depends on the surface area relief. Transects should be randomly placed within the location but clearly defined so they can be repeated during subsequent surveys. The transects path should be chosen by an expert that is experienced in monitoring. The line transects are predefined and all field research is executed in the same area in all field visits.

Given the large size of the project area and the diversity of habitats, the qualitative and quantitative composition of amphibians and reptiles will need to be assessed in a systematic and uniform manner. This means ensuring equal representation of habitat types within the transects to be established and surveyed at the same time periods and at the same times. Transects will also need to be set up in such a way that they are evenly dispersed throughout the sub-area, so that the data obtained on species composition and abundance of both classes are sufficiently representative of the micro-region surrounding the transect.

Figure 3 Line transect within the project area of Stip - Radovis windmill park

Figure 4 Transect area 1 – Bucim. Source: Bogoljub Sterijovski

[9] Dodd, C., K. (2010): Amphibian ecology and conservation. A handbook of techniques. Oxford University Press. pp.556

Figure 5 Transect area 2/ Ljuboten - Ciflik. Source: Bogoljub Sterijovski

Figure 6 Transect area 3 – Kosevo. Source: Bogoljub Sterijovski

Figure 7 Transect area 4 – Sasavrlija. Source: Bogoljub Sterijovski

Figure 8 Transect area 5/ Dolani – Lipov Dol. Source: Bogoljub Sterijovski

Figure 9 Referent Transect area Goracino. Source: Bogoljub Sterijovski

FIELD SURVEY RESULTS

The survey area of the Shtip-Radovis wind farm project is characterized by various types of habitats located at altitudes between 290 and 750 meters above sea level. In this region, the northern side of the project area is bordered by the slopes of the Plackovica mountain, while the southern side is limited by the Lakavica river valley and the area of the village of Bucm. River valleys, riparian belts, hill pastures, arable land, rocky areas, open degraded oak forests, mixed forests in combination with the low sea level as well as the fact that through the Braglanica river valley and through the Lakavica river a climate with Mediterranean influence prevails[10], creating a favorable environment for a rich composition of amphibians and reptiles. Hence, each research position requires equal attention in order to conduct a detailed analysis of the biodiversity of amphibians and reptiles in the project area.

Figure 10 Pelophylax ridibundus near village Ljuboten Source: Bogoljub Sterijovski

All species recorded in the literature were recorded on the field research within the project area of WF Stip.

Table 2 Class, species name, English name and Macedonian name of the amphibian and reptile's species from field research for the project area of Stip-Radovis windmill park

Class	Species Scientific name	English name	Macedonian name	Field data
Amphibians	*Salamandra salamandra* (Linnaeus 1758)	Fire salamander	Дождовник	X
Amphibians	*Bombina variegata* (Mertens & Muller 1928)	Fire belly toad	Жолт мукач	X
Amphibians	*Hyla arborea* (Linnaeus 1758)	European tree	Гаталинка	X

[10] Lazarevski, A. 1993. Klimata na Makedonija. Mladinska kniga. Skopje

Class	Species Scientific name	English name	Macedonian name	Field data
		frog		
Amphibians	*Bufo bufo* (Mertens & Muller 1928)	Common toad	Обична крастава жаба	X
Amphibians	*Bufotes viridis* (Laurenti 1768)	Green toad	Зелена крастава жаба	X
Amphibians	*Rana dalmatina (Bonaparte 1839)*	Agile frog	Горска жаба	X
Amphibians	*Rana graeca (Bulenger, 1891)*	Stream frog	Поточна жаба	X
Amphibians	*Pelophylax ridibundus* (Pallas 1771)	Marsh frog	Езерска жаба	X
Reptiles	*Testudo graeca* (Linnaeus 1758)	Greek tortoise	Шумска желка	X
Reptiles	*Testudo hermanni* (Gmelin 1788)	Herman's tortoise	Ридска желка	X
Reptiles	*Anguis fragilis* (Linnaeus 1758)	Slowworm	Слепче	X
Reptiles	*Lacerta trilineata* (Bedriaga 1886)	Balkan green lizard	Голем зелен гуштер	X
Reptiles	*Lacerta viridis* (Laurenti 1768)	Green lizard	Зелен гуштер	X
Reptiles	*Podarcis erhardi* (Bedriaga 1882)	Balkan wall lizard	Балканска гуштерица	X
Reptiles	*Podarcis muralis* (Laurenti 1768)	Wall lizard	Ѕидна гуштерица	X
Reptiles	*Coronella austriaca* (Laurenti 1768)	Smooth snake	Планински смок	X
Reptiles	*Dolichophis caspius* (Gmelin 1789)	Caspian whip snake	Жолт смок	X
Reptiles	*Elaphe quatuorlineata* (Lacepede 1789)	Four-lined snake	Ждрепка	X
Reptiles	*Malpolon insignitus* (Hermann 1804)	Eastern Montpellier snake	Длабокочелен смок	X
Reptiles	*Telescopus fallax* (Fleischmann, 1831)	Cat snake	Мачја змија	X
Reptiles	*Natrix natrix* (Linnaeus 1758)	Grass snake	Белоушка	X
Reptiles	*Natrix tessellata* (Laurenti 1768)	Dice snake	Змија рибарка	X
Reptiles	*Zamenis longissimus* (Laurenti 1768)	Aesculapian snake	Шумски смок	X
Reptiles	*Zamenis situla* (Linnaeus 1758)	European rat snake	Леопардов смок	X
Reptiles	*Vipera ammodytes* (Linnaeus 1758)	Nose-horned viper	Поскок	X

Figure 11 Birds flying over a Dolichophis caspius in hunt in Transect area 1. Source: Bogoljub Sterijovski

Figure 12 Natrix tessellata snake in the intersection of Trnka and Chengica spring in Transect area 5 (Dolani – Lipov Dol). Source: Bogoljub Sterijovski

Priority Biodiversity Features (PBF) and Critical Habitats (CH)

Critical Habitat and Priority Biodiversity Feature assessment is a process designed for identification of areas of the highest biodiversity value, considered especially sensitive to impact, and where particular attention must be paid. The CHA process comprises an initial project screening to identify potential CH/PBF trigger habitats or species present within the area affected by the project. Initial screening is conducted in order to establish trigger features, followed by analysis and verification. As a guidance the "EBRD Performance Requirement 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources - Guidance Note" was used.

CRITERIA FOR IDENTIFICATION AMPHIBIANS AND REPTILES PRIORITY BIODIVERSITY FEATURES (PBF) AND CRITICAL HABITATS (CH)

To identify the PBF and CH according to the EBRD Performance Requirement 6 of biodiversity (bartaho and herpetofauna species), different documents like red lists, legal regulations, scientific papers and reports from projects were used with priority for biodiversity assessment (Table 3).

Table 3 Documents used to biodiversity assessment

Documents used to biodiversity assessment		
	European level	***National***
Amphibians	IUCN Global Red List – version 2020-1 IUCN European Red List EU Habitat directive 92/43/EEC Anex II, IV and V	National red list of amphibians and reptiles List of Strictly Protected and Protected Wild Species (MOEPP 2011)
Reptiles	IUCN Global Red List – version 2020-1 IUCN European Red List EU Habitat directive 92/43/EEC Anex II, IV and V	National red list of amphibians and reptiles List of Strictly Protected and Protected Wild Species (MOEPP 2011) Contribution of the knowledge of the Reptile fauna and diversity in FYR of Macedonia – (Sterijovski et al. 2014)

For this purpose, the valorization of amphibians and reptiles was used following the international and national directives and legislatives that concern the conservation status of amphibians and reptiles, given in the table 4.

Table 4 Valorization criteria

Criteria for valorization of biological diversity in the area of wind turbines park "Stip - Radovis"		
	Valorization	**Criteria**
Amphibians	National Red List of Threatened Herpetofauna.	Classified as Vulnerable (VU) and endangered (EN)
	IUCN Global Red List;	Classified as Vulnerable (VU) and endangered (EN)
	IUCN European Red List	Classified as Vulnerable (VU) and endangered (EN)
	EU Habitat directive 92/43/EEC	*Annex II, Annex IV and Annex V;*
	Bern Convention – Conservation of European Wildlife and Natural Habitats;	*Appendix II* and *Appendix III*
	List of Strictly Protected and Protected Wild Species (MOEPP 2011)	List of protected wild species
	Endemism	According to the newest systematics literature
Reptiles	National Red List of Threatened Herpetofauna.	Classified as Vulnerable (VU) and endangered (EN)
	IUCN Global Red List;	Classified as Vulnerable (VU) and endangered (EN)
	IUCN European Red List	Classified as Vulnerable (VU) and endangered (EN)
	EU Habitat directive 92/43/EEC	*Annex II, Annex IV and Annex V;*
	Bern Convention – Conservation of European Wildlife and Natural Habitats	*Appendix II* and *Appendix III*
	CITES Convention - Convention on International Trade in Endangered Species	*Appendix II*

	List of Strictly Protected and Protected Wild Species (MOEPP 2011)	List of protected wild species
	Endemism	According to the newest systematics literature
National Red List of Threatened Amphibians and Reptiles ***http://redlist.moepp.gov.mk***		
IUCN: IUCN Global Red List of Threatened Amphibians - www.iucnredlist.org EN: Endangered; VU: Vulnerable;		
IUCN: IUCN Global Red List of Threatened Reptiles - www.iucnredlist.org EN: Endangered; VU: Vulnerable;		
IUCN: IUCN European Red List of Threatened Amphibians - www.iucnredlist.org EN: Endangered; VU: Vulnerable;		
IUCN: IUCN European Red List of Threatened Reptiles - www.iucnredlist.org EN: Endangered; VU: Vulnerable;		
HABITATS DIRECTIVE: Council Directive (92/43/AEEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora. Annex II: Animal and plant species of Community interest whose conservation requires the designation of special areas of conservation. Annex IV: Animal and plant species of Community interest in need of strict protection. Annex V: Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures		
Convention on the conservation of European wildlife and natural habitats (Bern convention) Appendix II: Strictly protected fauna species *Appendix III: Protected fauna species*		
CITES - Convention on International Trade in Endangered Species *Appendix II*		

So, according to the above-mentioned criteria, the valorisation of the amphibians is given in the Table 5 below.

Table 5 Valorisation of amphibians in the wind park project area

	Amphibians	**National Red Lists**	**IUCN Global (2025-1)**	**IUCN EU (2025-1)**	**Habitat directive (Annex II, IV, V)**	**Bern convention (Appendix II, III)**	**CITES (Appendix II)**	List of Strictly Protected and Protected Wild Species	Endemism
1	Salamandra salamandra	LC	VU	VU	/	III	/	/	/
2	Bombina variegata	LC	LC	LC	II, IV	II	/	Protected	Balkan endemic11
3	Pelophylax ridibundus	LC	LC	LC	V	III	/	/	/
4	Rana dalmatina	NT	LC	LC	IV	II	/	Protected	/
5	Rana graeca	N	LC	LC	IV	III	/	Protected	Balkan endemic[12]

[11] According to Pabijan et al (2013) in the Balkans the subspecies of Bombina variegata scabra subspecies is present (Pabijan M., Wandycz A., Hofman S., Wecek K., Piwczynski M., Szymura J. M. (2017b): "Complete mitochondrial genomes resolve phylogenetic relationships within Bombina (Anura: Bombinatoridae)". Molecular Phylogenetics and Evolution. 69. 6 pp

[12] According to Dubois (1992) the distribution of this species is listed only for the Balkan Peninsula (Dubois, A. (1992). Notes sur la classification des Ranidae (Amphibiens anoures). Bulletin Mensuel de la Société Linnéenne de Lyon 61: 305–352.

		T							
6	Bufo bufo	LC	LC	LC	/	III	/	/	/
7	Bufotes viridis	LC	LC	LC	IV	II	/	Protected	/
8	Hyla arborea	NT	LC	LC	IV	II	/	Protected	/

Same for the reptiles, according to the above-mentioned criteria, the valorisation for this taxonomic group is given in the table 6 below.

Table 6 Valorisation of reptiles in the wind park project area

	Reptiles	**National Red Lists**	**IUCN Global (2025-1)**	**IUCN EU (2025-1)**	**Habitat directive (Annex II, IV, V)**	**Bern convention (Appendix II, III)**	**CITES (Appendix II)**	List of Strictly Protected and Protected Wild Species	Endemism
1	Testudo graeca	VU	VU	NT	II, IV	II	II	Protected	/
2	Testudo hermanni	VU	VU	VU	II, IV	II	II	Protected	/
3	Lacerta trilineata	LC	LC	LC	IV	II	/	Protected	/
4	Lacerta viridis	LC	LC	LC	IV	II	/	Protected	/
5	Podarcis erhardii	LC	LC	LC	IV	II	/	Protected	Balkan endemic[13]
6	Podarcis muralis	LC	LC	LC	IV	II	/	Protected	/
7	Anguis fragilis	LC	LC	/	/	III	/	/	/
8	Dolichophis caspius	LC	LC	LC	IV	II	/	Protected	/
9	Coronella austriaca	LC	LC	LC	IV	II	/	Protected	/
10	Elaphe quatuorlineata	NT	NT	NT	II, IV	II	/	Protected	/
11	Zamenis longissimus	LC	LC	LC	IV	II	/	Protected	/
12	Zamenis situla	NT	LC	LC	II, IV	II	/	Protected	/
13	Malpolon insignitus	NT	LC	LC	/	III	/	/	/
14	Natrix natrix	LC	LC	LC	/	III	/	/	/
15	Natrix tessellata	NT	LC	LC	IV	II	/	Protected	/
16	Telescopus fallax	VU	LC	LC	IV	II	/	Protected	/
17	Vipera ammodytes	LC	LC	LC	IV	II	/	Protected	/

Table 7 Amphibian and reptile species that trigger PBF found within the project area

Species	**Priority features - criteria**			
	(i)	**(ii)**	**(iii)**	**(iv)**
Bombina variegata		HD Annex II		
Testudo graeca		HD Annex II National Red Lists of Threatened		

[13] According to Sindaco & Jeremčenko (2008) in terms of distribution this species is considered a Balkan endemic (Sindaco, R., Jeremcenko, V.K. (2008). The reptiles of the Western Palearctic. Edizioni Belvedere, Latina (Italy), 579 pp.)

Species	Priority features - criteria			
	(i)	(ii)	(iii)	(iv)
		Amphibians assessed as threatened and recognized as vulnerable (VU). IUCN Global red list assessed as threatened and recognized as vulnerable (VU).		
Testudo hermanni		HD Annex II National Red Lists of Threatened Reptiles assessed as threatened and recognized as vulnerable (VU). IUCN Global red list assessed as threatened and recognized as vulnerable (VU).		
Elaphe quatuorlineata		HD Annex II		
Zamenis situla		HD Annex II		

Critical Habitats

Following the EBRD Performance Requirement 6 for the critical habitats the following amphibians and reptile species trigger this criterion.

Table 8 Species that trigger CH found within the project area

Species	Critical Habitats - criteria				
	Criterion (i)	Criterion (ii)	Criterion (iii)	Criterion (iv)	Criterion (v)
Bombina variegata		HD Annex IV			
Rana dalmatina		HD Annex IV			
Rana graeca		HD Annex IV			
Bufotes viridis		HD Annex IV			
Hyla arborea		HD Annex IV			
Testudo graeca		HD Annex IV			
Testudo hermanni		HD Annex IV			
Lacerta trilineata		HD Annex IV			
Lacerta viridis		HD Annex IV			
Podarcis erhardii		HD Annex IV			
Podarcis muralis		HD Annex IV			
Dolichophis caspius		HD Annex IV			
Coronella austriaca		HD Annex IV			
Elaphe quatuorlineata		HD Annex IV			
Zamenis longissimus		HD Annex IV			
Zamenis situla		HD Annex IV			
Natrix tessellata		HD Annex IV			
Telescopus fallax		HD Annex IV			
Vipera ammodytes		HD Annex IV			

INVASIVE SPECIES

No invasive species of amphibians and reptiles have been detected in the project area.

CONCLUSION

Both the literature and the field research indicate that the region of the project area of the Shtip-Radoviš wind farm shows a rich diversity of amphibians and reptiles. A total of 57% of all amphibian species at the national level and 53% of all reptile species have been recorded, which in turn indicates that this region has the potential for the presence of additional species that have not been recorded so far from the two taxonomic classes. First of all, we are talking about the presence of newts from amphibians and the presence of species from the lizard family and the colubrid family.

In addition to the above, we will also mention the fact that through the Bregalnica arm as a left tributary of the Vardar River and further the Lakavica River, the influence of the Mediterranean climate penetrates the region, which penetrates high into the project area through the valleys of Dolani, Ljuboten, Baltalija and Gracino, thus ensuring the presence of preferred habitats for these two classes of animals. Additionally, the relief and altitude also provide favorable conditions for the rich diversity of amphibians and reptiles in the project area.

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ANNEXES

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ANNEX 1 - COMPLETE LIST OF REPTILES SPECIES

No	kingdom	phylum	class	order	family	acceptedName	TaxonID_GBIF	Economy	classicLoc	locCurrentName	verbatimCoordinates	latitude(N)	longitude(E)	accuracy	georeferencedBy	georeferencingComent	GBIF_latitude	GBIF_longitude	GBIF_accuracy
1	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo graeca	Testudo graeca	NMK		Bucim		41,677241	22,323103	GPS	Bogoljub Sterijovski	No	41,677241	22,323103	GPS
2	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,677083	22,323761	GPS	Bogoljub Sterijovski	No	41,677083	22,323761	GPS
4	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim		41,677426	22,324525	GPS	Bogoljub Sterijovski	No	41,677426	22,324525	GPS
5	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Bucim		41,677478	22,325078	GPS	Bogoljub Sterijovski	No	41,677478	22,325078	GPS
7	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,677821	22,326131	GPS	Bogoljub Sterijovski	No	41,677821	22,326131	GPS
8	Animalia	Chordata	Reptilia	Squamata	Colubridae	Dolichophis caspius	Dolichophis caspius	NMK		Bucim		41,678031	22,326315	GPS	Bogoljub Sterijovski	No	41,678031	22,326315	GPS
9	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,678242	22,326842	GPS	Bogoljub Sterijovski	No	41,678242	22,326842	GPS
10	Animalia	Chordata	Reptilia	Squamata	Viperidae	Vipera ammodytes	Vipera ammodytes	NMK		Bucim		41,678321	22,327052	GPS	Bogoljub Sterijovski	No	41,678321	22,327052	GPS
12	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,678321	22,327052	GPS	Bogoljub Sterijovski	No	41,678321	22,327052	GPS
13	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,678372	22,327215	GPS	Bogoljub Sterijovski	No	41,678372	22,327215	GPS
14	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Bucim		41,678372	22,327307	GPS	Bogoljub Sterijovski	No	41,678372	22,327307	GPS
15	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,678382	22,327602	GPS	Bogoljub Sterijovski	No	41,678382	22,327602	GPS
16	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,678392	22,327806	GPS	Bogoljub Sterijovski	No	41,678392	22,327806	GPS
18	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,678443	22,328285	GPS	Bogoljub Sterijovski	No	41,678443	22,328285	GPS
19	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,678565	22,328448	GPS	Bogoljub Sterijovski	No	41,678565	22,328448	GPS
20	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Bucim		41,678616	22,328641	GPS	Bogoljub Sterijovski	No	41,678616	22,328641	GPS
21	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,678657	22,328926	GPS	Bogoljub Sterijovski	No	41,678657	22,328926	GPS
22	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,678718	22,329120	GPS	Bogoljub Sterijovski	No	41,678718	22,329120	GPS
23	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,678718	22,329415	GPS	Bogoljub Sterijovski	No	41,678718	22,329415	GPS
25	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim		41,678718	22,329894	GPS	Bogoljub Sterijovski	No	41,678718	22,329894	GPS
26	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim		41,678738	22,330240	GPS	Bogoljub Sterijovski	No	41,678738	22,330240	GPS
27	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,678820	22,330485	GPS	Bogoljub Sterijovski	No	41,678820	22,330485	GPS
28	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim		41,678952	22,330800	GPS	Bogoljub Sterijovski	No	41,678952	22,330800	GPS

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30	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,679207	22,331860	GPS	Bogoljub Sterijovski	No	41,679207	22,331860	GPS
31	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Bucim		41,679309	22,332114	GPS	Bogoljub Sterijovski	No	41,679309	22,332114	GPS
32	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,679390	22,332369	GPS	Bogoljub Sterijovski	No	41,679390	22,332369	GPS
33	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim		41,679492	22,332491	GPS	Bogoljub Sterijovski	No	41,679492	22,332491	GPS
34	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,679523	22,332715	GPS	Bogoljub Sterijovski	No	41,679523	22,332715	GPS
35	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,679523	22,332980	GPS	Bogoljub Sterijovski	No	41,679523	22,332980	GPS
37	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,679553	22,333194	GPS	Bogoljub Sterijovski	No	41,679553	22,333194	GPS
38	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,679655	22,333652	GPS	Bogoljub Sterijovski	No	41,679655	22,333652	GPS
39	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,679696	22,333876	GPS	Bogoljub Sterijovski	No	41,679696	22,333876	GPS
40	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo graeca	Testudo graeca	NMK		Bucim		41,679726	22,334009	GPS	Bogoljub Sterijovski	No	41,679726	22,334009	GPS
41	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,679737	22,334192	GPS	Bogoljub Sterijovski	No	41,679737	22,334192	GPS
42	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,679757	22,334243	GPS	Bogoljub Sterijovski	No	41,679757	22,334243	GPS
43	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,679686	22,334121	GPS	Bogoljub Sterijovski	No	41,679686	22,334121	GPS
44	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani		41,694752	22,220884	GPS	Bogoljub Sterijovski	No	41,694752	22,220884	GPS
45	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Dolani		41,694801	22,221129	GPS	Bogoljub Sterijovski	No	41,694801	22,221129	GPS
46	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,694752	22,221309	GPS	Bogoljub Sterijovski	No	41,694752	22,221309	GPS
47	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani		41,694736	22,221439	GPS	Bogoljub Sterijovski	No	41,694736	22,221439	GPS
48	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,694752	22,221734	GPS	Bogoljub Sterijovski	No	41,694752	22,221734	GPS
50	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,694981	22,222159	GPS	Bogoljub Sterijovski	No	41,694981	22,222159	GPS
52	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,695684	22,222535	GPS	Bogoljub Sterijovski	No	41,695684	22,222535	GPS
53	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Dolani		41,696272	22,222632	GPS	Bogoljub Sterijovski	No	41,696272	22,222632	GPS
54	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani		41,696644	22,222649	GPS	Bogoljub Sterijovski	No	41,696644	22,222649	GPS
56	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,697303	22,222767	GPS	Bogoljub Sterijovski	No	41,697303	22,222767	GPS
57	Animalia	Chordata	Reptilia	Squamata	Colubridae	Natrix tessellata	Natrix tessellata	NMK		Dolani		41,697709	22,223004	GPS	Bogoljub Sterijovski	No	41,697709	22,223004	GPS
58	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,698249	22,223190	GPS	Bogoljub Sterijovski	No	41,698249	22,223190	GPS
60	Animalia	Chordata	Reptilia	Squamata	Anguidae	Anguis fragilis	Anguis fragilis	NMK		Dolani		41,699043	22,223730	GPS	Bogoljub Sterijovski	No	41,699043	22,223730	GPS
61	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,699905	22,223950	GPS	Bogoljub Sterijovski	No	41,699905	22,223950	GPS
62	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Dolani		41,700412	22,224187	GPS	Bogoljub Sterijovski	No	41,700412	22,224187	GPS
64	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,701460	22,224322	GPS	Bogoljub Sterijovski	No	41,701460	22,224322	GPS
65	Animalia	Chordata	Reptilia	Squamata	Viperidae	Vipera ammodytes	Vipera ammodytes	NMK		Dolani		41,701679	22,224660	GPS	Bogoljub Sterijovski	No	41,701679	22,224660	GPS
66	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,701950	22,224879	GPS	Bogoljub Sterijovski	No	41,701950	22,224879	GPS

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68	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,702406	22,225167	GPS	Bogoljub Sterijovski	No	41,702406	22,225167	GPS
69	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani		41,699618	22,223933	GPS	Bogoljub Sterijovski	No	41,699618	22,223933	GPS
70	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani		41,699510	22,223890	GPS	Bogoljub Sterijovski	No	41,699510	22,223890	GPS
72	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,699460	22,223869	GPS	Bogoljub Sterijovski	No	41,699460	22,223869	GPS
73	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Dolani		41,699442	22,223864	GPS	Bogoljub Sterijovski	No	41,699442	22,223864	GPS
74	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,699437	22,223864	GPS	Bogoljub Sterijovski	No	41,699437	22,223864	GPS
75	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani		41,699414	22,223863	GPS	Bogoljub Sterijovski	No	41,699414	22,223863	GPS
76	Animalia	Chordata	Reptilia	Squamata	Colubridae	Eaphe quatuorlineata	Eaphe quatuorlineata	NMK		Dolani		41,699423	22,223863	GPS	Bogoljub Sterijovski	No	41,699423	22,223863	GPS
78	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani		41,699375	22,223847	GPS	Bogoljub Sterijovski	No	41,699375	22,223847	GPS
79	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani		41,699363	22,223846	GPS	Bogoljub Sterijovski	No	41,699363	22,223846	GPS
81	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,699317	22,223838	GPS	Bogoljub Sterijovski	No	41,699317	22,223838	GPS
82	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani		41,699304	22,223838	GPS	Bogoljub Sterijovski	No	41,699304	22,223838	GPS
83	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Goracino		41,638512	22,263206	GPS	Bogoljub Sterijovski	No	41,638512	22,263206	GPS
84	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Goracino		41,638712	22,263557	GPS	Bogoljub Sterijovski	No	41,638712	22,263557	GPS
85	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino		41,638327	22,264026	GPS	Bogoljub Sterijovski	No	41,638327	22,264026	GPS
87	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino		41,637942	22,265047	GPS	Bogoljub Sterijovski	No	41,637942	22,265047	GPS
89	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino		41,638227	22,266051	GPS	Bogoljub Sterijovski	No	41,638227	22,266051	GPS
90	Animalia	Chordata	Reptilia	Squamata	Colubridae	Natrix natrix	Natrix natrix	NMK		Goracino		41,637876	22,266654	GPS	Bogoljub Sterijovski	No	41,637876	22,266654	GPS
91	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino		41,638160	22,267056	GPS	Bogoljub Sterijovski	No	41,638160	22,267056	GPS
93	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino		41,638260	22,267558	GPS	Bogoljub Sterijovski	No	41,638260	22,267558	GPS
94	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo graeca	Testudo graeca	NMK		Goracino		41,638076	22,268010	GPS	Bogoljub Sterijovski	No	41,638076	22,268010	GPS
96	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Goracino		41,638093	22,268227	GPS	Bogoljub Sterijovski	No	41,638093	22,268227	GPS
98	Animalia	Chordata	Reptilia	Squamata	Colubridae	Coronella austriaca	Coronella austriaca	NMK		Goracino		41,638127	22,268646	GPS	Bogoljub Sterijovski	No	41,638127	22,268646	GPS
99	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Goracino		41,638344	22,269081	GPS	Bogoljub Sterijovski	No	41,638344	22,269081	GPS
101	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Goracino		41,638612	22,269617	GPS	Bogoljub Sterijovski	No	41,638612	22,269617	GPS
103	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Goracino		41,638913	22,270035	GPS	Bogoljub Sterijovski	No	41,638913	22,270035	GPS
105	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino		41,638160	22,268897	GPS	Bogoljub Sterijovski	No	41,638160	22,268897	GPS
106	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Goracino		41,639198	22,270621	GPS	Bogoljub Sterijovski	No	41,639198	22,270621	GPS
107	Animalia	Chordata	Reptilia	Squamata	Colubridae	Zamenis situla	Zamenis situla	NMK		Goracino		41,639215	22,270872	GPS	Bogoljub Sterijovski	No	41,639215	22,270872	GPS
108	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino		41,639516	22,270939	GPS	Bogoljub Sterijovski	No	41,639516	22,270939	GPS
111	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino		41,639432	22,271809	GPS	Bogoljub Sterijovski	No	41,639432	22,271809	GPS

112	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino		41,639683	22,271809	GPS	Bogoljub Sterijovski	No	41,639683	22,271809	GPS
113	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Goracino		41,639616	22,272412	GPS	Bogoljub Sterijovski	No	41,639616	22,272412	GPS
114	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Goracino		41,639700	22,272730	GPS	Bogoljub Sterijovski	No	41,639700	22,272730	GPS
115	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino		41,639784	22,273081	GPS	Bogoljub Sterijovski	No	41,639784	22,273081	GPS
117	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino		41,639934	22,273600	GPS	Bogoljub Sterijovski	No	41,639934	22,273600	GPS
119	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Goracino		41,640202	22,274069	GPS	Bogoljub Sterijovski	No	41,640202	22,274069	GPS
120	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Goracino		41,640118	22,274086	GPS	Bogoljub Sterijovski	No	41,640118	22,274086	GPS
121	Animalia	Chordata	Reptilia	Squamata	Colubridae	Telescopus falax	Telescopus falax	NMK		Goracino		41,640269	22,273885	GPS	Bogoljub Sterijovski	No	41,640269	22,273885	GPS
122	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,703969	22,334144	GPS	Bogoljub Sterijovski	No	41,703969	22,334144	GPS
124	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,704081	22,334666	GPS	Bogoljub Sterijovski	No	41,704081	22,334666	GPS
125	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,704081	22,335100	GPS	Bogoljub Sterijovski	No	41,704081	22,335100	GPS
126	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,704158	22,335267	GPS	Bogoljub Sterijovski	No	41,704158	22,335267	GPS
127	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo graeca	Testudo graeca	NMK		Kosevo		41,704203	22,335600	GPS	Bogoljub Sterijovski	No	41,704203	22,335600	GPS
128	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,704281	22,335812	GPS	Bogoljub Sterijovski	No	41,704281	22,335812	GPS
130	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,704448	22,336735	GPS	Bogoljub Sterijovski	No	41,704448	22,336735	GPS
131	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,704670	22,337190	GPS	Bogoljub Sterijovski	No	41,704670	22,337190	GPS
132	Animalia	Chordata	Reptilia	Squamata	Colubridae	Malpolon insignitus	Malpolon insignitus	NMK		Kosevo		41,704370	22,336457	GPS	Bogoljub Sterijovski	No	41,704370	22,336457	GPS
133	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,705004	22,337758	GPS	Bogoljub Sterijovski	No	41,705004	22,337758	GPS
134	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,705315	22,338169	GPS	Bogoljub Sterijovski	No	41,705315	22,338169	GPS
138	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,705526	22,338536	GPS	Bogoljub Sterijovski	No	41,705526	22,338536	GPS
139	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,705637	22,338603	GPS	Bogoljub Sterijovski	No	41,705637	22,338603	GPS
140	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo graeca	Testudo graeca	NMK		Kosevo		41,705793	22,338592	GPS	Bogoljub Sterijovski	No	41,705793	22,338592	GPS
141	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,705960	22,338680	GPS	Bogoljub Sterijovski	No	41,705960	22,338680	GPS
142	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,706027	22,338792	GPS	Bogoljub Sterijovski	No	41,706027	22,338792	GPS
143	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,706104	22,338936	GPS	Bogoljub Sterijovski	No	41,706104	22,338936	GPS
144	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Kosevo		41,706193	22,339081	GPS	Bogoljub Sterijovski	No	41,706193	22,339081	GPS
145	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Kosevo		41,706327	22,339203	GPS	Bogoljub Sterijovski	No	41,706327	22,339203	GPS
146	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Kosevo		41,706371	22,339381	GPS	Bogoljub Sterijovski	No	41,706371	22,339381	GPS
147	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,706405	22,339359	GPS	Bogoljub Sterijovski	No	41,706405	22,339359	GPS
149	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Kosevo		41,706471	22,339559	GPS	Bogoljub Sterijovski	No	41,706471	22,339559	GPS
150	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Kosevo		41,706505	22,339659	GPS	Bogoljub Sterijovski	No	41,706505	22,339659	GPS

151	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,706571	22,339748	GPS	Bogoljub Sterijovski	No	41,706571	22,339748	GPS
152	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,706605	22,339859	GPS	Bogoljub Sterijovski	No	41,706605	22,339859	GPS
153	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,706616	22,339993	GPS	Bogoljub Sterijovski	No	41,706616	22,339993	GPS
154	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,706649	22,340093	GPS	Bogoljub Sterijovski	No	41,706649	22,340093	GPS
156	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707027	22,340726	GPS	Bogoljub Sterijovski	No	41,707027	22,340726	GPS
157	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707116	22,340871	GPS	Bogoljub Sterijovski	No	41,707116	22,340871	GPS
158	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,707227	22,340982	GPS	Bogoljub Sterijovski	No	41,707227	22,340982	GPS
159	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Kosevo		41,707328	22,341093	GPS	Bogoljub Sterijovski	No	41,707328	22,341093	GPS
160	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707439	22,341193	GPS	Bogoljub Sterijovski	No	41,707439	22,341193	GPS
161	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707583	22,341349	GPS	Bogoljub Sterijovski	No	41,707583	22,341349	GPS
162	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707739	22,341405	GPS	Bogoljub Sterijovski	No	41,707739	22,341405	GPS
163	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo graeca	Testudo graeca	NMK		Kosevo		41,707605	22,341305	GPS	Bogoljub Sterijovski	No	41,707605	22,341305	GPS
164	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707505	22,341227	GPS	Bogoljub Sterijovski	No	41,707505	22,341227	GPS
165	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Kosevo		41,707305	22,341060	GPS	Bogoljub Sterijovski	No	41,707305	22,341060	GPS
166	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Kosevo		41,707817	22,341471	GPS	Bogoljub Sterijovski	No	41,707817	22,341471	GPS
167	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707928	22,341516	GPS	Bogoljub Sterijovski	No	41,707928	22,341516	GPS
169	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,708117	22,341594	GPS	Bogoljub Sterijovski	No	41,708117	22,341594	GPS
170	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,708161	22,341683	GPS	Bogoljub Sterijovski	No	41,708161	22,341683	GPS
171	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,708284	22,341705	GPS	Bogoljub Sterijovski	No	41,708284	22,341705	GPS
175	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,708484	22,341994	GPS	Bogoljub Sterijovski	No	41,708484	22,341994	GPS
176	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,708573	22,342072	GPS	Bogoljub Sterijovski	No	41,708573	22,342072	GPS
177	Animalia	Chordata	Reptilia	Squamata	Colubridae	Dolichophis caspius	Dolichophis caspius	NMK		Kosevo		41,708628	22,342127	GPS	Bogoljub Sterijovski	No	41,708628	22,342127	GPS
178	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,708640	22,342161	GPS	Bogoljub Sterijovski	No	41,708640	22,342161	GPS
179	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,708829	22,342183	GPS	Bogoljub Sterijovski	No	41,708829	22,342183	GPS
180	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Kosevo		41,708729	22,342183	GPS	Bogoljub Sterijovski	No	41,708729	22,342183	GPS
181	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,708940	22,342305	GPS	Bogoljub Sterijovski	No	41,708940	22,342305	GPS
182	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,708995	22,342383	GPS	Bogoljub Sterijovski	No	41,708995	22,342383	GPS
183	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo graeca	Testudo graeca	NMK		Kosevo		41,709040	22,342450	GPS	Bogoljub Sterijovski	No	41,709040	22,342450	GPS
184	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Kosevo		41,709095	22,342517	GPS	Bogoljub Sterijovski	No	41,709095	22,342517	GPS
185	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,709207	22,342572	GPS	Bogoljub Sterijovski	No	41,709207	22,342572	GPS
186	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Kosevo		41,709262	22,342650	GPS	Bogoljub Sterijovski	No	41,709262	22,342650	GPS

187	Animalia	Chordata	Reptilia	Squamata	Colubridae	Coronella austriaca	Coronella austriaca	NMK		Kosevo		41,709307	22,342717	GPS	Bogoljub Sterijovski	No	41,709307	22,342717	GPS
188	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707557	22,341268	GPS	Bogoljub Sterijovski	No	41,707557	22,341268	GPS
189	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo		41,707551	22,341263	GPS	Bogoljub Sterijovski	No	41,707551	22,341263	GPS
190	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707546	22,341260	GPS	Bogoljub Sterijovski	No	41,707546	22,341260	GPS
192	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707531	22,341251	GPS	Bogoljub Sterijovski	No	41,707531	22,341251	GPS
193	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707526	22,341247	GPS	Bogoljub Sterijovski	No	41,707526	22,341247	GPS
194	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707534	22,341253	GPS	Bogoljub Sterijovski	No	41,707534	22,341253	GPS
195	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo		41,707536	22,341254	GPS	Bogoljub Sterijovski	No	41,707536	22,341254	GPS
196	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten		41,679833	22,251960	GPS	Bogoljub Sterijovski	No	41,679833	22,251960	GPS
198	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten		41,679810	22,252742	GPS	Bogoljub Sterijovski	No	41,679810	22,252742	GPS
202	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten		41,679430	22,254889	GPS	Bogoljub Sterijovski	No	41,679430	22,254889	GPS
204	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten		41,679341	22,255493	GPS	Bogoljub Sterijovski	No	41,679341	22,255493	GPS
206	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten		41,679229	22,255918	GPS	Bogoljub Sterijovski	No	41,679229	22,255918	GPS
208	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten		41,679072	22,257461	GPS	Bogoljub Sterijovski	No	41,679072	22,257461	GPS
211	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten		41,678715	22,259205	GPS	Bogoljub Sterijovski	No	41,678715	22,259205	GPS
212	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten		41,678536	22,259697	GPS	Bogoljub Sterijovski	No	41,678536	22,259697	GPS
213	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten		41,678424	22,260458	GPS	Bogoljub Sterijovski	No	41,678424	22,260458	GPS
215	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten		41,677954	22,261352	GPS	Bogoljub Sterijovski	No	41,677954	22,261352	GPS
216	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Ljuboten		41,677820	22,261732	GPS	Bogoljub Sterijovski	No	41,677820	22,261732	GPS
217	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Ljuboten		41,677753	22,262180	GPS	Bogoljub Sterijovski	No	41,677753	22,262180	GPS
218	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten		41,677596	22,262582	GPS	Bogoljub Sterijovski	No	41,677596	22,262582	GPS
219	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,724932	22,299426	GPS	Bogoljub Sterijovski	No	41,724932	22,299426	GPS
220	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo graeca	Testudo graeca	NMK		Sasavarlija		41,724478	22,299286	GPS	Bogoljub Sterijovski	No	41,724478	22,299286	GPS
221	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,724181	22,299129	GPS	Bogoljub Sterijovski	No	41,724181	22,299129	GPS
222	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,723936	22,298971	GPS	Bogoljub Sterijovski	No	41,723936	22,298971	GPS
223	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,723814	22,298867	GPS	Bogoljub Sterijovski	No	41,723814	22,298867	GPS
225	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija		41,723501	22,298738	GPS	Bogoljub Sterijovski	No	41,723501	22,298738	GPS
226	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija		41,723400	22,298630	GPS	Bogoljub Sterijovski	No	41,723400	22,298630	GPS
228	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,723118	22,298462	GPS	Bogoljub Sterijovski	No	41,723118	22,298462	GPS
229	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,722990	22,298449	GPS	Bogoljub Sterijovski	No	41,722990	22,298449	GPS
230	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Sasavarlija		41,722849	22,298395	GPS	Bogoljub Sterijovski	No	41,722849	22,298395	GPS

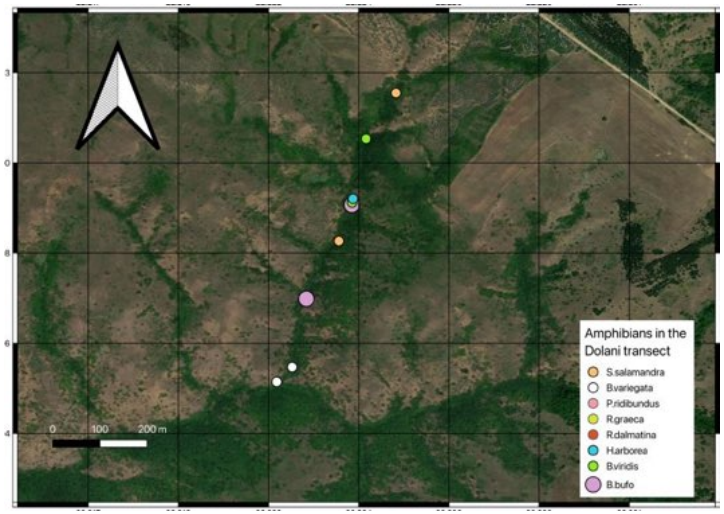
231	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,722762	22,298382	GPS	Bogoljub Sterijovski	No	41,722762	22,298382	GPS
233	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija		41,722426	22,298342	GPS	Bogoljub Sterijovski	No	41,722426	22,298342	GPS
234	Animalia	Chordata	Reptilia	Squamata	Viperidae	Vipera ammodytes	Vipera ammodytes	NMK		Sasavarlija		41,722211	22,298342	GPS	Bogoljub Sterijovski	No	41,722211	22,298342	GPS
235	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,722097	22,298328	GPS	Bogoljub Sterijovski	No	41,722097	22,298328	GPS
236	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Sasavarlija		41,722030	22,298288	GPS	Bogoljub Sterijovski	No	41,722030	22,298288	GPS
237	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija		41,721909	22,298301	GPS	Bogoljub Sterijovski	No	41,721909	22,298301	GPS
238	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,721815	22,298348	GPS	Bogoljub Sterijovski	No	41,721815	22,298348	GPS
239	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija		41,721708	22,298321	GPS	Bogoljub Sterijovski	No	41,721708	22,298321	GPS
240	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija		41,721224	22,298422	GPS	Bogoljub Sterijovski	No	41,721224	22,298422	GPS
241	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo graeca	Testudo graeca	NMK		Sasavarlija		41,720875	22,298503	GPS	Bogoljub Sterijovski	No	41,720875	22,298503	GPS
242	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,720533	22,298462	GPS	Bogoljub Sterijovski	No	41,720533	22,298462	GPS
243	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,720211	22,298603	GPS	Bogoljub Sterijovski	No	41,720211	22,298603	GPS
246	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,719170	22,298744	GPS	Bogoljub Sterijovski	No	41,719170	22,298744	GPS
247	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,718780	22,298785	GPS	Bogoljub Sterijovski	No	41,718780	22,298785	GPS
248	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija		41,718579	22,298845	GPS	Bogoljub Sterijovski	No	41,718579	22,298845	GPS
249	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Sasavarlija		41,717881	22,298939	GPS	Bogoljub Sterijovski	No	41,717881	22,298939	GPS
250	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,717605	22,299020	GPS	Bogoljub Sterijovski	No	41,717605	22,299020	GPS
251	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija		41,717411	22,298979	GPS	Bogoljub Sterijovski	No	41,717411	22,298979	GPS
252	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija		41,717249	22,299060	GPS	Bogoljub Sterijovski	No	41,717249	22,299060	GPS
253	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Sasavarlija		41,717209	22,299141	GPS	Bogoljub Sterijovski	No	41,717209	22,299141	GPS

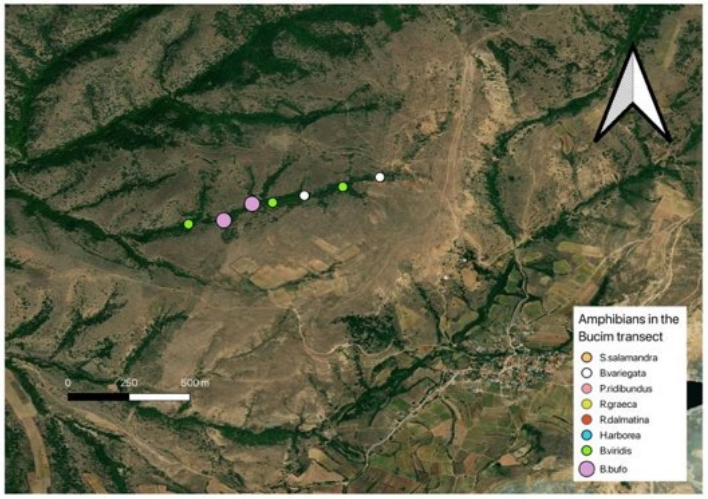
ANNEX 2 - COMPLETE LIST OF AMPHIBIAN SPECIES

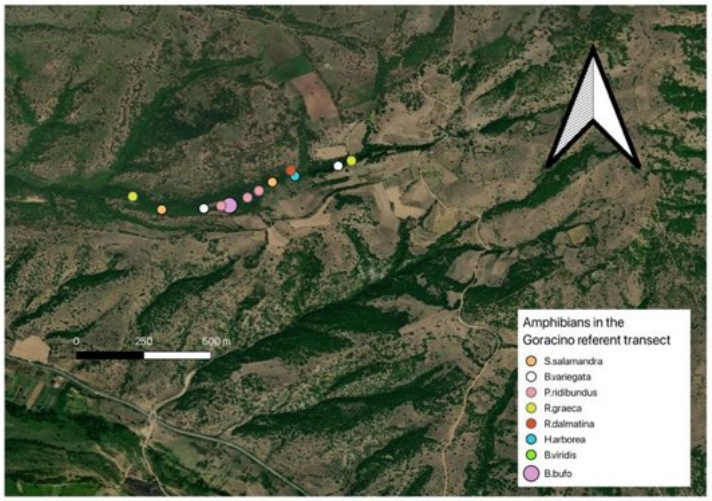
No	kingdom	phylum	class	order	family	acceptedName	TaxonID_GBIF	Economy	classicLoc	locCurrentName	verbatimCoordinates	latitude(N)	longitude(E)	accuracy	georeferencedBy	georeferencingComent	GBIF_latitude	GBIF_longitude	GBIF_accuracy
3	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Bucim		41,677320	22,323919	GPS	Bogoljub Sterijovski	No	41,677320	22,323919	GPS
6	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Bucim		41,677505	22,325657	GPS	Bogoljub Sterijovski	No	41,677505	22,325657	GPS
11	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Bucim		41,678321	22,327052	GPS	Bogoljub Sterijovski	No	41,678321	22,327052	GPS
17	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Bucim		41,678382	22,328061	GPS	Bogoljub Sterijovski	No	41,678382	22,328061	GPS
24	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK		Bucim		41,678728	22,329629	GPS	Bogoljub Sterijovski	No	41,678728	22,329629	GPS
29	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Bucim		41,679156	22,331524	GPS	Bogoljub Sterijovski	No	41,679156	22,331524	GPS
36	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK		Bucim		41,679635	22,333347	GPS	Bogoljub Sterijovski	No	41,679635	22,333347	GPS
49	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK		Dolani		41,694834	22,221930	GPS	Bogoljub Sterijovski	No	41,694834	22,221930	GPS
51	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK		Dolani		41,695210	22,222322	GPS	Bogoljub Sterijovski	No	41,695210	22,222322	GPS
55	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Dolani		41,696948	22,222683	GPS	Bogoljub Sterijovski	No	41,696948	22,222683	GPS
59	Animalia	Chordata	Amphibia	Urodela	Salamandridae	Salamandra salamandra	Salamandra salamandra	NMK		Dolani		41,698418	22,223511	GPS	Bogoljub Sterijovski	No	41,698418	22,223511	GPS
63	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Dolani		41,701020	22,224204	GPS	Bogoljub Sterijovski	No	41,701020	22,224204	GPS
67	Animalia	Chordata	Amphibia	Urodela	Salamandridae	Salamandra salamandra	Salamandra salamandra	NMK		Dolani		41,702186	22,224964	GPS	Bogoljub Sterijovski	No	41,702186	22,224964	GPS
71	Animalia	Chordata	Amphibia	Anura	Hylidae	Hyla arborea	Hyla arborea	NMK		Dolani		41,699494	22,223871	GPS	Bogoljub Sterijovski	No	41,699494	22,223871	GPS
77	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Dolani		41,699400	22,223848	GPS	Bogoljub Sterijovski	No	41,699400	22,223848	GPS
80	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Dolani		41,699339	22,223841	GPS	Bogoljub Sterijovski	No	41,699339	22,223841	GPS
86	Animalia	Chordata	Amphibia	Anura	Ranidae	Rana graeca	Rana graeca	NMK		Goracino		41,638495	22,264160	GPS	Bogoljub Sterijovski	No	41,638495	22,264160	GPS
88	Animalia	Chordata	Amphibia	Urodela	Salamandridae	Salamandra salamandra	Salamandra salamandra	NMK		Goracino		41,637909	22,265449	GPS	Bogoljub Sterijovski	No	41,637909	22,265449	GPS
92	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK		Goracino		41,637959	22,267323	GPS	Bogoljub Sterijovski	No	41,637959	22,267323	GPS
95	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino		41,638076	22,268093	GPS	Bogoljub Sterijovski	No	41,638076	22,268093	GPS
97	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Goracino		41,638093	22,268462	GPS	Bogoljub Sterijovski	No	41,638093	22,268462	GPS
100	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino		41,638445	22,269265	GPS	Bogoljub Sterijovski	No	41,638445	22,269265	GPS
102	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino		41,638746	22,269767	GPS	Bogoljub Sterijovski	No	41,638746	22,269767	GPS
104	Animalia	Chordata	Amphibia	Urodela	Salamandridae	Salamandra salamandra	Salamandra salamandra	NMK		Goracino		41,639131	22,270370	GPS	Bogoljub Sterijovski	No	41,639131	22,270370	GPS
109	Animalia	Chordata	Amphibia	Anura	Ranidae	Rana dalmatina	Rana dalmatina	NMK		Goracino		41,639650	22,271190	GPS	Bogoljub Sterijovski	No	41,639650	22,271190	GPS

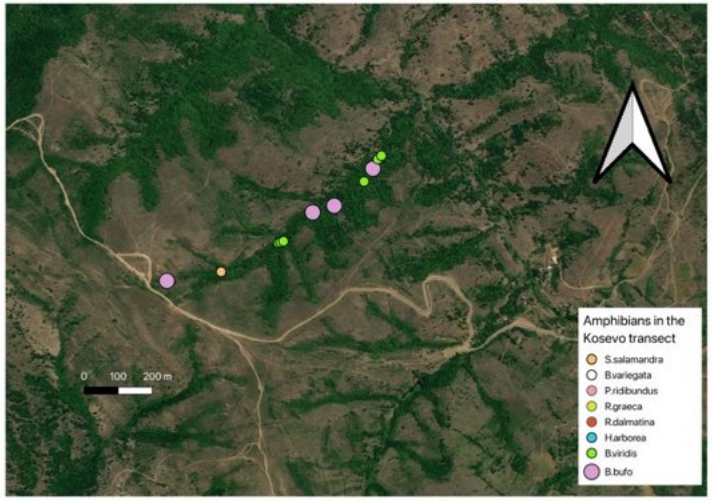
110	Animalia	Chordata	Amphibia	Anura	Hylidae	Hyla arborea	Hyla arborea	NMK		Goracino		41,639399	22,271374	GPS	Bogoljub Sterijovski	No	41,639399	22,271374	GPS
116	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK		Goracino		41,639851	22,273299	GPS	Bogoljub Sterijovski	No	41,639851	22,273299	GPS
118	Animalia	Chordata	Amphibia	Anura	Ranidae	Rana graeca	Rana graeca	NMK		Goracino		41,640085	22,273885	GPS	Bogoljub Sterijovski	No	41,640085	22,273885	GPS
123	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Kosevo		41,704025	22,334299	GPS	Bogoljub Sterijovski	No	41,704025	22,334299	GPS
129	Animalia	Chordata	Amphibia	Urodela	Salamandridae	Salamandra salamandra	Salamandra salamandra	NMK		Kosevo		41,704348	22,336212	GPS	Bogoljub Sterijovski	No	41,704348	22,336212	GPS
135	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Kosevo		41,705370	22,338236	GPS	Bogoljub Sterijovski	No	41,705370	22,338236	GPS
136	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Kosevo		41,705393	22,338314	GPS	Bogoljub Sterijovski	No	41,705393	22,338314	GPS
137	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Kosevo		41,705426	22,338414	GPS	Bogoljub Sterijovski	No	41,705426	22,338414	GPS
148	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Kosevo		41,706449	22,339448	GPS	Bogoljub Sterijovski	No	41,706449	22,339448	GPS
155	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Kosevo		41,706683	22,340204	GPS	Bogoljub Sterijovski	No	41,706683	22,340204	GPS
168	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Kosevo		41,707995	22,341572	GPS	Bogoljub Sterijovski	No	41,707995	22,341572	GPS
172	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Kosevo		41,708362	22,341816	GPS	Bogoljub Sterijovski	No	41,708362	22,341816	GPS
173	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Kosevo		41,708328	22,341749	GPS	Bogoljub Sterijovski	No	41,708328	22,341749	GPS
174	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Kosevo		41,708451	22,341872	GPS	Bogoljub Sterijovski	No	41,708451	22,341872	GPS
191	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Kosevo		41,707539	22,341258	GPS	Bogoljub Sterijovski	No	41,707539	22,341258	GPS
197	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Ljuboten		41,679788	22,252385	GPS	Bogoljub Sterijovski	No	41,679788	22,252385	GPS
199	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Ljuboten		41,679855	22,253123	GPS	Bogoljub Sterijovski	No	41,679855	22,253123	GPS
200	Animalia	Chordata	Amphibia	Urodela	Salamandridae	Salamandra salamandra	Salamandra salamandra	NMK		Ljuboten		41,679743	22,253570	GPS	Bogoljub Sterijovski	No	41,679743	22,253570	GPS
201	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Ljuboten		41,679587	22,254330	GPS	Bogoljub Sterijovski	No	41,679587	22,254330	GPS
203	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK		Ljuboten		41,679453	22,255135	GPS	Bogoljub Sterijovski	No	41,679453	22,255135	GPS
205	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Ljuboten		41,679251	22,256231	GPS	Bogoljub Sterijovski	No	41,679251	22,256231	GPS
207	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Ljuboten		41,679229	22,257841	GPS	Bogoljub Sterijovski	No	41,679229	22,257841	GPS
209	Animalia	Chordata	Amphibia	Urodela	Salamandridae	Salamandra salamandra	Salamandra salamandra	NMK		Ljuboten		41,679184	22,257036	GPS	Bogoljub Sterijovski	No	41,679184	22,257036	GPS
210	Animalia	Chordata	Amphibia	Anura	Ranidae	Rana dalmatina	Rana dalmatina	NMK		Ljuboten		41,679050	22,258490	GPS	Bogoljub Sterijovski	No	41,679050	22,258490	GPS
214	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Ljuboten		41,678155	22,260838	GPS	Bogoljub Sterijovski	No	41,678155	22,260838	GPS
224	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Sasavarlija		41,723648	22,298832	GPS	Bogoljub Sterijovski	No	41,723648	22,298832	GPS
227	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Sasavarlija		41,723239	22,298530	GPS	Bogoljub Sterijovski	No	41,723239	22,298530	GPS
232	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Sasavarlija		41,722661	22,298368	GPS	Bogoljub Sterijovski	No	41,722661	22,298368	GPS
244	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Sasavarlija		41,719781	22,298671	GPS	Bogoljub Sterijovski	No	41,719781	22,298671	GPS
245	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Sasavarlija		41,719539	22,298738	GPS	Bogoljub Sterijovski	No	41,719539	22,298738	GPS
254	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Sasavarlija		41,717021	22,299053	GPS	Bogoljub Sterijovski	No	41,717021	22,299053	GPS

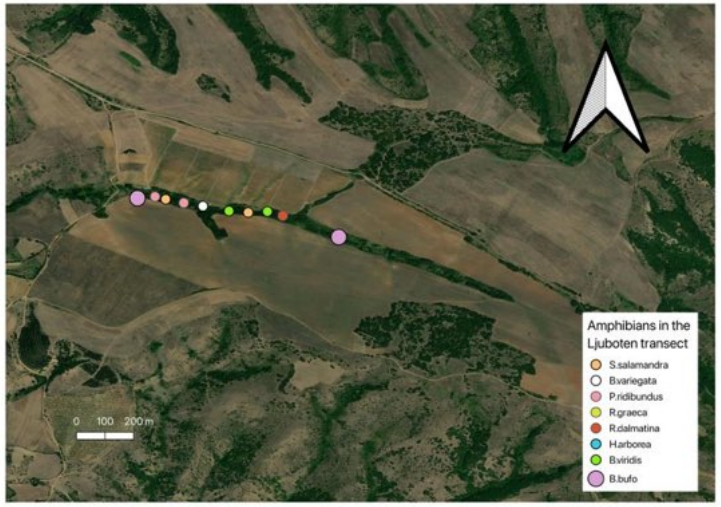
ANNEX 3 – MAPS OF SPECIES AND TRANSECT FOR AMPHIBIANS AND REPTILES IN THE PROJECT AREA

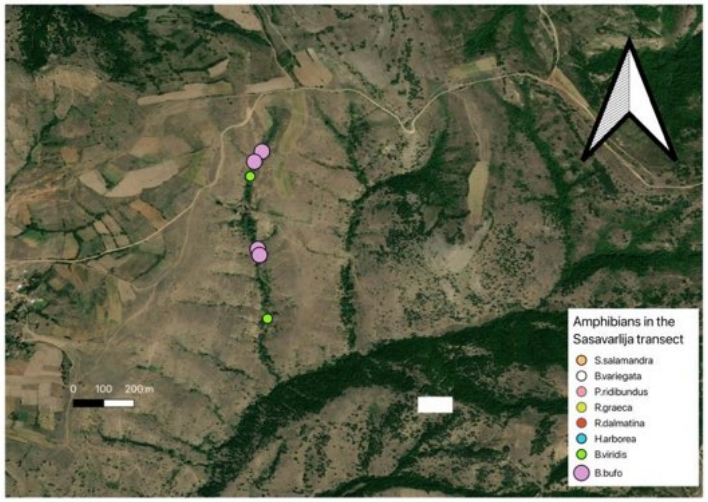




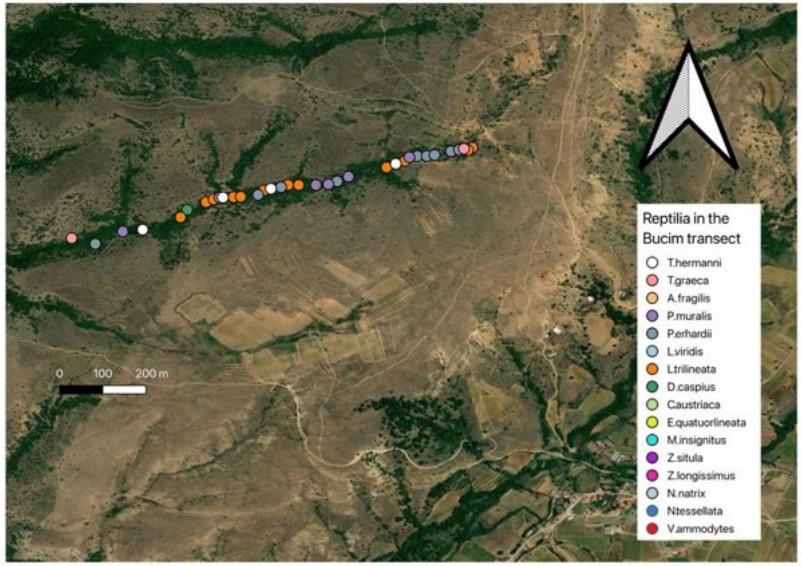


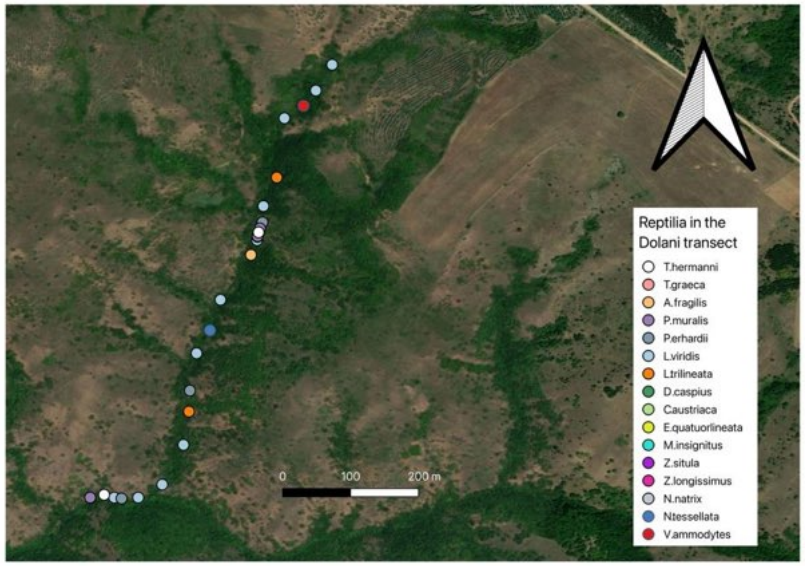


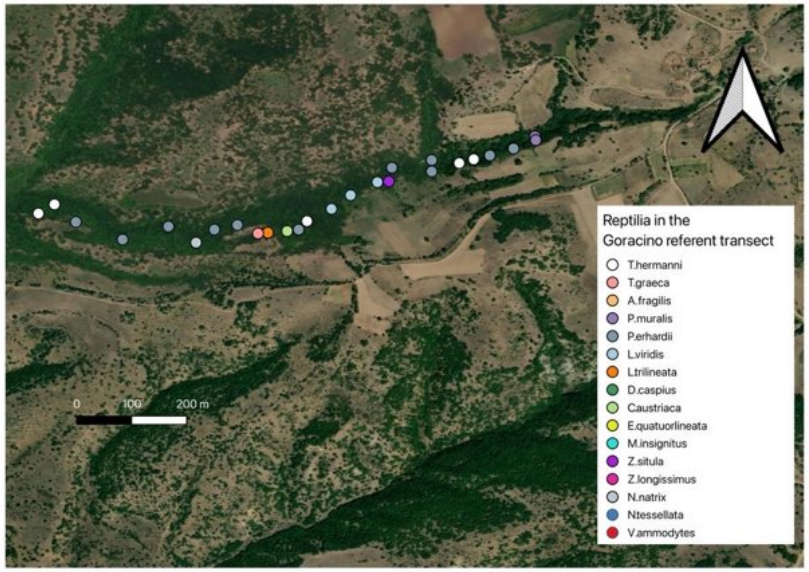

Amphibians in the Ljuboten transect
S.salamandra
B.variegata
P.ridibundus
R.graeca
R.dalmatina
H.arborea
B.viridis
B.bufo
0 100 200 m

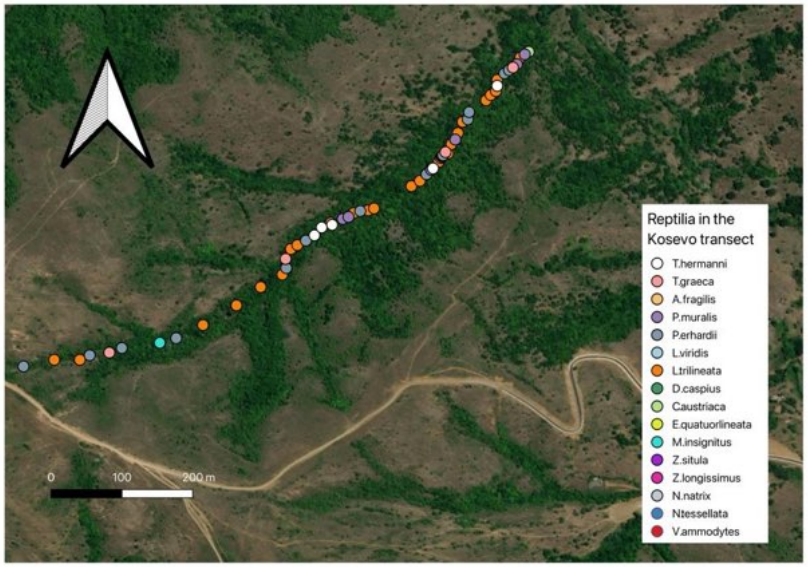

Amphibians in the Sasavarlija transect
S.salamandra
B.variegata
P.ridibundus
R.graeca
R.dalmatina
H.arborea
B.viridis
B.bufo
0 100 200 m

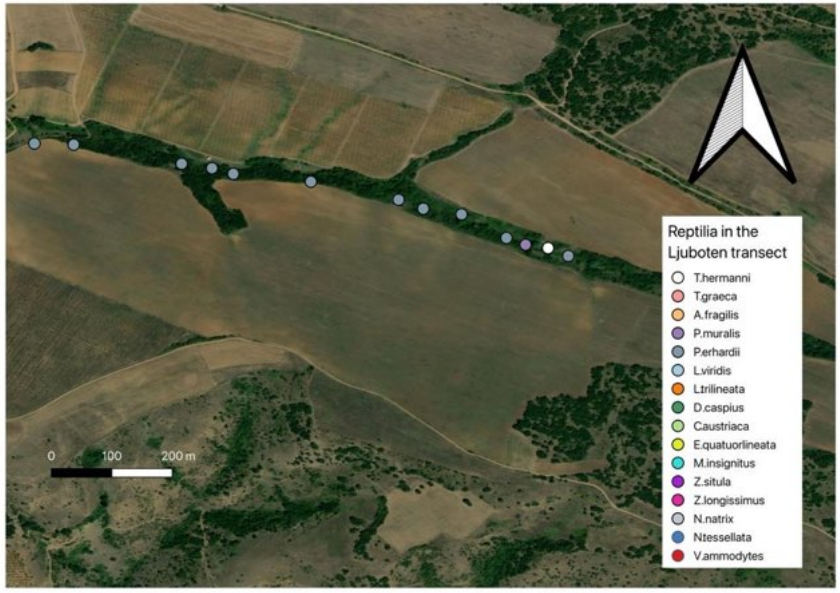
ANNEX 4 MAP OF IDENTIFIED REPTILE IMPORTANT SPECIES

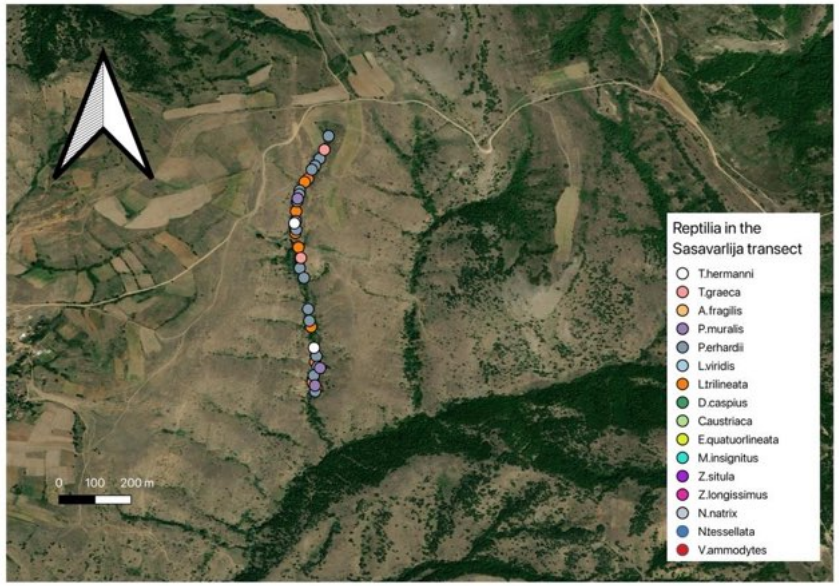









Reptilia in the
Ljuboten transect
T.hermanni
T.graeca
A.fragilis
P.muralis
P.erhardii
L.viridis
L.trilineata
D.caspius
Caustriaca
E.quatuorlineata
M.insignitus
Z.situla
Z.longissimus
N.natrix
Ntessellata
V.ammodytes
0 100 200 m


Reptilia in the
Sasavarlija transect
T.hermanni
T.graeca
A.fragilis
P.muralis
P.erhardii
L.viridis
L.trilineata
D.caspius
Caustriaca
E.quatuorlineata
M.insignitus
Z.situla
Z.longissimus
N.natrix
Ntessellata
V.ammodytes
0 100 200 m

STIP WIND FARM

Biodiversity Baseline Survey

FIELD REPORT

Biodiversity Kingdom/Class: HERPETOFAUNA

Biodiversity Specialist: Bogoljub Sterijovski

Reporting Period: June, 2025

Date:
June 2025

Mott MacDonald Restricted

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Mott MacDonald Restricted

STIP WIND FARM, Biodiversity Baseline Survey

FIELD REPORT, Herpetofauna

1 | INTRODUCTION

BACKGROUND

The construction of Stip Wind Farm has been planned in the region south of the city of Stip, in the area between the villages of Dolani and Bucim. In accordance with the location of individual wind turbines, the area to be covered by the Stip Wind Farm has been divided into three sectors for the purpose of the survey, for easier organization of field activities, and more appropriate processing, analysis and presentation of the obtained data. The current design includes up to 54 wind turbine generators (WTGs), each with a nominal capacity of 6-8 MW, for a total installed capacity of up to 400 MW.

PURPOSE OF THIS REPORT

The purpose of the herpetofauna survey is to identify if any species could be affected, which might be considered 'a priority biodiversity feature' in a national or international context. This report refers on the field surveys that were conducted during June 2025.

SURVEY AREA

The area of the wind farm in Stip will occupy an area of approximately 400 ha. The focus of the plant survey and habitat mapping is about 1,000-m wide corridor on the central line of the proposed WF together with the related infrastructure (overhead lines and transformer station). The cited area is deemed appropriate for a survey, and it is sufficiently large to encompass most impacts on herpetofauna arising during the construction works and operational needs in the projected area.

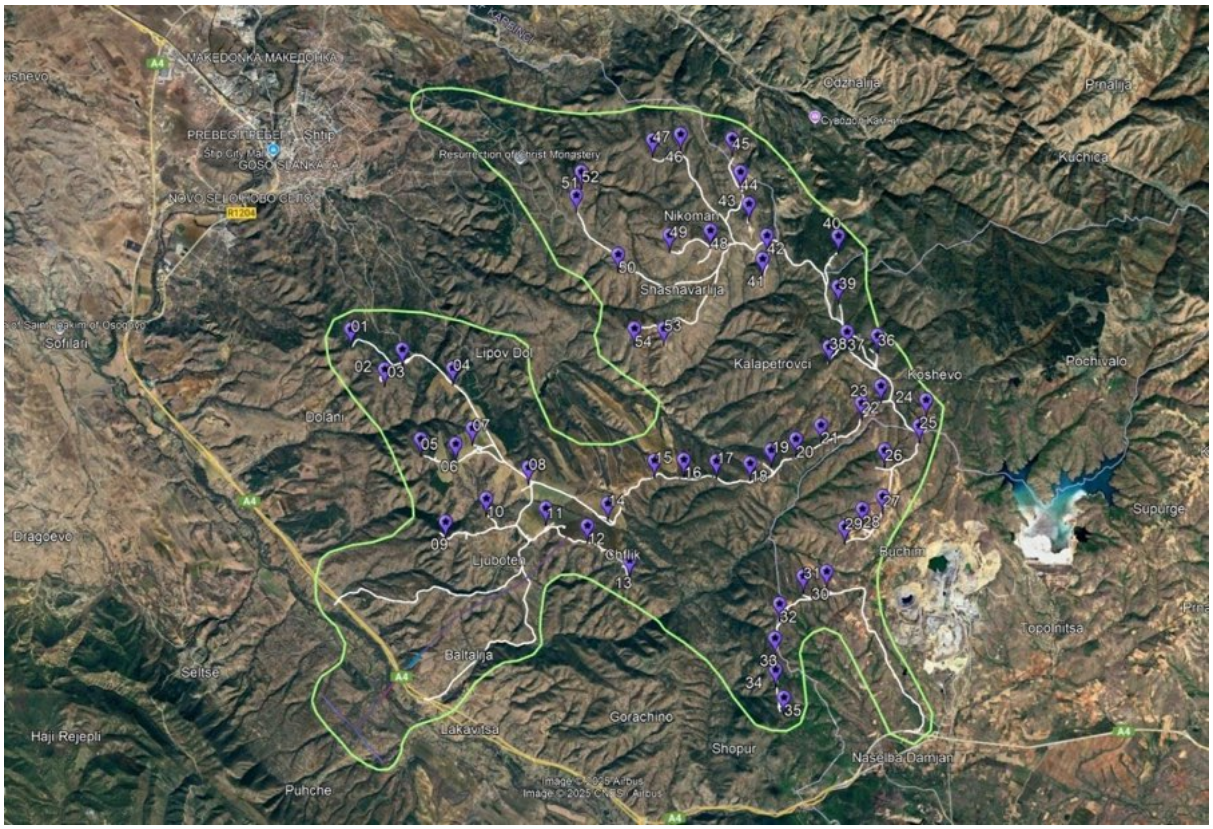

Figure 1 Survey Area

SURVEY PERIOD

This report refers to the following survey period: June 2025.

The field visits were organized to transect locations in the survey area between 12 and 15 June 2025.

SURVEY SPECIALIST

The survey was conducted by Bogoljub Sterijovski.

2 | SCOPE OF WORK

Field survey is foreseen for the months of May, June and September of 2025.

Subject of survey is seasonal research in all habitats and valorisation of herpetofauna.

3 | METHODOLOGY

FIELD SURVEY

The survey methodology remained the same as used in the May session.
The specimens observed in the field were determined according to the field guides of Radovanović (1951)[1] and Arnold & Owenden (2002)[2]. The methodology for determining the specimens of reptiles in their natural habitats was different in terms of the biology and ecology of each species separately in the morning and night hours.
Survey methodologies

"Search-and-seize" method

Determining the presence / distribution of species with the "catch-and-release" method, i.e., "search-and-seize" (Vogt 1982)[3] is likely the most basic and often-used approach. The researcher carefully walks through the natural habitat observing the activity. At a suitable moment the observer tries to catch an individual using gloves, nets or hooks. Following capture, the species can be determined in situ, and all additional data collected according to the monitoring protocol (sex, size, GPS coordinates, etc.). This method is suitable for searching species in their preferable habitats.

Field surveys in June as well as in May, were conducted throughout the survey area to determine the presence / distribution of species with the search and capture method, i.e. "Search-and-seize" (Vogt 1982).

Line transects - in order to determine the average number of individuals in the amphibian and reptile classes, the line transect sampling method is used (Buckland et al., 1993, Everitt 2002). These methods is used to determine biodiversity richness, density, and population size of amphibians and reptiles for a simple reason characteristic of low-mobility animals (McDiarmid et al., 2012).

[1] Radovanović, M. (1951): Vodozemci i gmizavci naše zemlje. Naučna knjiga, Beograd.

[2] Arnold, N., Ovenden, D. (2002): Reptiles and Amphibians of Britain and Europe. Collins, London.

[3] Vogt, R.C. and Hine, R.L. (1982): Evaluation of techniques for assessment of amphibian and reptile populations in Wisconsin. Herpetological communities. Wildlife Res. Report. Fish and wildlife service, U.S. Dept. of Interior. Pp. 201-217

Field research takes place in the most active period of these two classes, from May to September. The scope of the research is to determine the qualitative composition of the diversity of amphibians and reptiles in the researched area. Additionally, by using the proposed methodologies, basic quantitative parameters are acquired to primarily show the frequency of the species of these two classes and their abundance. This approach can determine the state of diversity of amphibians and reptiles in the surveyed area. In addition to all the above, the dynamics of continuous surveying in the active period of these two taxonomic groups (from May to September) is essential in order to cover the reproductive period of amphibians and reptiles where a higher frequency of occurrence is expected and the period in which these animals are preparing for hibernation (September).

Given the large size of the project area and the diversity of habitats, the qualitative and quantitative composition of amphibians and reptiles is assessed in a systematic and uniform manner, ensuring equal representation of habitat types within the transects to be established and surveyed at the same time periods and at the same times. Transects are set up in such a way that they are evenly dispersed throughout the sub-area, so that the data obtained on species composition and abundance of both classes are sufficiently representative of the micro-region surrounding the transect: Bucim transect [1], Ljuboten – Ciflik transect [2], Koshevo transect [3], Shashavarlija – Nikoman trasect [4] and Dolani – Lipov dol transect [5]), and one control transect that has the same habitat types and ecological conditions and traits outside the surveyed area but in near vicinity (Gorachino transect [C]).

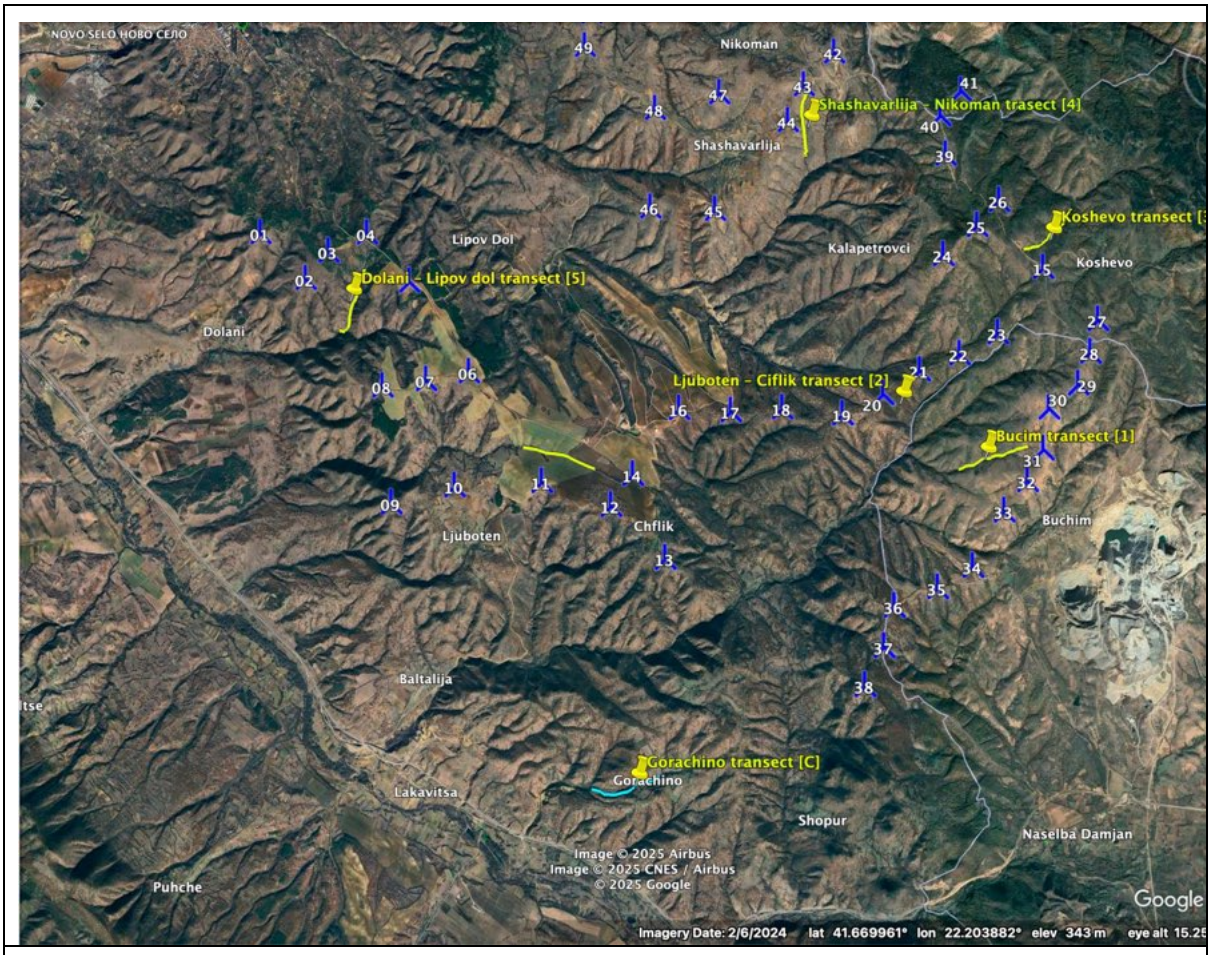

Figure 2 HD Map of draft line transects for amphibians and reptiles (Yellow lines are the draft line transects within the project area - from point 1 to 5, and turquoise line is Gorachino control transect- point C). Source: Bogoljub Sterijovski

The surveys are conducted in the morning hours when the frequencies of occurrence of these two classes of animals are higher. The work on one transect with a time interval is on average about 4-6 hours, depending on the population's density of the amphibians and reptiles as well as the quantity of ecological data that is collected for a particular field research day.

JUNE SESSION OF FIELD SURVEYS FOR AMPHIBIANS AND REPTILES

The composition of species of amphibian and reptile species in the project area remained the same, i.e. no new species were observed in the project area. Thus, 6 species (*Bombina variegata, Bufo bufo, Bufotes viridis, Hyla arborea, Pelophylax ridibundus* and *Rana graeca*) form the amphibinas and 10 of reptiles (*Testudo graeca, Testudo hermanni, Anguis fragilis, Lacerta trilineata, Lacerta viridis, Podarcis erhardi, Podarcis muralis, Dolichophis caspius, Elaphe quatuorlineata* and *Vipera ammodytes*) were recorded in the June field surveys.

LIMITATIONS

For the amphibia and reptiles class there are no limitations in terms of research.

4 | SURVEY RESULTS

SURVEY SITES

In order to make a comparison and summary of the presence of species at the end of the research in the 2025 seasons, from which the abundance of species in the project area will be determined, the same transects that were established in the research in May are used. Survey was carried out at same several locations, summarized in 6 transects, based on the differences in the present habitats, distance to wind turbines, and altitude…

Table 1 Survey sites/points/tranches for flora and habitats.

Site Reference	Location	Additional Details - Habitats
Transect 1	Buchim	Bucim transect is consist of hilly pastures intersected with temporary water flows and small ponds. This is typical habitat opposite of the village Bucim. Due to the low altitude (between 639 and 718 meters of altitude) it is preferred habitat for many reptilian species. However, due to lack of water courses the populations of the amphibian species are low.
Transect 2	Ljuboten – Ciflik	Ljuboten – Ciflik transect is situated on the boundary of two agricultural blocks. Theses boundary belts are often preferred habitat for many reptile species and some of the amphibian species se well. It is on a low altitude between 610 and 633 meters.
Transect 3	Koshevo	Koshevo transect is on the highest altitude of all transects, between 773 and 883 meters. This is hilly pasture habitat with shrubs and low vegetation as a preferred habitat by the reptilian species mainly. Also it is a suitable home for the "terrestrial toads" such as

Site Reference	Location	Additional Details - Habitats
		the *Bufo bufo* and *Bufotes viridis* from the amphibian species.
Transect 4	Shashavarlija – Nikoman	Shashavarlija – Nikoman is hilly pasture transect situated in the small valley between two hills. Preferred habitat for the reptile's class but also there are some temporary water bodies that are small safe haven for the amphibian's species for a short period in a springtime. The altitude is between 713 and 820 meters.
Transect 5	Dolani – Lipov dol	This is most various transect in terms of habitat types. It is consisting of riparian belt vegetation with meadows on the side of the Cengica spring. Habitats found here are suitable for the species of both classes. The altitude is between 505 and 601 meters.
Transect 6	Gorachno	Goracino transect is chosen to be referent transect that will have no effect of the installation of wind park in the project area. This transect area is situated within the valley below the Goracino village. Within the transect there are suitable habitats for all species of amphibians and reptiles that can be found within the wider region of and around the project area.

Transect surveys

Line transects (Buckland et al., 1993[4]; Everitt 2002[5]) can be used to determine the richness of biodiversity, the density and size of populations of amphibians and reptiles characterized with low-mobility (McDiarmid et al., 2012[6]). This technique can be easily conducted, on a shorter monitoring period (two active seasons minimum) and with small capacity in terms of human resources. The transect survey technique is used to measure the relative abundance of selected species and known sub-populations. Regular surveys are the basis for assessing the impact of threats to amphibian populations. A transect consists of a person walking from point A to point B along a defined path. A person counts the number of individuals seen and/or heard within approximately 1 m distance from the path. Surveying relies upon detecting amphibians and reptiles with the naked eye or with the aid of binoculars. If identification from the distance is not possible, a simple hand net can be used to catch and identify specimens, and to release them again. The transect length can vary from 50 m up to 1000 meters depending on the geographical relief and habitat types (Dodd 2010[7]). The number of transects also depends on the surface area relief. Transects should be randomly placed within the location but clearly defined so they can be repeated during subsequent surveys. The transects

[4] Buckland, S. T., Anderson, D. R., Burnham, K. P. and Laake, J. L. (1993): *Distance Sampling: Estimating Abundance of Biological Populations*. London: Chapman and Hall

[5] Everitt, B. S. (2002): *The Cambridge Dictionary of Statistics*, 2nd Edition.

[6] McDiarmid et al. (2012): Reptile Biodiversity: Standard Methods for Inventory and Monitoring. University of California Press Ltd. London. 424 pp.

[7] Dodd, C., K. (2010): Amphibian ecology and conservation. A handbook of techniques. Oxford University Press. pp.556

path should be chosen by an expert that is experienced in monitoring. The line transects are predefined and all field research is executed in the same area in all field visits.

Given the large size of the project area and the diversity of habitats, the qualitative and quantitative composition of amphibians and reptiles will need to be assessed in a systematic and uniform manner. This means ensuring equal representation of habitat types within the transects to be established and surveyed at the same time periods and at the same times. Transects will also need to be set up in such a way that they are evenly dispersed throughout the sub-area, so that the data obtained on species composition and abundance of both classes are sufficiently representative of the micro-region surrounding the transect.

Figures 2-4 Pictures taken from the line transect within the project area of Stip - Radovis windmill park

Figure 3 Temporary pond in the Transect area 1 – Bucim. Source: Bogoljub Sterijovski

Figure 4 Mixed habitats in Kosevo transect area. Source: Bogoljub Sterijovski

Figure 5 Stone piles used as place for summer estivation for reptiles in transect area 4 – Sasavrlija. Source: Bogoljub Sterijovski

FIELD SURVEY RESULTS

The survey area of the Shtip-Radovis wind farm project is characterized by various types of habitats located at altitudes between 290 and 750 meters above sea level. In this region, the northern side of the project area is bordered by the slopes of the Plackovica mountain, while

the southern side is limited by the Lakavica river valley and the area of the village of Bucm. River valleys, riparian belts, hill pastures, arable land, rocky areas, open degraded oak forests, mixed forests in combination with the low sea level as well as the fact that through the Braglanica river valley and through the Lakavica river a climate with Mediterranean influence prevails[8], creating a favorable environment for a rich composition of amphibians and reptiles. Hence, each research position requires equal attention in order to conduct a detailed analysis of the biodiversity of amphibians and reptiles in the project area.

Figure 6 Rana graeca in Dolani transect area Source: Bogoljub Sterijovski

[8] Lazarevski, A. 1993. Klimata na Makedonija. Mladinska kniga. Skopje

All species recorded in the literature were recorded on the field research within the project area of WF Stip.

Table 2 Class, species name, English name and Macedonian name of the amphibian and reptile's species from field research for the project area of Stip-Radovis windmill park

Class	Species Scientific name	English name	Macedonian name	Field data
Amphibians	*Bombina variegata* (Mertens & Muller 1928)	Fire belly toad	Жолт мукач	X
Amphibians	*Hyla arborea* (Linnaeus 1758)	European tree frog	Гаталинка	X
Amphibians	*Bufo bufo* (Mertens & Muller 1928)	Common toad	Обична крастава жаба	X
Amphibians	*Bufotes viridis* (Laurenti 1768)	Green toad	Зелена крастава жаба	X
Amphibians	*Rana graeca (Bulenger, 1891)*	Stream frog	Поточна жаба	X
Amphibians	*Pelophylax ridibundus* (Pallas 1771)	Marsh frog	Езерска жаба	X
Reptiles	*Testudo graeca* (Linnaeus 1758)	Greek tortoise	Шумска желка	X
Reptiles	*Testudo hermanni* (Gmelin 1788)	Herman's tortoise	Ридска желка	X
Reptiles	*Anguis fragilis* (Linnaeus 1758)	Slowworm	Слепче	X
Reptiles	*Lacerta trilineata* (Bedriaga 1886)	Balkan green lizard	Голем зелен гуштер	X
Reptiles	*Lacerta viridis* (Laurenti 1768)	Green lizard	Зелен гуштер	X
Reptiles	*Podarcis erhardi* (Bedriaga 1882)	Balkan wall lizard	Балканска гуштерица	X
Reptiles	*Podarcis muralis* (Laurenti 1768)	Wall lizard	Ѕидна гуштерица	X
Reptiles	*Dolichophis caspius* (Gmelin 1789)	Caspian whip snake	Жолт смок	X
Reptiles	*Elaphe quatuorlineata* (Lacepede 1789)	Four-lined snake	Ждрепка	X
Reptiles	*Vipera ammodytes* (Linnaeus 1758)	Nose-horned viper	Поскок	X

Priority Biodiversity Features (PBF) and Critical Habitats (CH)

Critical Habitat and Priority Biodiversity Feature assessment is a process designed for identification of areas of the highest biodiversity value, considered especially sensitive to impact, and where particular attention must be paid. The CHA process comprises an initial project screening to identify potential CH/PBF trigger habitats or species present within the area affected by the project. Initial screening is conducted in order to establish trigger features, followed by analysis and verification. As a guidance the "EBRD Performance Requirement 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources - Guidance Note" was used.

Criteria for identification amphibians and reptiles Priority Biodiversity Features (PBF) and Critical Habitats (CH)

To identify the PBF and CH according to the EBRD Performance Requirement 6 of biodiversity (bartaho and herpetofauna species), different documents like red lists, legal

regulations, scientific papers and reports from projects were used with priority for biodiversity assessment (Table X).

Table 3 Documents used to biodiversity assessment

Documents used to biodiversity assessment		
	European level	***National***
Amphibians	IUCN Global Red List – version 2020-1 IUCN European Red List EU Habitat directive 92/43/EEC Anex II, IV and V	National red list of amphibians and reptiles List of Strictly Protected and Protected Wild Species (MOEPP 2011)
Reptiles	IUCN Global Red List – version 2020-1 IUCN European Red List EU Habitat directive 92/43/EEC Anex II, IV and V	National red list of amphibians and reptiles List of Strictly Protected and Protected Wild Species (MOEPP 2011) Contribution of the knowledge of the Reptile fauna and diversity in FYR of Macedonia – (Sterijovski et al. 2014)

For this purpose, the valorization of amphibians and reptiles was used following the international and national directives and legislatives that concern the conservation status of amphibians and reptiles, given in the table X.

Criteria for valorization of biological diversity in the area of wind turbines park "Stip - Radovis"		
	Valorization	**Criteria**
Amphibians	National Red List of Threatened Herpetofauna.	Classified as Vulnerable (VU) and endangered (EN)
	IUCN Global Red List;	Classified as Vulnerable (VU) and endangered (EN)
	IUCN European Red List	Classified as Vulnerable (VU) and endangered (EN)
	EU Habitat directive 92/43/EEC	*Annex II, Annex IV and Annex V;*
	Bern Convention – Conservation of European Wildlife and Natural Habitats;	*Appendix II* and *Appendix III*
	List of Strictly Protected and Protected Wild Species (MOEPP 2011)	List of protected wild species
	Endemism	According to the newest systematics literature
Reptiles	National Red List of Threatened Herpetofauna.	Classified as Vulnerable (VU) and endangered (EN)
	IUCN Global Red List;	Classified as Vulnerable (VU) and endangered (EN)
	IUCN European Red List	Classified as Vulnerable (VU) and endangered (EN)
	EU Habitat directive 92/43/EEC	*Annex II, Annex IV and Annex V;*
	Bern Convention – Conservation of European Wildlife and Natural Habitats	*Appendix II* and *Appendix III*
	CITES Convention - Convention on International Trade in Endangered Species	*Appendix II*
	List of Strictly Protected and Protected Wild Species (MOEPP 2011)	List of protected wild species
	Endemism	According to the newest systematics literature
National Red List of Threatened Amphibians and Reptiles http://redlist.moepp.gov.mk		
IUCN: IUCN Global Red List of Threatened Amphibians - www.iucnredlist.org EN: Endangered; VU: Vulnerable;		
IUCN: IUCN Global Red List of Threatened Reptiles - www.iucnredlist.org EN: Endangered; VU: Vulnerable;		
IUCN: IUCN European Red List of Threatened Amphibians - **www.iucnredlist.org** EN: Endangered; VU: Vulnerable;		
IUCN: IUCN European Red List of Threatened Reptiles - www.iucnredlist.org EN: Endangered; VU: Vulnerable;		
HABITATS DIRECTIVE: Council Directive (92/43/AEEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora. **Annex II:** Animal and plant species of Community interest whose conservation requires the designation of special areas of conservation. **Annex IV:** Animal and plant species of Community interest in need of strict protection. Annex V: Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures		
Convention on the conservation of European wildlife and natural habitats (Bern convention) Appendix II: Strictly protected fauna species Appendix III: Protected fauna species		

CITES - Convention on International Trade in Endangered Species Appendix II

So, according to the above-mentioned criteria, the valorisation of the amphibians is given in the table X below.

Table 4 Valorisation of amphibians in the wind park project area

	Amphibians	**National Red Lists**	**IUCN Global (2025-1)**	**IUCN EU (2025-1)**	**Habitat directive (Annex II, IV, V)**	**Bern convention (Appendix II, III)**	**CITES (Appendix II)**	List of Strictly Protected and Protected Wild Species	Endemism
1	*Bombina variegata*	LC	LC	LC	II, IV	II	/	Protected	Balkan endemic9
2	*Pelophylax ridibundus*	LC	LC	LC	V	III	/	/	/
3	*Rana graeca*	NT	LC	LC	IV	III	/	Protected	Balkan endemic[10]
4	*Bufo bufo*	LC	LC	LC	/	III	/	/	/
5	*Bufotes viridis*	LC	LC	LC	IV	II	/	Protected	/
6	*Hyla arborea*	NT	LC	LC	IV	II	/	Protected	/

Same for the reptiles, according to the above-mentioned criteria, the valorisation for this taxonomic group is given in the table X below.

Table 5 Valorisation of reptiles in the wind park project area

	Reptiles	**National Red Lists**	**IUCN Global (2025-1)**	**IUCN EU (2025-1)**	**Habitat directive (Annex II, IV, V)**	**Bern convention (Appendix II, III)**	**CITES (Appendix II)**	List of Strictly Protected and Protected Wild Species	Endemism
1	*Testudo graeca*	VU	VU	NT	II, IV	II	II	Protected	/
2	*Testudo hermanni*	VU	VU	VU	II, IV	II	II	Protected	/
3	*Lacerta trilineata*	LC	LC	LC	IV	II	/	Protected	/
4	*Lacerta viridis*	LC	LC	LC	IV	II	/	Protected	/
5	*Podarcis erhardii*	LC	LC	LC	IV	II	/	Protected	Balkan endemic[11]
6	*Podarcis muralis*	LC	LC	LC	IV	II	/	Protected	/
7	*Anguis fragilis*	LC	LC	/	/	III	/	/	/
8	*Dolichophis caspius*	LC	LC	LC	IV	II	/	Protected	/

[9] According to Pabijan et al (2013) in the Balkans the subspecies of Bombina variegata scabra subspecies is present (Pabijan M., Wandycz A., Hofman S., Wecek K., Piwczynski M., Szymura J. M. (2017b): "Complete mitochondrial genomes resolve phylogenetic relationships within Bombina (Anura: Bombinatoridae)". Molecular Phylogenetics and Evolution. 69. 6 pp

[10] According to Dubois (1992) the distribution of this species is listed only for the Balkan Peninsula (Dubois, A. (1992). Notes sur la classification des Ranidae (Amphibiens anoures). Bulletin Mensuel de la Société Linnéenne de Lyon 61: 305–352.

[11] According to Sindaco & Jeremčenko (2008) in terms of distribution this species is considered a Balkan endemic (Sindaco, R., Jeremcenko, V.K. (2008). The reptiles of the Western Palearctic. Edizioni Belvedere, Latina (Italy), 579 pp.)

9	*Elaphe quatuorlineata*	NT	NT	NT	II, IV	II	/	Protected	/
10	*Vipera ammodytes*	LC	LC	LC	IV	II	/	Protected	/

Table 6 Amphibian and reptile species that trigger PBF found within the project area

Species	Priority features - criteria			
	(i)	(ii)	(iii)	(iv)
Bombina variegata		HD Annex II		
Testudo graeca		HD Annex II National Red Lists of Threatened Amphibians assessed as threatened and recognized as vulnerable (VU). IUCN Global red list assessed as threatened and recognized as vulnerable (VU).		
Testudo hermanni		HD Annex II National Red Lists of Threatened Reptiles assessed as threatened and recognized as vulnerable (VU). IUCN Global red list assessed as threatened and recognized as vulnerable (VU).		
Elaphe quatuorlineata		HD Annex II		

Critical Habitats

Following the EBRD Performance Requirement 6 for the critical habitats the following amphibians and reptile species trigger this criterion.

Table 7 Species that trigger CH found within the project area

Species	Critical Habitats - criteria				
	Criterion (i)	Criterion (ii)	Criterion (iii)	Criterion (iv)	Criterion (v)
Bombina variegata		HD Annex IV			
Rana graeca		HD Annex IV			
Bufotes viridis		HD Annex IV			
Hyla arborea		HD Annex IV			
Testudo graeca		HD Annex IV			
Testudo hermanni		HD Annex IV			
Lacerta trilineata		HD Annex IV			
Lacerta viridis		HD Annex IV			
Podarcis erhardii		HD Annex IV			
Podarcis muralis		HD Annex IV			
Dolichophis caspius		HD Annex IV			
Elaphe quatuorlineata		HD Annex IV			
Vipera ammodytes		HD Annex IV			

Invasive Species

No invasive species of amphibians and reptiles have been detected in the project area.

CONCLUSION

The systematic research of the area from the aspect of amphibians and reptiles continued in June in the same transect areas as in May 2025. It should be noted that unlike the May session, higher temperatures were observed in June, which in turn affected the frequency of species of both classes of animals due to an increased frequency of activity in the morning hours, which after 11 a.m. sharply decreases with the increase of taxa in their daytime hiding places.

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ANNEXES

Mott MacDonald Restricted

ANNEX 1 - COMPLETE LIST OF AMPHIBIAN AND REPTILES SPECIES

No	kingdom	phylum	class	order	family	acceptedName	TaxonID_GBIF	Economy	classicLoc	locCurrentName	verbatimCoordinates	latitude(N)	longitude(E)	accuracy	georeferencedBy	georeferencingComent	GBIF_latitude	GBIF_longitude	GBIF_accuracy	Season
261	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Bucim		41,677044	22,323343	GPS	Bogoljub Sterijovski		41,677044	22,323343	GPS	Jun.25
262	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Bucim		41,677242	22,323838	GPS	Bogoljub Sterijovski		41,677242	22,323838	GPS	Jun.25
263	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Bucim		41,677374	22,324564	GPS	Bogoljub Sterijovski		41,677374	22,324564	GPS	Jun.25
264	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK		Bucim		41,677473	22,324993	GPS	Bogoljub Sterijovski		41,677473	22,324993	GPS	Jun.25
265	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Bucim		41,677506	22,325554	GPS	Bogoljub Sterijovski		41,677506	22,325554	GPS	Jun.25
266	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK		Bucim		41,677935	22,326280	GPS	Bogoljub Sterijovski		41,677935	22,326280	GPS	Jun.25
267	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK		Bucim		41,678232	22,327501	GPS	Bogoljub Sterijovski		41,678232	22,327501	GPS	Jun.25
268	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK		Bucim		41,678595	22,329316	GPS	Bogoljub Sterijovski		41,678595	22,329316	GPS	Jun.25
269	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Bucim		41,679123	22,331295	GPS	Bogoljub Sterijovski		41,679123	22,331295	GPS	Jun.25
270	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK		Bucim		41,679717	22,333671	GPS	Bogoljub Sterijovski		41,679717	22,333671	GPS	Jun.25
271	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim		41,677077	22,323475	GPS	Bogoljub Sterijovski		41,677077	22,323475	GPS	Jun.25
272	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,677143	22,323904	GPS	Bogoljub Sterijovski		41,677143	22,323904	GPS	Jun.25
273	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,677308	22,324201	GPS	Bogoljub Sterijovski		41,677308	22,324201	GPS	Jun.25
274	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim		41,677374	22,324597	GPS	Bogoljub Sterijovski		41,677374	22,324597	GPS	Jun.25
275	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,677407	22,324960	GPS	Bogoljub Sterijovski		41,677407	22,324960	GPS	Jun.25
276	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Bucim		41,677440	22,325422	GPS	Bogoljub Sterijovski		41,677440	22,325422	GPS	Jun.25
277	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim		41,677671	22,325818	GPS	Bogoljub Sterijovski		41,677671	22,325818	GPS	Jun.25
278	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,677803	22,326379	GPS	Bogoljub Sterijovski		41,677803	22,326379	GPS	Jun.25
279	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim		41,678100	22,326775	GPS	Bogoljub Sterijovski		41,678100	22,326775	GPS	Jun.25
280	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim		41,678199	22,327270	GPS	Bogoljub Sterijovski		41,678199	22,327270	GPS	Jun.25
281	Animalia	Chordata	Reptilia	Squamata	Colubridae	Dolichophis caspius	Dolichophis caspius	NMK		Bucim		41,678364	22,327732	GPS	Bogoljub Sterijovski		41,678364	22,327732	GPS	Jun.25
282	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,678529	22,328326	GPS	Bogoljub Sterijovski		41,678529	22,328326	GPS	Jun.25
283	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim		41,678562	22,328854	GPS	Bogoljub Sterijovski		41,678562	22,328854	GPS	Jun.25
284	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim		41,678595	22,329415	GPS	Bogoljub Sterijovski		41,678595	22,329415	GPS	Jun.25
285	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,678661	22,330174	GPS	Bogoljub Sterijovski		41,678661	22,330174	GPS	Jun.25
286	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim		41,678793	22,330536	GPS	Bogoljub Sterijovski		41,678793	22,330536	GPS	Jun.25

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287	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Bucim	41,678925	22,330899	GPS	Bogoljub Sterijovski	41,678925	22,330899	GPS	Jun.25
288	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Bucim	41,679024	22,331196	GPS	Bogoljub Sterijovski	41,679024	22,331196	GPS	Jun.25
289	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Bucim	41,679090	22,331262	GPS	Bogoljub Sterijovski	41,679090	22,331262	GPS	Jun.25
290	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Bucim	41,679123	22,331559	GPS	Bogoljub Sterijovski	41,679123	22,331559	GPS	Jun.25
291	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Bucim	41,679156	22,331724	GPS	Bogoljub Sterijovski	41,679156	22,331724	GPS	Jun.25
292	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Bucim	41,679354	22,332186	GPS	Bogoljub Sterijovski	41,679354	22,332186	GPS	Jun.25
293	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Bucim	41,679453	22,332648	GPS	Bogoljub Sterijovski	41,679453	22,332648	GPS	Jun.25
294	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Bucim	41,679519	22,333011	GPS	Bogoljub Sterijovski	41,679519	22,333011	GPS	Jun.25
295	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Bucim	41,679585	22,333242	GPS	Bogoljub Sterijovski	41,679585	22,333242	GPS	Jun.25
296	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Bucim	41,679651	22,333638	GPS	Bogoljub Sterijovski	41,679651	22,333638	GPS	Jun.25
297	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Bucim	41,679684	22,334100	GPS	Bogoljub Sterijovski	41,679684	22,334100	GPS	Jun.25
298	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK	Dolani	41,694666	22,221025	GPS	Bogoljub Sterijovski	41,694666	22,221025	GPS	Jun.25
299	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Dolani	41,694729	22,221507	GPS	Bogoljub Sterijovski	41,694729	22,221507	GPS	Jun.25
300	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK	Dolani	41,694729	22,221884	GPS	Bogoljub Sterijovski	41,694729	22,221884	GPS	Jun.25
301	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Dolani	41,694876	22,222094	GPS	Bogoljub Sterijovski	41,694876	22,222094	GPS	Jun.25
302	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK	Dolani	41,695148	22,222240	GPS	Bogoljub Sterijovski	41,695148	22,222240	GPS	Jun.25
303	Animalia	Chordata	Amphibia	Anura	Ranidae	Rana graeca	Rana graeca	NMK	Dolani	41,695379	22,222261	GPS	Bogoljub Sterijovski	41,695379	22,222261	GPS	Jun.25
304	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Dolani	41,695903	22,222450	GPS	Bogoljub Sterijovski	41,695903	22,222450	GPS	Jun.25
305	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Dolani	41,696867	22,222638	GPS	Bogoljub Sterijovski	41,696867	22,222638	GPS	Jun.25
306	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK	Dolani	41,697391	22,222785	GPS	Bogoljub Sterijovski	41,697391	22,222785	GPS	Jun.25
307	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Dolani	41,697957	22,223183	GPS	Bogoljub Sterijovski	41,697957	22,223183	GPS	Jun.25
308	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Dolani	41,698565	22,223477	GPS	Bogoljub Sterijovski	41,698565	22,223477	GPS	Jun.25
309	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Dolani	41,698879	22,223582	GPS	Bogoljub Sterijovski	41,698879	22,223582	GPS	Jun.25
310	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Dolani	41,699780	22,223875	GPS	Bogoljub Sterijovski	41,699780	22,223875	GPS	Jun.25
311	Animalia	Chordata	Amphibia	Anura	Hylidae	Hyla arborea	Hyla arborea	NMK	Dolani	41,700116	22,224085	GPS	Bogoljub Sterijovski	41,700116	22,224085	GPS	Jun.25
312	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Dolani	41,700723	22,224189	GPS	Bogoljub Sterijovski	41,700723	22,224189	GPS	Jun.25
313	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK	Dolani	41,701080	22,224336	GPS	Bogoljub Sterijovski	41,701080	22,224336	GPS	Jun.25
314	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Dolani	41,701541	22,224462	GPS	Bogoljub Sterijovski	41,701541	22,224462	GPS	Jun.25
315	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Dolani	41,694666	22,221255	GPS	Bogoljub Sterijovski	41,694666	22,221255	GPS	Jun.25
316	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Dolani	41,694729	22,221842	GPS	Bogoljub Sterijovski	41,694729	22,221842	GPS	Jun.25
317	Animalia	Chordata	Reptilia	Squamata	Viperidae	Vipera ammodytes	Vipera ammodytes	NMK	Dolani	41,695567	22,222450	GPS	Bogoljub Sterijovski	41,695567	22,222450	GPS	Jun.25
318	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Dolani	41,696217	22,222492	GPS	Bogoljub Sterijovski	41,696217	22,222492	GPS	Jun.25
319	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK	Dolani	41,697035	22,222659	GPS	Bogoljub Sterijovski	41,697035	22,222659	GPS	Jun.25
320	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Dolani	41,697684	22,222974	GPS	Bogoljub Sterijovski	41,697684	22,222974	GPS	Jun.25

321	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Dolani	41,698187	22,223267	GPS	Bogoljub Sterijovski	41,698187	22,223267	GPS	Jun.25
322	Animalia	Chordata	Reptilia	Squamata	Anguidae	Anguis fragilis	Anguis fragilis	NMK	Dolani	41,698879	22,223603	GPS	Bogoljub Sterijovski	41,698879	22,223603	GPS	Jun.25
323	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Dolani	41,699424	22,223812	GPS	Bogoljub Sterijovski	41,699424	22,223812	GPS	Jun.25
324	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Dolani	41,699822	22,224043	GPS	Bogoljub Sterijovski	41,699822	22,224043	GPS	Jun.25
325	Animalia	Chordata	Reptilia	Squamata	Colubridae	Dolichophis caspius	Dolichophis caspius	NMK	Dolani	41,700346	22,224085	GPS	Bogoljub Sterijovski	41,700346	22,224085	GPS	Jun.25
326	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Dolani	41,701059	22,224273	GPS	Bogoljub Sterijovski	41,701059	22,224273	GPS	Jun.25
327	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Dolani	41,701583	22,224462	GPS	Bogoljub Sterijovski	41,701583	22,224462	GPS	Jun.25
328	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Dolani	41,701751	22,224755	GPS	Bogoljub Sterijovski	41,701751	22,224755	GPS	Jun.25
329	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK	Dolani	41,702379	22,225070	GPS	Bogoljub Sterijovski	41,702379	22,225070	GPS	Jun.25
330	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Dolani	41,702505	22,225258	GPS	Bogoljub Sterijovski	41,702505	22,225258	GPS	Jun.25
331	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Dolani	41,702526	22,225363	GPS	Bogoljub Sterijovski	41,702526	22,225363	GPS	Jun.25
332	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK	Goracino	41,638638	22,263697	GPS	Bogoljub Sterijovski	41,638638	22,263697	GPS	Jun.25
333	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Goracino	41,638054	22,266088	GPS	Bogoljub Sterijovski	41,638054	22,266088	GPS	Jun.25
334	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Goracino	41,638248	22,268062	GPS	Bogoljub Sterijovski	41,638248	22,268062	GPS	Jun.25
335	Animalia	Chordata	Amphibia	Anura	Ranidae	Rana graeca	Rana graeca	NMK	Goracino	41,638499	22,268757	GPS	Bogoljub Sterijovski	41,638499	22,268757	GPS	Jun.25
336	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK	Goracino	41,639166	22,270063	GPS	Bogoljub Sterijovski	41,639166	22,270063	GPS	Jun.25
337	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK	Goracino	41,639611	22,271870	GPS	Bogoljub Sterijovski	41,639611	22,271870	GPS	Jun.25
338	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Goracino	41,638665	22,263419	GPS	Bogoljub Sterijovski	41,638665	22,263419	GPS	Jun.25
339	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Goracino	41,638554	22,264087	GPS	Bogoljub Sterijovski	41,638554	22,264087	GPS	Jun.25
340	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Goracino	41,638276	22,264615	GPS	Bogoljub Sterijovski	41,638276	22,264615	GPS	Jun.25
341	Animalia	Chordata	Reptilia	Squamata	Colubridae	Elaphe quatuorlineata	Elaphe quatuorlineata	NMK	Goracino	41,638054	22,264976	GPS	Bogoljub Sterijovski	41,638054	22,264976	GPS	Jun.25
342	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Goracino	41,637998	22,265532	GPS	Bogoljub Sterijovski	41,637998	22,265532	GPS	Jun.25
343	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Goracino	41,638026	22,265838	GPS	Bogoljub Sterijovski	41,638026	22,265838	GPS	Jun.25
344	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Goracino	41,637998	22,266283	GPS	Bogoljub Sterijovski	41,637998	22,266283	GPS	Jun.25
345	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Goracino	41,638026	22,266588	GPS	Bogoljub Sterijovski	41,638026	22,266588	GPS	Jun.25
346	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Goracino	41,63797	22,267033	GPS	Bogoljub Sterijovski	41,63797	22,267033	GPS	Jun.25
347	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Goracino	41,637998	22,267478	GPS	Bogoljub Sterijovski	41,637998	22,267478	GPS	Jun.25
348	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Goracino	41,638137	22,267784	GPS	Bogoljub Sterijovski	41,638137	22,267784	GPS	Jun.25
349	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Goracino	41,638248	22,267923	GPS	Bogoljub Sterijovski	41,638248	22,267923	GPS	Jun.25
350	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Goracino	41,638304	22,268395	GPS	Bogoljub Sterijovski	41,638304	22,268395	GPS	Jun.25
351	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Goracino	41,638387	22,268784	GPS	Bogoljub Sterijovski	41,638387	22,268784	GPS	Jun.25
352	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Goracino	41,638471	22,269146	GPS	Bogoljub Sterijovski	41,638471	22,269146	GPS	Jun.25
353	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo graeca	Testudo graeca	NMK	Goracino	41,638415	22,269452	GPS	Bogoljub Sterijovski	41,638415	22,269452	GPS	Jun.25
354	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Goracino	41,638582	22,269591	GPS	Bogoljub Sterijovski	41,638582	22,269591	GPS	Jun.25

355	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Goracino	41,638916	22,270008	GPS	Bogoljub Sterijovski	41,638916	22,270008	GPS	Jun.25
356	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Goracino	41,639055	22,270341	GPS	Bogoljub Sterijovski	41,639055	22,270341	GPS	Jun.25
357	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Goracino	41,639277	22,270703	GPS	Bogoljub Sterijovski	41,639277	22,270703	GPS	Jun.25
358	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Goracino	41,639277	22,271064	GPS	Bogoljub Sterijovski	41,639277	22,271064	GPS	Jun.25
359	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Goracino	41,639416	22,271397	GPS	Bogoljub Sterijovski	41,639416	22,271397	GPS	Jun.25
360	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Goracino	41,639527	22,271787	GPS	Bogoljub Sterijovski	41,639527	22,271787	GPS	Jun.25
361	Animalia	Chordata	Reptilia	Squamata	Viperidae	Vipera ammodytes	Vipera ammodytes	NMK	Goracino	41,639555	22,272231	GPS	Bogoljub Sterijovski	41,639555	22,272231	GPS	Jun.25
362	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Goracino	41,639638	22,272537	GPS	Bogoljub Sterijovski	41,639638	22,272537	GPS	Jun.25
363	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Goracino	41,639777	22,272843	GPS	Bogoljub Sterijovski	41,639777	22,272843	GPS	Jun.25
364	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK	Goracino	41,639805	22,273121	GPS	Bogoljub Sterijovski	41,639805	22,273121	GPS	Jun.25
365	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Goracino	41,639916	22,273538	GPS	Bogoljub Sterijovski	41,639916	22,273538	GPS	Jun.25
366	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Goracino	41,639972	22,27376	GPS	Bogoljub Sterijovski	41,639972	22,27376	GPS	Jun.25
367	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Goracino	41,640055	22,274038	GPS	Bogoljub Sterijovski	41,640055	22,274038	GPS	Jun.25
368	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Goracino	41,640222	22,274122	GPS	Bogoljub Sterijovski	41,640222	22,274122	GPS	Jun.25
369	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK	Kosevo	41,70408	22,334481	GPS	Bogoljub Sterijovski	41,70408	22,334481	GPS	Jun.25
370	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK	Kosevo	41,704291	22,336001	GPS	Bogoljub Sterijovski	41,704291	22,336001	GPS	Jun.25
371	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK	Kosevo	41,705557	22,338449	GPS	Bogoljub Sterijovski	41,705557	22,338449	GPS	Jun.25
372	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK	Kosevo	41,706866	22,340391	GPS	Bogoljub Sterijovski	41,706866	22,340391	GPS	Jun.25
373	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK	Kosevo	41,708639	22,342248	GPS	Bogoljub Sterijovski	41,708639	22,342248	GPS	Jun.25
374	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK	Kosevo	41,708976	22,342375	GPS	Bogoljub Sterijovski	41,708976	22,342375	GPS	Jun.25
375	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Kosevo	41,703953	22,334102	GPS	Bogoljub Sterijovski	41,703953	22,334102	GPS	Jun.25
376	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Kosevo	41,704038	22,33503	GPS	Bogoljub Sterijovski	41,704038	22,33503	GPS	Jun.25
377	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Kosevo	41,704122	22,335537	GPS	Bogoljub Sterijovski	41,704122	22,335537	GPS	Jun.25
378	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK	Kosevo	41,704164	22,336508	GPS	Bogoljub Sterijovski	41,704164	22,336508	GPS	Jun.25
379	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Kosevo	41,704418	22,336845	GPS	Bogoljub Sterijovski	41,704418	22,336845	GPS	Jun.25
380	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Kosevo	41,704798	22,337647	GPS	Bogoljub Sterijovski	41,704798	22,337647	GPS	Jun.25
381	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK	Kosevo	41,705093	22,338112	GPS	Bogoljub Sterijovski	41,705093	22,338112	GPS	Jun.25
382	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Kosevo	41,705684	22,33866	GPS	Bogoljub Sterijovski	41,705684	22,33866	GPS	Jun.25
383	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Kosevo	41,706233	22,339125	GPS	Bogoljub Sterijovski	41,706233	22,339125	GPS	Jun.25
384	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK	Kosevo	41,70657	22,339969	GPS	Bogoljub Sterijovski	41,70657	22,339969	GPS	Jun.25
385	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Kosevo	41,706781	22,340602	GPS	Bogoljub Sterijovski	41,706781	22,340602	GPS	Jun.25
386	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Kosevo	41,707161	22,340898	GPS	Bogoljub Sterijovski	41,707161	22,340898	GPS	Jun.25
387	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Kosevo	41,707668	22,341404	GPS	Bogoljub Sterijovski	41,707668	22,341404	GPS	Jun.25
388	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Kosevo	41,70809	22,341657	GPS	Bogoljub Sterijovski	41,70809	22,341657	GPS	Jun.25

389	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Kosevo	41,708428	22,341869	GPS	Bogoljub Sterijovski	41,708428	22,341869	GPS	Jun.25
390	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Kosevo	41,708681	22,342248	GPS	Bogoljub Sterijovski	41,708681	22,342248	GPS	Jun.25
391	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Kosevo	41,709399	22,342839	GPS	Bogoljub Sterijovski	41,709399	22,342839	GPS	Jun.25
392	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK	Ljuboten	41,679963	22,252467	GPS	Bogoljub Sterijovski	41,679963	22,252467	GPS	Jun.25
393	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufo bufo	Bufo bufo	NMK	Ljuboten	41,679442	22,254859	GPS	Bogoljub Sterijovski	41,679442	22,254859	GPS	Jun.25
394	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK	Ljuboten	41,67911	22,25718	GPS	Bogoljub Sterijovski	41,67911	22,25718	GPS	Jun.25
395	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK	Ljuboten	41,678684	22,259879	GPS	Bogoljub Sterijovski	41,678684	22,259879	GPS	Jun.25
396	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK	Ljuboten	41,677784	22,261798	GPS	Bogoljub Sterijovski	41,677784	22,261798	GPS	Jun.25
397	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Ljuboten	41,679987	22,252159	GPS	Bogoljub Sterijovski	41,679987	22,252159	GPS	Jun.25
398	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Ljuboten	41,679821	22,252940	GPS	Bogoljub Sterijovski	41,679821	22,252940	GPS	Jun.25
399	Animalia	Chordata	Reptilia	Squamata	Colubridae	Dolichophis caspius	Dolichophis caspius	NMK	Ljuboten	41,679916	22,253461	GPS	Bogoljub Sterijovski	41,679916	22,253461	GPS	Jun.25
400	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Ljuboten	41,679513	22,254243	GPS	Bogoljub Sterijovski	41,679513	22,254243	GPS	Jun.25
401	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Ljuboten	41,679537	22,254953	GPS	Bogoljub Sterijovski	41,679537	22,254953	GPS	Jun.25
402	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Ljuboten	41,679371	22,255451	GPS	Bogoljub Sterijovski	41,679371	22,255451	GPS	Jun.25
403	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Ljuboten	41,679323	22,256185	GPS	Bogoljub Sterijovski	41,679323	22,256185	GPS	Jun.25
404	Animalia	Chordata	Reptilia	Squamata	Viperidae	Vipera ammodytes	Vipera ammodytes	NMK	Ljuboten	41,679134	22,257535	GPS	Bogoljub Sterijovski	41,679134	22,257535	GPS	Jun.25
405	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Ljuboten	41,678874	22,258956	GPS	Bogoljub Sterijovski	41,678874	22,258956	GPS	Jun.25
406	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Ljuboten	41,678258	22,260590	GPS	Bogoljub Sterijovski	41,678258	22,260590	GPS	Jun.25
407	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Ljuboten	41,677595	22,262390	GPS	Bogoljub Sterijovski	41,677595	22,262390	GPS	Jun.25
408	Animalia	Chordata	Amphibia	Anura	Bombinatoridae	Bombina variegata	Bombina variegata	NMK	Sasavarlija	41,716497	22,298890	GPS	Bogoljub Sterijovski	41,716497	22,298890	GPS	Jun.25
409	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK	Sasavarlija	41,718093	22,298890	GPS	Bogoljub Sterijovski	41,718093	22,298890	GPS	Jun.25
410	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Sasavarlija	41,716050	22,298794	GPS	Bogoljub Sterijovski	41,716050	22,298794	GPS	Jun.25
411	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Sasavarlija	41,716752	22,299050	GPS	Bogoljub Sterijovski	41,716752	22,299050	GPS	Jun.25
412	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Sasavarlija	41,717263	22,298922	GPS	Bogoljub Sterijovski	41,717263	22,298922	GPS	Jun.25
413	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Sasavarlija	41,717805	22,298858	GPS	Bogoljub Sterijovski	41,717805	22,298858	GPS	Jun.25
414	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Sasavarlija	41,718284	22,298922	GPS	Bogoljub Sterijovski	41,718284	22,298922	GPS	Jun.25
415	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Sasavarlija	41,718986	22,298635	GPS	Bogoljub Sterijovski	41,718986	22,298635	GPS	Jun.25
416	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Sasavarlija	41,719944	22,298603	GPS	Bogoljub Sterijovski	41,719944	22,298603	GPS	Jun.25
417	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Sasavarlija	41,720454	22,298284	GPS	Bogoljub Sterijovski	41,720454	22,298284	GPS	Jun.25
418	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK	Sasavarlija	41,721029	22,298220	GPS	Bogoljub Sterijovski	41,721029	22,298220	GPS	Jun.25
419	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Sasavarlija	41,721507	22,298188	GPS	Bogoljub Sterijovski	41,721507	22,298188	GPS	Jun.25
420	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK	Sasavarlija	41,722082	22,298220	GPS	Bogoljub Sterijovski	41,722082	22,298220	GPS	Jun.25
421	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Sasavarlija	41,722560	22,298316	GPS	Bogoljub Sterijovski	41,722560	22,298316	GPS	Jun.25
422	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK	Sasavarlija	41,722656	22,298411	GPS	Bogoljub Sterijovski	41,722656	22,298411	GPS	Jun.25

423	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Sasavarlija	41,722688	22,298411	GPS	Bogoljub Sterijovski	41,722688	22,298411	GPS	Jun.25
424	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Sasavarlija	41,722784	22,298475	GPS	Bogoljub Sterijovski	41,722784	22,298475	GPS	Jun.25
425	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Sasavarlija	41,722911	22,298571	GPS	Bogoljub Sterijovski	41,722911	22,298571	GPS	Jun.25
426	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Sasavarlija	41,723135	22,298635	GPS	Bogoljub Sterijovski	41,723135	22,298635	GPS	Jun.25
427	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Sasavarlija	41,723263	22,298762	GPS	Bogoljub Sterijovski	41,723263	22,298762	GPS	Jun.25
428	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Sasavarlija	41,723646	22,298762	GPS	Bogoljub Sterijovski	41,723646	22,298762	GPS	Jun.25
429	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Sasavarlija	41,723773	22,298890	GPS	Bogoljub Sterijovski	41,723773	22,298890	GPS	Jun.25
430	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK	Sasavarlija	41,724028	22,299018	GPS	Bogoljub Sterijovski	41,724028	22,299018	GPS	Jun.25
431	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Sasavarlija	41,724156	22,299145	GPS	Bogoljub Sterijovski	41,724156	22,299145	GPS	Jun.25
432	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK	Sasavarlija	41,724380	22,299241	GPS	Bogoljub Sterijovski	41,724380	22,299241	GPS	Jun.25
433	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK	Sasavarlija	41,724635	22,299369	GPS	Bogoljub Sterijovski	41,724635	22,299369	GPS	Jun.25
434	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK	Sasavarlija	41,724890	22,299369	GPS	Bogoljub Sterijovski	41,724890	22,299369	GPS	Jun.25

Mott MacDonald Restricted

STIP WIND FARM

Biodiversity Baseline Survey

FIELD REPORT

Biodiversity Kingdom/Class: HERPETOFAUNA

Biodiversity Specialist: Bogoljub Sterijovski

Reporting Period: September 2025

Date:
September 2025

Mott MacDonald Restricted

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STIP WIND FARM, Biodiversity Baseline Survey
FIELD REPORT, Herpetofauna

1 | INTRODUCTION

BACKGROUND

The construction of Stip Wind Farm has been planned in the region south of the city of Stip, in the area between the villages of Dolani and Bucim. In accordance with the location of individual wind turbines, the area to be covered by the Stip Wind Farm has been divided into three sectors for the purpose of the survey, for easier organization of field activities, and more appropriate processing, analysis and presentation of the obtained data. The current design includes up to 54 wind turbine generators (WTGs), each with a nominal capacity of 6-8 MW, for a total installed capacity of up to 400 MW.

PURPOSE OF THIS REPORT

The purpose of the herpetofauna survey is to identify if any species could be affected, which might be considered 'a priority biodiversity feature' in a national or international context and also to meet the EBRD Performance Requirement 6. This report refers on the field surveys that were conducted during September 2025.

SURVEY AREA

The area of the wind farm in Stip will occupy an area of approximately 400 ha. The focus of the survey and habitats mapping is on six line transects (1,000-m wide corridor on the central line of the proposed WF together with the location of the wind mill turbine locations. The cited areas is deemed appropriate for a survey, and it is sufficiently large to encompass most impacts on herpetofauna preferable habitas arising during the construction works and operational needs in the projected area.

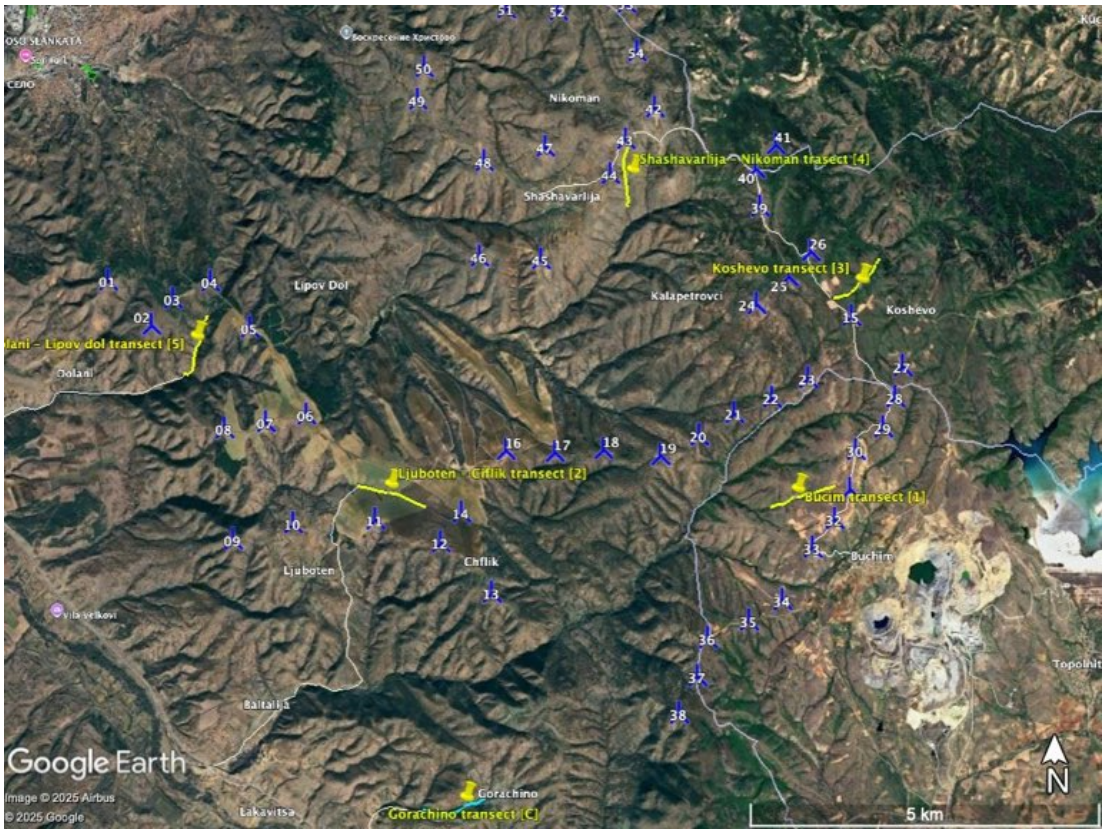

Figure 1 Project Survey Area (yellow lines are six 1km line transects) and the locations of the windmill turbines showed with number figures

The areas with the transect sites lare considered suitable for investigation and are large enough to cover most impacts on preferred herpetofauna habitats arising during construction and operational needs in the design area. Also, all transect sites will be a subject of surveying in all seasons for amphibians and reptiles.
Construction activities will cause habitat destruction at all locations where wind turbines are to be installed and relate to:

- construction of wide tamped access roads
- construction of concrete pedestals for wind turbines
- installation of ancillary elements such as the power grid and power lines.

Transect lines have been selected to cover a representative sample of habitats located adjacent to the wind turbine locations, thereby establishing the composition of amphibian and reptile species that would be affected by the impacts of the wind farm installation.

SURVEY PERIOD

This report refers to the following survey period: September 2025.

The field visits were organized to transect locations in the survey area between 12 and 14 September 2025.

SURVEY SPECIALIST

The survey was conducted by Bogoljub Sterijovski.

2 | SCOPE OF WORK

Field survey is foreseen for the months of May, June and September of 2025.

Subject of survey is seasonal research in all habitats and valorisation of herpetofauna.

3 | METHODOLOGY

FIELD SURVEY

The survey methodology remained the same as used in the May and June session.
The specimens observed in the field were determined according to the field guides of Radovanović (1951)[1] and Arnold & Owenden (2002)[2]. The methodology for determining the specimens of reptiles in their natural habitats was different in terms of the biology and ecology of each species separately in the morning and night hours.
Survey methodologies

"Search-and-seize" method

Determining the presence / distribution of species with the "catch-and-release" method, i.e., "search-and-seize" (Vogt 1982)[3] is likely the most basic and often-used approach. The researcher carefully walks through the natural habitat observing the activity. At a suitable moment the observer tries to catch an individual using gloves, nets or hooks. Following

[1] Radovanović, M. (1951): Vodozemci i gmizavci naše zemlje. Naučna knjiga, Beograd.

[2] Arnold, N., Ovenden, D. (2002): Reptiles and Amphibians of Britain and Europe. Collins, London.

[3] Vogt, R.C. and Hine, R.L. (1982): Evaluation of techniques for assessment of amphibian and reptile populations in Wisconsin. Herpetological communities. Wildlife Res. Report. Fish and wildlife service, U.S. Dept. of Interior. Pp. 201-217

capture, the species can be determined in situ, and all additional data collected according to the monitoring protocol (sex, size, GPS coordinates, etc.). This method is suitable for searching species in their preferable habitats.

Field surveys in September as well as in May and June, were conducted throughout the survey area to determine the presence / distribution of species with the search and capture method, i.e. "Search-and-seize" (Vogt 1982).

Line transects - in order to determine the average number of individuals in the amphibian and reptile classes, the line transect sampling method is used (Buckland et al., 1993, Everitt 2002). These methods is used to determine biodiversity richness, density, and population size of amphibians and reptiles for a simple reason characteristic of low-mobility animals (McDiarmid et al., 2012).

Field research takes place in the most active period of these two classes, from May to September. The scope of the research is to determine the qualitative composition of the diversity of amphibians and reptiles in the researched area. Additionally, by using the proposed methodologies, basic quantitative parameters are acquired to primarily show the frequency of the species of these two classes and their abundance. This approach can determine the state of diversity of amphibians and reptiles in the surveyed area. In addition to all the above, the dynamics of continuous surveying in the active period of these two taxonomic groups (from May to September) is essential in order to cover the reproductive period of amphibians and reptiles where a higher frequency of occurrence is expected and the period in which these animals are preparing for hibernation (September).

Given the large size of the project area and the diversity of habitats, the qualitative and quantitative composition of amphibians and reptiles is assessed in a systematic and uniform manner, ensuring equal representation of habitat types within the transects to be established and surveyed at the same time periods and at the same times. Transects are set up in such a way that they are evenly dispersed throughout the sub-area, so that the data obtained on species composition and abundance of both classes are sufficiently representative of the micro-region surrounding the transect: Bucim transect [1], Ljuboten – Ciflik transect [2], Koshevo transect [3], Shashavarlija – Nikoman trasect [4] and Dolani – Lipov dol transect [5]), and one control transect that has the same habitat types and ecological conditions and traits outside the surveyed area but in near vicinity (Gorachino transect [C]).

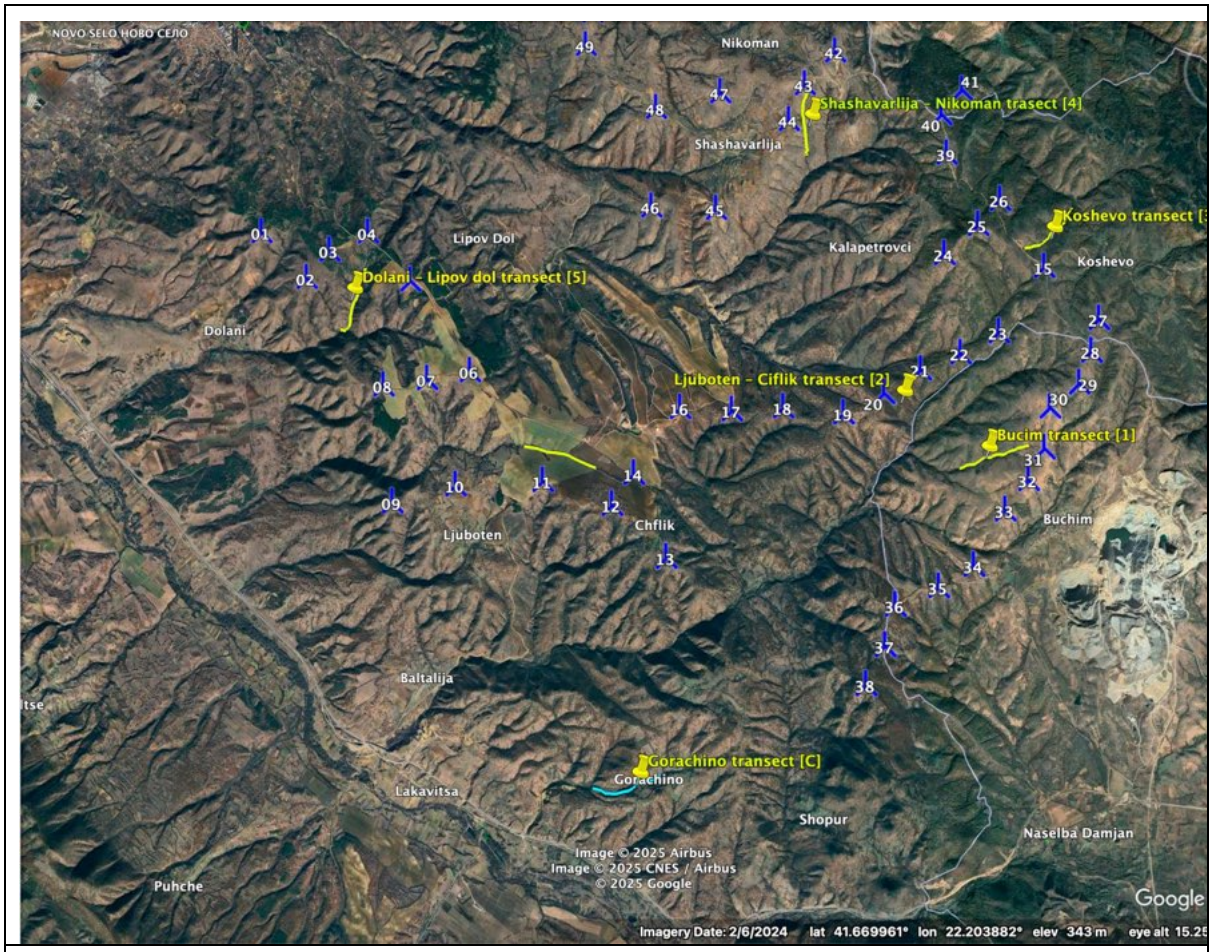

Figure 2 HD Map of draft line transects for amphibians and reptiles (Yellow lines are the draft line transects within the project area - from point 1 to 5, and turquoise line is Gorachino control transect- point C). Source: Bogoljub Sterijovski

The surveys are conducted in the morning hours when the frequencies of occurrence of these two classes of animals are higher. The work on one transect with a time interval is on average about 4-6 hours, depending on the population's density of the amphibians and reptiles as well as the quantity of ecological data that is collected for a particular field research day.

SEPTEMBER SESSION OF FIELD SURVEYS FOR AMPHIBIANS AND REPTILES

The composition of species of amphibian and reptile species in the project area remained the same, i.e. no new species were observed in the project area. Thus, five species (*Bombina variegata, Bufo bufo, Bufotes viridis, Pelophylax ridibundus* and *Rana graeca*) from the amphibians and seven of reptiles (*Testudo hermanni, Anguis fragilis, Lacerta trilineata, Lacerta viridis, Podarcis erhardi, Podarcis muralis* and *Vipera ammodytes*) were recorded in the September field surveys.

LIMITATIONS

As summer progresses, the days begin to shorten, and the nights become colder from late August. These conditions directly affect the classes amphibians and reptiles, as their body temperature depends on the temperature of the external environment (Dodd, 2016).

The low activity frequency of amphibians and reptiles in autumn can be scientifically explained by their ecophysiological traits and environmental conditions that influence their behavior during this season:

- *Ectothermy and Temperature Sensitivity*
  Amphibians and reptiles are ectothermic (cold-blooded) animals, meaning their body temperature and metabolic activity depend largely on external environmental temperatures.
  In autumn, temperatures start to decline significantly, leading to lower body temperatures in these animals. This reduction in temperature decreases their metabolic rate, resulting in reduced movement, feeding, and other activities.

- *Preparation for Overwintering / hibernation*
  As temperatures fall and daylight shortens, amphibians and reptiles undergo behavioral changes to prepare for winter hibernation or brumation.
  They begin to reduce activity to conserve energy, seek shelter in burrows, leaf litter, or underwater habitats where temperatures are more stable, and reduce feeding.
  This inactive or lethargic state helps them survive the cold months when food availability is low and environmental conditions are harsh.

- *Moisture and Habitat Conditions*
  Amphibians are especially reliant on moist environments for skin respiration and hydration. Autumn rains may initially increase activity, but as moisture decreases and ponds start to dry or cool, amphibians reduce surface activity.
  Reptiles also require specific thermal microhabitats for basking, and with reduced sunlight and cooler weather in autumn, opportunities for effective thermoregulation decrease, limiting their activity.

- Ecological Timing
  Many amphibian and reptile species have life cycles synchronized with seasonal changes. Autumn typically marks the end of their active reproductive and foraging seasons.
  This natural timing leads to a physiological downregulation of activity levels as they enter a phase of dormancy.

4 | SURVEY RESULTS

SURVEY SITES

In order to make a comparison and summary of the presence of species at the end of the research in the 2025 seasons, from which the abundance of species in the project area will be determined, the same transects that were established in the research in May and June are used in September as well. Survey was carried out at same several locations, summarized in 6 transects, based on the differences in the present habitats, distance to wind turbines, and altitude…

Table 1 Survey sites/points/tranches for flora and habitats.

Site Reference	Location	Additional Details - Habitats
Transect 1	Buchim	Bucim transect is consisted of hilly pastures intersected with temporary water flows and small ponds. This is typical habitat opposite of the village Bucim. Due to the low altitude (between 639 and 718 meters of altitude) it is preferred habitat for many reptilian species. However, due to lack of water courses the populations of the amphibian species are low.
Transect 2	Ljuboten – Ciflik	Ljuboten – Ciflik transect is situated on the boundary of two agricultural blocks. Theses boundary belts are often preferred habitat for many reptile species and some of the amphibian species se well. It is on a low altitude between 610 and 633 meters.
Transect 3	Koshevo	Koshevo transect is on the highest altitude of all transects, between 773 and 883 meters. This is hilly pasture habitat with shrubs and low vegetation as a preferred habitat by the reptilian species mainly. Also it is a suitable home for the "terrestrial toads" such as the *Bufo bufo* and *Bufotes viridis* from the amphibian species.
Transect 4	Shashavarlija – Nikoman	Shashavarlija – Nikoman is hilly pasture transect situated in the small valley between two hills. Preferred habitat for the reptile's class but also there are some temporary water bodies that are small safe haven for the amphibian's species for a short period in a springtime. The altitude is between 713 and 820 meters.
Transect 5	Dolani – Lipov dol	This is most various transect in terms of habitat types. It is consisting of riparian belt vegetation with meadows on the side of the Cengica spring. Habitats found here are suitable for the species of both classes. The altitude is between 505 and 601 meters.
Transect 6	Gorachno	Goracino transect is chosen to be referent transect that will have no effect of the installation of wind park in the project area. This transect area is situated within the valley below the Goracino village. Within the transect there are suitable habitats for all species of amphibians and reptiles that can be found within the wider region of and around the project area.

Transect surveys

Line transects (Buckland et al., 1993[4]; Everitt 2002[5]) can be used to determine the richness of biodiversity, the density and size of populations of amphibians and reptiles characterized

[4] Buckland, S. T., Anderson, D. R., Burnham, K. P. and Laake, J. L. (1993): *Distance Sampling: Estimating Abundance of Biological Populations*. London: Chapman and Hall

[5] Everitt, B. S. (2002): *The Cambridge Dictionary of Statistics*, 2nd Edition.

with low-mobility (McDiarmid et al., 2012[6]). This technique can be easily conducted, on a shorter monitoring period (two active seasons minimum) and with small capacity in terms of human resources. The transect survey technique is used to measure the relative abundance of selected species and known sub-populations. Regular surveys are the basis for assessing the impact of threats to amphibian populations. A transect consists of a person walking from point A to point B along a defined path. A person counts the number of individuals seen and/or heard within approximately 1 m distance from the path. Surveying relies upon detecting amphibians and reptiles with the naked eye or with the aid of binoculars. If identification from the distance is not possible, a simple hand net can be used to catch and identify specimens, and to release them again. The transect length can vary from 50 m up to 1000 meters depending on the geographical relief and habitat types (Dodd 2010[7]). The number of transects also depends on the surface area relief. Transects should be randomly placed within the location but clearly defined so they can be repeated during subsequent surveys. The transects path should be chosen by an expert that is experienced in monitoring. The line transects are predefined and all field research is executed in the same area in all field visits.

Given the large size of the project area and the diversity of habitats, the qualitative and quantitative composition of amphibians and reptiles will need to be assessed in a systematic and uniform manner. This means ensuring equal representation of habitat types within the transects to be established and surveyed at the same time periods and at the same times. Transects will also need to be set up in such a way that they are evenly dispersed throughout the sub-area, so that the data obtained on species composition and abundance of both classes are sufficiently representative of the micro-region surrounding the transect.

FIELD SURVEY RESULTS

The survey area of the Shtip-Radovis wind farm project is characterized by various types of habitats located at altitudes between 290 and 750 meters above sea level. In this region, the northern side of the project area is bordered by the slopes of the Plackovica mountain, while the southern side is limited by the Lakavica river valley and the area of the village of Bucm. River valleys, riparian belts, hill pastures, arable land, rocky areas, open degraded oak forests, mixed forests in combination with the low sea level as well as the fact that through the Braglanica river valley and through the Lakavica river a climate with Mediterranean influence prevails[8], creating a favorable environment for a rich composition of amphibians and reptiles. Hence, each research position requires equal attention in order to conduct a detailed analysis of the biodiversity of amphibians and reptiles in the project area.

[6] McDiarmid et al. (2012): Reptile Biodiversity: Standard Methods for Inventory and Monitoring. University of California Press Ltd. London. 424 pp.

[7] Dodd, C., K. (2010): Amphibian ecology and conservation. A handbook of techniques. Oxford University Press. pp.556

[8] Lazarevski, A. 1993. Klimata na Makedonija. Mladinska kniga. Skopje

Figure 3. *Rana graeca* in Dolani transect area Source: Bogoljub Sterijovski

All species recorded in the literature were recorded on the field research within the project area of WF Stip.

Table 2 Class, species name, English name and Macedonian name of the amphibian and reptile's species from field research for the project area of Stip-Radovis windmill park

Class	**Species Scientific name**	**English name**	**Macedonian name**	**Field data**
Amphibians	*Bombina variegata* (Mertens & Muller 1928)	Fire belly toad	Жолт мукач	X
Amphibians	*Bufo bufo* (Mertens & Muller 1928)	Common toad	Обична крастава жаба	X
Amphibians	*Bufotes viridis* (Laurenti 1768)	Green toad	Зелена крастава жаба	X
Amphibians	*Rana graeca (Bulenger, 1891)*	Stream frog	Поточна жаба	X
Amphibians	*Pelophylax ridibundus* (Pallas 1771)	Marsh frog	Езерска жаба	X
Reptiles	*Testudo hermanni* (Gmelin 1788)	Herman's tortoise	Ридска желка	X
Reptiles	*Anguis fragilis* (Linnaeus 1758)	Slowworm	Слепче	X
Reptiles	*Lacerta trilineata* (Bedriaga 1886)	Balkan green lizard	Голем зелен гуштер	X
Reptiles	*Lacerta viridis* (Laurenti 1768)	Green lizard	Зелен гуштер	X
Reptiles	*Podarcis erhardi* (Bedriaga 1882)	Balkan wall lizard	Балканска гуштерица	X
Reptiles	*Podarcis muralis* (Laurenti 1768)	Wall lizard	Ѕидна гуштерица	X

Class	Species Scientific name	English name	Macedonian name	Field data
Reptiles	*Zamenis longissimus* (Laurenti 1768)	Aesculapian snake	Шумски смок	X
Reptiles	*Vipera ammodytes* (Linnaeus 1758)	Nose-horned viper	Поскок	X

Priority Biodiversity Features (PBF) and Critical Habitats (CH)

Critical Habitat and Priority Biodiversity Feature assessment is a process designed for identification of areas of the highest biodiversity value, considered especially sensitive to impact, and where particular attention must be paid. The CHA process comprises an initial project screening to identify potential CH/PBF trigger habitats or species present within the area affected by the project. Initial screening is conducted in order to establish trigger features, followed by analysis and verification. As a guidance the "EBRD Performance Requirement 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources - Guidance Note" was used.

Criteria for identification amphibians and reptiles Priority Biodiversity Features (PBF) and Critical Habitats (CH)

To identify the PBF and CH according to the EBRD Performance Requirement 6 of biodiversity (bartaho and herpetofauna species), different documents like red lists, legal regulations, scientific papers and reports from projects were used with priority for biodiversity assessment (Table X).

Table 3 Documents used to biodiversity assessment

Documents used to biodiversity assessment		
	International level	***National***
Amphibians	IUCN Global Red List – version 2020-1 IUCN European Red List EU Habitat directive 92/43/EEC Anex II, IV and V EBRD PBF and CH species[9]	National red list of amphibians and reptiles List of Strictly Protected and Protected Wild Species (MOEPP 2011)
Reptiles	IUCN Global Red List – version 2020-1 IUCN European Red List EU Habitat directive 92/43/EEC Anex II, IV and V EBRD PBF and CH species[9]	National red list of amphibians and reptiles List of Strictly Protected and Protected Wild Species (MOEPP 2011) Contribution of the knowledge of the Reptile fauna and diversity in FYR of Macedonia – (Sterijovski et al. 2014)

For this purpose, the valorization of amphibians and reptiles was used following the international and national directives and legislatives that concern the conservation status of amphibians and reptiles, given in the table X.

[9] EBRD Performance Requirement 6 (2022): Biodiversity Conservation and Sustainable Management of Living Natural. Resources. Guidance Note

Criteria for valorization of biological diversity in the area of wind turbines park "Stip - Radovis"		
	Valorization	**Criteria**
Amphibians	National Red List of Threatened Herpetofauna.	Classified as Vulnerable (VU) and endangered (EN)
	IUCN Global Red List;	Classified as Vulnerable (VU) and endangered (EN)
	IUCN European Red List	Classified as Vulnerable (VU) and endangered (EN)
	EU Habitat directive 92/43/EEC	*Annex II, Annex IV and Annex V;*
	Bern Convention – Conservation of European Wildlife and Natural Habitats;	*Appendix II* and *Appendix III*
	List of Strictly Protected and Protected Wild Species (MOEPP 2011)	List of protected wild species
	Endemism	According to the newest systematics literature
Reptiles	National Red List of Threatened Herpetofauna.	Classified as Vulnerable (VU) and endangered (EN)
	IUCN Global Red List;	Classified as Vulnerable (VU) and endangered (EN)
	IUCN European Red List	Classified as Vulnerable (VU) and endangered (EN)
	EU Habitat directive 92/43/EEC	*Annex II, Annex IV and Annex V;*
	Bern Convention – Conservation of European Wildlife and Natural Habitats	*Appendix II* and *Appendix III*
	CITES Convention - Convention on International Trade in Endangered Species	*Appendix II*
	List of Strictly Protected and Protected Wild Species (MOEPP 2011)	List of protected wild species
	Endemism	According to the newest systematics literature
National Red List of Threatened Amphibians and Reptiles http://redlist.moepp.gov.mk		
IUCN: IUCN Global Red List of Threatened Amphibians - www.iucnredlist.org EN: Endangered; VU: Vulnerable;		
IUCN: IUCN Global Red List of Threatened Reptiles - www.iucnredlist.org EN: Endangered; VU: Vulnerable;		
IUCN: IUCN European Red List of Threatened Amphibians - **www.iucnredlist.org** EN: Endangered; VU: Vulnerable;		
IUCN: IUCN European Red List of Threatened Reptiles - www.iucnredlist.org EN: Endangered; VU: Vulnerable;		
HABITATS DIRECTIVE: Council Directive (92/43/AEEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora. **Annex II:** Animal and plant species of Community interest whose conservation requires the designation of special areas of conservation. **Annex IV:** Animal and plant species of Community interest in need of strict protection. Annex V: Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures		
Convention on the conservation of European wildlife and natural habitats (Bern convention) Appendix II: Strictly protected fauna species Appendix III: Protected fauna species		

CITES - Convention on International Trade in Endangered Species Appendix II
EBRD Performance Requirement 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. Guidance Note Priority Biodiversity Features Critical Habitats

So, according to the above-mentioned criteria, the valorisation of the amphibians is given in the table X below.

Table 4 Valorisation of amphibians in the wind park project area

Amphibians		**National Red Lists**	**IUCN Global (2025-1)**	**IUCN EU (2025-1)**	**Habitat directive (Annex II, IV, V)**	**Bern convention (Appendix II, III)**	**CITES (Appendix II)**	List of Strictly Protected and Protected Wild Species	Endemism
1	*Bombina variegata*	LC	LC	LC	II, IV	II	/	Protected	Balkan endemic10
2	*Pelophylax ridibundus*	LC	LC	LC	V	III	/	/	/
3	*Rana graeca*	NT	LC	LC	IV	III	/	Protected	Balkan endemic[11]
4	*Bufo bufo*	LC	LC	LC	/	III	/	/	/
5	*Bufotes viridis*	LC	LC	LC	IV	II	/	Protected	/

Same for the reptiles, according to the above-mentioned criteria, the valorisation for this taxonomic group is given in the table X below.

Table 5 Valorisation of reptiles in the wind park project area

Reptiles		**National Red Lists**	**IUCN Global (2025-1)**	**IUCN EU (2025-1)**	**Habitat directive (Annex II, IV, V)**	**Bern convention (Appendix II, III)**	**CITES (Appendix II)**	List of Strictly Protected and Protected Wild Species	Endemism
1	*Testudo hermanni*	VU	VU	VU	II, IV	II	II	Protected	/
2	*Lacerta trilineata*	LC	LC	LC	IV	II	/	Protected	/
3	*Lacerta viridis*	LC	LC	LC	IV	II	/	Protected	/
4	*Podarcis erhardii*	LC	LC	LC	IV	II	/	Protected	Balkan endemic[12]
5	*Podarcis muralis*	LC	LC	LC	IV	II	/	Protected	/
6	*Anguis fragilis*	LC	LC	/	/	III	/	/	/
7	*Zamenis longissimus*	LC	LC	LC	IV	II	/	Protected	/

[10] According to Pabijan et al (2013) in the Balkans the subspecies of Bombina variegata scabra subspecies is present (Pabijan M., Wandycz A., Hofman S., Wecek K., Piwczynski M., Szymura J. M. (2017b): "Complete mitochondrial genomes resolve phylogenetic relationships within Bombina (Anura: Bombinatoridae)". Molecular Phylogenetics and Evolution. 69. 6 pp

[11] According to Dubois (1992) the distribution of this species is listed only for the Balkan Peninsula (Dubois, A. (1992). Notes sur la classification des Ranidae (Amphibiens anoures). Bulletin Mensuel de la Société Linnéenne de Lyon 61: 305–352.

[12] According to Sindaco & Jeremčenko (2008) in terms of distribution this species is considered a Balkan endemic (Sindaco, R., Jeremcenko, V.K. (2008). The reptiles of the Western Palearctic. Edizioni Belvedere, Latina (Italy), 579 pp.)

10	*Vipera ammodytes*	LC	LC	LC	IV	II	/	Protected	/

Table 6 Amphibian and reptile species that trigger PBF found within the project area

Species	Priority features - criteria			
	(i)	(ii)	(iii)	(iv)
Bombina variegata		HD Annex II		
Testudo hermanni		HD Annex II National Red Lists of Threatened Reptiles assessed as threatened and recognized as vulnerable (VU). IUCN Global red list assessed as threatened and recognized as vulnerable (VU).		

Critical Habitats

Following the EBRD Performance Requirement 6 for the critical habitats the following amphibians and reptile species trigger this criterion.

Table 7 Species that trigger CH found within the project area

Species	Critical Habitats - criteria				
	Criterion (i)	Criterion (ii)	Criterion (iii)	Criterion (iv)	Criterion (v)
Bombina variegata		HD Annex IV			
Rana graeca		HD Annex IV			
Bufotes viridis		HD Annex IV			
Testudo hermanni		HD Annex IV			
Lacerta trilineata		HD Annex IV			
Lacerta viridis		HD Annex IV			
Podarcis erhardii		HD Annex IV			
Podarcis muralis		HD Annex IV			
Zamenis longissimus		HD Annex IV			
Vipera ammodytes		HD Annex IV			

Invasive Species

No invasive species of amphibians and reptiles have been detected in the project area.

Habitat Preferences of Amphibians and Reptiles

Amphibians and reptiles in project area, as in much of in the wide area on Stip – Radovis region, occupy a variety of natural and semi-natural habitats including:

- Freshwater ecosystems: streams, rivers, springs, temporary ponds, and wetlands.
- Woodlands and forests: broadleaved, mixed, and coniferous forests covering various altitudinal ranges (340 up to 780 meters of altitude).

- Grasslands and scrublands: hilly grasslands, meadows, scrub, Mediterranean-type shrublands.

Figure 4. *Testudo hermanni* in grasslands and scrublands in Bucim transect Source: Bogoljub Sterijovski

- Rocky and inland cliff habitats which provide shelter and basking sites for reptiles.
- Agricultural lands and rural habitats with some anthropogenic influence but retaining structural habitat elements.

Figure 5. *Podarcis erhardii* in agricultural lands and rural habitats with some anthropogenic influence in Goracino transect

- Amphibians favor moist, aquatic, or semi-aquatic habitats for breeding including high-quality, oligotrophic standing waters, river litteral zones with herbal vegetation, spring mires, and reedbeds. They require clean water bodies with aquatic vegetation for laying eggs and larval development.
- Reptiles prefer warmer, drier habitats such as open grasslands, rocky slopes, forest edges, and scrublands, often requiring basking sites with good sun exposure. They also use wetlands edges and riparian zones for access to water and prey.

Ecological Traits for amphibians and reptiles in the project area

- Amphibians in this region show adaptations to seasonal variations in water availability, breeding mostly in spring and early summer in temporary or permanent water bodies. Some species are reliant on clean, well-oxygenated freshwater habitats with little pollution.
- Reptiles are ecothermic, relying on solar radiation for thermoregulation; thus, their distribution concentrates in habitats with sufficient sun exposure and shelter such as rocks, dense shrubs, or underground refugia.
- Both amphibians and reptiles play key roles in ecosystem function as predators of insects and other invertebrates, and as prey for higher trophic level species.
- The region's climatic variability (continental and sub-Mediterranean influences) and diverse topography create a mosaic of microhabitats supporting diverse herpetofauna.

Habitat Threats Impacting Amphibians and Reptiles

- Habitat degradation through agricultural intensification, water pollution, and modification of natural hydrological regimes threatens aquatic habitats crucial for amphibians.
- Urbanization, infrastructure development, and deforestation reduce habitat quality and connectivity.
- Climate change impacts such as droughts and temperature shifts alter habitat availability and species phenology.
- Conservation efforts in the region emphasize protecting freshwater habitats, riparian zones, and maintaining natural vegetation cover favourable to herpetofauna.

CONCLUSION

Amphibians and reptiles in the project area in Stip - Radovish region demonstrate ecological affinities for aquatic and semi-aquatic environments (especially for amphibians) and for sun-exposed, structurally complex terrestrial habitats (especially for reptiles). Their habitat preferences are shaped by the region's varied landscape of water bodies, forests, grasslands, and rocky areas, all under pressure from human activities and environmental change. Protecting diverse microhabitats within these broader ecosystems is critical for conserving the region's herpetofaunal biodiversity.

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ANNEXES

Mott MacDonald Restricted

ANNEX 1 - COMPLETE LIST OF AMPHIBIANS AND REPTILES SPECIES FROM SEPTEMBER FIELD SURVEY

ID	KINGDOM	PHYLUM	CLASS	ORDER	FAMILY	ACCEPTEDNAME	TAXONID_GBIF	ECONOMY	CLASSICLOC	LOCCURRENTNAME	VERBATIMCOORDINATES	LATITUDE(N)	LONGITUDE(E)	ACCURACY	GEOREFERENCEDBY	GEOREFERENCINGCOMENT	GBIF_LATITUDE	GBIF_LONGITUDE	GBIF_ACCURACY	SEASON
452	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	ANGUIDAE	ANGUIS FRAGILIS	ANGUIS FRAGILIS	NMK		BUCIM REP		41,679766	22,333712	GPS	BOGOLJUB STERIJOVSKI		41,679766	22,333712	GPS	SEP.25
564	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	ANGUIDAE	ANGUIS FRAGILIS	ANGUIS FRAGILIS	NMK		GORACINO REP		41,639702	22,272668	GPS	BOGOLJUB STERIJOVSKI		41,639702	22,272668	GPS	SEP.25
437	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		BUCIM AMP		41,678685	22,329041	GPS	BOGOLJUB STERIJOVSKI		41,678685	22,329041	GPS	SEP.25
457	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		DOLANI AMP		41,695752	22,222441	GPS	BOGOLJUB STERIJOVSKI		41,695752	22,222441	GPS	SEP.25
465	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		DOLANI AMP		41,699186	22,223822	GPS	BOGOLJUB STERIJOVSKI		41,699186	22,223822	GPS	SEP.25
466	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		DOLANI AMP		41,700007	22,223897	GPS	BOGOLJUB STERIJOVSKI		41,700007	22,223897	GPS	SEP.25
515	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		GORACINO AMP		41,638500	22,263607	GPS	BOGOLJUB STERIJOVSKI		41,638500	22,263607	GPS	SEP.25
526	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		GORACINO AMP		41,638742	22,269299	GPS	BOGOLJUB STERIJOVSKI		41,638742	22,269299	GPS	SEP.25
534	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		GORACINO AMP		41,639817	22,272811	GPS	BOGOLJUB STERIJOVSKI		41,639817	22,272811	GPS	SEP.25
536	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		GORACINO AMP		41,640014	22,273704	GPS	BOGOLJUB STERIJOVSKI		41,640014	22,273704	GPS	SEP.25
537	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		GORACINO AMP		41,640044	22,273931	GPS	BOGOLJUB STERIJOVSKI		41,640044	22,273931	GPS	SEP.25
614	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		LJUBOTEN AMP		41,679096	22,257976	GPS	BOGOLJUB STERIJOVSKI		41,679096	22,257976	GPS	SEP.25
615	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		LJUBOTEN AMP		41,679096	22,258192	GPS	BOGOLJUB STERIJOVSKI		41,679096	22,258192	GPS	SEP.25
616	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		LJUBOTEN AMP		41,679072	22,258527	GPS	BOGOLJUB STERIJOVSKI		41,679072	22,258527	GPS	SEP.25
620	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		SASAVARLIJA AMP		41,715716	22,298869	GPS	BOGOLJUB STERIJOVSKI		41,715716	22,298869	GPS	SEP.25
622	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BOMBINATORIDAE	BOMBINA VARIEGATA	BOMBINA VARIEGATA	NMK		SASAVARLIJA AMP		41,720037	22,298437	GPS	BOGOLJUB STERIJOVSKI		41,720037	22,298437	GPS	SEP.25
568	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BUFONIDAE	BUFO BUFO	BUFO BUFO	NMK		KOSEVO AMP		41,704539	22,337262	GPS	BOGOLJUB STERIJOVSKI		41,704539	22,337262	GPS	SEP.25
569	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BUFONIDAE	BUFO BUFO	BUFO BUFO	NMK		KOSEVO AMP		41,708398	22,342182	GPS	BOGOLJUB STERIJOVSKI		41,708398	22,342182	GPS	SEP.25
617	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BUFONIDAE	BUFO BUFO	BUFO BUFO	NMK		LJUBOTEN AMP		41,677371	22,263532	GPS	BOGOLJUB STERIJOVSKI		41,677371	22,263532	GPS	SEP.25
619	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BUFONIDAE	BUFO BUFO	BUFO BUFO	NMK		LJUBOTEN AMP		41,675887	22,267196	GPS	BOGOLJUB STERIJOVSKI		41,675887	22,267196	GPS	SEP.25
621	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	BUFONIDAE	BUFO BUFO	BUFO BUFO	NMK		SASAVARLIJA AMP		41,717444	22,299021	GPS	BOGOLJUB STERIJOVSKI		41,717444	22,299021	GPS	SEP.25

435	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Bucim AMP		41,676904	22,323669	GPS	Bogoljub Sterijovski		41,676904	22,323669	GPS	Sep.25
436	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Bucim AMP		41,678218	22,328252	GPS	Bogoljub Sterijovski		41,678218	22,328252	GPS	Sep.25
461	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Dolani AMP		41,697767	22,223262	GPS	Bogoljub Sterijovski		41,697767	22,223262	GPS	Sep.25
470	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Dolani AMP		41,700884	22,224270	GPS	Bogoljub Sterijovski		41,700884	22,224270	GPS	Sep.25
472	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Dolani AMP		41,701444	22,224419	GPS	Bogoljub Sterijovski		41,701444	22,224419	GPS	Sep.25
518	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Goracino AMP		41,638409	22,264682	GPS	Bogoljub Sterijovski		41,638409	22,264682	GPS	Sep.25
521	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Goracino AMP		41,638091	22,266075	GPS	Bogoljub Sterijovski		41,638091	22,266075	GPS	Sep.25
523	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Goracino AMP		41,638167	22,267528	GPS	Bogoljub Sterijovski		41,638167	22,267528	GPS	Sep.25
530	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Goracino AMP		41,639105	22,270707	GPS	Bogoljub Sterijovski		41,639105	22,270707	GPS	Sep.25
618	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Ljuboten AMP		41,676821	22,264921	GPS	Bogoljub Sterijovski		41,676821	22,264921	GPS	Sep.25
623	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Sasavarlija AMP		41,721180	22,298360	GPS	Bogoljub Sterijovski		41,721180	22,298360	GPS	Sep.25
624	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Sasavarlija AMP		41,721091	22,298525	GPS	Bogoljub Sterijovski		41,721091	22,298525	GPS	Sep.25
576	Animalia	Chordata	Amphibia	Anura	Bufonidae	Bufotes viridis	Bufotes viridis	NMK		Kosevo REP		41,706979	22,340631	GPS	Bogoljub Sterijovski		41,706979	22,340631	GPS	Sep.25
442	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim REP		41,677488	22,326033	GPS	Bogoljub Sterijovski		41,677488	22,326033	GPS	Sep.25
444	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim REP		41,678685	22,329099	GPS	Bogoljub Sterijovski		41,678685	22,329099	GPS	Sep.25
445	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim REP		41,678773	22,329829	GPS	Bogoljub Sterijovski		41,678773	22,329829	GPS	Sep.25
449	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim REP		41,679532	22,332018	GPS	Bogoljub Sterijovski		41,679532	22,332018	GPS	Sep.25
451	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Bucim REP		41,679707	22,333069	GPS	Bogoljub Sterijovski		41,679707	22,333069	GPS	Sep.25
477	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Dolani REP		41,694637	22,221194	GPS	Bogoljub Sterijovski		41,694637	22,221194	GPS	Sep.25
478	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Dolani REP		41,694656	22,221500	GPS	Bogoljub Sterijovski		41,694656	22,221500	GPS	Sep.25
481	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Dolani REP		41,694866	22,222094	GPS	Bogoljub Sterijovski		41,694866	22,222094	GPS	Sep.25
482	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Dolani REP		41,695116	22,222304	GPS	Bogoljub Sterijovski		41,695116	22,222304	GPS	Sep.25
484	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Dolani REP		41,695368	22,222538	GPS	Bogoljub Sterijovski		41,695368	22,222538	GPS	Sep.25
485	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Dolani REP		41,695602	22,222577	GPS	Bogoljub Sterijovski		41,695602	22,222577	GPS	Sep.25

494	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Dolani REP		41,697645	22,223063	GPS	Bogoljub Sterijovski		41,697645	22,223063	GPS	Sep.25
501	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Dolani REP		41,699610	22,223958	GPS	Bogoljub Sterijovski		41,699610	22,223958	GPS	Sep.25
508	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Dolani REP		41,701361	22,224483	GPS	Bogoljub Sterijovski		41,701361	22,224483	GPS	Sep.25
541	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Goracino REP		41,638652	22,264134	GPS	Bogoljub Sterijovski		41,638652	22,264134	GPS	Sep.25
542	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Goracino REP		41,638593	22,264312	GPS	Bogoljub Sterijovski		41,638593	22,264312	GPS	Sep.25
546	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Goracino REP		41,638161	22,265184	GPS	Bogoljub Sterijovski		41,638161	22,265184	GPS	Sep.25
547	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Goracino REP		41,638212	22,264939	GPS	Bogoljub Sterijovski		41,638212	22,264939	GPS	Sep.25
548	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Goracino REP		41,638127	22,265472	GPS	Bogoljub Sterijovski		41,638127	22,265472	GPS	Sep.25
555	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Goracino REP		41,638508	22,268359	GPS	Bogoljub Sterijovski		41,638508	22,268359	GPS	Sep.25
556	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Goracino REP		41,638686	22,268985	GPS	Bogoljub Sterijovski		41,638686	22,268985	GPS	Sep.25
560	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Goracino REP		41,639236	22,270399	GPS	Bogoljub Sterijovski		41,639236	22,270399	GPS	Sep.25
561	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Goracino REP		41,639338	22,271009	GPS	Bogoljub Sterijovski		41,639338	22,271009	GPS	Sep.25
571	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo REP		41,704659	22,337385	GPS	Bogoljub Sterijovski		41,704659	22,337385	GPS	Sep.25
573	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo REP		41,705861	22,338827	GPS	Bogoljub Sterijovski		41,705861	22,338827	GPS	Sep.25
575	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo REP		41,706390	22,339393	GPS	Bogoljub Sterijovski		41,706390	22,339393	GPS	Sep.25
578	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Kosevo REP		41,709732	22,342963	GPS	Bogoljub Sterijovski		41,709732	22,342963	GPS	Sep.25
580	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,680095	22,252814	GPS	Bogoljub Sterijovski		41,680095	22,252814	GPS	Sep.25
582	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,679707	22,253765	GPS	Bogoljub Sterijovski		41,679707	22,253765	GPS	Sep.25
584	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,679571	22,254793	GPS	Bogoljub Sterijovski		41,679571	22,254793	GPS	Sep.25
587	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,679338	22,256500	GPS	Bogoljub Sterijovski		41,679338	22,256500	GPS	Sep.25
589	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,679086	22,257838	GPS	Bogoljub Sterijovski		41,679086	22,257838	GPS	Sep.25
595	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,678427	22,260282	GPS	Bogoljub Sterijovski		41,678427	22,260282	GPS	Sep.25
597	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,677961	22,261659	GPS	Bogoljub Sterijovski		41,677961	22,261659	GPS	Sep.25
599	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,677515	22,263094	GPS	Bogoljub Sterijovski		41,677515	22,263094	GPS	Sep.25

600	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,677224	22,264064	GPS	Bogoljub Sterijovski		41,677224	22,264064	GPS	Sep.25
606	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,675983	22,267187	GPS	Bogoljub Sterijovski		41,675983	22,267187	GPS	Sep.25
612	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,675672	22,267187	GPS	Bogoljub Sterijovski		41,675672	22,267187	GPS	Sep.25
613	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Ljuboten REP		41,675750	22,267284	GPS	Bogoljub Sterijovski		41,675750	22,267284	GPS	Sep.25
633	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija REP		41,716806	22,298827	GPS	Bogoljub Sterijovski		41,716806	22,298827	GPS	Sep.25
640	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija REP		41,719414	22,298722	GPS	Bogoljub Sterijovski		41,719414	22,298722	GPS	Sep.25
641	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija REP		41,720822	22,298429	GPS	Bogoljub Sterijovski		41,720822	22,298429	GPS	Sep.25
642	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta trilineata	Lacerta trilineata	NMK		Sasavarlija REP		41,724964	22,299434	GPS	Bogoljub Sterijovski		41,724964	22,299434	GPS	Sep.25
506	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani REP		41,701186	22,224444	GPS	Bogoljub Sterijovski		41,701186	22,224444	GPS	Sep.25
558	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Goracino REP		41,638864	22,269595	GPS	Bogoljub Sterijovski		41,638864	22,269595	GPS	Sep.25
490	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Lacerta viridis	Lacerta viridis	NMK		Dolani REP		41,696711	22,222557	GPS	Bogoljub Sterijovski		41,696711	22,222557	GPS	Sep.25
438	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Bucim AMP		41,679678	22,334296	GPS	Bogoljub Sterijovski		41,679678	22,334296	GPS	Sep.25
439	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Bucim AMP		41,679941	22,334354	GPS	Bogoljub Sterijovski		41,679941	22,334354	GPS	Sep.25
454	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,694707	22,221639	GPS	Bogoljub Sterijovski		41,694707	22,221639	GPS	Sep.25
455	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,695024	22,222068	GPS	Bogoljub Sterijovski		41,695024	22,222068	GPS	Sep.25
456	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,695397	22,222385	GPS	Bogoljub Sterijovski		41,695397	22,222385	GPS	Sep.25
458	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,696629	22,222609	GPS	Bogoljub Sterijovski		41,696629	22,222609	GPS	Sep.25
460	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,697413	22,223057	GPS	Bogoljub Sterijovski		41,697413	22,223057	GPS	Sep.25
462	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,698197	22,223150	GPS	Bogoljub Sterijovski		41,698197	22,223150	GPS	Sep.25
463	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,698402	22,223244	GPS	Bogoljub Sterijovski		41,698402	22,223244	GPS	Sep.25
464	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,698756	22,223505	GPS	Bogoljub Sterijovski		41,698756	22,223505	GPS	Sep.25
467	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,700548	22,224027	GPS	Bogoljub Sterijovski		41,700548	22,224027	GPS	Sep.25
468	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,700566	22,224326	GPS	Bogoljub Sterijovski		41,700566	22,224326	GPS	Sep.25
469	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,700772	22,224065	GPS	Bogoljub Sterijovski		41,700772	22,224065	GPS	Sep.25

471	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,701276	22,224326	GPS	Bogoljub Sterijovski		41,701276	22,224326	GPS	Sep.25
473	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,701649	22,224643	GPS	Bogoljub Sterijovski		41,701649	22,224643	GPS	Sep.25
474	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,701985	22,224793	GPS	Bogoljub Sterijovski		41,701985	22,224793	GPS	Sep.25
475	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,702227	22,225147	GPS	Bogoljub Sterijovski		41,702227	22,225147	GPS	Sep.25
476	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Dolani AMP		41,702339	22,225427	GPS	Bogoljub Sterijovski		41,702339	22,225427	GPS	Sep.25
516	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,638545	22,263940	GPS	Bogoljub Sterijovski		41,638545	22,263940	GPS	Sep.25
517	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,638500	22,264379	GPS	Bogoljub Sterijovski		41,638500	22,264379	GPS	Sep.25
519	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,638212	22,265015	GPS	Bogoljub Sterijovski		41,638212	22,265015	GPS	Sep.25
520	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,638152	22,265666	GPS	Bogoljub Sterijovski		41,638152	22,265666	GPS	Sep.25
522	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,638106	22,266771	GPS	Bogoljub Sterijovski		41,638106	22,266771	GPS	Sep.25
524	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,638364	22,268769	GPS	Bogoljub Sterijovski		41,638364	22,268769	GPS	Sep.25
525	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,638545	22,269026	GPS	Bogoljub Sterijovski		41,638545	22,269026	GPS	Sep.25
527	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,638893	22,269965	GPS	Bogoljub Sterijovski		41,638893	22,269965	GPS	Sep.25
528	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,639136	22,270328	GPS	Bogoljub Sterijovski		41,639136	22,270328	GPS	Sep.25
529	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,639136	22,270540	GPS	Bogoljub Sterijovski		41,639136	22,270540	GPS	Sep.25
531	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,639136	22,270858	GPS	Bogoljub Sterijovski		41,639136	22,270858	GPS	Sep.25
532	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,639317	22,271055	GPS	Bogoljub Sterijovski		41,639317	22,271055	GPS	Sep.25
533	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,639650	22,272145	GPS	Bogoljub Sterijovski		41,639650	22,272145	GPS	Sep.25
535	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,639938	22,273341	GPS	Bogoljub Sterijovski		41,639938	22,273341	GPS	Sep.25
538	Animalia	Chordata	Amphibia	Anura	Ranidae	Pelophylax ridibundus	Pelophylax ridibundus	NMK		Goracino AMP		41,640271	22,274355	GPS	Bogoljub Sterijovski		41,640271	22,274355	GPS	Sep.25
447	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim REP		41,679503	22,331872	GPS	Bogoljub Sterijovski		41,679503	22,331872	GPS	Sep.25
453	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Bucim REP		41,679882	22,334179	GPS	Bogoljub Sterijovski		41,679882	22,334179	GPS	Sep.25
479	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,694637	22,221692	GPS	Bogoljub Sterijovski		41,694637	22,221692	GPS	Sep.25
488	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,696088	22,222401	GPS	Bogoljub Sterijovski		41,696088	22,222401	GPS	Sep.25

489	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,696439	22,222518	GPS	Bogoljub Sterijovski		41,696439	22,222518	GPS	Sep.25
491	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,697042	22,222732	GPS	Bogoljub Sterijovski		41,697042	22,222732	GPS	Sep.25
493	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,697470	22,223005	GPS	Bogoljub Sterijovski		41,697470	22,223005	GPS	Sep.25
495	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,697937	22,223355	GPS	Bogoljub Sterijovski		41,697937	22,223355	GPS	Sep.25
498	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,698598	22,223666	GPS	Bogoljub Sterijovski		41,698598	22,223666	GPS	Sep.25
499	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,698871	22,223744	GPS	Bogoljub Sterijovski		41,698871	22,223744	GPS	Sep.25
502	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,699824	22,224133	GPS	Bogoljub Sterijovski		41,699824	22,224133	GPS	Sep.25
504	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,700427	22,224328	GPS	Bogoljub Sterijovski		41,700427	22,224328	GPS	Sep.25
507	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,700991	22,224347	GPS	Bogoljub Sterijovski		41,700991	22,224347	GPS	Sep.25
509	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,701458	22,224717	GPS	Bogoljub Sterijovski		41,701458	22,224717	GPS	Sep.25
511	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,701964	22,225009	GPS	Bogoljub Sterijovski		41,701964	22,225009	GPS	Sep.25
512	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,702081	22,225106	GPS	Bogoljub Sterijovski		41,702081	22,225106	GPS	Sep.25
513	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Dolani REP		41,702529	22,225164	GPS	Bogoljub Sterijovski		41,702529	22,225164	GPS	Sep.25
539	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,638686	22,263550	GPS	Bogoljub Sterijovski		41,638686	22,263550	GPS	Sep.25
540	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,638669	22,263957	GPS	Bogoljub Sterijovski		41,638669	22,263957	GPS	Sep.25
544	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,638516	22,264541	GPS	Bogoljub Sterijovski		41,638516	22,264541	GPS	Sep.25
545	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,638364	22,264702	GPS	Bogoljub Sterijovski		41,638364	22,264702	GPS	Sep.25
549	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,638127	22,265946	GPS	Bogoljub Sterijovski		41,638127	22,265946	GPS	Sep.25
550	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,638152	22,266319	GPS	Bogoljub Sterijovski		41,638152	22,266319	GPS	Sep.25
551	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,638262	22,267174	GPS	Bogoljub Sterijovski		41,638262	22,267174	GPS	Sep.25
553	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,638406	22,267808	GPS	Bogoljub Sterijovski		41,638406	22,267808	GPS	Sep.25
554	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,638491	22,268088	GPS	Bogoljub Sterijovski		41,638491	22,268088	GPS	Sep.25
557	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,638779	22,269248	GPS	Bogoljub Sterijovski		41,638779	22,269248	GPS	Sep.25
559	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,638974	22,269942	GPS	Bogoljub Sterijovski		41,638974	22,269942	GPS	Sep.25

562	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,639482	22,271610	GPS	Bogoljub Sterijovski		41,639482	22,271610	GPS	Sep.25
563	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,639676	22,272422	GPS	Bogoljub Sterijovski		41,639676	22,272422	GPS	Sep.25
565	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,639846	22,272981	GPS	Bogoljub Sterijovski		41,639846	22,272981	GPS	Sep.25
566	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,639973	22,273328	GPS	Bogoljub Sterijovski		41,639973	22,273328	GPS	Sep.25
567	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Goracino REP		41,640265	22,274445	GPS	Bogoljub Sterijovski		41,640265	22,274445	GPS	Sep.25
570	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo REP		41,704046	22,335726	GPS	Bogoljub Sterijovski		41,704046	22,335726	GPS	Sep.25
572	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo REP		41,705801	22,338755	GPS	Bogoljub Sterijovski		41,705801	22,338755	GPS	Sep.25
574	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo REP		41,705921	22,338851	GPS	Bogoljub Sterijovski		41,705921	22,338851	GPS	Sep.25
577	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Kosevo REP		41,708266	22,341857	GPS	Bogoljub Sterijovski		41,708266	22,341857	GPS	Sep.25
579	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,680192	22,252252	GPS	Bogoljub Sterijovski		41,680192	22,252252	GPS	Sep.25
581	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,679784	22,253280	GPS	Bogoljub Sterijovski		41,679784	22,253280	GPS	Sep.25
583	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,679687	22,254308	GPS	Bogoljub Sterijovski		41,679687	22,254308	GPS	Sep.25
585	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,679377	22,255394	GPS	Bogoljub Sterijovski		41,679377	22,255394	GPS	Sep.25
586	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,679319	22,255801	GPS	Bogoljub Sterijovski		41,679319	22,255801	GPS	Sep.25
588	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,679183	22,256907	GPS	Bogoljub Sterijovski		41,679183	22,256907	GPS	Sep.25
590	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,678950	22,258420	GPS	Bogoljub Sterijovski		41,678950	22,258420	GPS	Sep.25
592	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,678834	22,259448	GPS	Bogoljub Sterijovski		41,678834	22,259448	GPS	Sep.25
593	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,678368	22,260456	GPS	Bogoljub Sterijovski		41,678368	22,260456	GPS	Sep.25
594	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,678562	22,259797	GPS	Bogoljub Sterijovski		41,678562	22,259797	GPS	Sep.25
596	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,678194	22,261038	GPS	Bogoljub Sterijovski		41,678194	22,261038	GPS	Sep.25
598	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,677786	22,262474	GPS	Bogoljub Sterijovski		41,677786	22,262474	GPS	Sep.25
601	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,676933	22,264607	GPS	Bogoljub Sterijovski		41,676933	22,264607	GPS	Sep.25
602	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,676797	22,265364	GPS	Bogoljub Sterijovski		41,676797	22,265364	GPS	Sep.25
603	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,676448	22,265984	GPS	Bogoljub Sterijovski		41,676448	22,265984	GPS	Sep.25

604	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,676235	22,266547	GPS	Bogoljub Sterijovski		41,676235	22,266547	GPS	Sep.25
605	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,676099	22,266935	GPS	Bogoljub Sterijovski		41,676099	22,266935	GPS	Sep.25
608	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,675711	22,267827	GPS	Bogoljub Sterijovski		41,675711	22,267827	GPS	Sep.25
609	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,675595	22,268176	GPS	Bogoljub Sterijovski		41,675595	22,268176	GPS	Sep.25
610	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,675517	22,267788	GPS	Bogoljub Sterijovski		41,675517	22,267788	GPS	Sep.25
611	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Ljuboten REP		41,675537	22,267400	GPS	Bogoljub Sterijovski		41,675537	22,267400	GPS	Sep.25
625	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija REP		41,715810	22,298882	GPS	Bogoljub Sterijovski		41,715810	22,298882	GPS	Sep.25
626	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija REP		41,715879	22,298743	GPS	Bogoljub Sterijovski		41,715879	22,298743	GPS	Sep.25
627	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija REP		41,715872	22,298855	GPS	Bogoljub Sterijovski		41,715872	22,298855	GPS	Sep.25
628	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija REP		41,716005	22,298868	GPS	Bogoljub Sterijovski		41,716005	22,298868	GPS	Sep.25
629	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija REP		41,716172	22,298868	GPS	Bogoljub Sterijovski		41,716172	22,298868	GPS	Sep.25
630	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija REP		41,716277	22,298910	GPS	Bogoljub Sterijovski		41,716277	22,298910	GPS	Sep.25
632	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija REP		41,716556	22,299029	GPS	Bogoljub Sterijovski		41,716556	22,299029	GPS	Sep.25
634	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija REP		41,717085	22,298959	GPS	Bogoljub Sterijovski		41,717085	22,298959	GPS	Sep.25
635	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija REP		41,717190	22,299175	GPS	Bogoljub Sterijovski		41,717190	22,299175	GPS	Sep.25
636	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija REP		41,717350	22,299043	GPS	Bogoljub Sterijovski		41,717350	22,299043	GPS	Sep.25
637	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis erhardii	Podarcis erhardii	NMK		Sasavarlija REP		41,717622	22,298917	GPS	Bogoljub Sterijovski		41,717622	22,298917	GPS	Sep.25
441	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim REP		41,677372	22,325741	GPS	Bogoljub Sterijovski		41,677372	22,325741	GPS	Sep.25
450	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Bucim REP		41,679678	22,332778	GPS	Bogoljub Sterijovski		41,679678	22,332778	GPS	Sep.25
480	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani REP		41,694656	22,221845	GPS	Bogoljub Sterijovski		41,694656	22,221845	GPS	Sep.25
486	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani REP		41,695855	22,222343	GPS	Bogoljub Sterijovski		41,695855	22,222343	GPS	Sep.25
487	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani REP		41,695972	22,222577	GPS	Bogoljub Sterijovski		41,695972	22,222577	GPS	Sep.25
492	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani REP		41,697236	22,223024	GPS	Bogoljub Sterijovski		41,697236	22,223024	GPS	Sep.25
496	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani REP		41,698306	22,223452	GPS	Bogoljub Sterijovski		41,698306	22,223452	GPS	Sep.25

497	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani REP		41,698404	22,223588	GPS	Bogoljub Sterijovski		41,698404	22,223588	GPS	Sep.25
500	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani REP		41,699221	22,223841	GPS	Bogoljub Sterijovski		41,699221	22,223841	GPS	Sep.25
505	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani REP		41,700661	22,224230	GPS	Bogoljub Sterijovski		41,700661	22,224230	GPS	Sep.25
510	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Dolani REP		41,701653	22,224892	GPS	Bogoljub Sterijovski		41,701653	22,224892	GPS	Sep.25
543	Animalia	Chordata	Reptilia	Squamata	Lacertidae	Podarcis muralis	Podarcis muralis	NMK		Goracino REP		41,638584	22,264422	GPS	Bogoljub Sterijovski		41,638584	22,264422	GPS	Sep.25
459	Animalia	Chordata	Amphibia	Anura	Ranidae	Rana graeca	Rana graeca	NMK		Dolani AMP		41,697133	22,222852	GPS	Bogoljub Sterijovski		41,697133	22,222852	GPS	Sep.25
440	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Bucim REP		41,676992	22,324136	GPS	Bogoljub Sterijovski		41,676992	22,324136	GPS	Sep.25
446	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Bucim REP		41,679620	22,332310	GPS	Bogoljub Sterijovski		41,679620	22,332310	GPS	Sep.25
448	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Bucim REP		41,679561	22,332865	GPS	Bogoljub Sterijovski		41,679561	22,332865	GPS	Sep.25
483	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Dolani REP		41,695174	22,222401	GPS	Bogoljub Sterijovski		41,695174	22,222401	GPS	Sep.25
503	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Dolani REP		41,700058	22,224211	GPS	Bogoljub Sterijovski		41,700058	22,224211	GPS	Sep.25
514	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Dolani REP		41,702392	22,225184	GPS	Bogoljub Sterijovski		41,702392	22,225184	GPS	Sep.25
552	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Goracino REP		41,638313	22,267529	GPS	Bogoljub Sterijovski		41,638313	22,267529	GPS	Sep.25
607	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Ljuboten REP		41,675789	22,267517	GPS	Bogoljub Sterijovski		41,675789	22,267517	GPS	Sep.25
638	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Sasavarlija REP		41,718229	22,298820	GPS	Bogoljub Sterijovski		41,718229	22,298820	GPS	Sep.25
639	Animalia	Chordata	Reptilia	Testudines	Testudinidae	Testudo hermanni	Testudo hermanni	NMK		Sasavarlija REP		41,718584	22,298764	GPS	Bogoljub Sterijovski		41,718584	22,298764	GPS	Sep.25
443	Animalia	Chordata	Reptilia	Squamata	Viperidae	Vipera ammodytes	Vipera ammodytes	NMK		Bucim REP		41,678569	22,328165	GPS	Bogoljub Sterijovski		41,678569	22,328165	GPS	Sep.25
591	Animalia	Chordata	Reptilia	Squamata	Viperidae	Vipera ammodytes	Vipera ammodytes	NMK		Ljuboten REP		41,678853	22,258963	GPS	Bogoljub Sterijovski		41,678853	22,258963	GPS	Sep.25
631	Animalia	Chordata	Reptilia	Squamata	Viperidae	Vipera ammodytes	Vipera ammodytes	NMK		Sasavarlija REP		41,716339	22,298945	GPS	Bogoljub Sterijovski		41,716339	22,298945	GPS	Sep.25

9 Collision risk assessment

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Executive summary

Mott MacDonald Limited has been appointed by Alcazar Energy (project proponent), an independent investment company specialised in renewable energy generation projects, to undertake a Collision Risk Assessment (CRA) of the 396MW Stip wind power project in North Macedonia (hereafter referred to as “the Project”). The Project consists of the development, construction, and operation of a greenfield 396 MW wind farm in North Macedonia. The Project will be connected to the grid through a new substation, using approximately 7 km of 400 kV overhead lines (OHL). The substation is to be constructed as part of the Project. The Project will also include the construction of approximately 68 km of access roads.

A collision risk modelling was carried using the collision risk model (CRM) tool recommended by NatureScot (2023a), and Vantage Point survey data was collected during two seasons (two six-month periods) between October 2024 and October 2025. A total of 9 VP locations were used across the survey period, total observation hours consisted of 72 at each VP1-VP8 (WTG) and 81 at VP9 (OHL). Seven raptor species met the criteria for inclusion in the collision risk modelling. The criteria comprised species recorded on at least three occasions flying within the potential collision height range (30–210 m) during the surveys, or species classified as Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) under the IUCN Red List.

Currently, there is no established statistical model that reliably predicts bird mortality associated with OHL. To address this, a full year of vantage point observations has been analysed to quantify flight activity along the proposed route and to identify sections where additional mitigation measures may be necessary.

Collison risk was calculated of the seven target species: Eurasian buzzard, Long-legged buzzard, Eurasian honey buzzard, Booted eagle, Eastern imperial eagle, Kestrel and Western marsh harrier. Only Eurasian buzzard and Kestrel had at least one collision within a year (3.2 and 1.3 respectively). None of the 30-year collision estimates would result in significant losses (>1%) of the global populations of any of the target species.

The number of birds recorded at collision risk height within the location of the OHL is not anticipated to threaten the global bird populations of the birds recorded. The mitigation and monitoring measures outlined in the ESIA provide an adaptive framework to manage impacts through the construction, operation and decommission.

9 Collision and risk assessment

9.1 Introduction

Mott MacDonald Limited has been appointed by Alcazar Energy (project proponent), an independent investment company specialised in renewable energy generation projects, to undertake a Collision Risk Assessment (CRA) of the 396MW Stip wind power project in North Macedonia (hereafter referred to as “the Project”).

The Project is located in a rural area, approximately 75km south-east from the capital city of Skopje near the city of Stip in North Macedonia. The Project is located predominantly within the municipality of Stip and Radovic and to a minor extent in municipality of Karbinci.

The municipality of Stip is situated in the central eastern part of North Macedonia, comprising 556km², approximately 3.1% of the national territory. Stip municipality lies in the middle of a watershed area of the river Bregalnica, and the area is mainly mountainous. The Project location itself is also characterised by hilly and mountainous relief with elevation ranging between 500m and 900m above sea level. The location of the wind farm borders the massif of the mountain Plackovica to the east, the valley of the river Kriva Lakavica to the west and the Derven Gorge to the south. On the northern side, the wind farm is open towards Ovce Pole and along the length of the river Bregalnica towards the valley of the Vardar River.

9.1.1 Project description

The Project consists of the development, construction, and operation of a greenfield 396 MW wind farm in North Macedonia. The Project will be constructed over a 418.7 ha area, including the swept area of blades (335.3 ha without swept area). Wind Turbine Generators (WTGs) will be connected via 35kV buried cables to a 35/400 kV substation (which will incorporate the switchgear and metering building), to be built for the Project. Cables will be laid in trenches and then backfilled with excavated subsoil and topsoil. From the substation, the Project will connect to a 400kV transmission line. Final Project parameters remain subject to modification during the ongoing design process.

The Project will be connected to the grid through a new substation, using approximately 7 km of 400 kV overhead lines (OHL). The substation is to be constructed as part of the Project. The Project will also include the construction of approximately 68 km of access roads.

Collision risk modelling was carried using the collision risk model (CRM) tool recommended by NatureScot (2024), the approach used follows the NatureScot (2024) guidance on CRM. Data was obtained during two seasons of vantage point surveys which has been used to determine the theoretical collision risk for a range of species by incorporation into a collision risk model ('CRM') (Band, 2024) and herein referred to as ‘the Band model’.

9.1.2 Assessment objectives

The aim of this report is to present the results of the collision risk assessment for 396MW Stip wind power project in North Macedonia.

9.2 Methodology

To inform this CRA, a combination of desk-based studies and field surveys was undertaken. Full details of these activities are provided in the biodiversity chapter (Chapter 8) of Volume II of the Environmental and Social Impact Assessment (ESIA). Vantage point (VP) surveys were

conducted to provide site-specific data on bird flight activity and behaviour. These VP surveys recorded observations of target species within defined survey areas and time periods, enabling the estimation of flight activity rates and informing collision risk modelling. A summary of the VP survey effort and key findings is presented below. In addition to the primary data sources, supplementary information was analysed to support the CRA, including outputs from the Soaring Bird Sensitivity Mapping Tool.

This chapter also explains the application of The Band Model which is a widely used approach for estimating bird collision risk with wind turbines and other structures such as OHL. Assumptions and limitations associated with the CRM are outlined to ensure transparency in the interpretation of results.

9.2.1 Soaring bird sensitivity mapping tool

The Soaring Bird Sensitivity tool (BirdLife International, 2025a) has been designed to provide developers, planning authorities and other interested stakeholders with early access to information on the distribution of soaring bird migration between Europe, the Middle East and East Africa. This is designed to inform early decision-making and enabling safe siting of new developments, such as wind farms, ensuring that negative impacts on this crucial migration route are minimized.

9.2.2 Summary of vantage point surveys

Vantage Point surveys were undertaken between October 2024- October 2025 across both breeding and non-breeding seasons (six month each). A total of 9 VP locations were used across the survey period, the location of the VP is shown in Table 9.1 and Annex A. A summary of survey effort is shown in Table 9.1. Total observation hours consisted of 72 at each VP1-VP8 (WTG) and 81 at VP9 (OHL). The watches were divided into 2.5 or 3-hour sessions and the sessions spread to include a representative sample of daylight hours (Maneko Solutions, 2025, Appendix A.2 of ESIA). Flying time was divided by the period of the watch (in seconds) and the area watched to give the average density of birds in flight per square kilometre. The chosen height bands for VP 1-8 corresponded to the turbine parameters (detailed in Table 9.5) which consisted of <30 m, 30-210 m and >210 m.

Table 9.1: VP locations and viewing direction

Component covered	VP number	Latitude	Longitude	Main viewing direction
WTG 1- WTG 7	1	41.70257407	22.23055546	SW
WTG 8- WTG 13	2	41.68414418	22.24893167	SE
WTG 14- WTG 20	3	41.67625649	22.29561585	NW
WTG 29 – WTG 35	4	41.65910152	22.31093371	SE
WTG 21 – WTG 28	5	41.68675321	22.34272697	NW
WTG 22, WTG 23 and WTG 36 – WTG 40	6	41.71153233	22.33318229	W
WTG 41- WTG 49	7	41.73583973	22.30270298	W
WTG 50 – WTG 55	8	41.7216294	22.27477918	W
OHL	9	41.662573	22.238636	S

Source: Mott Macdonald, 2025 Maneko Solutions, 2025

Table 9.2: VP survey effort

VP	Oct 24	Nov 24	Dec 24	Jan 25	Feb 25	Mar 25	Apr 25	May 25	Jun 25	Jul 25	Aug 25	Sept 25	Oct 25	Total (hours)
1	5	4	6	4	4	10	6	6	6	6	6	6	3	72
2	5	4	6	4	4	10	6	6	6	6	6	6	3	72
3	5	4	6	4	4	10	6	6	6	6	6	6	3	72
4	5	4	6	4	4	10	6	6	6	6	6	6	3	72
5	5	4	4	6	4	10	6	6	6	6	6	6	3	72
6	5	4	4	6	4	10	6	6	6	6	6	6	3	72
7	5	4	4	6	4	10	6	6	6	6	6	6	3	72
8	5	4	4	6	4	10	6	6	6	6	6	6	3	72
9	6	6	6	6	6	6	6	6	6	9	9	6	3	81

Source: Mott MacDonald (2025) Maneko Solutions, 2025.

All the raptor species recorded at least three times flying at potential collision height (30-210 m) during the surveys or species recorded that are IUCN critically endangered (CR)/ endangered (EN)/ vulnerable (VU) listed (IUCN, 2025), were included in the modelling of predicted transits. Species taken forward into the model are listed in Table 9.3, this table also shows all target species recorded. Species were recorded less than three times flying at potential collision height (30-210m) during the surveys, therefore, are not subject to a CRA assessment. Collision mortality risks for all other target species can therefore be reasonably concluded to be very small (negligible) and not significant at any population level without the requirement for detailed analysis. A total of seven target species were assessed in the model.

Table 9.3: Summary of species flight activity and CRA determination

Common name	Latin name	IUCN status	Total flights	'at risk' flights	CRA undertaken
Common kestrel	*Falco tinnunculus*	LC	136	65	Yes
Eurasian buzzard	*Buteo buteo*	LC	258	156	Yes
Long-legged buzzard	*Buteo rufinus*	LC	6	6	Yes
Hen harrier	*Circus cyaneus*	LC	10	2	No
Western marsh harrier	*Circus aeruginosus*	LC	5	3	Yes
Booted eagle	*Hieraaetus pennatus*	LC	3	3	Yes
Eastern imperial eagle	*Aquila heliaca*	VU	2	2	Yes
European honey buzzard	*Pernis apivorus*	LC	8	5	Yes
Montagu's harrier	*Circus pygargus*	LC	2	1	No
Lesser kestrel	*Falco naumanni*	LC	4	1	No
Northern goshawk	*Accipiter gentilis*	LC	3	2	No
Eurasian sparrowhawk	*Accipiter nisus*	LC	23	0	No
Peregrine falcon	*Falco peregrinus*	LC	1	1	No

Common name	Latin name	IUCN status	Total flights	'at risk' flights	CRA undertaken
Eurasian hobby	*Falco subbuteo*	LC	2	1	No
Short-toed snake eagle	*Circaetus gallicus*	LC	2	2	No

Source: Mott Macdonald, 2025 Maneko Solutions, 2025.

No other target species recorded more than three 'at collision risk' flights during the survey year.

9.2.3 The Band Model

Bird collision risk with turbine rotors has been evaluated using the Band model, which estimates the number of bird strikes over a defined time period (Band, 2024; NatureScot, 2025). This model relies on input data including species-specific biometrics and flight behaviour, turbine specifications, and observed flight activity. It also requires an estimate of how much time each species is active within the survey area during different seasons.

Collision Risk Modelling (CRM) applies statistical techniques to estimate the likelihood of birds colliding with wind turbines. It uses pre-construction flight activity data to forecast potential collision risks once the wind farm becomes operational.

The model consists of six stages:

9.2.3.1 Stage A: Flight Activity

This stage assesses the potential number of bird flights at risk from wind turbines, assuming no displacement, avoidance, or attraction effects. It relies on field data to quantify flight activity within the proposed wind farm area.

Recorded flight data is scaled to reflect the total flight activity across the wind farm site over a full year over a breeding (October 2024-March 2025 and October 2025) and non-breeding period (April 2025- September 2025). All vantage points covered separate areas other than VP5 and VP6 which overlapped approximately 1.2 km^2. The breeding and non-breeding seasons of the target species used in the CRA are listed in Table 9.4.

Table 9.4: Breeding and Non-breeding seasons of target species recorded

Species	Breeding season	Non-breeding season
Eurasian buzzard	April to September	October to March
Long-legged buzzard	April to September	October to March
Eurasian honey buzzard	April to September	October to March
Booted eagle	April to September	October to March
Eastern imperial eagle	April to September	October to March
Common kestrel	April to September	October to March
Western marsh harrier	April to September	October to March

Source: Mott Macdonald, 2025 Birdlife 2025b

Areal Bird Density (D_A) represents the number of birds in flight per unit area at any height, per unit area. The total time (in seconds) was calculated for each species for each VP per season. The Vantage Point view-shed is the survey area associated with each VP, calculated as a 180-degree arc of a 2km-radius applied around each VP location. Resulting in an area of the viewshed was considered 6.28 km^2 and the time recorded at each VP is 36 hours per season (129600 seconds).

"D_A = b / (t x A) bird-seconds m-2

(b) is the number of flight seconds from a vantage point;
(t) is the time (in seconds) that the vantage point is watched (129600);
(A) is the area of the vantage point view-shed (6.28 km^2)."

The proportion of birds flying at risk height was calculated for the time birds were recorded between 30-210 m against the total time birds were recorded per VP per season.

9.2.3.2 Stage B: Estimating the number of bird flights through rotors

Although birds may pass through the rotor-swept area, collisions are rare because turbine blades occupy only a fraction of that space at any given moment. This stage calculates the probability of a bird striking a blade during a transit. A key output within the collision risk assessment shows the potential number of bird transits per month and per year through the wind farm turbines, assuming birds take no avoiding action. Stage B draws on the figures for bird density (D_A), the proportion at risk height and the figures for monthly daylight and night hours as established in Stage A. To estimate the number of birds flying through rotors, additional information is required on the number of turbines, the rotor radius and flight speed of the species being observed (detailed in Table 9.5 and Table 9.6). All target species are considered diurnal species and therefore, having a nocturnal factor of 1.

9.2.3.3 Stage C: Probability of collision for a single rotor transit

Stage C uses information on the size and speed of the turbines and physical details on the size and speed of the bird to compute the risk of collision for a bird flying through a rotating rotor. It calculates the probability of a bird colliding when passing randomly through the rotor disk on a flight path perpendicular to the rotor plane, assuming collision risk is the same for oblique approaches, with no turbulence or slipstream effects. Users specify whether the species typically uses gliding or flapping flight, as gliding slightly reduces risk near the hub, though this difference is usually minor. Collision risk is higher for upwind than downwind flight, the default flight weighting has been selected for all species (default 50:50).

Turbine parameters

For CRM, it is assumed that the turbine specifications will feature a hub height of 120 m and a rotor diameter of 182 m, resulting in a potential collision risk height (PCH) of 29-211 m. A comprehensive list of parameters adopted for the Project is presented Table 9.5. Collision risk should be evaluated using the turbine rotational speed for an operating turbine. The turbines operate with a range of rotational speeds; therefore, the calculation was done using a mean operational turbine speed (8 rpm).

Table 9.5: Turbine Technical Parameters

Parameter	Turbine Specifications	Unit
Number of turbines	54	
Latitude	41.727768	
Number of blades	3	
Approximate hub height	120	m
Approximate rotor radius	91 (182 diameter)	m
Maximum height to blade tip	211	m
Minimum height to blade tip	29	m
PCH	29-211	m
Pitch	47.5	degrees
Blade width	5.08	m
Rotation speed	8	rpm

Parameter	Turbine Specifications	Unit
Wind farm width	12	km

Source: Alcazar Energy (2025), Mott MacDonald (2025)

Bird parameters

Biometric measurements for bird species were taken from Birds of the World (Cornell University, 2025). Flight speeds from Alerstam et al., (2007) and are presented in Table 9.6. Avoidance rates were taken from current guidance (NatureScot, 2025).

Table 9.6: Bird Biometric Parameters

Species	Avoidance rate (%)	Length (m)	Wingspan (m)	Flight speed (m/s)	Flight style
Common kestrel	95	0.35	0.79	10.1	Flapping
Eurasian buzzard	98	0.52	1.2	11.6	Soaring and gliding
Long-legged buzzard	98	0.62	1.6	11.6	Soaring and gliding
Eurasian honey buzzard	98	0.60	1.5	12.5	Soaring and gliding
Western marsh harrier	99	0.54	1.45	12.5	Gliding
Eastern imperial eagle	99	0.84	2.15	11.9	Gliding
Booted eagle	99	0.51	1.38	11.9	Gliding

Source: Cornell University (2025) Alerstam et al. (2007), Nature Scot (2025) and Mott MacDonald (2025)

9.2.3.4 Stage D: Probability of collision for a single rotor transit

Turbines do not operate all the time. A turbine may typically be at rest or idling for a considerable proportion of time because the wind is too weak to generate power or, exceptionally, because the turbines have been closed down to avoid damage in high wind. There is also a requirement for some downtime for maintenance.

The operational times of the wind farm assumed for the model are based on Stip 2 met mast, wind speeds above 3 m/s (turbine operational occur about 77% of the time, with negligible periods above 25 m/s. Therefore, an operational percentage of 75% has been assumed year-round to account for maintenance and downtime.

9.2.3.5 Stage E: Applying the avoidance rate

Most birds actively avoid turbine blades either by steering clear of the wind farm or by taking evasive action during close encounters. To account for this, the model applies species-specific avoidance rates. The final collision estimate is derived by multiplying the number of predicted transits by the collision probability (assuming no avoidance) and then adjusting for avoidance and other relevant factors. To account for this, species-specific avoidance rates are incorporated into the model to refine the collision risk estimates (Nature Scot, 2025).

The model ultimately provides projections of expected bird collisions over a given season, year, or across the operational lifespan of the wind farm.

The basic mathematical method for calculating predicted transits using the occupancy method (as described above) is explained by Nature Scot (2025), and, in any case, can be easily derived from first principles. However, Nature Scot (2025) does not provide guidance on how to incorporate data from multiple vantage points in calculations of predicted transits.

The model assumes that risks are additive, i.e. that a wind farm with 50 turbines will have 50 times the risk of a single turbine. However, where a bird passes successively through two or more turbines, it is exposed to the risk for each rotor transit. While it is possible that a bird encountering its first turbine may deviate to pursue a safer course through, above or around the wind farm, this is avoidance behaviour and therefore properly considered at Stage E.

9.2.3.6 Stage F: Expressing uncertainty

In a collision risk estimate following the above method, there are many sources of variability or uncertainty in the output, e.g. survey data is sampled, often both in time and space, and usually exhibits a high degree of variability, survey data is unavailable for certain conditions, including nighttime and storm conditions; there is natural variability in bird populations, over time and space, for ecological reasons. Any assumptions and limitations to the model have been included in section 2.6.

9.2.4 Collision risk modelling OHL

Currently, there is no established statistical model that reliably predicts bird mortality associated with OHL. Collision risk is highly site-, season-, and species-specific, making generic models unsuitable for accurate mortality estimates. To address this, a full year of vantage point observations has been analysed to quantify flight activity along the proposed route and to identify sections where additional mitigation measures may be necessary.

9.2.5 Assumptions and limitations

No viewshed analysis has been undertaken for the VPs therefore the visible area of the viewshed has been assumed as 100% of the 2 km arc (6.28 km^2).

The wind turbine pitch angle is to be a variable pitch (-0.5 to 90), the band model used for the CRM does not account for a variable pitch. Therefore, a default value of 47.5°. Band (2012) was chosen which is a mid-pitch angle reasonable assumption for a typical large turbine.

An additional 3 hours of vantage point surveys were undertaken during the subsequent non-breeding season (October 2025) to account for survey effort missed during the originally scheduled period (October 2024-March 2025). While these surveys help to supplement the dataset, temporal differences may influence activity levels and visibility, and therefore direct comparability with breeding season data may be limited. The CRA has been undertaken by collating data by season, which removes confounding effects of seasonal variation to remove the risk of sampling bias.

Avoidance factors of individual species are those currently recommended by Nature Scot (2025) and Whitfield & Madders (2006b). An avoidance factor is applied to the results to account for avoidance of the turbines by birds in flight. This corrects for the ability of the birds to detect and manoeuvre around the turbines.

There are inherent uncertainties and variability in flight activity data, arising from several factors. These include imprecision in estimating flight heights, which can affect the classification of birds within or outside the rotor-swept zone, and limited understanding of nocturnal behaviour for many species. Additional sources of uncertainty may stem from seasonal or weather-related fluctuations in flight patterns, observer bias during vantage point surveys, and gaps in data coverage for periods of peak migration or adverse conditions. Collectively, these limitations introduce variability into collision risk assessments and highlight the need for cautious interpretation and, where possible, the application of conservative assumptions or sensitivity analyses.

Uncertainty also arises from limitations inherent in the collision risk model itself. These include variability in bird morphology and flight speed, which can influence collision probabilities but are often generalized in the model. Additionally, the model simplifies complex shapes representing birds and turbine blades as idealized forms rather than accounting for detailed aerodynamic interactions or behavioural responses. Such assumptions, while necessary for practical modelling, introduce potential inaccuracies and highlight the need for cautious interpretation and, where feasible, sensitivity analysis to understand the influence of these simplifications on predicted outcomes.

To ensure that conservation context was appropriately considered, the National Red List of North Macedonia (IUCN ECARO, 2018) was reviewed to identify species of conservation concern. In addition, BirdLife International's (BirdLife, 2025b) species factsheets and regional monitoring outputs were consulted to understand broader European and global population trends. While these sources offer important contextual information on conservation status and trajectories, they do not supply the national-scale demographic data required for integration into a collision risk model. Quantitative assessments of the National-level populations of certain priority species have been made (MoEPP, 2014a, 2014b), and trends in the populations of certain bird species, however, many of these are outdated (over 10 years old) and standardised population estimates needed to support robust quantitative assessment of collision vulnerability. Therefore, global populations were considered the most appropriate population data to assess, if national-level data become available, these should be incorporated to refine and inform the development of collision-risk thresholds.

Despite these assumptions, the assessment remains valid because the model applies standardised, peer-reviewed methodologies that are widely accepted in industry and regulatory contexts, ensuring results are robust enough to inform decision-making within the intended scope. Furthermore, the mitigation and monitoring measures outlined in the ESIA provide an adaptive framework to manage residual uncertainties, allowing for corrective actions and validation of predictions through ongoing observation and data collection.

9.3 Results

9.3.1 Soaring bird sensitivity mapping tool

The area is not known to lie along any significant migration bottleneck. An assessment based by the Sensitivity Map indicates a very high sensitivity index (0.475) for soaring birds largely because of the presence of four Important Bird and Biodiversity Areas (IBAs) within 20 km and the maximum counts of the 13 soaring species vulnerable to collision risk within 20 km of the Project. The soaring species recorded at least three times flying at potential collision height (30-210 m) during the surveys or species recorded that are IUCN critically endangered (CR)/ endangered (EN)/ vulnerable (VU) listed (IUCN, 2025), were included in the modelling of predicted transits. These included seven target species: Eurasian buzzard, Long-legged buzzard, Eurasian honey buzzard, Booted eagle, Eastern imperial eagle, Kestrel and Western marsh harrier.

9.3.2 Collison risk model WTG

Collison risks were calculated using flight data recorded during vantage point surveys at ten vantage point locations within the study area between October 2024 and October 2025. The Flight paths have been mapped for Eastern imperial eagle in Annex A. The results of the CRM, showing flight details, annual and longer-term collision risks, are shown in Table 9.7 and Table 9.8. Full details are given in Annex B.

Table 9.7: Flight activity results WTG

Species	Number of flights observed		% observed time observed at risk height		% observed time observed at risk height
	Breeding	Non-breeding	Breeding	Non-breeding	Average
Eurasian buzzard	104	154	33.5	29.6	31.6
Long-legged buzzard	4	2	75	76.6	75.8
Eurasian honey buzzard	8	0	47.9	0	47.9
Booted eagle	3	0	90	0	90
Eastern imperial eagle	2	0	100	0	100
Common kestrel	66	70	11.9	11.3	11.6
Western marsh harrier	3	2	0	12.1	10.6

Source: Mott Macdonald, 2025 Maneko Solutions, 2025

Table 9.8: Probability of collision for birds passing through rotors

Species	Annual collision rate before avoidance rates	Avoidance rate (%)	Annual collision rate after avoidance rates	Number of years for a singular collision	30-year collision estimate after avoidance rates	Period
Eurasian buzzard	158	98	3.2	<1 year	96	All year
Long-legged buzzard	9	98	0.2	5 years	6	All year
European honey buzzard	21	98	0.4	<3 years	12	Breeding/Passage
Booted eagle	8	99	0.1	10 years	3	Breeding/Passage
Eastern imperial eagle	9	99	0.1	10 years	3	Breeding/Passage
Western marsh harrier	4	99	<0.1	>10 years	<3	All year
Common kestrel	25	95	1.3	<1 year	39	All year

Source: Band, 2024, Mott MacDonald 2025

Of the seven species recorded only two were recorded at an annual collision rate of above 1.0 which would result in a collision within the first year of operation. These were Common kestrel and Eurasian buzzard, all other species were recorded at annual collision rates lower than 1.0.

Eurasian buzzard typically utilise thermal uplift to soar at medium to high altitudes, often well above the height envelope of most WTGs. Their foraging flights are usually slow, deliberate, and at a height that reduces the likelihood of direct collision. They possess excellent vision and demonstrate strong obstacle avoidance behaviour. Typically, they are not fast or erratic fliers and rarely pursue prey in a way that forces rapid manoeuvring close to solid structures. The species' reliance on soaring flight, high manoeuvrability, and predominantly high altitude movement results in a low collision risk.

Common kestrels exhibit a well-known hover hunting technique, which occurs at consistent, modest heights typically between 5–20 m above ground. This behaviour is highly controlled, with minimal horizontal movement, significantly reducing the likelihood of colliding with WTGs. As a small falcon, the species is extremely agile and capable of rapid directional changes. Flight

is visually guided and typically slow during hunting phases, making collision events uncommon. Given their controlled, low altitude, and obstacle aware hunting behaviour, results in a low collision risk.

Eastern imperial eagles are soaring birds, using thermal and orographic uplift to maintain flight with minimal flapping and often at considerable height. Such behaviour reduces repeated exposure to rotor swept airspace. This type of movement generally carries a lower collision risk compared with localised foraging flight, which involves repeated low altitude circling or hovering. The mapped flight lines indicate that Eastern imperial eagle activity within the survey area is limited, with movements largely concentrated at the western extent, at specific vantage point (1 and 2), rather than being widely distributed across the entire development footprint. Only two Eastern imperial eagle flights were recorded at the WTG VPs, and the recorded flights appear to follow distinct directional paths. This suggests that the birds are utilising the area primarily for transit movements rather than for foraging or territorial behaviour. Where flight lines pass in proximity to proposed turbines, they are generally linear and directional, although both were at risk height. No clustering of flight paths or repeated activity was recorded indicative of a preferred feeding area, roost, or nesting location is evident based on the mapped data. Overall, the pattern of observed flight activity suggests only occasional transit use of the site. Based on the available evidence, results in a low collision risk.

The 30-year collision rate has been compared against the global populations and where available local populations of the target species. None of the 30-year collision estimates would result in significant losses (>1%) of the global populations of any of the target species (Table 9.9).

Table 9.9: Comparison of global populations against 30-year collision estimates

Species	Global population	30-year collision estimates	% of global population
Eurasian buzzard	2,038,000	96	<1%
Long-legged buzzard	100,000	6	<1%
European honey buzzard	294,000	12	<1%
Booted eagle	150,000	3	<1%
Eastern imperial eagle	3,500	3	<1%
Western marsh harrier	500,000	<3	<1%
Common kestrel	4,330,000	39	<1%

Source: Mott Macdonald, 2025 BirdLife, 2025b

9.3.3 OHL collision risk

A total of ten target species were recorded at VP9 within the vicinity of the proposed OHL. Of the ten species only five were recorded at risk height. Table 9.10 shows the flight activity results of the five species recorded at risk height.

Table 9.10: Flight activity results OHL

Species	Number of flights observed		% observed time observed at risk height		% observed time observed at risk height
	Breeding	Non-breeding	Breeding	Non-breeding	Average
Eurasian buzzard	11	11	8.6	14.4	11.5
Common kestrel	7	6	20	5.4	12.7
Lesser kestrel	2	1	11.1	0	8.8
Eurasian hobby	1	0	66.6	0	66.6

Species	Number of flights observed		% observed time observed at risk height		% observed time observed at risk height
	Breeding	Non-breeding	Breeding	Non-breeding	Average
Western marsh harrier	1	1	5.5	0	2.3

Source: Mott Macdonald, 2025 Maneko Solutions, 2025

The highest recorded species was Eurasian buzzard (22 flights) followed by Common kestrel (13 flights) both are IUCN LC species. These species also had an average % observed at risk height of <15% however, this percentage does not account for avoidance behaviour or as an indicator of mortality. Even if mortality does occur based on the number of birds recorded at collision risk height there is no anticipated threat to the global bird populations within the location of the OHL.

9.4 Conclusion

Based on the CRA, impacts to collision risk to birds is considered low risk and not significant. However, as there is still a risk of collision to several species including priority bird species (e.g. Eastern imperial eagle). A proactive approach to reducing potential impacts of WTG should be implemented. This can include timed turbine shutdowns and ensuring turbines are inactive when priority birds are nearby. In this case, observer led shutdowns could be used, as the overall collision risk to birds is assessed as low, and the presence of trained personnel will provide an appropriate and proportionate level of safeguarding. This approach should be undertaken during the peak bird activity periods migration and breeding (March to September inclusive). When implemented effectively, it has minimal effect on potential energy output and offers a practical means of reducing risk to priority bird species. More advanced radar/camera/AI based technologies are not considered necessary based on the risk profile of the Project.

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Appendices

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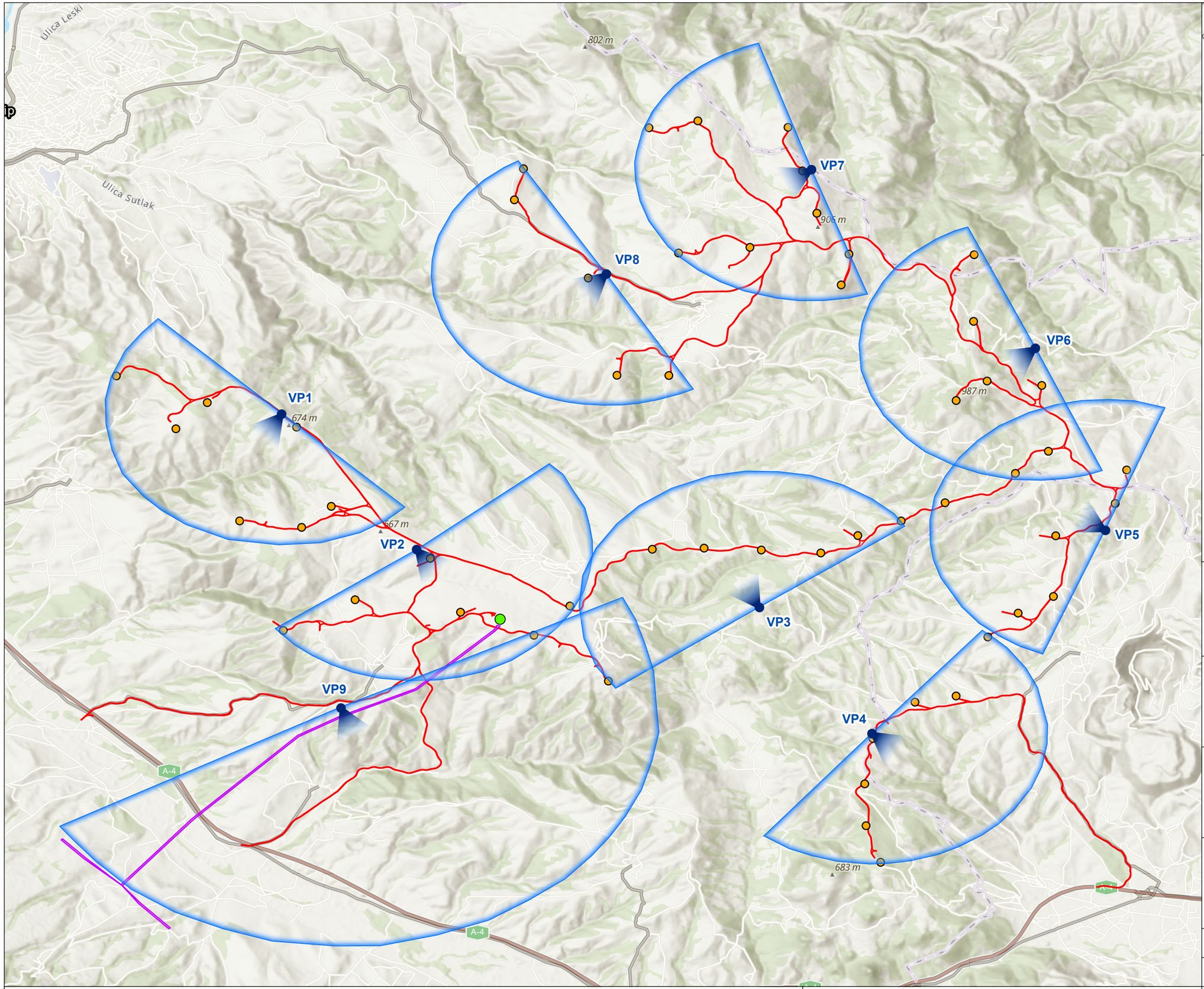
A. Vantage points viewing



Project components

- Wind turbine
- Substation
- Overhead line
- Road
- Vantage point
- Vantage point arc

Coordinate system: GCS WGS 1984; Datum: WGS 1984

Data sources: Project components: Alcazar Energy, 2025; Vantage Points: Maneko Solutions, 2025.

Background mapping: Esri, Intermap, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

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ALCAZAR ENERGY

STIP Macedonia Wind Farm

Vantage Points

Drawn	GIS Checked	Checked	Approved
K Vahakuopus	A Poole	A Poole	R Hawkins
Scale at A3	Status	Revision	Security
1:55,000	INF	01	STD

0 1 2 3 4 km

Vantage Points

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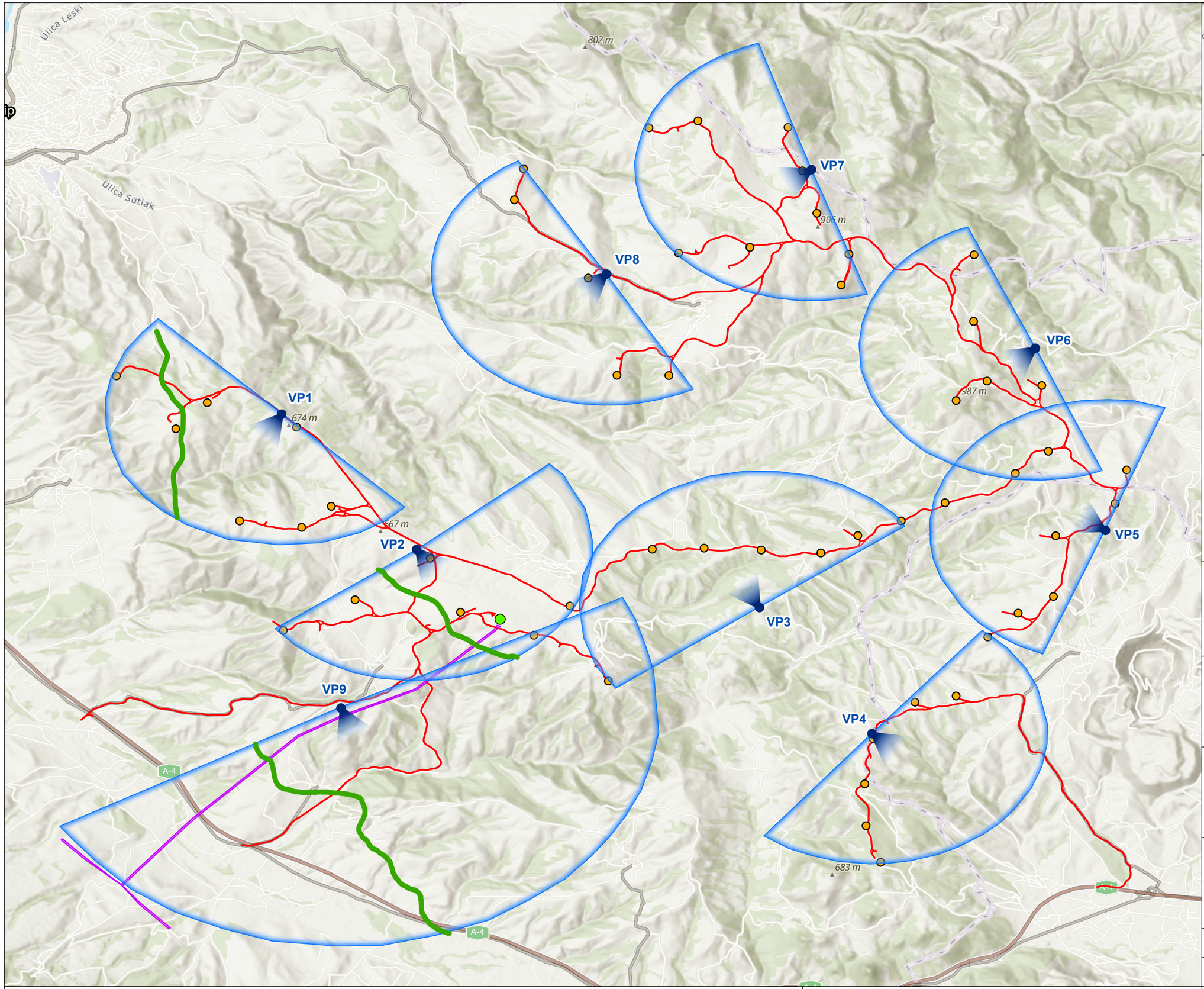
B. Eastern imperial eagle flight line map



Project components

- Wind turbine
- Substation
- Overhead line
- Road
- Vantage point
- Vantage point arc

Species flight path

- Eastern Imperial Eagle (*Aquila heliaca*)

Coordinate system: GCS WGS 1984; Datum: WGS 1984

Data sources: Project components: Alcazar Energy, 2025; Vantage Points and species flight path: Maneko Solutions, 2025.

Background mapping: Esri, Intermap, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

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Alcazar Energy

ALCAZAR ENERGY

STIP Macedonia Wind Farm

Eastern Imperial Eagle Results

Drawn	GIS Checked	Checked	Approved
K Vahakuopus	A Poole	A Poole	R Hawkins
Scale at A3	Status	Revision	Security
1:55,000	INF	01	STD

0 1 2 3 4 km

Eastern Imperial Eagle Results

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C. Collision risk model calculations

COLLISION RISK MODEL

Required input data is in	orange	boxes
Calculated output is in	blue	boxes
	green	boxes are for information only, to show variables used at each stage

Bird data		Value	Units
Species name		Eurasian buzzard	
Bird length	L	0.52	m
Wingspan	W	1.2	m
Bird flight speed	v	13.3	m s^{-1}
Flight type, flapping or gliding		gliding	
% of flights upwind/downwind		50%	50%
Nocturnal activity ranking 1-5		1	
Nocturnal activity factor	f_{night}	0%	

Windfarm data		Value	Units
Site name		STIP	
Latitude		41.686887	degrees
No of turbines	T	54	
Width of windfarm	w	12	km

Turbine data		Value	Units
Model		8MW	
Hub height		120	m
Rotor radius	R	91	m
No of blades	b	3	
Rotation speed	Ω	8	rpm
Max blade width	C	5.08	m
Blade pitch	λ	47.5	degrees
Risk height range		29-211	m

normal approach

Set to 'normal approach' to use survey data on bird density
Set to 'birds on migration' to use 'Migrant collision risk' sheet in place of Stage A

Stage A

				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Daytime bird density	D_A		birds/km^2	0.00663	0.0066302	0.0066302	0.004056	0.0040561	0.0040561	0.0040561	0.0040561	0.0040561	0.0066302	0.0066302	0.0066302	0.0053
Proportion at rotor risk height	Q_{2R}	31.60%														
At latitude 41.7		Daylight hours per month		295.3	295.9	369.1	399.2	449.8	454.3	461.2	429.6	375.7	345.0	296.6	285.7	4457.4
		Nighttime hours per month		448.7	376.1	374.9	320.8	294.2	265.7	282.8	314.4	344.3	399.0	423.4	458.3	4302.6

Stage B

No of turbines	T	54		
Rotor radius	R	91	m	
		Total rotor frontal area m^2		1404839
Nocturnal activity factor	f_{night}	0%		
Bird flight speed	v	13.3	m s^{-1}	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year total
Projected number of rotor transits	228.6	229.1	285.8	189.1	213.1	215.2	218.5	203.5	178.0	267.1	229.7	221.2	**2679**

Stage C

No of blades	b	3	
Rotation speed	Ω	8	rpm
Rotor radius	R	91	m
Max blade width	C	5.08	m
Pitch	λ	47.5	degrees
Blade profile		see Blade profile sheet	

Bird length	l	0.52	m
Wingspan	w	1.2	m
Bird flight speed	v	13.3	m s^{-1}
Flight type		gliding	
% of flights upwind/downwind		50%	50%

Single transit risk	
upwind	10.06%
downwind	5.72%
weighted mean	**7.89%**

Stage D

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Proportion of time operational	Q_{op}	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%
		Collision rates before avoidance												year total
		13.53	13.56	16.91	11.19	12.61	12.73	12.93	12.04	10.53	15.80	13.59	13.09	**158**

Stage E

Allow for large array correction?		Yes	
Width of windfarm	w	12	km

Avoidance rates modelled		large array correction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	per year
			Collision rates allowing for avoidance												
	95.00%	99.92%	0.68	0.68	0.84	0.56	0.63	0.64	0.65	0.60	0.53	0.79	0.68	0.65	**7.9**
	98.00%	99.97%	0.27	0.27	0.34	0.22	0.25	0.25	0.26	0.24	0.21	0.32	0.27	0.26	**3.2**
	99.00%	99.98%	0.14	0.14	0.17	0.11	0.13	0.13	0.13	0.12	0.11	0.16	0.14	0.13	**1.6**
	99.50%	99.99%	0.07	0.07	0.08	0.06	0.06	0.06	0.06	0.06	0.05	0.08	0.07	0.07	**0.8**

COLLISION RISK MODEL

Required input data is in	orange	boxes
Calculated output is in	blue	boxes
	green	boxes are for information only, to show variables used at each stage

Bird data		Value	Units
Species name		Long legged buzzard	
Bird length	L	0.62	m
Wingspan	W	1.6	m
Bird flight speed	v	13.5	m s^{-1}
Flight type, flapping or gliding		gliding	
% of flights upwind/downwind		50%	50%
Nocturnal activity ranking 1-5		1	
Nocturnal activity factor	f_{night}	0%	

Windfarm data		Value	Units
Site name		STIP	
Latitude		41.686887	degrees
No of turbines	T	54	
Width of windfarm	w	12	km

Turbine data		Value	Units
Model		8MW	
Hub height		120	m
Rotor radius	R	91	m
No of blades	b	3	
Rotation speed	Ω	8	rpm
Max blade width	C	5.08	m
Blade pitch	λ	47.5	degrees
Risk height range		29-211	m

normal approach

Set to 'normal approach' to use survey data on bird density
Set to 'birds on migration' to use 'Migrant collision risk' sheet in place of Stage A

Stage A

				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Daytime bird density	D_A		birds/km^2	9.83E-05	9.829E-05	9.829E-05	0.000129	0.000129	0.000129	0.000129	0.000129	0.000129	9.829E-05	9.829E-05	9.829E-05	0.0001
Proportion at rotor risk height	Q_{2R}	75.80%														
At latitude 41.7		Daylight hours per month		295.3	295.9	369.1	399.2	449.8	454.3	461.2	429.6	375.7	345.0	296.6	285.7	4457.4
		Nighttime hours per month		448.7	376.1	374.9	320.8	294.2	265.7	282.8	314.4	344.3	399.0	423.4	458.3	4302.6

Stage B

No of turbines	T	54		
Rotor radius	R	91	m	
		Total rotor frontal area m^2		1404839
Nocturnal activity factor	f_{night}	0%		
Bird flight speed	v	13.5	m s^{-1}	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year total
Projected number of rotor transits	8.3	8.3	10.3	14.6	16.5	16.7	16.9	15.8	13.8	9.6	8.3	8.0	**147**

Stage C

No of blades	b	3		Bird length	l	0.62	m	
Rotation speed	Ω	8	rpm	Wingspan	w	1.6	m	
Rotor radius	R	91	m	Bird flight speed	v	13.5	m s^{-1}	
Max blade width	C	5.08	m	Flight type		gliding		
Pitch	λ	47.5	degrees	% of flights upwind/downwind		50%		50%
Blade profile		see Blade profile sheet						

Single transit risk	
upwind	10.30%
downwind	5.97%
weighted mean	**8.13%**

Stage D

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Proportion of time operational	Q_{op}	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%
		Collision rates before avoidance												year total
		0.50	0.50	0.63	0.89	1.01	1.02	1.03	0.96	0.84	0.59	0.51	0.49	**9**

Stage E

Allow for large array correction?		Yes	
Width of windfarm	w	12	km

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	per year
		large array correction	Collision rates allowing for avoidance												
Avoidance rates modelled	95.00%	99.92%	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.05	0.04	0.03	0.03	0.02	**0.4**
	98.00%	99.97%	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	**0.2**
	99.00%	99.98%	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	**0.1**
	99.50%	99.99%	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	**0.0**

COLLISION RISK MODEL

Required input data is in	orange	boxes
Calculated output is in	blue	boxes
	green	boxes are for information only, to show variables used at each stage

Bird data		Value	Units
Species name		Marsh Harrier	
Bird length	L	0.54	m
Wingspan	W	1.45	m
Bird flight speed	v	12.5	m s^{-1}
Flight type, flapping or gliding		gliding	
% of flights upwind/downwind		50%	50%
Nocturnal activity ranking 1-5		1	
Nocturnal activity factor	f_{night}	0%	

Windfarm data		Value	Units
Site name		STIP	
Latitude		41.686887	degrees
No of turbines	T	54	
Width of windfarm	w	12	km

Turbine data		Value	Units
Model		8MW	
Hub height		120	m
Rotor radius	R	91	m
No of blades	b	3	
Rotation speed	Ω	8	rpm
Max blade width	C	5.08	m
Blade pitch	λ	47.5	degrees
Risk height range		29-211	m

normal approach

Set to 'normal approach' to use survey data on bird density
Set to 'birds on migration' to use 'Migrant collision risk' sheet in place of Stage A

Stage A

				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Daytime bird density	D_A		birds/km^2	0.000207	0.000207	0.0002073	0.000378	0.0003778	0.0003778	0.0003778	0.0003778	0.0003778	0.0002073	0.0002073	0.0002073	0.0003
Proportion at rotor risk height	Q_{2R}	12.15%														
At latitude 41.7		Daylight hours per month		295.3	295.9	369.1	399.2	449.8	454.3	461.2	429.6	375.7	345.0	296.6	285.7	4457.4
		Nighttime hours per month		448.7	376.1	374.9	320.8	294.2	265.7	282.8	314.4	344.3	399.0	423.4	458.3	4302.6

Stage B

No of turbines	T	54		
Rotor radius	R	91	m	
		Total rotor frontal area m^2		1404839
Nocturnal activity factor	f_{night}	0%		
Bird flight speed	v	12.5	m s^{-1}	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year total
Projected number of rotor transits	2.6	2.6	3.2	6.4	7.2	7.2	7.4	6.8	6.0	3.0	2.6	2.5	**57**

Stage C

No of blades	b	3		Bird length	l	0.54	m
Rotation speed	Ω	8	rpm	Wingspan	w	1.45	m
Rotor radius	R	91	m	Bird flight speed	v	12.5	m s^{-1}
Max blade width	C	5.08	m	Flight type		gliding	
Pitch	λ	47.5	degrees	% of flights upwind/downwind		50%	50%
Blade profile		see Blade profile sheet					

Single transit risk	
upwind	10.65%
downwind	6.27%
weighted mean	**8.46%**

Stage D

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Proportion of time operational	Q_{op}	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%
		Collision rates before avoidance												year total
		0.16	0.16	0.20	0.40	0.46	0.46	0.47	0.43	0.38	0.19	0.16	0.16	**4**

Stage E

Allow for large array correction?		Yes	
Width of windfarm	w	12	km

			large array correction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	per year
				Collision rates allowing for avoidance												
Avoidance rates modelled		95.00%	99.91%	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	**0.2**
		98.00%	99.96%	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	**0.1**
		99.00%	99.98%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.0**
		99.50%	99.99%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.0**

COLLISION RISK MODEL

Required input data is in	orange	boxes
Calculated output is in	blue	boxes
	green	boxes are for information only, to show variables used at each stage

Bird data		Value	Units
Species name		Honey buzzard	
Bird length	L	0.6	m
Wingspan	W	1.5	m
Bird flight speed	v	13.4	m s^{-1}
Flight type, flapping or gliding		gliding	
% of flights upwind/downwind		50%	50%
Nocturnal activity ranking 1-5		1	
Nocturnal activity factor	f_{night}	0%	

Windfarm data		Value	Units
Site name		STIP	
Latitude		41.68689	degrees
No of turbines	T	54	
Width of windfarm	w	12	km

Turbine data		Value	Units
Model		8MW	
Hub height		120	m
Rotor radius	R	91	m
No of blades	b	3	
Rotation speed	Ω	8	rpm
Max blade width	C	5.08	m
Blade pitch	λ	47.5	degrees
Risk height range		29-211	m

normal approach

Set to 'normal approach' to use survey data on bird density
Set to 'birds on migration' to use 'Migrant collision risk' sheet in place of Stage A

Stage A

				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Daytime bird density	D_A		birds/km^2	0	0	0	0.000756	0.0007556	0.0007556	0.0007556	0.0007556	0.0007556	0	0	0	0.0004
Proportion at rotor risk height	Q_{2R}	47.90%														
At latitude 41.7		Daylight hours per month		295.3	295.9	369.1	399.2	449.8	454.3	461.2	429.6	375.7	345.0	296.6	285.7	4457.4
		Nighttime hours per month		448.7	376.1	374.9	320.8	294.2	265.7	282.8	314.4	344.3	399.0	423.4	458.3	4302.6

Stage B

No of turbines	T	54																
Rotor radius	R	91	m															
		Total rotor frontal area m^2		1404839														
Nocturnal activity factor	f_{night}	0%																
Bird flight speed	v	13.4	m s^{-1}		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year total	
		Projected number of rotor transits			0.0	0.0	0.0	53.8	60.6	61.2	62.2	57.9	50.6	0.0	0.0	0.0	**346**	

Stage C

No of blades	b	3		Bird length	l	0.6	m	
Rotation speed	Ω	8	rpm	Wingspan	w	1.5	m	
Rotor radius	R	91	m	Bird flight speed	v	13.4	m s^{-1}	
Max blade width	C	5.08	m	Flight type		gliding		
Pitch	λ	47.5	degrees	% of flights upwind/downwind		50%		50%
Blade profile		see Blade profile sheet						
		Single transit risk	upwind	10.28%				
			downwind	5.95%				
			weighted mean	**8.11%**				

Stage D

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Proportion of time operational	Q_{op}	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%
		Collision rates before avoidance												year total
		0.00	0.00	0.00	3.27	3.69	3.73	3.78	3.52	3.08	0.00	0.00	0.00	**21**

Stage E

Allow for large array correction?		Yes																
Width of windfarm	w	12	km															
			large array correction		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	per year	
Avoidance rates modelled					Collision rates allowing for avoidance													
		95.00%	99.92%		0.00	0.00	0.00	0.16	0.18	0.19	0.19	0.18	0.15	0.00	0.00	0.00	**1.1**	
		98.00%	99.97%		0.00	0.00	0.00	0.07	0.07	0.07	0.08	0.07	0.06	0.00	0.00	0.00	**0.4**	
		99.00%	99.98%		0.00	0.00	0.00	0.03	0.04	0.04	0.04	0.04	0.03	0.00	0.00	0.00	**0.2**	
		99.50%	99.99%		0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	**0.1**	

COLLISION RISK MODEL

Required input data is in	orange	boxes
Calculated output is in	blue	boxes
	green	boxes are for information only, to show variables used at each stage

Bird data		Value	Units
Species name		Eastern imperial eagle	
Bird length	L	0.84	m
Wingspan	W	2.15	m
Bird flight speed	v	11.9	m s^{-1}
Flight type, flapping or gliding		gliding	
% of flights upwind/downwind		50%	50%
Nocturnal activity ranking 1-5		1	
Nocturnal activity factor	f_{night}	0%	

Windfarm data		Value	Units
Site name		STIP	
Latitude		41.686887	degrees
No of turbines	T	54	
Width of windfarm	w	12	km

Turbine data		Value	Units
Model		8MW	
Hub height		120	m
Rotor radius	R	91	m
No of blades	b	3	
Rotation speed	Ω	8	rpm
Max blade width	C	5.08	m
Blade pitch	λ	47.5	degrees
Risk height range		29-211	m

normal approach

Set to 'normal approach' to use survey data on bird density
Set to 'birds on migration' to use 'Migrant collision risk' sheet in place of Stage A

Stage A

				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Daytime bird density	D_A		birds/km^2	0	0	0	0.000147	0.0001474	0.0001474	0.0001474	0.0001474	0.0001474	0	0	0	0.0001
Proportion at rotor risk height	Q_{2R}	100.00%														
At latitude 41.7		Daylight hours per month		295.3	295.9	369.1	399.2	449.8	454.3	461.2	429.6	375.7	345.0	296.6	285.7	4457.4
		Nighttime hours per month		448.7	376.1	374.9	320.8	294.2	265.7	282.8	314.4	344.3	399.0	423.4	458.3	4302.6

Stage B

No of turbines	T	54																
Rotor radius	R	91	m															
		Total rotor frontal area m^2		1404839														
Nocturnal activity factor	f_{night}	0%																
Bird flight speed	v	11.9	m s^{-1}		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year total	
		Projected number of rotor transits			0.0	0.0	0.0	19.5	21.9	22.2	22.5	20.9	18.3	0.0	0.0	0.0	**125**	

Stage C

No of blades	b	3		Bird length	l	0.84	m	
Rotation speed	Ω	8	rpm	Wingspan	w	2.15	m	
Rotor radius	R	91	m	Bird flight speed	v	11.9	m s^{-1}	
Max blade width	C	5.08	m	Flight type		gliding		
Pitch	λ	47.5	degrees	% of flights upwind/downwind		50%		50%
Blade profile		see Blade profile sheet						

Single transit risk	upwind	12.11%
	downwind	7.73%
	weighted mean	**9.92%**

Stage D

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Proportion of time operational	Q_{op}	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%
		Collision rates before avoidance												year total
		0.00	0.00	0.00	1.45	1.63	1.65	1.67	1.56	1.36	0.00	0.00	0.00	**9**

Stage E

Allow for large array correction?		Yes																
Width of windfarm	w	12	km															
			large array correction		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	per year	
					Collision rates allowing for avoidance													
Avoidance rates modelled		95.00%	99.90%		0.00	0.00	0.00	0.07	0.08	0.08	0.08	0.08	0.07	0.00	0.00	0.00	**0.5**	
		98.00%	99.96%		0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.00	0.00	0.00	**0.2**	
		99.00%	99.98%		0.00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.01	0.00	0.00	0.00	**0.1**	
		99.50%	99.99%		0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	**0.0**	

COLLISION RISK MODEL

Required input data is in	orange	boxes
Calculated output is in	blue	boxes
	green	boxes are for information only, to show variables used at each stage

Bird data		Value	Units
Species name		Kestrel	
Bird length	L	0.35	m
Wingspan	W	0.79	m
Bird flight speed	v	10.1	m s^{-1}
Flight type, flapping or gliding		flapping	
% of flights upwind/downwind		50%	50%
Nocturnal activity ranking 1-5		1	
Nocturnal activity factor	f_{night}	0%	

Windfarm data		Value	Units
Site name		STIP	
Latitude		41.686887	degrees
No of turbines	T	54	
Width of windfarm	w	12	km

Turbine data		Value	Units
Model		8MW	
Hub height		120	m
Rotor radius	R	91	m
No of blades	b	3	
Rotation speed	Ω	8	rpm
Max blade width	C	5.08	m
Blade pitch	λ	47.5	degrees
Risk height range		29-211	m

normal approach

Set to 'normal approach' to use survey data on bird density
Set to 'birds on migration' to use 'Migrant collision risk' sheet in place of Stage A

Stage A

				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Daytime bird density	D_A		birds/km^2	0.002394	0.0023936	0.0023936	0.002417	0.002417	0.002417	0.002417	0.002417	0.002417	0.0023936	0.0023936	0.0023936	0.0024
Proportion at rotor risk height	Q_{2R}	11.60%														
At latitude 41.7		Daylight hours per month		295.3	295.9	369.1	399.2	449.8	454.3	461.2	429.6	375.7	345.0	296.6	285.7	4457.4
		Nighttime hours per month		448.7	376.1	374.9	320.8	294.2	265.7	282.8	314.4	344.3	399.0	423.4	458.3	4302.6

Stage B

No of turbines	T	54		
Rotor radius	R	91	m	
		Total rotor frontal area m^2		1404839
Nocturnal activity factor	f_{night}	0%		
Bird flight speed	v	10.1	m s^{-1}	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year total
Projected number of rotor transits	23.0	23.1	28.8	31.4	35.4	35.8	36.3	33.8	29.6	26.9	23.1	22.3	**349**

Stage C

No of blades	b	3		Bird length	l	0.35	m	
Rotation speed	Ω	8	rpm	Wingspan	w	0.79	m	
Rotor radius	R	91	m	Bird flight speed	v	10.1	m s^{-1}	
Max blade width	C	5.08	m	Flight type		flapping		
Pitch	λ	47.5	degrees	% of flights upwind/downwind		50%		50%
Blade profile		see Blade profile sheet						

Single transit risk		
	upwind	11.80%
	downwind	7.36%
	weighted mean	**9.58%**

Stage D

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Proportion of time operational	Q_{op}	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%
		Collision rates before avoidance												year total
		1.65	1.66	2.07	2.26	2.54	2.57	2.61	2.43	2.12	1.93	1.66	1.60	**25**

Stage E

Allow for large array correction?		Yes	
Width of windfarm	w	12	km

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	per year
		large array correction	Collision rates allowing for avoidance												
Avoidance rates modelled	95.00%	99.90%	0.08	0.08	0.10	0.11	0.13	0.13	0.13	0.12	0.11	0.10	0.08	0.08	**1.3**
	98.00%	99.96%	0.03	0.03	0.04	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.03	0.03	**0.5**
	99.00%	99.98%	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	**0.3**
	99.50%	99.99%	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	**0.1**

COLLISION RISK MODEL

Required input data is in	orange	boxes
Calculated output is in	blue	boxes
	green	boxes are for information only, to show variables used at each stage

Bird data		Value	Units
Species name		Booted eagle	
Bird length	L	0.51	m
Wingspan	W	1.38	m
Bird flight speed	v	11.9	m s^{-1}
Flight type, flapping or gliding		gliding	
% of flights upwind/downwind		50%	50%
Nocturnal activity ranking 1-5		1	
Nocturnal activity factor	f_{night}	0%	

Windfarm data		Value	Units
Site name		STIP	
Latitude		41.686887	degrees
No of turbines	T	54	
Width of windfarm	w	12	km

Turbine data		Value	Units
Model		8MW	
Hub height		120	m
Rotor radius	R	91	m
No of blades	b	3	
Rotation speed	Ω	8	rpm
Max blade width	C	5.08	m
Blade pitch	λ	47.5	degrees
Risk height range		29-211	m

normal approach

Set to 'normal approach' to use survey data on bird density
Set to 'birds on migration' to use 'Migrant collision risk' sheet in place of Stage A

Stage A				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Daytime bird density	D_A		birds/km^2	0	0	0	0.000157	0.000157	0.000157	0.000157	0.000157	0.000157	0	0	0	0.0001
Proportion at rotor risk height	Q_{2R}	90.00%														
At latitude 41.7		Daylight hours per month		295.3	295.9	369.1	399.2	449.8	454.3	461.2	429.6	375.7	345.0	296.6	285.7	4457.4
		Nighttime hours per month		448.7	376.1	374.9	320.8	294.2	265.7	282.8	314.4	344.3	399.0	423.4	458.3	4302.6

Stage B																	
No of turbines	T	54															
Rotor radius	R	91	m														
		Total rotor frontal area m^2		1404839													
Nocturnal activity factor	f_{night}	0%															
Bird flight speed	v	11.9	m s^{-1}		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year total
		Projected number of rotor transits			0.0	0.0	0.0	18.6	21.0	21.2	21.5	20.0	17.5	0.0	0.0	0.0	**120**

Stage C								
No of blades	b	3		Bird length	l	0.51	m	
Rotation speed	Ω	8	rpm	Wingspan	w	1.38	m	
Rotor radius	R	91	m	Bird flight speed	v	11.9	m s^{-1}	
Max blade width	C	5.08	m	Flight type		gliding		
Pitch	λ	47.5	degrees	% of flights upwind/downwind		50%		50%
Blade profile		see Blade profile sheet						
		Single transit risk	upwind	10.94%				
			downwind	6.56%				
			weighted mean	**8.75%**				

Stage D		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year avge
Proportion of time operational	Q_{op}	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%
		Collision rates before avoidance												year total
		0.00	0.00	0.00	1.22	1.38	1.39	1.41	1.31	1.15	0.00	0.00	0.00	**8**

Stage E																	
Allow for large array correction?		Yes															
Width of windfarm	w	12	km														
			large array correction		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	per year
					Collision rates allowing for avoidance												
Avoidance rates modelled		95.00%	99.91%		0.00	0.00	0.00	0.06	0.07	0.07	0.07	0.07	0.06	0.00	0.00	0.00	**0.4**
		98.00%	99.96%		0.00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.02	0.00	0.00	0.00	**0.2**
		99.00%	99.98%		0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	**0.1**
		99.50%	99.99%		0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	**0.0**

10 Critical habitat assessment

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	17/12/25	J. Poole A. Poole	R. Griffiths		Draft
B	22/01/26	J. Poole A Poole	R. Griffiths	K. Dinucci	Updated draft
C	20/02/26	J. Poole A Poole R. Griffiths	S. Crute	K. Dinucci	Draft for consultation

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1 Critical habitat assessment

1.1 Introduction

This Critical Habitat Assessment (CHA) has been undertaken by Mott MacDonald as part of the Environmental and Social Impact Assessment (ESIA) for the proposed STIP Windfarm (the Project).

The assessment has been undertaken in accordance with international best practice, specifically the requirements of:

- International Finance Corporation (IFC) Performance Standard 6 (PS6): Biodiversity Conservation and Sustainable Management of Living Natural Resources,
- European Bank for Reconstruction and Development (EBRD) Environmental and Social Requirement 6 (ESR6): Biodiversity Conservation and Sustainable Management of Living Natural Resources, and
- European Investment Bank (EIB) Environmental and Social Standards 4 (ESS4): Biodiversity and Ecosystems

The purpose of this CHA is to determine whether the Project is located within Critical Habitat, as defined by IFC PS6, EBRD ESR6, and EIB ESS4 and to evaluate the potential impacts of the proposed development on Critical Habitat features.

This appendix provides a detailed account of the methodology, findings, and conclusions of the CHA, and forms a key component of the ESIA's biodiversity impact assessment. It is intended to guide the development of a Biodiversity Action Plan (BAP) if required.

1.1.1 Project Overview

The Project is a large-scale renewable energy project located in a rural, mountainous area approximately 75 km southeast of Skopje, near the city of Štip in North Macedonia. Covering a footprint of approximately 335 ha (418.7 ha including blade swept areas), the project will comprise up to 54 wind turbine generators (WTGs), each with a nominal capacity of 8 MW, totalling up to 396 MW and generating over 1,340 GWh annually.

The site lies within the watershed of the Bregalnica River and is bordered by the Plackovica mountain massif, Kriva Lakavica valley, Derven Gorge, and Ovče Pole.

Key infrastructure includes a 35/400 kV substation, approximately 80 km of buried cabling, a 7 km 400 kV overhead transmission line, and around 68 km of upgraded and new access roads.

The project also includes permanent met masts, remote monitoring systems, and long-term operation and maintenance facilities, with a design life of approximately 25 years.

A detailed project description can be found in Volume II, Chapter 2 of the ESIA.

1.1.2 Scope and Objectives of this CHA

The scope of this CHA is to evaluate the potential presence of Critical Habitat within the Project and its broader Ecologically Appropriate Area of Analysis (EAAA), in line with the requirements of IFC, EBRD and EIB. The assessment covers terrestrial habitats, species, and ecosystems that may meet Critical Habitat thresholds. The CHA has been developed in accordance with the Project's ESG Compliance Framework and ESIA scope, ensuring consistency with IFC

Performance Standard 6, EBRD PR6/ESR6, EIB ESS4 requirements and EIB Guidance Note for Standard 3 on Biodiversity and Ecosystems.

The primary objectives of the CHA are to:

- Identify and classify biodiversity features that may qualify as Critical Habitat, including threatened species, endemic or restricted-range species, migratory or congregatory species, and unique or threatened ecosystems.
- Assess the potential impacts of the Project on these biodiversity features, considering both direct and indirect effects across all project phases.
- Determine the project's alignment with IFC, EBRD and EIB biodiversity safeguards and assess whether Critical Habitat is likely to be affected.
- Inform mitigation and management strategies, including the application of the mitigation hierarchy and the potential need for a Biodiversity Action Plan (BAP).
- Support decision-making by project stakeholders and ensure that biodiversity risks are appropriately addressed in project planning and implementation.

This CHA integrates desktop research, field surveys, and stakeholder consultation to provide a robust and defensible assessment of biodiversity risks and opportunities associated with the Project.

1.1.3 Regulatory Requirements

IFC PS6, EBRD ESR6 and EIB ESS4 set out rigorous criteria for identifying and managing Critical Habitat to safeguard biodiversity in project development.

Under IFC PS6, Critical Habitat is defined using five criteria, including the presence of:

- Critically Endangered or Endangered species
- Endemic or restricted-range species
- Migratory or congregatory species
- Highly threatened or unique ecosystems
- Areas associated with key evolutionary processes

Projects must demonstrate that they will not cause measurable adverse impacts on biodiversity values and must achieve a net gain for affected critical habitat features. The mitigation hierarchy (avoid, minimise, restore, offset) must be applied, and stakeholder engagement is essential.

EBRD ESR6 aligns closely with IFC PS6 but places additional emphasis on:

- Priority Biodiversity Features, including Vulnerable species and ecosystems of international importance
- Precautionary principle and alignment with international conventions (e.g. Convention on Biological Diversity (CBD) and Ramsar)
- No net loss or net gain requirements for critical habitat
- Integration of biodiversity measures into the Environmental and Social Action Plan (ESAP)

EIB Standard 3 refers to Critical Habitat defined using six criterion which are::

- A highly threatened and/or unique ecosystem;
- A habitat that supports a population of critically endangered, endangered or vulnerable species, as defined by the IUCN Red List of threatened species and in relevant legislation.;
- A habitat that supports Population range or distribution of endemic or restricted-range species, or highly distinctive assemblages of species

- A habitat required for the survival of migratory species and/or congregatory species;
- Biodiversity and/or an ecosystem of significant social, economic or cultural importance to local communities and indigenous groups;
- A habitat of key scientific value and/or associated with key evolutionary processes.

While there are some nuances between the three standards, this CHA has been designed to meet the requirements of IFC PS6, EBRD ESR6 and EIB ESS4, ensuring full alignment with international biodiversity safeguards.

1.2 Methodology

The CHA methodology includes the definition of the study area, description of the project's area of influence, and determination of the EAAA for assessing potential presence of Critical Habitat. It draws on a combination of desktop data review, field surveys, and stakeholder engagement to identify biodiversity features.

Key components of the methodology include:

- Data collection and sources, including global and national biodiversity datasets, scientific literature, and expert input;
- Habitat mapping to characterise land cover and ecological features;
- Application of assessment criteria based on IFC PS6, EBRD ESR6 and EIS ESS4 for Critical Habitat determination;
- Consideration of limitations and assumptions that may influence the interpretation of findings.

Together, these elements provide a comprehensive framework for identifying Critical Habitat and informing biodiversity management measures for the Project.

Figure 1.1 presents the step-wise process of undertaking this CHA. Step 1 identifies Critically Endangered (CR) or Endangered (EN) Species, Endemic or Restricted-Range Species and Migratory or Congregatory Species based on IUCN and Macedonia Red List within 50km of the Project. It also identifies Vulnerable (VU) species that are associated with any of the internationally recognised and legally protected areas within 50km of the Project and recorded during field surveys. These species are then screened in for further investigation at Step 2.

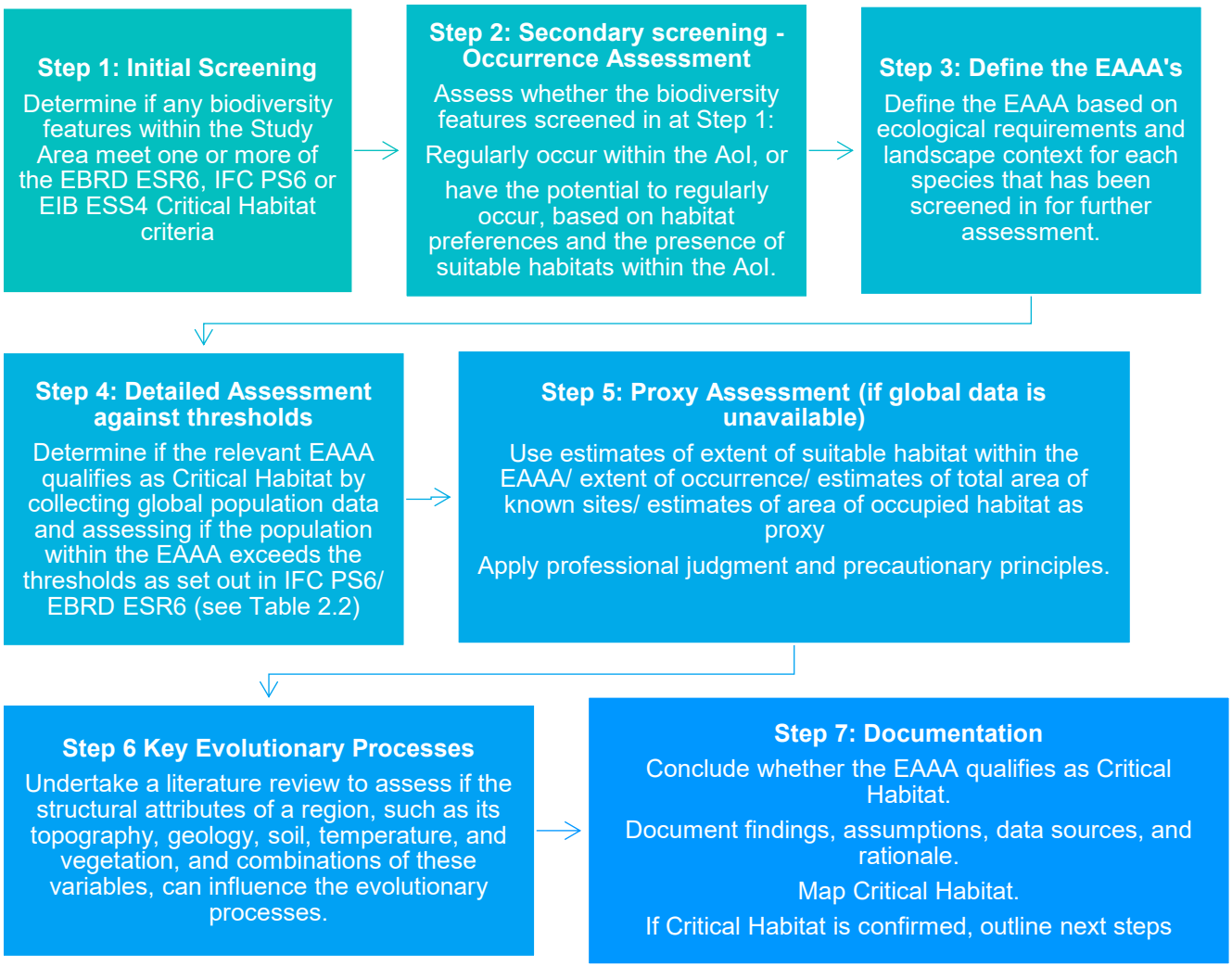
Step 2 draws on information and conclusions from Volume II Chapter 8 ESIA baseline to understand if the species are regularly occurring within the AoI. Where species and habitats have been identified following surveys/ literature review, or where species have a likelihood of regularly occurring within the Project AoI based on their preferences and presence of suitable habitats, these will be further investigated.

Within Step 3 an EAAA will be delineated for each species and ecosystem to be assessed (see Section 1.2.1.1 for more details on EAAAs).

At Step 4, assessments against the quantitative thresholds (see **Error! Reference source not found.**) will be undertaken using global population data and where this information is not available Step 5 includes an assessment using proxy data. A literature review will be undertaken for Step 6 for Key Evolutionary Processes as this is a qualitative assessment.

Conclusions and next steps will then be documented at Step 7.

Figure 1.1: CHA step-wise methodology



1.2.1 Study areas

To determine if the Project is located in Critical Habitat, four areas of interest to biodiversity are defined, the Biodiversity Study Area (BSA), the field survey area, the Area of Influence (AoI) and EAAAs. These are summarised in Table 1.1 below. The EAAAs are described in more detail in section 1.2.1.1 below.

Table 1.1: Study areas defined for the Project

Study Element	Spatial extent	Taxa/ Features included
Biodiversity Study Area (BSA)	50 km buffer around the Project for protected areas and IBAT species list	Protected area; Species list[1]

[1] This list is drawn from the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (purchased from Integrated Biodiversity Assessment Tool (IBAT).

Study Element	Spatial extent	Taxa/ Features included
Field Survey Area	Transects and points within the Project site plus 500 m beyond the site boundary.	All biodiversity receptors surveyed per field methods (habitats, flora, mammals, bats, birds, herpetofauna)
Biodiversity Area of Influence (AoI)	500m around each Project component for habitats, flora, mammals, herpetofauna; 2km around each Project component for birds, extended to 6km for breeding large raptors.	500m - habitats, flora, mammals, herpetofauna 2km – birds 6km – breeding raptors
Ecologically appropriate area of analysis	Refer to Section 1.2.1.2 for Terrestrial habitats, flora and fauna EAAA	Habitats, flora, mammals, herpetofauna
	Refer to Section 1.2.1.3 for Birds and bats EAAA	Birds and bats

1.2.1.1 Ecologically appropriate area of analysis

As per GN59 in IFC PS6 Guidance Note (IFC, 2019) “The project should identify an Ecologically Appropriate Area of Analysis to determine the presence of Critical Habitat for *each* species with regular occurrence in the project’s area of influence, or ecosystem, covered by Criteria 1-4.”

“For some wide-ranging species, Critical Habitat may be informed by areas of aggregation, recruitment, or other specific habitat features of importance to the species. In all cases, the Critical Habitat should consider the distribution and connectivity of such features in the landscape/seascape and the ecological processes that support them. Where it can be shown that multiple values have largely overlapping ecological requirements and distributions, a common or aggregated area of Critical Habitat may be appropriate.”

EBRD ESR6 includes an Annex explains how to draw an EAAA which is closely aligned to IFC PS6. For the purposes of this CHA, two EAAA’s have been defined: terrestrial habitats, flora and fauna (excluding birds and bats) EAAA and birds and bats EAAA. These are described in more detail below. EIB Guidance requires the establishment of a suitable EAAA but is not prescriptive in its approach to determining species EAAAs.

1.2.1.2 Terrestrial habitats, flora and fauna EAAA

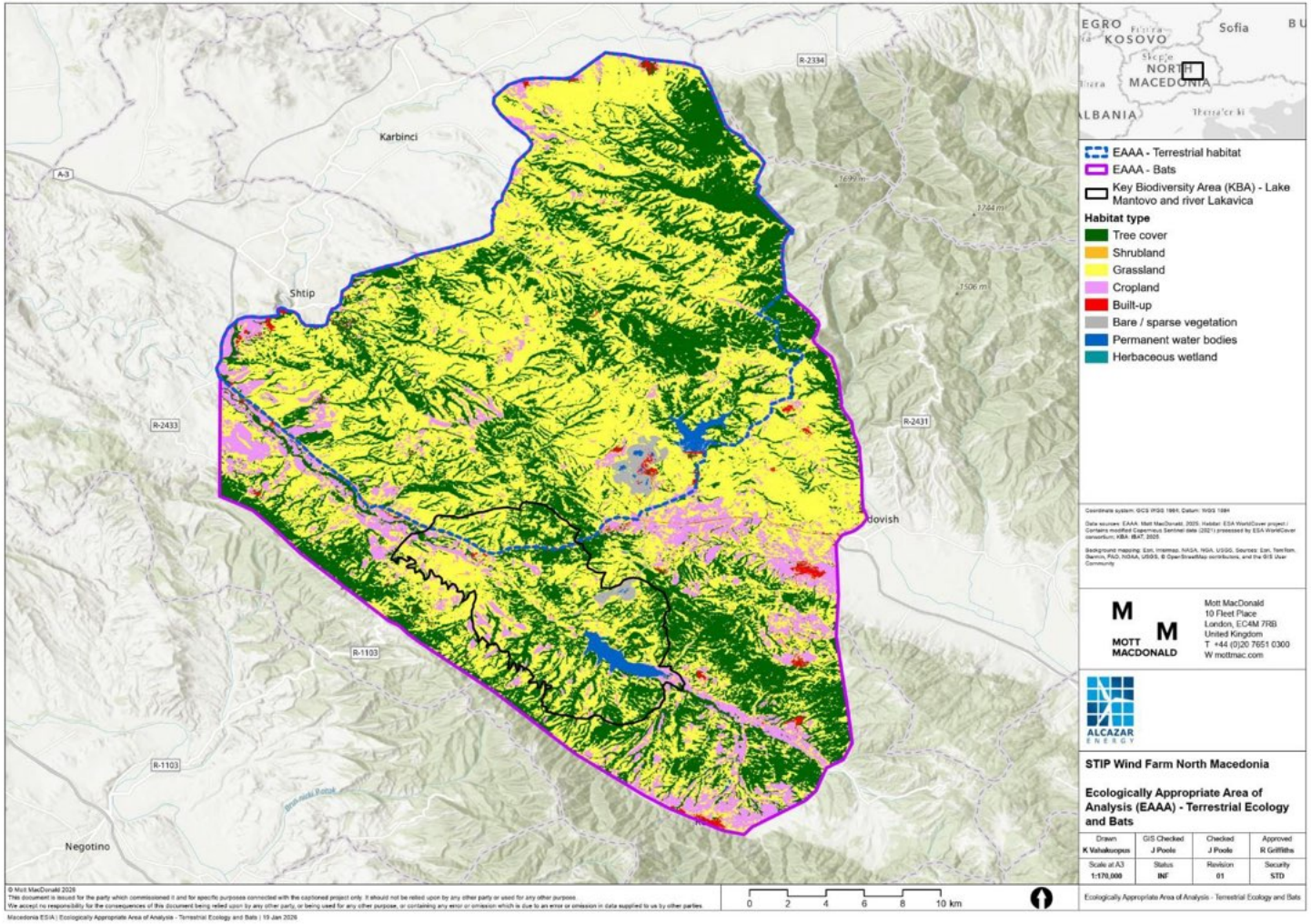
For terrestrial habitats, flora and fauna (excluding birds and bats), the EAAA was defined taking into account the habitat continuity with the AoI (with the predominant type constituting grassland) and physical barriers to the movement of terrestrial fauna, including the A4 road on the southwest edge of the EAAA, the town of Štip on the western side, and the quarry and lake on the eastern side. The northern side of the EAAA is delineated by the change in habitat type (from predominantly grassland to cropland or tree cover). The boundaries were aligned with similar elevation features, such as rivers, valleys, and roads. This EAAA is presented in Figure 1.2.

1.2.1.3 Birds and bats EAAA

The EAAA for birds and bats shares one physical barrier with the terrestrial habitats, flora, and fauna EAAA, with the town of Štip to the northwest. In addition, habitat continuity is used to define the limits of the EAAA to the north, south, southwest, and northeast. One new physical barrier was used in the town of Radoviš limiting the EAAA to the east. The boundaries were aligned with similar elevation features, such as rivers and valleys but is larger than the terrestrial

habitats, flora and fauna EAAA to account for species in flight. The EAAA for birds and bats is presented in Figure 1.2.

Figure 1.2: Ecologically Appropriate Area of Analysis for Terrestrial habitats, flora and fauna, and Birds and Bats



Source: Mott MacDonald, 2025

1.2.2 Data Collection and Sources

The assessment involved establishing a baseline understanding of habitats and associated biodiversity present within the study area. This was undertaken through a desk study of national and international secondary data sources which included:

- Critical Ecosystem Partnership Fund (CEPF, 2018)
- WWF Terrestrial Ecoregions of the World (Biomes) - ArcGIS Viewer (ESRI, 2022)
- IBAT– a list of threatened species and internationally recognised and legally protected areas under the IUCN Red List within a 50km buffer surrounding the site was purchased in November 2024. (IBAT Alliance, 2025)
- IUCN Red List of Threatened Species (IUCN, 2025)
- The National Red List of North Macedonia– includes plants, mammals, reptiles, amphibians and fungi (National Red List of North Macedonia, 2025)
- EUNIS, the European Nature Information System (EEA, 2025))
- UNEP-WCMC Global Critical Habitat screening layer (Version 2.1) (UNEP-WCMC, 2025)
-

IUCN Red List and National Red List

As part of this ESIA, the IUCN Red List of threatened species has been consulted following the purchase of IBAT data in 2024. In 2018, “National Red Lists for Species Conservation in North Macedonia” (IUCN ECARO, 2018) was produced in order to help set the framework for the national Red List assessments. The report provides background to the global IUCN Red List and the differences with National Red Lists and gives recommendations for structuring the North Macedonian Red List process. A number of species from plants, mammals, amphibians and reptiles have since been assessed at national level following IUCN criteria. These have been included in the assessment, were available. Birds have not been assessed according to a National Red List.

Information on the following nature conservation areas and other protected areas (existing or proposed) within the BSA has also been collected and reviewed using IBAT data (IBAT, 2025):

- Ramsar sites
- Key Biodiversity Areas (KBA)
- Important Bird and Biodiversity Areas (IBA)
- World Heritage Sites (WHS)
- UNESCO Biosphere Reserves

1.2.3 Habitat Mapping and Calculations

A total of 20 different habitat types were identified within 500m of the Project however, 14 were identified during the field surveys undertaken in May, June and September 2025. The remaining six habitat types were identified using ESA WorldCover data to fill any gaps (ESA, 2021).

The three main habitat types identified within the 500m AoI are; Eastern Quercus pubescens woods (25.65%), Arable land (21.03%) and Helleno-Balkanic *(Satureja montana)* steppes (19.37%). Habitats present in the 500m AoI and 2km AoI are presented in Biodiversity Chapter 8 of Volume II of the ESIA.

Natural, modified and Critical Habitat were mapped and are presented in Biodiversity Chapter 8 of Volume II of the ESIA.

As part of the assessment, the overlap between the global range of each species screened in at Step 2 (Figure 1.1) and the relevant EAAA was calculated. This approach assumes an even distribution of each species across its range; however, it was applied only in one aspect of the assessment to determine whether the EAAA significantly overlaps with the species' global range in addition to habitat preferences, confirmation of presence through survey data, elevation, consultation with the local subconsultants etc.

1.2.4 Assessment Criteria (IFC PS6 Critical Habitat Determination)

Error! Reference source not found. summarises the criteria and thresholds used to determine Critical Habitat under IFC, EBRD and EIB. Where threshold values used in the quantitative criteria across the standards vary, this CHA has adopted a precautionary approach and applied the most stringent threshold.

Table 1.2: IFC and EBRD (and EIB) thresholds for Critical Habitat

Criterion	IFC PS6 Critical Habitat Thresholds	EBRD ESR6 Critical Habitat Thresholds	EBRD Priority Biodiversity Features Thresholds	EIB Critical Habitat definitions
Legally Protected and Internationally Recognised Areas	Not a standalone criterion but considered in context of other thresholds.	Not a standalone criterion. But considered in the context of other thresholds. In addition, Appropriate Assessments required in areas affecting Natura 2000 or Emerald Network sites.	-	Not a standalone criterion. All projects likely to have significant effects on a Natura 2000 site, a protected and/or Key Biodiversity Area shall be subject to an assessment according to the EU Habitats Directive (i.e. an Appropriate Assessment)
Threatened species: IUCN Critically Endangered (CR) or Endangered (EN) Species, EU protected species	(a) Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (⩾ 0.5% of the global population AND ⩾ 5 reproductive unitsGN16 of a CR or EN species). (b) Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in (a). (c) As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species.	(a) EAAA supports species listed in Annex II of Habitats Directive marked as “priority species” (b) EAAA supports ⩾ 0.5 per cent of the global population AND ⩾ 5 reproductive units of a CR or EN species, or EAAA supports globally significant population of VU species necessary to prevent a change of IUCN Red List status to EN or CR (c) EAAA for important concentrations of species with national or regional status of EN or CR	(a) Species in the area of impact listed in Annex II of Habitats Directive, Annex I of Birds Directive or Resolution 6 of Bern Convention (b) Species in the area of impact with IUCN global Red List status of VU, EN or CR (c) Species in the area of impact with national or regional status of EN or CR	a) A population of an IUCN Red-listed endangered or critically endangered species that is ≥ 0.5% of the global population and/or ≥ 5 established reproductive units of an endangered or critically endangered species; b) Significant concentration of an IUCN Red-listed vulnerable species or of multiple IUCN Red-listed vulnerable species, especially where the loss of the area would result in the change of the IUCN Red List status to endangered or critically endangered. c) Nationally or regionally-important concentration of a species listed as endangered or critically endangered on a regional/national IUCN Red List, or equivalent on national/regional listing. d) A population of species listed in Annex II and IV of the Habitats Directive.
Endemic or Restricted-Range (<100,000 km²) Species	a) Areas that regularly hold ⩾10% of the global population size AND ⩾10 reproductive units of a species.	a) EAAA regularly holds ⩾ 10 per cent of global population AND ⩾ 10 reproductive units of the species	a) All range-restricted species in the area of impact	a) They regularly hold ⩾10% of the global population size and support ⩾10 reproductive units of an endemic or restricted-range species. b) They are considered by relevant specialists to support unique or rare assemblages of species that occur there habitually, predictably or repeatably. The constituent species may

Criterion	IFC PS6 Critical Habitat Thresholds	EBRD ESR6 Critical Habitat Thresholds	EBRD Priority Biodiversity Features Thresholds	EIB Critical Habitat definitions
				not meet other critical habitat thresholds mentioned here in their own right, but may present assemblages that are considered important to maintain high biodiversity in the area
Migratory or Congregatory Species	(a) Areas known to sustain, on a cyclical or otherwise regular basis, ⩾ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle. (b) Areas that predictably support ⩾10 percent of the global population of a species during periods of environmental stress.	(a) EAAA sustains, on a cyclical or otherwise regular basis, ⩾ 1 per cent of the global population at any point of the species' lifecycle (b) EAAA predictably supports ⩾ 10 per cent of global population during periods of environmental stress	(a) All migratory species in the area of impact	a) They sustain ⩾ 1%of the global population of a migratory or congregatory species at any point of the species' lifecycle on a cyclical or otherwise regular basis. b) They are needed to support migratory or congregatory species during periods of environmental stress.
Unique or Threatened Ecosystems	a) Areas representing ⩾5% of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN. b) Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.	(a) Habitat type listed in Annex 1 of EU Habitats Directive marked as "priority habitat type" (b) EAAA ⩾ 5 per cent of global extent of an ecosystem type with IUCN status of CR or EN (c) EAAA is ecosystem determined to be of high priority for conservation by national systematic conservation planning	(a) Habitat type listed in Annex 1 of EU Habitats Directive or Resolution 4 of Bern Convention (b) Ecosystem type with IUCN status of EN or CR	a) Priority Habitats listed in Annex I of the Habitats Directive and habitats considered to be their equivalent in countries outside the EU; b) ⩾5% of the global extent of an ecosystem type meeting the criteria for IUCN's Red List of Ecosystems with a status of critically endangered or endangered; c) Examples of ecosystems outside the EU and not yet assessed by IUCN, but determined to be of high priority for conservation on the basis of regional or national level systematic conservation planning or informed specialist input.
Key Evolutionary Processes	Areas essential for maintaining genetic diversity, speciation, or ecological processes (e.g. refugia, transition zones).	Similar to IFC PS6 Ecosystems recognised by the scientific community as being associated with key evolutionary processes.	-	a) Landscapes with high spatial heterogeneity and therefore high levels of species diversity; b) Environmental gradients, also known as ecotones, that produce transitional habitat which is associated with the process of speciation and high species and genetic diversity;

Criterion	IFC PS6 Critical Habitat Thresholds	EBRD ESR6 Critical Habitat Thresholds	EBRD Priority Biodiversity Features Thresholds	EIB Critical Habitat definitions
				c) *Edaphic* interfaces that juxtapose soil types (e.g. serpentine outcrops, limestone and gypsum deposits), which have led to the formation of unique plant communities; d) Connectivity between habitats (e.g. biological corridors) with importance for species migration and gene flow, which is especially important in fragmented habitats and for the conservation of metapopulations. This also includes biological corridors across altitudinal and climatic gradients and from "crest to coast." e) Sites of demonstrated importance to climate change adaptation for either species or ecosystems.
Social, economic or cultural importance	-	-	-	a) ecosystems retain the capacity to supply the services on which indigenous people or local communities depend b) to ensure that they are able to obtain essential benefits. In some circumstances communities may accept alternative benefits to those derived from ecosystem services affected by a project, but those alternatives should not be imposed on people without meaningful consultation

Note: Thresholds are applied using the concepts of irreplaceability and vulnerability, and assessments must be supported by scientific evidence, expert input, and stakeholder consultation. This CHA applies IFC, EBRD and EIB thresholds to ensure full compliance with international biodiversity safeguards, recognising and addressing any nuanced differences between the two standards.

1.3 Critical Habitat Determination

1.3.1 Overview of Baseline from ESIA

Volume II, Chapter 8 of the ESIA presents the full biodiversity baseline for the Project. A total of 1125 species that were identified within the 50km buffer from the project according to IBAT, GBIF and field survey data collection. Table 1.3 below presents the counts for all species considered in the ESIA and CHA for each Kingdom and Class. The table presents the number of CR, EN, VU, NT, LC, Restricted Range and Migratory species that were identified. All of the species have been considered as part of the CHA and some species were screened out along the process described in Chapter 1.2. The numbers of species screening out at Stage 1 and Stage 2 are presented in the Table 1.3.

Table 1.3: Summary table of all species considered in the ESIA and CHA

Kingdom/ Class	IUCN category					Restricted Range	Movement pattern		
	CR	EN	VU	NT	LC	Restricted Range	Full Migrant	Screened in for CHA (Step 1)	Screened in for CHA (Step 2)
PLANTAE									
Bryopsida			1		1				
Liliopsida					118				
Magnoliopsida		1		3	136	1		3	
Pinopsida				1	2				
Polypodiopsida		1			4			2	
ANIMALIA									
Mammalia		1	5	4	68		11	23	20
Aves		3	5	11	235		207[2]	208	89
Amphibia			3		11			5	3
Reptilia			2		27			17	15
Actinopterygii	1		1	1	49	2	17	19	
Bivalvia			2		10				
Gastropoda	1	2	5	5	113	5		7	
Insecta		5	7	20	164	7	7	7	
Malacostraca			2	2	2	1	1	1	
Petromyzonti					1				
FUNGI									
Agaricomycetes		1	9	5	5			3	
Lecanoromycetes					4				
Sordariomycetes					1				
Grand Total	**2**	**14**	**42**	**52**	**951**	**16**	**243**	**295**	**127**

This chapter presents the results of the Critical Habitat determination. The assessment included a total of 1125 species and 20 habitat types within the study area. Of these, eight species were

[2] Where IBAT has classified a species this has been checked against movement pattern within North Macedonia to establish whether the species qualifies as a PBF

screened in for assessment under Criterion 1 (C1), none under Criterion 2 (C2), and 98 under Criterion 3 (C3). For Criterion 4, three habitat types were screened in for assessment.

In addition to these criteria, this chapter also includes assessment for Criterion 5 (C5), which consider key evolutionary processes. The analysis further identifies any Internationally Recognised and Legally Protected Areas, and Priority Biodiversity Features that may contribute to the determination of Critical Habitat.

According to the Global Critical Habitat screening layer (Version 2.1) (UNEP-WCMC, 2025), which looks at Critical Habitat in relation to IFC PS6, the project is located in an area that is 'unclassified'. Lake Mantovo and river Lakavica, are defined as 'likely' Critical Habitat and the areas have been assessed in more detail in this report.

The findings presented in this chapter form the basis for identifying areas that may qualify as Critical Habitat under IFC PS6 and EBRD ESR6 (and EIB).

1.3.2 Internationally Recognised and Legally Protected Areas

The Project components do not overlap with any internationally recognised or legally protected areas. However, the birds and bats EAAA includes Lake Mantovo and river Lakavica Key Biodiversity Area (KBA) and Important Bird and Biodiversity Area (IBAs). This site is considered a KBA (since 2016) and IBA (since 2008) for two qualifying species - European roller (*Coracias garrulus*) with is IUCN LC and masked shrike (*Lanius nubicus*) which is IUCN LC (KBA, 2025). In 2008, the site became an IBA due to significant populations of European roller, as these were considered NT at the time, and for regionally important population of masked shrike (LC). However, in 2025, this site only qualifies as KBA due to the previously established criteria and thresholds for the identification of the IBA. Current data indicates that it does not meet global KBA criteria and thresholds set out in the Global Standard (KBA, 2025). Therefore, Lake Mantovo and river Lakavica KBA is not considered to be Critical Habitat. The qualifying species have been assessed against Critical Habitat and PBF thresholds in Sections 1.3.3 and 1.3.5.

Ovce Pole (18.38km Northwest of the Project) and Dolna Bregalnica (7.29 km West of the Project) have been identified as future Sites of Community Interest (SCI) and are considered potential Natura 2000 sites. This means that there are predominantly habitats here that are of interest for Europe and are on Annex I of the Habitats Directive, as well as hosting species of interest for the protection of Europe that are on Annex II of the Directive. In addition, Dolna Bregalnica has been identified under the Birds Directive due to the recording of birds included under the Annex I of the Birds Directive, making this area a future Special Protection Area (SPA). Given the distance to the Project to these potential Natura2000 sites, they are not located within the EAAAs associated with the Project and therefore unlikely to significantly affect the qualifying features of the potential Natura2000 sites.

1.3.3 Criterion 1: Threatened species

A total of eight species were assessed against this Criterion 1. A summary of the results and the outcome against each requirement are presented in Table 1.4. The detailed assessment for all species screened in for Criterion 1 is presented in **Error! Reference source not found.** (Appendix A.1). The calculation of global range overlap with the EAAA showed that none of the species had an overlap greater than 0.23%. The EAAA does not support $\geqslant$ 0.5 per cent of global population and $\geqslant$ 5 reproductive units of an IUCN CR or EN species for regularly occurring nationally or regionally listed EN or CR species. The analysis under Criterion 1 also considered the national RDL status for species (where available and applicable), however no national CR/EN species were identified based on the screening in Appendix A.1.

The EAAA does support five bat (Barbastelle bat, Schreiber's bent-winged bat, Geoffroy's bat, Greater mouse-eared bat and Lesser horseshoe bat) and two reptile species (European ratsnake and four-lined snake) that are listed Annex II and Annex IV of the Habitats Directive

and therefore meet the critical habitat threshold under EIB Criterion 1.The full list of all species assessed that are considered Critical Habitat and/or PBFs under EBRD and EIB are presented in Table 1.9.

Table 1.4: Summary of assessment results against each requirement for Criterion 1.

Criterion 1	IFC Critical Habitat	EBRD Critical Habitat	EBRD PBF	EIB Critical Habitat
Analysis	None were found to meet the thresholds for Critical Habitat under Criterion 1 in accordance with IFC PS6	None were found to meet the thresholds for Critical Habitat under Criterion 1 in accordance with EBRD ESR6.	A total of 35 species meet PBF criteria under Criterion 1. These include one flora species, five bats, one amphibian, four reptiles listed under, Annex II of the Habitats Directive, 22 bird species listed on Annex I of the Birds Directive, two amphibian species (one listed under Annex I of the Habitats directive and one IUCN VU species and one reptile species listed as IUCN VU and on Annex II of the Habitats Directive. Two of the bird species are also listed as IUCN VU (Turtle dove and Eastern imperial eagle) These species are listed in Table **1.9**	The following species are listed Annex II and Annex IV of the Habitats Directive and is found in the EAAA: • European ratsnake • Four-lined snake • Barbastelle bat • Schreiber's bent-winged bat • Geoffroy's bat • Greater mouse-eared bat • Lesser horseshoe bat These species are therefore considered to meet Critical Habitat under E ESR6.
Outcome	Not Critical Habitat	Not Critical Habitat	**PBF present**	**Critical Habitat**

1.3.4 Criterion 2: Endemic or Restricted-Range Species

None of the species studied as part of this assessment are considered restricted range, and therefore no species were assessed against this criterion.

1.3.5 Criterion 3: Migratory or Congregatory Species

A total of 98 species were assessed against this criterion. The full list of these is included in **Error! Reference source not found.** within Appendix .. A summary of the results and the outcome against each requirement are presented in Table 1.5.

Of the 98 species assessed, none were found to meet the Critical Habitat thresholds for criterion 3 under IFC PS6, EBRD ESR6 or EIB. The calculation of global range overlap with the EAAA showed that none of the species had an overlap greater than 0.23%. The EAAA is not known to sustain, on a cyclical or otherwise regular basis, >1% of the global population of a migratory or congregatory species at any point of the species' lifecycle. The EAAA does not have features that would be able to predictably support >10% of the global population of a species during periods of environmental stress.

The full list of all species assessed that are considered Critical Habitat and/or PBFs under EBRD and EIB are presented in Table 1.9.

Table 1.5: Summary of assessment results against each requirement for Criterion 3.

Criterion 3	IFC Critical Habitat	EBRD Critical Habitat	EBRD PBF	EIB Critical Habitat
Analysis	None were found to meet the thresholds for Critical Habitat under Criterion 3 in accordance with IFC PS6	None were found to meet the thresholds for Critical Habitat under Criterion 3 in accordance with EBRD ESR6	A total of eight migratory bat species and 65 migratory bird species meet the thresholds for PBF under EBRD ESR6. These species are listed in Table **1.9**	None were found to meet the thresholds for Critical Habitat under Criterion 3 in accordance with EIB.
Outcome	Not Critical Habitat	Not Critical Habitat	**PBF present**	Not Critical Habitat

1.3.6 Criterion 4: Unique or Threatened Ecosystems

North Macedonia overlaps with four ecoregions, according to WWF Terrestrial Ecoregions of the World map (ESRI, 2022). The main ecoregion which is also where the Project is located is Balkan mixed forests, these forests are a mix of deciduous and coniferous species and host a variety of endemic and threatened flora and fauna. Rodope montane mixed forest, Aegean and Western Turkey and Pindus Mountains mixed forests are also found in North Macedonia.

A total of 28 key ecosystem types have been identified, corresponding to 177 habitat types under the European Nature Information System (EUNIS) classification (EEA, 2025). No formal assessment of the ecosystems overlapping with the Project AoI have been undertaken under the IUCN Red List of Ecosystems (IUCN RLE, 2025). In the absence of this formal assessment, the habitat types present within the terrestrial habitats, flora and fauna EAAA have been assessed.

The habitats within this EAAA largely comprise of tree cover and grassland according to ESA WorldCover data (ESA, 2021). Where homogenous with the Project AoI, these are considered to be Eastern white oak woods (EU Habitats Directive (Annex I ‘priority’ habitat) and Helleno-Balkanic *(Satureja montana)* steppes (EU Habitats Directive (Annex I)). Eastern white oak woods are determined to be of high priority for conservation by regional or national systematic conservation planning and therefore meet Critical Habitat requirements under EBRD which would also meet requirement under IFC PS6 and EIB ESS4.

Terrestrial habitats of relevance and the European (EU) Red Data List (RDL) status assigned to the key Annex I habitat types are as follows for the Project:

- 91AA* Eastern white oak woods = EU Red Data List (RDL) status: ‘LC’.
- 6210 Helleno-Balkanic *(Satureja montana)* steppes (Semi-dry perennial calcareous grassland)= EU RDL status: ‘VU’.
- 3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion)= EU RDL status: ‘VU’.

Helleno-Balkanic *(Satureja montana)* steppes and, Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion meet requirements for Priority Biodiversity Features (PBF) under EBRD given they are listed under Annex I of the habitats directive.

A summary of the results and the outcome against each requirement are presented in Table 1.6. The full list of all species assessed that are considered Critical Habitat and/or PBFs are presented in Table 1.9.

Table 1.6: Summary of assessment results against each requirement for Criterion 4.

Criterion 4	IFC Critical Habitat	EBRD Critical Habitat	EBRD PBF	EIB Critical Habitat
Analysis	Eastern white oak woods (EU Habitats Directive (Annex I 'priority' habitat) is considered Critical Habitat in accordance with IFC PS6	Eastern white oak woods (EU Habitats Directive (Annex I 'priority' habitat) meet the thresholds for Critical Habitat under Criterion 4 in accordance with EBRD ESR6	Helleno-Balkanic *(Satureja montana)* steppes, and Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion thresholds for PBF under Criterion 4 in accordance with EBRD ESR6	Eastern white oak woods (EU Habitats Directive (Annex I 'priority' habitat) is considered Critical Habitat in accordance with EIB.
Outcome	**Critical Habitat**	**Critical Habitat**	**PBF present**	**Critical Habitat**

1.3.7 Criterion 5: Key Evolutionary Processes

IFC, EBRD and EIB require the consideration of key evolutionary processes as part of the determination of Critical Habitat. These are defined as spatial features that are unique or idiosyncratic of the landscape have been associated with genetically unique populations or subpopulations of plant and animal species. Physical or spatial features have been described as surrogates or spatial catalysts for evolutionary and ecological processes, and such features are often associated with species diversification.

Given the homogeneity between the landscape and habitats in the AoI and those surrounding it, and throughout Europe, and considering the limited range restricted and rare species identified through the IBAT data and survey results, it is determined that they are all widespread species. Therefore, there are no significant attributes in the landscape are preset that influence key evolutionary processes. A summary of the results and the outcome against each requirement are presented in Table 1.7.

The full list of all species assessed that are considered Critical Habitat and/or PBFs under EBRD and EIB are presented in Table 1.9.

Table 1.7: Summary of assessment results against each requirement for Criterion 5.

Criterion 5	IFC Critical Habitat	EBRD Critical Habitat	EBRD PBF	EIB Critical Habitat
Analysis	None were found to meet the thresholds for Critical Habitat under Criterion 5 in accordance with IFC PS6	None were found to meet the thresholds for Critical Habitat under Criterion 5 in accordance with EBRD ESR6	N/A	None were found to meet the thresholds for Critical Habitat under Criterion 5 in accordance with EIB.
Outcome	Not Critical Habitat	Not Critical Habitat	N/A	Not Critical Habitat

1.3.8 EIB: Social, economic or cultural importance

The project is not located within any internationally recognised areas which are designated for social, economic or cultural importance. The Socio Economic and Culture Chapter (Chapter 7) and Natural Capital and Ecosystem Services Assessment (Chapter 9) highlights agricultural and arable land that is of economic importance to the local people however, it is not considered significant. Economic displacement is unknown however, local employment will be significantly beneficial. There are no significant impacts to cultural heritage. No biodiversity and/or ecosystem of significant social, economic or cultural importance to local communities and indigenous groups was identified during the assessment.

1.3.9 Summary

The Project's terrestrial EAAA meets the requirements of Critical Habitat in accordance with IFC, EBRD and EIB due to the presence of Annex I 'priority habitat' listed under EU Habitats Directive (Eastern white oak woods). In addition the Project's EAAA's meet the requirement of Critical Habitat under EIB for five bat species (barbastelle bat, Schreiber's bent-winged bat, Geoffroy's bat, greater mouse-eared bat and lesser horseshoe bat) and two reptile species (four-lined snake and European ratsnake), listed in Annex II and Annex IV of Habitats Directive.. Table 1.8 presents a summary of the Critical Habitat and PBFs that are met under IFC PS6, EBRD ESR6 and EIB ESS4.

The Project also meets the thresholds for 80 PBFs under EBRD ESR6 Criteria 1 and/or 3 supporting threatened species and migratory bird species, regularly occurring within the EAAA. A summary of which lender requirements are triggered by Critical Habitat/ PBF are presented in Table 1.8. The full list of species meeting Critical Habitat and PBF thresholds are presented in Table 1.9.

Table 1.8: Critical Habitat and Priority Biodiversity Features under EBRD and EIB

Criterion	IFC PS6 Critical Habitat Thresholds	EBRD ESR6 Critical Habitat Thresholds	EBRD Priority Biodiversity Features Thresholds	EIB Critical Habitat definitions
Internationally recognised and legally protected areas	Not Critical Habitat	Not Critical Habitat	N/A	Not Critical Habitat
1. Threatened species: IUCN Critically Endangered (CR) or Endangered (EN) Species, EU protected species	Not Critical Habitat	Not Critical Habitat	**PBF present** - See Table **1.9**	**Critical Habitat** Annex II and Annex IV Habitats Directive recorded in the AoI: -Four-lined Snake -European ratsnake -Barbastelle bat -Schreiber's bent-winged bat -Geoffroy's bat -Greater mouse-eared bat -Lesser horseshoe bat
2. Endemic or Restricted-Range (<100,000 km²) Species	Not Critical Habitat	Not Critical Habitat	No PBF	Not Critical Habitat
3. Migratory or Congregatory Species	Not Critical Habitat	Not Critical Habitat	**PBF present** - See Table **1.9**	Not Critical Habitat
4. Unique or Threatened Ecosystems	**Critical Habitat** Annex I priority habitat recorded in the AoI: - Eastern white oak woods	**Critical Habitat** Annex I priority habitat recorded in the AoI: - Eastern white oak woods	**PBF present** Annex I habitat recorded in the AoI: - Helleno-Balkanic *(Satureja montana)* steppes (Semi-natural dry grasslands and scrubland facies on	**Critical Habitat** Annex I priority habitat recorded in the AoI: - Eastern white oak woods

Criterion	IFC PS6 Critical Habitat Thresholds	EBRD ESR6 Critical Habitat Thresholds	EBRD Priority Biodiversity Features Thresholds	EIB Critical Habitat definitions
			calcareous substrates (*Festuco Brometalia*)) - Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	
5. Key Evolutionary Processes	Not Critical Habitat	Not Critical Habitat	No PBF	Not Critical Habitat
6. Social, economic or cultural importance	N/A	N/A	N/A	Not Critical Habitat

Source: Mott MacDonald, 2026.

Table 1.9: Critical Habitat and Priority Biodiversity Features under EBRD.

Class and Scientific name	Common name	IUCN Status	Movement pattern	EU Habitats Directive	EU Birds Directive	CH	PBF	Criteria
Mammalia								
Barbastella barbastellus	Barbastelle Bat	NT		II, IV		Yes	Yes	1
Miniopterus schreibersii	Schreiber's Bent-winged Bat	VU	Full Migrant	II, IV		Yes	Yes	1 and 3
Myotis emarginatus	Geoffroy's Bat	LC		II, IV		Yes	Yes	1
Myotis myotis	Greater Mouse-eared Bat	LC	Full Migrant	II, IV		Yes	Yes	1 and 3
Nyctalus leisleri	Leisler's Bat	LC	Full Migrant	IV			Yes	3
Nyctalus noctula	Common Noctule	LC	Full Migrant	IV			Yes	3
Pipistrellus nathusii	Nathusius' Pipistrelle	LC	Full Migrant	IV			Yes	3
Vespertilio murinus	Parti-coloured Bat	LC	Full Migrant	IV			Yes	3
Rhinolophus hipposideros	Lesser Horseshoe Bat	LC		II, IV		Yes	Yes	1
Eptesicus serotinus	Serotine	LC	Full Migrant	IV			Yes	3
Pipistrellus pipistrellus	Common Pipistrelle	LC	Full Migrant	IV			Yes	3
Aves								
Neophron percnopterus	Egyptian vulture	EN	Full migrant		I		Yes	1 and 3
Alectoris graeca	Rock partridge	NT			I and IIB		Yes	1

Class and Scientific name	Common name	IUCN Status	Movement pattern	EU Habitats Directive	EU Birds Directive	CH	PBF	Criteria
Anthus campestris	Tawny pipit	LC	Full Migrant		I		Yes	1 and 3
Anthus pratensis	Meadow pipit	LC	Full Migrant				Yes	3
Anthus spinoletta	Water pipit	LC	Full Migrant				Yes	3
Anthus trivialis	Tree pipit	LC	Full Migrant				Yes	3
Apus pallidus	Pallid swift	LC	Full Migrant				Yes	3
Aquila heliaca	Eastern imperial eagle	VU	Full Migrant		I		Yes	1 and 3
Burhinus oedicnemus	Eurasian Thick-knee	LC			I		Yes	1
Buteo rufinus	Long-legged buzzard	LC	Full Migrant		I		Yes	1 and 3
Calandrella brachydactyla	Greater short-toed lark	LC	Full Migrant		I		Yes	1 and 3
Caprimulgus europaeus	Nightjar	LC	Full Migrant		I		Yes	1 and 3
Carduelis spinus	Eurasian siskin	LC	Full Migrant				Yes	3
Cecropis rufula	Red-rumped swallow	LC	Full Migrant				Yes	3
Circaetus gallicus	Short-toed snake eagle	LC	Full Migrant		I		Yes	1 and 3
Circus aeruginosus	Western marsh harrier	LC	Full Migrant		I		Yes	1 and 3
Circus cyaneus	Hen harrier	LC	Full Migrant		I		Yes	1 and 3
Circus pygargus	Montagu's harrier	LC	Full Migrant		I		Yes	1 and 3
Columba oenas	Stock dove	LC	Full Migrant				Yes	3
Columba palumbus	Woodpigeon	LC	Full Migrant		II and III		Yes	3
Coracias garrulus	European roller	LC	Full Migrant				Yes	3
Cuculus canorus	Cuckoo	LC	Full Migrant				Yes	3
Curruca communis	Common whitethroat	LC	Full Migrant				Yes	3
Curruca crassirostris	Eastern orphean warbler	LC	Full Migrant				Yes	3
Curruca curruca	Lesser whitethroat	LC	Full Migrant				Yes	3
Curruca nisoria	Barred warbler	LC	Full Migrant				Yes	3
Delichon urbicum	House martin	LC	Full Migrant				Yes	3
Dryocopus martius	Black Woodpecker	LC			I		Yes	1

Class and Scientific name	Common name	IUCN Status	Movement pattern	EU Habitats Directive	EU Birds Directive	CH	PBF	Criteria
Emberiza melanocephala	Black-headed bunting	NE	Full Migrant	LC			Yes	3
Emberiza schoeniclus	Reed bunting	LC	Full Migrant				Yes	3
Falco naumanni	Lesser kestrel	LC	Full Migrant		I		Yes	1 and 3
Falco peregrinus	Peregrine	LC			I		Yes	1
Falco subbuteo	Hobby	LC	Full Migrant		I		Yes	1 and 3
Fringilla montifringilla	Brambling	LC	Full Migrant				Yes	3
Hieraaetus pennatus	Booted eagle	LC	Full Migrant		I		Yes	1 and 3
Hirundo rustica	Barn swallow	LC	Full Migrant				Yes	3
Lanius collurio	Red-backed shrike	LC	Full Migrant		I		Yes	1 and 3
Lanius excubitor	Great grey shrike	LC	Full Migrant				Yes	3
Lanius minor	Lesser grey shrike	LC	Full Migrant		I		Yes	1 and 3
Lanius nubicus	Masked shrike	LC	Full Migrant		I		Yes	1 and 3
Lanius senator	Woodchat Shrike	NT	Full Migrant				Yes	3
Lullula arborea	Woodlark	LC			I		Yes	1
Luscinia megarhynchos	Nightingale	LC	Full Migrant				Yes	3
Melanocorypha calandra	Calandra Lark	LC			I		Yes	1
Merops apiaster	Bee-eater	LC	Full Migrant				Yes	3
Muscicapa striata	Spotted flycatcher	LC	Full Migrant				Yes	3
Oenanthe oenanthe	Northern wheatear	LC	Full Migrant				Yes	3
Oriolus oriolus	Golden oriole	LC	Full Migrant				Yes	3
Otus scops	Scops owl	LC	Full Migrant				Yes	3
Pernis apivorus	European honey buzzard	LC	Full Migrant		I		Yes	1 and 3
Phoenicurus phoenicurus	Common redstart	LC	Full Migrant				Yes	3
Phylloscopus collybita	Common Chiffchaff	LC	Full Migrant				Yes	3
Phylloscopus trochilus	Willow Warbler	LC	Full Migrant				Yes	3
Regulus ignicapilla	Firecrest	LC	Full Migrant				Yes	3
Saxicola rubetra	Whinchat	LC	Full Migrant				Yes	3
Streptopelia turtur	European turtle dove	VU	Full Migrant				Yes	3

Class and Scientific name	Common name	IUCN Status	Movement pattern	EU Habitats Directive	EU Birds Directive	CH	PBF	Criteria
Sylvia atricapilla	Eurasian Blackcap	LC	Full Migrant				Yes	3
Sylvia borin	Garden warbler	LC	Full Migrant				Yes	3
Sylvia communis	Whitethroat	LC	Full Migrant				Yes	3
Turdus iliacus	Redwing	NT	Full Migrant		II		Yes	3
Turdus pilaris	Fieldfare	LC	Full Migrant		II		Yes	3
Upupa epops	Hoopoe	LC	Full Migrant				Yes	3
Spinus spinus	Siskin	LC	Full Migrant				Yes	3
Amphibia								
Bombina variegata	Yellow-bellied Toad	LC	N/A	II			Yes	1
Salamandra salamandra	Common Fire Salamander	VU	N/A				Yes	1
Reptilia								
Elaphe quatuorlineata	Four-lined Snake	LC	N/A	II and IV		Yes	Yes	1
Testudo graeca	Greek Tortoise / Spur-thighed Tortoise	NT (Europe)	N/A	II			Yes	1
Testudo hermanni	Hermann's Tortoise	VU	N/A	II			Yes	1
Zamenis situla	European ratsnake	LC	N/A	II and IV		Yes	Yes	1
Grand Total						**7**	**80**	

Source: Mott MacDonald, 2026

1.4 Impact Assessment

1.4.1 Potential Project Impacts on Critical Habitat features and Priority Biodiversity Features

Table 1.10 provides a high-level summary of potential impacts to biodiversity associated with the wind farm across all project phases, specifically focusing on Critical Habitat features and PBF. The summary reflects the key impact pathways already assessed in ESIA Volume II, Chapter 8, such as habitat loss, fragmentation, disturbance, spread of invasive species, and collision risks, grouped by ecological aspects including Critical Habitats, natural habitats and PBF, terrestrial fauna, and birds and bats.

Likely receptors and corresponding mitigation measures are also presented, drawing on the avoidance and minimisation measures embedded in the Project design and those detailed further in the ESIA. These include measures such as preconstruction ecological checks, timing restrictions, lighting controls, species specific protocols, and operational monitoring requirements. As this CHA does not duplicate the full ESIA impact assessment, more detailed descriptions of impact mechanisms, sensitivity ratings, significance evaluations construction ecological checks, timing restrictions, lighting controls, species-specific protocols, operational monitoring requirements, and mitigation strategies are provided in Biodiversity Chapter 8 of

Volume II of the ESIA. In addition, it is worth noting that key sensitivity timings for bird species are highlighted in the ESIA and BMP, providing the suggested times of the year to be avoided for sensitive breeding birds and raptors.

Table 1.10: Summary of impacts to biodiversity for the wind farm.

Aspect	Project phase	Key issues / impacts and potential effects	Likely receptors	Mitigation
Critical habitat (habitats and flora) - Annex I 'priority habitat' Eastern *Quercus pubescens* woods	Construction (primary) and Operation	Direct loss or fragmentation of Annex I priority habitat within the development footprint. Reduced ecological function for CH-associated species. Increased vulnerability to edge effects, dust, potential invasive alien species (IAS) spread during construction, operation and decommissioning phases both outside of their current extent and the AoI. Micro-siting constraints due to CH presence (per Project Compliance Framework).	Eastern *Quercus pubescens* woods Birds and bats associated with the woodland	• Avoidance through micro-siting (already applied in Project design). • Minimisation measures provided in the ESIA and BMP. • Prevention of IAS and management • Pre-construction checks • Pre-construction tree marking - Identification of trees to be removed for the development • Net gain measures for Eastern *Quercus pubescens* woods (to be developed in the BAP).
Natural habitats and PBF	Construction (primary) and Operation	Habitat degradation from ground disturbance, dust deposition, soil compaction causing physical and indirect harm. Disturbance to associated flora and fauna. IAS spread impacting floristic composition during construction, operation and decommissioning phases both outside of their current extent and the AoI.	Helleno-Balkanic *(Satureja montana)* steppes and Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion (temporary running waters) in the AoI and flora and fauna associated with these could also be affected.	• Avoidance and minimisation measures in the ESIA and BMP. • Dust control and minimisation of ground disturbance. • Prevention of IAS and management. • Pre-construction checks • No net loss of natural habitats and PBF (Helleno-Balkanic *(Satureja montana)* steppes) requirement (BAP)
Critical habitat and PBF (terrestrial fauna)	Construction	Direct mortality risk from machinery, vehicle movements, and trenching. Temporary habitat loss or functionality reduction during works. Temporary fragmentation or barriers (e.g., fencing, construction areas). Disturbance (noise, vibration, presence of workers).	CH species: • Four-lined snake • European ratsnake Other PBF terrestrial fauna: • *Salamandra salamandra* (VU) • *Testudo* spp. (VU)	• Avoidance and minimisation measures in the ESIA and BMP. • Pre-construction checks • Minimisation of habitat clearance and retention of vegetated corridors • Timing works outside sensitive seasons • Speed limits • Species-specific translocation protocols • Net Gain for CH reptile species (BAP)

Aspect	Project phase	Key issues / impacts and potential effects	Likely receptors	Mitigation
Critical habitat and PBF (birds and bats)	Construction and Operation	Construction Habitat loss and fragmentation, disturbance from noise and vibration, displacement, artificial lighting, barrier effects (temporary fencing, road widening), hydrological changes. Operation Collision mortality, barotrauma, loss of nesting/ roosting habitat, barrier effects/ disruption to migratory corridors.	CH species: • Barbastelle bat • Schreiber's bent-winged bat • Geoffroy's bat • Greater mouse-eared bat • Lesser horseshoe bat PBF Species: • Annex I birds • Migratory birds • Migratory bats • IUCN VU species (*Aquila heliaca, Streptopelia turtur*)	• Avoidance and minimisation measures in the ESIA and BMP. • Pre-construction checks • Timing works outside sensitive seasons • Lighting management • Operational bird and bat monitoring protocol • Net Gain for CH bats (BAP) • No net loss requirement for PBF birds and bats

1.5 Conclusion and Recommendations

1.5.1 Summary of Critical Habitat Findings

The Project's terrestrial habitat EAAA meets Critical Habitat criteria under IFC PS6, EBRD ESR6 and EIB ESS4 due to the presence of Annex I 'priority' habitat Eastern Quercus pubescens woods. The EAAAs also meet EIB Critical Habitat criteria for fauna due to the regular occurrence of species listed under Annex II and Annex IV of the EU Habitats Directive. Additionally, a total of 80 PBFs were identified, including species listed under Annex II of the EU Habitats Directive, migratory bats, migratory birds and bird listed under Annex I of the Birds Directive.

Key findings include:

- Critical Habitat under IFC PS6, EBRD ESR6 and EIB ESS4 for Annex I 'priority' habitat:
  - Eastern *Quercus pubescens* woods.
- Critical Habitat under EIB for species due to the presence of Annex II and Annex IV Habitats Directive five bat and two reptile species within the EAAA.
- Priority Biodiversity Features (PBFs) under EBRD ESR6, including:
  - Migratory bird species and Annex I Birds Directive recorded within the EAAA
  - Migratory bats
  - Annex I habitat types meeting PBF thresholds (Helleno-Balkanic steppes; Intermittently flowing Mediterranean rivers)
  - Annex II species: five bat species, yellow-bellied toad, Greek Tortoise / Spur-thighed Tortoise and Hermann's Tortoise
  - IUCN Vulnerable species: common fire salamander, Hermann's tortoise, Schreiber's bent-winged bat, eastern imperial eagle, and turtle dove.

These CHA findings directly inform the biodiversity mitigation hierarchy and the development of the Project's Biodiversity Management Plan (BMP) and Biodiversity Action Plan (BAP), ensuring that IFC, EBRD and EIB Critical Habitat requirements and PBF obligations are fully addressed in line with the Project's ESG Compliance Framework. Where a species or habitat qualifies as PBF under one lender's framework but Critical Habitat under another, the Project will apply the highest and most precautionary requirement across the BMP and BAP. This hierarchical approach ensures that mitigation and management measures reflect the most stringent standard applicable, regardless of which lender framework triggers it.

1.5.2 Recommendations

The following recommendations reflect the requirements for a Project located within Critical Habitat and supporting PBFs. Framework level mitigation is presented in ESIA Volume II, Chapter 8. Detailed, operational mitigation covering avoidance, minimisation, restoration, and the achievement of *no net loss* (*and net gain where possible*) for PBFs and *net gain* for Critical Habitat features will be developed in the Biodiversity Management Plan (BMP) and Biodiversity Action Plan (BAP), in line with the Project's ESG Compliance Framework.

Application of the mitigation hierarchy

- Minimisation:
  - Implement timing restrictions for construction to avoid sensitive breeding and migration periods for birds and bats (March to September inclusive for birds), where feasible;
  - Undertake pre-construction ecological checks, including species-specific surveys where required.

  - Implement translocation protocols for tortoise species and other relevant fauna.
- Restoration:
  - Rehabilitate temporary construction areas following completion of works;
  - Restore native vegetation and maintain soil stability and habitat structure post-construction.
- Offsetting:
  - Develop biodiversity offsets to achieve net gain for Eastern *Quercus pubescens* woods (Annex I 'priority' habitat).

Develop a Biodiversity Action Plan (BAP)

The BAP will provide the pathway to achieving lender requirements related to Critical Habitat and PBFs, including:

- Achieving net gain for Eastern *Quercus pubescens* woods and for the two Annex II and Annex IV bat and reptile species .
- Achieving no net loss of Helleno-Balkanic (*Satureja montana*) steppe.
- Including species-specific measures for Annex II species, Annex I birds and migratory fauna to ensure no net loss.
- Setting clear, measurable targets and monitoring indicators aligned with IFC, EBRD and EIB requirements.

Implement monitoring and adaptive management

- Establish operational bird and bat collision monitoring programme, consistent with ESIA Chapter 8.
- Define quantitative thresholds and triggers for adaptive management (e.g., turbine curtailment, observer-led shutdown).
- Monitor invasive alien species and habitat condition throughout the Project lifecycle and implement rapid response measures where required.
- Track the effectiveness of mitigation measures and adjust them based on monitoring outcomes.

Stakeholder engagement

- Engage with national biodiversity authorities, protected area institutions and local conservation groups during the development of the BAP to validate mitigation measures and monitoring plans.
- Use stakeholder inputs to validate mitigation measures, monitoring protocols and offset proposals, ensuring alignment with national priorities and lender expectations.

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Appendices

A. Critical Habitat screening and determination (All 293 species) 32

A. Critical Habitat screening and determination (All 293 species)

A.1 Critical Habitat screening and determination (296 species)

Table A.1: Species assessed as part of this CHA.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
PLANTAE								
Pilularia minuta	Dwarf Pillwort	EN	NE	In	This species is usually found in temporary pools at low elevation in diverse landscapes such as forests, matorrals or agricultural lands. It is a small amphibious fern of small stature, with a threadlike rhizome (Geophyte with rhizome). The germination of the spores requires very humid (water saturated) or flooded conditions; the maturation of the sporocarpes only takes place after complete exposure to air at the end of the spring. This species was not recorded during the field surveys. It is considered unlikely that this species is present in the AoI given its reliance on very humid or flooded conditions which are not present.	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Rhododendron myrtifolium		EN	NE	In	This shrub, usually less than 60 cm, is found in forest pine scrub to open moorland on acid and limestone. It can form large stands in the alpine heaths growing along with Juniperus nana. The species prefers humid places protected against the wind, where erosion is limited, often on northern aspect slopes. This species was not recorded during the field surveys. It is considered unlikely that this species is present in the AoI given its preference for humid places with limited erosion. As the site is located on mountainous landscape, the right conditions are likely not present for this species.	Out		This species does not meet the thresholds for critical habitat under IFC PS6 or EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Marsilea quadrifolia	Water Shamrock	LC	EN	In	Typically grows in the stagnant waters and sporadically drying meadows, shallow margins and draw-down zones of lakes, marshes, river margins, oxbow lakes and sometimes ditches. Its elevation range is from sea level up to 400 m. It is intolerant of competition and usually occurs on otherwise bare soils. It can be found in the following Habitats Directive habitats: – 3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation. – 3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea. – 3110 Oligotrophic waters containing very few minerals of sandy plains. Given this species' preference for aquatic habitats, as well as the elevation range having an upper limit of 400m above sea level (and the site having an elevation range of 500-900m), it is considered unlikely this species is present in	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					the AoI. This species was not recorded during the field surveys.			

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Menyanthes trifoliata	Bogbean	LC	EN	In	M. trifoliata is found in various wetland habitats such as fens, pools, marshes, older woods, ditches, bogs, lake shores, swampy prairies, particularly in acid or oligotrophic conditions. Given this species' preference for aquatic habitats, it is considered unlikely to be present in the AoI. This species was not recorded during the field surveys.	Out		
Trapa natans	Water Caltrop	LC	EN	In	This species is an annual floating-leaved plant that grows in standing waters such as lakes, ponds and marshes, as well as in channels with weak currents. It primarily occurs in unpolluted nutrient-rich lowlands without too much calcium. Given this species' preference for aquatic habitats, it is considered unlikely to be present in the AoI. This species was not recorded during the field surveys.	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Anacamptis morio (L.) R.M.Bateman, Pridgeon & M.W.Chase	Green-winged Orchid	NT (Europe); NE globally	NE	Out	*Anacamptis morio* shows a broad ecological tolerance of habitats including short and poor grassland, unimproved meadows, alpine pastures, forest fringes and open woodland. It prefers alkaline rich soil in full sun light and it can settle on poor ground, clay-free, of lime and low in nitrogen content. The flowering time of the species takes place from April to May-June. This species was confirmed within the AoI.	In	PBF	This species does not meet Critical Habitat thresholds under IFC PS6 or EBRD ESR6. However, it is listed under Annex II of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, species protected under Annex II would typically trigger Priority Biodiversity Feature (PBF) requirements.
FUNGI								
Hyphoderma etruriae	Етрурска коричка	EN	NE	In	Hyphoderma etruriae grows only on Juniperus. There is no suitable habitat for this species to grow within the AoI.	Out	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 40,000,000.
Bovista paludosa	Fen Puffball	VU	CR	In	This species primarily occurs in wetland habitats in high alpine peat bogs and is associated with mosses. There is no suitable habitat for this species within the AoI.	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 4,770,000. However, as this species is listed under Annex I of the Birds Directive, it is considered

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
								to be a Priority Biodiversity Features under EBRD ESR6.
Alessioporus ichnusanus	Boleto Sardo	VU	EN	In	Most of the records are from thermophile oak forests, both deciduous and evergreen. In North Macedonia it has very fragmented and isolated populations. It is known from only three localities, one of them within Galicica National Park but the other two sites are situated in unprotected areas not located within the AoI.	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 75,900,000.
MAMMALIA								

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Spermophilus citellus	European Ground Squirrel	EN	NE	In	This species has two ranges within Europe divided by the Carpathian mountains. The south-eastern portion extends from southern Serbia, North Macedonia and Greece through Bulgaria and southern Romania to Turkish Thrace, Moldova and Ukraine. In North Macedonia the species is found in Mount Jakupica and at least 15 scattered ground squirrel colonies are found in the lowlands of south-eastern North Macedonia (excluding Strumica area), all patchily distributed and embedded between fields and vineyards. The project AoI is outside the range for this species in Macedonia. It is unlikely that this species will be present in the Project AoI. No signs of European Ground Squirrel were recorded during the surveys.	Out	No	

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Myotis capaccinii	Long-fingered Bat	VU	NE	In	The Long-fingered Bat (*Myotis capaccinii*) depends strictly on aquatic habitats. It forages over wetlands and waterways (including artifical waterbodies, such as canals and reservoirs), also scrub. It seems to prefer clutter-free water surfaces when foraging, probably because the echolocation of preys is facilitated above them. It generally roosts in underground habitats (principally caves). In the Balkans it is confined to karst areas. Given the lack of permanent water bodies in the AoI, it is considered unlikely that this species occurs on site.	Out	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occurring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Miniopterus schreibersii	Schreiber's Bent-winged Bat	VU	NE	In	This bat roosts almost exclusively in natural and artificial underground sites. It forages mainly in deciduous woodlands and mature orchards, gardens, along hedgerows separating pastures and riverine forests and in urban areas. In the Mediterranean area, they can use grasslands but avoid arable land and maquis. This species has been identified between October - November and April - October during the field surveys. Therefore, this species occurs in the AoI.	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 150,000,000.
Myotis emarginatus	Geoffroy's Bat	LC	NE	Out	In summer, Geoffroy's Bats mostly roost in buildings, although in southern Europe, they often use caves as well as buildings. Hibernation takes place in natural or artificial underground sites. Foraging bats cover straight distances up to ca. 12 km from their nursery to feeding sites, but shorter distances are generally flown. The species selects a broad range of foraging habitats that change according to the region, including riparian habitats, olive orchards, farmland, and	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 145,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					forest. Myotis sp were identified as part of the 2025 Surveys and given their habitat preferences, it is possible they are present.			
Myotis mystacinus	Whiskered Bat	LC	NE	Out	The Whiskered Myotis (Myotis mystacinus) inhabits forest, woodland edge, shrubland, open meadows, steppe and semi-desert habitats and wooded landscape near to water sources, but is generally more a house-dwelling than woodland bat, and is commonly sighted in parks, gardens and villages. It roosts in colonies, living in trees, amongst rocks, and in livestock pens, and is also known to roost in caves, living there year round, and moving further back into the cave to hibernate during winter. Summer maternity roosts are	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 75,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					typically sited in trees, buildings, and bird and bat boxes. It hibernates in small groups in underground sites (caves, mines, and cellars). Myotis sp were identified as part of the 2025 Surveys and given their habitat preferences, it is possible they are present.			

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Myotis aurascens	Steppe Whiskered Bat	LC	NE	Out	The Greater Mouse-eared Bat (Myotis myotis) forages over deciduous woodland edge, open deciduous woodland and pasture. In much of its range, this bat roosts in underground sites all year, while in northern parts of its range it uses also buildings (loft-spaces) during summer. Myotis species were recorded during the surveys in 2025.	In	PBF	Myotis species have been recorded within the Project AoI. This species does not meet Critical Habitat thresholds under IFC PS6 or EBRD ESR6.
Barbastella barbastellus	Barbastelle Bat	NT	NE	Out	A typical forest bat that, in summer, typically forms small reproductive groups of adult females (a dozen or so) and their pups in tree cavities (especially under flaking bark in dead trees) or more rarely rock crevices. Infrequently, larger reproductive colonies may be observed in buildings or bat boxes. Barbastelle	In	PBF	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					Bats often switch between different roosts, which implies that large numbers of suitable trees need to be preserved to ensure the viability of even small populations. This species was confirmed within the AoI during surveys in 2025.			EAAA is considered Critical Habitat under EBRD ESR6.
Plecotus austriacus	Grey Long-eared Bat	NT	NE	Out	This is a sedentary species that usually moves < 30 km between summer and winter quarters and up to 5 km from summer roosts to foraging sites. This species was confirmed within the AoI during surveys in 2025.	In	PBF	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
Myotis myotis	Greater Mouse-eared Bat	LC	NE	In	In Europe, the Greater Mouse-eared Bat occurs in the western, central and southern parts of the continent. Hibernation mostly takes place in natural or artificial underground sites. Nursery colonies use buildings in central and eastern Europe and	In	PBF	Myotis species have been recorded within the Project AoI. This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and could regularly occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					underground sites in the south of the continent. Tree cavities or bat boxes are occasionally used. Myotis sp, were recorded during the surveys, therefore this species may be regularly occurring within the AoI.			regularly occur can be assessed as Critical Habitat. Taking a precautionary approach, the EAAA is considered Critical Habitat under EBRD ESR6.
Nyctalus leisleri	Leisler's Bat	LC	NE	In	The Lesser Noctule is widely distributed in Europe. This species forages over woodland, pasture, and river valleys, where it feeds on flies (including mosquitos), moths and beetles. It is linked to old trees. Summer nursery roosts are located in tree holes, but also in buildings and bat boxes. This species was recorded between April and October during the surveys, therefore this species may be regularly occurring within the AoI.	In	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Nyctalus noctula	Common Noctule	LC	NE	In	The Common Noctule occurs across much of continental Europe. They generally roosts in tree cavities, especially those dug by woodpeckers, but may use bat boxes or artificial bird nests or, locally, buildings (panel buildings or wall crevices). This species is an open space forager that catches prey on the wing, mostly over lakes, pastures, grassland or along the forest edge; it may also feed in urban areas, where they avoid artificial illumination when commuting, but not necessarily when foraging. This species has been identified between October - November and April - October during the field surveys. Therefore, this species occurs in the AoI.	In	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Pipistrellus nathusii	Nathusius' Pipistrelle	LC	NE	In	*Pipistrellus nathusii* is a western Palearctic migratory bat species occurring in western, central, and southern Europe. This is a long-range migratory species that typically moves over a NE-SW route. The species roosts in a range of tree cavities and spaces in buildings and readily colonises bat boxes. Hibernation takes place in trees, buildings or spaces on cliffs. This species was recorded between May and August during the surveys, therefore this species may be regularly occurring within the AoI.	In	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Pipistrellus kuhlii	Kuhl's Pipistrelle	LC	NE	Out	An opportunist species foraging in a range of habitats, including riparian vegetation, forest edges, farmland, and urban areas, where it often feeds near streetlamps. Summer roosts are typically found in buildings, whereas hibernation takes place in rock crevices or deep, narrow spaces of human-made constructions. This species was confirmed within the AoI during surveys in 2025.	In	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
Vespertilio murinus	Parti-coloured Bat	LC	NE	In	Vespertilio murinus has a wide distribution in the northern Palaearctic. In the reproductive season, *Vespertilio murinus* is highly synanthropic and roosts almost exclusively in buildings (often underneath roof tiles, eaves, or behind window blinds) and other human-made structures, rarely in trees. This species was recorded between	In	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					March and September during the surveys, therefore this species may be regularly occurring within the AoI.			
Rhinolophus hipposideros	Lesser Horseshoe Bat	LC	NE	Out	Maternity colonies of lesser horseshoe bats, generally numbering dozens to (rarely) hundreds of bats, often roost in attics of buildings of different sizes, but (especially in the south of the range) also in caves or, very rarely, in hollow trees. This species was confirmed within the AoI during surveys in 2025.	In	PBF	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.

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Tadarida teniotis	European Free-tailed Bat	LC	NE	Out	The species is associated with roosts in cliffs. It may also use human-made structures such as buildings, bridges, aqueducts, etc. Since it forages (mostly on moths) at such high elevations, the species shows no real habitat selection pattern and forages where prey is most abundant at any time regardless of the habitat type found on the ground, for which reason it may also hunt high above the sea. This species was confirmed within the AoI during surveys in 2025.	In	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
Hypsugo savii	Savi's Pipistrelle	LC	NE	Out	A flexible opportunist that shows different patterns of habitat selection across its range. The species roost in rock crevices as well as in narrow spaces of buildings. This species was confirmed within the AoI during surveys in 2025.	In	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Cervus elaphus	Red Deer	LC	NE	In	Red deer inhabits open deciduous woodland, mixed deciduous-coniferous and coniferous woodland, upland moors and open mountainous areas. It could be present in the Project AoI. However, given it was not recorded during the surveys, it is unlikley to be regularly occuring.	Out		
Eptesicus serotinus	Serotine	LC	NE	In	This species was recorded during the surveys and is regularly occuring within the Project AoI.	In	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
Pipistrellus pipistrellus	Common Pipistrelle	LC	NE	In	This species was recorded during the surveys and is regularly occuring within the Project AoI.	In	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Myotis daubentonii	Daubenton's Bat	LC	NE	In	Myotis sp, were recorded during the surveys, therefore this species may be regularly occurring within the AoI.	In	No	Myotis species have been recorded within the Project AoI. This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and could regularly occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Taking a precautionary approach, the EAAA is considered Critical Habitat under EBRD ESR6.
Myotis brandtii	Brandt's Bat	LC	NE	In	Myotis sp, were recorded during the surveys, therefore this species may be regularly occurring within the AoI.	In	No	Myotis species have been recorded within the Project AoI. This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and could regularly occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Taking a precautionary approach, the EAAA is considered Critical Habitat under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Myotis nattereri	Natterer's Bat	LC		In	Myotis sp, were recorded during the surveys, therefore this species may be regularly occurring within the AoI.	In	No	Myotis species have been recorded within the Project AoI. This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and could regularly occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Taking a precautionary approach, the EAAA is considered Critical Habitat under EBRD ESR6.
AVES								
Oxyura leucocephala	White-headed Duck	EN	NE	In	White-headed duck is found in North Macedonia primarily as a passage migrant. They prefer shallow wetlands and lakes. It was not recorded during any of the 2024/2025 bird surveys and considering it is a rare passage visitor, it is considered unlikely this species is present in the AoI.	Out		
Neophron percnopterus	Egyptian Vulture	EN	NE	In	Egyptian vulture is a native summer breeder and passage migrant in North Macedonia and occupies open arid landscapes which include grassland and rock outcrops. As well as arable land, pasture and occasionally urban areas. They nest mainly on cliffs	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. No birds were recorded in the Project AoI. It is unlikely that the EAAA would support >0.5% or >1% of the global population estimated to be 12,400 - 36,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					and rocky ledges and occasionally buildings, pylons and trees. Egyptian vulture are a qualifying species of the River Topolka river/Babuna river Bregalnica KBA/IBA 11km west and other KBAs in the AoI of the Project. There were 12 breeding territories in North Macedonia in 2020, three of which are distributed in central N.Macedonia where the project is situated (Saravia, V et al., 2020). Although, no birds were recorded during the field surveys given the habitats within the AoI are suitable for Egyptian vultures and they are known to breed in the area, it is considered this species occurs in the AoI.			
Falco cherrug	Saker Falcon	EN	NE	In	Saker Falcon is found in North Macedonia primarily as a passage migrant, however there have been historic records of 0-3 pairs breeding (BirdLife International, 2025). They prefer steppe, semi-desert and grasslands. It was not recorded during any of the 2024/2025 bird surveys and considering it is a rare passage	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >0.5% or >1% of the global population estimated to be 12800000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					visitor, it is considered unlikely this species is present in the AoI.			
Anser erythropus	Lesser White-fronted Goose	VU	NE	In	Lesser white-fronted goose is found in North Macedonia primarily as a passage migrant and occasional winter visitor. They prefer Wetlands, bogs, and lakes. It was not recorded during any of the 2024/2025 bird surveys and considering it is a rare passage visitor, it is considered unlikely this species is present in the AoI.	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 330,000. However, as this species is listed under Annex I of the Birds Directive, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Streptopelia turtur	European Turtle-dove	VU	NE	In	European turtle dove is a migrant breeder and passage migrant which occupies open or semi-open landscapes with a mix of woodland edges, hedgerows and farmland with scattered trees or shrubs. This species was recorded within the AoI during the breeding bird surveys in 2025. Therefore, this species occurs in the AoI.	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 14,600,000. However, as this species is a full migrant, recorded in the AoI and IUCN VU, it is considered to be a Priority Biodiversity Features under EBRD.
Clanga clanga	Greater Spotted Eagle	VU	NE	In	Greater spotted eagle is a non-breeding migrant species of North Macedonia and occupies a variety of woodlands near wetlands,	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					marshes and rivers. It also, uses agricultural areas such as arable land and pasture particularly during migration and when wintering. There are limited records of greater spotted eagle in North Macedonia (BirdLife International., 2021). It was not recorded during any of the 2024/2025 bird surveys and considering it is a rare passage and winter visitor, therefore it is considered unlikely this species is present in the AoI.			AoI, the EAAA is unlikely to support >1% of the global population estimated to be 1,700,000.
Aquila heliaca	Eastern Imperial Eagle	VU	NE	In	Eastern imperial eagle is a native resident and passage migrant in North Macedonia. They occupy woodlands, steppe and agricultural areas with scattered trees and nest on cliff faces as well as pylons. Eastern imperial eagle are a qualifying species of Ovche Pole KBA 8.5km northwest, River Topolka river/Babuna river Bregalnica KBA/IBA 11km west and other KBAs in the AoI of the Project. This species was recorded within the AoI during the vantage point surveys in 2025. In addition, two	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 51,000,000. However, as this species is a full migrant, recorded in the AoI and IUCN VU, it is considered to be a Priority Biodiversity Features under EBRD.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					adult individual and a juvenile eagle were recorded during the raptor surveys within the AoI. Therefore, this species occurs in the AoI.			
Falco vespertinus	Red-footed Falcon	VU	NE	In	Red-footed falcon is a migratory species in North Macedonia and occupies lowland habitats such as meadows and agricultural land with scattered trees and often near wetlands. It was not recorded during any of the 2024/2025 bird surveys and considering it is a rare passage visitor, with limited suitable habitat within the AoI, it is considered unlikely this species is present in the AoI	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 21,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Alectoris graeca	Rock Partridge	NT	NE	Out	Rock partridge is a native resident species in North Macedonia and occupies dry, open, and rocky upland areas, including mountain slopes and forested hillsides. This species was recorded within the AoI during the breeding bird surveys in 2025. Therefore, this species occurs in the AoI.	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, on 2 occasions with a peak count of 1, the EAAA is unlikely to support >1% of the global population estimated to be 150,000. However, as this species is listed as an Annex I species under EU Birds Directive, it is considered to be a Priority Biodiversity Features under EBRD.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Aythya nyroca	Ferruginous Duck	NT	NE	In	Not recorded within AoI during 2025 surveys	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, on 4 occasions with a peak count of 3, the EAAA is unlikely to support >1% of the global population estimated to be 80-134,000. However, as this species is listed under Annex I of the Birds Directive, it is considered to be a Priority Biodiversity Features under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Gallinago media	Great Snipe	NT	NE	In	Not recorded within AoI during 2025 surveys	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 900,000.
Limosa limosa	Black-tailed Godwit	NT	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 21,900,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Numenius arquata	Eurasian Curlew	NT	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 1,400,000. However, as this species is listed under Annex I of the Birds Directive, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Vanellus vanellus	Northern Lapwing	NT	NE	In	Not recorded within AoI during 2025 surveys	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 54,000,000.
Circus macrourus	Pallid Harrier	NT	NE	In	Not recorded within AoI during 2025 surveys	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
								>1% of the global population estimated to be 37,100,000.
Pelecanus crispus	Dalmatian Pelican	NT	NE	In	Not recorded within AoI during 2025 surveys	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 17,500,000.
Lanius senator	Woodchat Shrike	NT	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 20,500,000. However, as this species is a full migrant, recorded in the AoI, it is considered to be a Priority Biodiversity Features under EBRD.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Turdus iliacus	Redwing	NT	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 55,000,000. However, as this species is a full migrant, recorded in the AoI, it is considered to be a Priority Biodiversity Features under EBRD.
Accipiter gentilis	Northern Goshawk	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 1,000,000.
Accipiter nisus	Eurasian Sparrowhawk	LC	NE	In	Eurasian sparrowhawk is a native resident species of North Macedonia and occupies dense woodlands as well as urban areas including parks and gardens. It will often nest in tall trees. This species was recorded within the AoI during the vantage point surveys in 2024/25. Therefore, this species occurs in the AoI.	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 2,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Aegithalos caudatus	Long-tailed Tit	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 36,200,000.
Alauda arvensis	Eurasian Skylark	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Anthus pratensis	Meadow Pipit	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 24,000,000. However, as this species is a full migrant, recorded in the AoI, it is considered to be a Priority Biodiversity Features under EBRD.
Anthus spinoletta	Water Pipit	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 10,000,000. However, as this species is a full migrant, recorded in the AoI, it is considered to be a Priority Biodiversity Features under EBRD.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Anthus trivialis	Tree Pipit	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 100,000,000. However, as this species is a full migrant, recorded in the AoI, it is considered to be a Priority Biodiversity Features under EBRD.
Buteo buteo	Common Buzzard	LC	NE	In	Eurasian buzzard is a native resident species of North Macedonia and occupies dense woodlands as well as open areas such as arable fields and woodland edges. It will often nest in tall trees and woodland. This species was recorded within the AoI during the vantage point surveys in 2024/25. In addition, five confirmed territories were identified during the raptor surveys. Therefore, this species occurs in the AoI.	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 2,000,000.
Buteo rufinus	Long-legged Buzzard	LC	NE	In	Long-legged buzzard is a native resident species of North Macedonia and occupies open areas such as steppe and dry grasslands and temperate shrublands. It will often nest on	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					rocky outcrops or cliffs and occasionally scattered trees. This species was recorded within the AoI during the vantage point surveys in 2024/25. Therefore, this species occurs in the AoI.			estimated to be 100,000. However, as this species is listed under Annex I of the Birds Directive and a migratory species, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Calandrella brachydactyla	Greater Short-toed Lark	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 9,460,000. However, as this species is listed under Annex I of the Birds Directive, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Carduelis carduelis	European Goldfinch	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 101,000,000.
Chloris chloris	European Greenfinch	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 48,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Circus aeruginosus	Western Marsh Harrier	LC	NE	In	Western marsh harrier is a native resident species of North Macedonia and occupies dense marsh vegetation as well as wetlands, floodplains and reedbeds where they nest. This species was recorded within the AoI during the vantage point surveys in 2024/25. Therefore, this species occurs in the AoI.	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 600,000. However, as this species is listed under Annex I of the Birds Directive and migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Circus cyaneus	Hen Harrier	LC	NE	In	Hen harrier is a non-breeding migrant species of North Macedonia and occupies a variety of open landscapes including grassland, shrublands and marshes. It also, uses agricultural areas such as arable land and pasture particularly during migration and when wintering. This species was recorded within the AoI during the vantage point surveys in 2024/25. Therefore, this species occurs in the AoI.	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 330,000. However, as this species is listed under Annex I of the Birds Directive and migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Coccothraustes coccothraustes	Hawfinch	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 14,600,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Columba oenas	Stock Dove	LC	NE	In	Stock Dove is a partially migratory species in North Macedonia, typically found in open woodlands, parklands, and agricultural areas with scattered trees. It nests in tree cavities or old woodpecker holes and prefers quiet rural habitats over urban environments. Three were recorded in suitable habitat during the breeding bird surveys in 2025. Therefore, this species occurs in the AoI.	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 1,700,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Columba palumbus	Common Wood Pigeon	LC	NE	In	Woodpigeon is a partial migrant in North Macedonia, commonly found in deciduous and coniferous woodlands, agricultural fields, and urban green spaces. It nests in trees and forages mainly on plant material, including crops, making it a frequent presence in both rural and suburban areas. They were recorded throughout the ornithological surveys in 2024/25. Therefore, this species occurs in the AoI.	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 51,000,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6
Corvus corax	Common Raven	LC	NE	In	Common Raven is a non-migratory species in North Macedonia, inhabiting a wide range of habitats including mountain forests, rocky cliffs, open plains, and scrubby	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					woodlands. It is highly adaptable, often found near human settlements, landfills, and agricultural areas, and is known for its intelligence and opportunistic feeding behavior as both a scavenger and predator. They were recorded throughout the ornithological surveys in 2024/25. Therefore, this species occurs in the AoI.			>1% of the global population estimated to be 21,000,000.
Cyanistes caeruleus	Eurasian Blue Tit	LC	NE	In	Recorded within AoI during 2025 surveys,	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 62,800,000.
Dendrocopos minor	Lesser Spotted Woodpecker	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Dryocopus martius	Black Woodpecker	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 3,540,000. However, as this species is listed under Annex I of the Birds Directive, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Emberiza schoeniclus	Reed Bunting	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 20,000,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6
Erithacus rubecula	European Robin	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 130,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Falco tinnunculus	Common Kestrel	LC	NE	In	Kestrel is a native resident species of North Macedonia and occupies open areas such as grasslands, agricultural fields as well as urban areas. It will often nest on rocky outcrops or cliffs and occasionally within trees and buildings. This species was recorded within the AoI during the vantage point surveys in 2025. In addition, six confirmed territories were identified during the raptor surveys in 2025. Therefore, this species occurs in the AoI.	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 43,000,000.
Fringilla coelebs	Common Chaffinch	LC	NE	In	Recorded within AoI during 2025 surveys,	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 500,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Fringilla montifringilla	Bramblin g	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 35,000,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6
Galerida cristata	Crested Lark	LC	NE	In	Recorded within AoI during 2025 surveys,	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 172,000,000.
Lanius excubitor	Great Grey Shrike	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 640,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6
Linaria cannabina	Common Linnet	LC	NE	In	Recorded within AoI during 2025 surveys,	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
								AoI, the EAAA is unlikley to support >1% of the global population estimated to be 50,000,000.
Lullula arborea	Woodlark	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 4,770,000. However, as this species is listed under Annex I of the Birds Directive, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Melanocorypha calandra	Calandra Lark	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 44,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Phoenicurus ochruros	Black Redstart	LC	NE	In	Not recorded in AoI during 2025 surveys. No suitable habitat within AoI	Out		
Phylloscopus collybita	Common Chiffchaff	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 75,900,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6
Phylloscopus trochilus	Willow Warbler	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 236,000,000. However, as this species is migratory,

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
								it is considered to be a Priority Biodiversity Features under EBRD ESR6
Pica pica	Eurasian Magpie	LC	NE	In	Recorded within AoI during 2025 surveys,	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 64,300,000.
Prunela modularis	Dunnock	LC	NE	In	Recorded within AoI during 2025 surveys,	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 25,000,000.
Pyrrhula pyrrhula	Eurasian Bullfinch	LC	NE	In	Recorded within AoI during 2025 surveys,	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
								species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 35,000,000.
Regulus ignicapilla	Firecrest	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 9,600,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6
Regulus regulus	Goldcrest	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 98,000,000.
Saxicola rubicola	European Stonechat	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Sturnus vulgaris	Common Starling	LC	NE	In	Recorded within AoI during 2025 surveys,	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 150,000,000.
Sylvia atricapilla	Eurasian Blackcap	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 93,000,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Troglodytes troglodytes	Eurasian Wren	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 215,000,000.
Turdus merula	Common Blackbird	LC	NE	In	Recorded within AoI during 2025 surveys,	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 145,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Turdus philomelos	Song Thrush	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 75,000,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6
Turdus pilaris	Fieldfare	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 27,100,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Turdus viscivorus	Mistle Thrush	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 12,200,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Gyps fulvus	Griffon Vulture	LC	NE	In	Recorded in GBIF.	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. This species was not recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 80,000. However, although this species is listed under Annex I of the Birds Directive, it is was not recorded in the AoI, therefore not considered to be a Priority Biodiversity Features under EBRD ESR6.
Coracias garrulus	European Roller	LC	NE	In	Not recorded within AoI during 2025 surveys. Suitable habitat is present in the AoI	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. This species was not recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 100,000-499,000. However, as this species is listed under Annex I of the Birds Directive and migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Lanius nubicus	Masked shrike	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. This species was recorded in the Project AoI on five occasions across all surveys with a peak count of 2, the EAAA is unlikley to support >1% of the global population estimated to be 121,000-

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
								355,000. However, as this species is listed under Annex I of the Birds Directive and migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Burhinus oedicnemus	Eurasian Thick-knee	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 360,000. However, as this species is listed under Annex I of the Birds Directive, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Ixobrychus minutus	Common Little Bittern	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Ficedula parva	Red-breasted Flycatcher	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Falco peregrinus	Peregrine Falcon	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, it was only recorded on one occasion, the EAAA is unlikley to support >1% of the global population estimated to be 100,000. However, as this species is listed under Annex I of the Birds Directive, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Gallinula chloropus	Common Moorhen	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Egretta garzetta	Little Egret	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Oriolus oriolus	Eurasian Golden Oriole	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 13,400,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Oenanthe oenanthe	Northern Wheatear	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 10,000,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Delichon urbicum	Northern House Martin	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 38,300,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Cecropis daurica	Red-rumped Swallow	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 57,200,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Riparia riparia	Collared Sand Martin	LC	NE	In	Not recorded in AoI during 2025 surveys. Potential for migratory movements through AoI.	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Motacilla flava	Western Yellow Wagtail	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Curruca cantillans	Subalpine Warbler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Acrocephalus arundinaceus	Great Reed-warbler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Otus scops	Eurasian Scops-owl	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 790,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Remiz pendulinus	Eurasian Penduline-tit	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Milvus migrans	Black Kite	LC	NE	In	Not recorded in AoI during 2025 surveys. Potential for migratory movements through AoI.	Out		
Coturnix coturnix	Common Quail	LC	NE	In	Recorded within AoI during 2025 surveys,	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 15,000,000.
Cygnus olor	Mute Swan	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Anser fabalis	Bean Goose	LC	NE	In	Not recorded in AoI during 2025 surveys. Potential for migratory movements through AoI.	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Anser albifrons	Greater White-fronted Goose	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Anser anser	Greylag Goose	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Mareca strepera	Gadwall	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Mareca penelope	Eurasian Wigeon	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Anas platyrhynchos	Mallard	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Spatula clypeata	Northern Shoveler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Anas acuta	Northern Pintail	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Spatula querquedula	Garganey	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Anas crecca	Common Teal	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Jynx torquilla	Eurasian Wryneck	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Upupa epops	Common Hoopoe	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 4,030,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Alcedo atthis	Common Kingfisher	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Merops apiaster	European Bee-eater	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Cuculus canorus	Common Cuckoo	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 34,600,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Tachymarptis melba	Alpine Swift	LC	NE	In	Not recorded in AoI during 2025 surveys. Potential for migratory movements through AoI.	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Apus apus	Common Swift	LC	NE	In	Not recorded in AoI during 2025 surveys. Potential for migratory movements through AoI.	Out		
Apus pallidus	Pallid Swift	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 800,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Asio otus	Northern Long-eared Owl	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 2,200,000.
Asio flammeus	Short-eared Owl	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Caprimulgus europaeus	European Nightjar	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 2,980,000. However, as this species is listed under Annex I of the Birds Directive and migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Crex crex	Corncrake	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Zapornia pusilla	Baillon's Crake	LC	NE	In	Not recorded in AoI during 2025 surveys. No suitable habitat within AoI	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Porzana porzana	Spotted Crake	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Fulica atra	Common Coot	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Scolopax rusticola	Eurasian Woodcock	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Gallinago gallinago	Common Snipe	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Lymnocryptes minimus	Jack Snipe	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Tringa erythropus	Spotted Redshank	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Tringa totanus	Common Redshank	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Tringa ochropus	Green Sandpiper	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Calidris alpina	Dunlin	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Recurvirostra avosetta	Pied Avocet	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Pluvialis apricaria	Eurasian Golden Plover	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Charadrius dubius	Little Ringed Plover	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Glareola pratincola	Collared Pratincole	LC	NE	In	Not recorded in AoI during 2025 surveys. Potential for migratory movements through AoI.	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Larus ridibundus	Black-headed Gull	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Chlidonias hybrida	Whiskered Tern	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Chlidonias niger	Black Tern	LC	NE	In	Not recorded in AoI during 2025 surveys. Potential for migratory movements through AoI.	Out		
Pandion haliaetus	Osprey	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Pernis apivorus	European Honey-buzzard	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
								AoI, on 9 occasions with a peak count of 4, the EAAA is unlikley to support >1% of the global population estimated to be 290,000-430,000. However, as this species is listed under Annex I of the Birds Directive and migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Milvus milvus	Red Kite	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Haliaeetus albicilla	White-tailed Sea-eagle	LC	NE	In	Not recorded in AoI during 2025 surveys. No suitable habitat within AoI	Out		
Circus pygargus	Montagu's Harrier	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, on 2 occasions with a peak count of 1, the EAAA is unlikley to support >1% of the global population estimated to be 300,000. However, as this species is listed on Annex I of the EU Bird's Directive and is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Accipiter brevipes	Levant Sparrowhawk	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Buteo lagopus	Rough-legged Buzzard	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Clanga pomarina	Lesser Spotted Eagle	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Aquila chrysaetos	Golden Eagle	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Hieraaetus pennatus	Booted Eagle	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, on 2 occasions with a peak count of 1, the EAAA is unlikley to support >1% of the global population estimated to be 150,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Falco naumanni	Lesser Kestrel	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
								IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, on 4 occasions with a peak count of 3, the EAAA is unlikley to support >1% of the global population estimated to be 80-134,000. However, as this species is listed under Annex I of the Birds Directive and migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Falco columbarius	Merlin	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Falco subbuteo	Eurasian Hobby	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 900,000. However, as this species is listed under Annex I of the Birds Directive and migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Tachybaptus ruficollis	Little Grebe	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Podiceps grisegena	Red-necked Grebe	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Podiceps cristatus	Great Crested Grebe	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Podiceps nigricollis	Black-necked Grebe	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Microcarbo pygmaeus	Pygmy Cormorant	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Ardea cinerea	Grey Heron	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Ardea purpurea	Purple Heron	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Ardea alba	Great White Egret	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Ardeola ralloides	Squacco Heron	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Nycticorax nycticorax	Black-crowned Night-heron	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Botaurus stellaris	Eurasian Bittern	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Plegadis falcinellus	Glossy Ibis	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Platalea leucorodia	Eurasian Spoonbill	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Ciconia nigra	Black Stork	LC	NE	In	Not recorded in AoI during 2025 surveys. Potential for migratory movements through AoI.	Out		
Ciconia ciconia	White Stork	LC	NE	In		Out		
Lanius collurio	Red-backed Shrike	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 21,900,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Lanius minor	Lesser Grey Shrike	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 1,400,000. However, as this species is listed under Annex I of the Birds Directive and migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Corvus monedula	Eurasian Jackdaw	LC	NE	In	Not recorded in AoI during 2025 surveys. Potential suitable habtiat within the AoI.	Out		
Corvus frugilegus	Rook	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Corvus corone	Carrion Crow	LC	NE	In	Not recorded in AoI during 2025 surveys. Potential habitat within AoI.	Out		
Cinclus cinclus	White-throated Dipper	LC	NE	In	Not recorded in AoI during 2025 surveys. No suitable habitat within AoI	Out		
Monticola saxatilis	Rufous-tailed Rock-thrush	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Monticola solitarius	Blue Rock-thrush	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Turdus torquatus	Ring Ouzel	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Muscicapa striata	Spotted Flycatcher	LC	NE	In	Recorded within AoI during 2025 surveys	In	Yes	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 54,000,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Ficedula albicollis	Collared Flycatcher	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Ficedula semitorquata	Semi-collared Flycatcher	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Luscinia megarhynchos	Common Nightingale	LC	NE	In	Recorded within AoI during 2025 surveys,	In	Yes	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 37,100,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Luscinia svecica	Bluethroat	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Cercotrichas galactotes	Rufous-tailed Scrub-robin	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Phoenicurus phoenicurus	Common Redstart	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 17,500,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Saxicola rubetra	Whinchat	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 20,500,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Saxicola torquatus	Common Stonechat	LC	NE	In	Recorded within AoI during 2025 surveys,	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 55,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Oenanthe hispanica	Black-eared Wheatear	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Pastor roseus	Rosy Starling	LC	NE	In		Out		
Tichodroma muraria	Wallcreeper	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Ptyonoprogne rupestris	Eurasian Crag Martin	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Hirundo rustica	Barn Swallow	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 290,000,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Cettia cetti	Cetti's Warbler	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Locustella fluviatilis	River Warbler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Locustella luscinioides	Savi's Warbler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Acrocephalus melanopogon	Moustached Warbler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Acrocephalus schoenobaenus	Sedge Warbler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Acrocephalus scirpaceus	Common Reed-warbler	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Acrocephalus palustris	Marsh Warbler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Hippolais olivetorum	Olive-tree Warbler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Phylloscopus sibilatrix	Wood Warbler	LC	NE	In	Not recorded in AoI during 2025 surveys. Suitable habitat within AoI	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Sylvia borin	Garden Warbler	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 29,000,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Curruca communis	Common Whitethroat	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 60,300,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Curruca nisoria	Barred Warbler	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 2,300,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Curruca melanocephala	Sardinian Warbler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Eremophila alpestris	Horned Lark	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Passer hispaniolensis	Spanish Sparrow	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 61,000,000.
Motacilla alba	White Wagtail	LC	NE	In	Not recorded in AoI during 2025 surveys. No suitable habitat within AoI	Out		
Motacilla cinerea	Grey Wagtail	LC	NE	In	Not recorded in AoI during 2025 surveys. No suitable habitat within AoI	Out		
Anthus campestris	Tawny Pipit	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
								estimated to be 4,000,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Prunella collaris	Alpine Accentor	LC	NE	In	Not recorded in AoI during 2025 surveys. No suitable habitat within AoI	Out		
Serinus serinus	European Serin	LC	NE	In	Recorded within AoI during 2025 surveys	In	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 45,000,000.
Spinus spinus	Eurasian Siskin	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 24,900,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Emberiza hortulana	Ortolan Bunting	LC	NE	In	Not recorded in AoI during 2025 surveys. Habitat suitable within AoI	Out	PBF	

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Emberiza melanocephala	Black-headed Bunting	LC	NE	In	Recorded within AoI during 2025 surveys,	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 7,600,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Rallus aquaticus	Western Water Rail	LC	NE	In	Not recorded in AoI during 2025 surveys. No suitable habitat within AoI	Out		
Himantopus himantopus	Black-winged Stilt	LC	NE	In	Not recorded in AoI during 2025 surveys. No habitat suitable within AoI	Out		
Phylloscopus orientalis	Eastern Bonelli's Warbler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Circaetus gallicus	Short-toed Snake-eagle	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, on 2 occasions with a peak count of 1, the EAAA is unlikley to support >1% of the global population estimated to be 50,000. However, as this species is listed on Annex I of the Bird's Directive and is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Iduna pallida	Olivaceous Warbler	LC	NE	In	Not recorded within AoI during 2025 surveys	Out		
Curruca crassirostris	Eastern Orphean Warbler	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 291,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
Curruca curruca	Lesser Whitethroat	LC	NE	In	Recorded within AoI during 2025 surveys	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikley to support >1% of the global population estimated to be 27,900,000. However, as this species is migratory, it is considered to be a Priority Biodiversity Features under EBRD ESR6.
AMPHIBIA								
Salamandra salamandra	Common Fire Salamander	VU	LC	In	This species is associated with wet cool deciduous, mixed, or rarely, coniferous forests with well shaded brooks and small rivers. Within the mountain forest belt, the species can be found in woodlands, glades and forest	Out	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 24,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					edges, rocky slopes, dense bush, and herbaceous vegetation. The species prefers microhabitats covered with dense leaf-litter and moss. It does tolerate some habitat modification and has even been found in gardens. This species was confirmed in the AoI in 2025.			
Bombina variegata	Yellow-bellied Toad	LC	LC	Out	This species can be found in coniferous, deciduous and mixed forests, bushlands and meadows, floodplains and grasslands, pastures and Mediterranean maquis. This species was confirmed in the AoI during the 2025 surveys.	In	PBF	This species does not meet Critical Habitat thresholds under IFC PS6 or EBRD ESR6. However, it is listed under Annex II of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, species protected under Annex II trigger Priority Biodiversity Feature (PBF) requirements.
Ichthyosaura alpestris	Alpine Newt	LC	EN	In	This species is found throughout much of Europe however, it's global range only overlaps with North-east and western borders of North Macedonia. This is a mostly aquatic species that is generally found close to water but the Project AoI does not have any permanent waterbodies. It was not recorded during the 2025 surveys and is unlikely to be regularly occurring within the AoI.	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Bufotes viridis	European Green Toad	LC	LC	Out	This species lives in a wide range of forests, forest steppe, scrubland, grassland and alpine habitats. This species was recorded during the 2025 surveys.	In	EBRD CH	This species does not meet critical habitat thresholds under IFC PS6 or EBRD ESR6 based on global or regional criteria. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, species protected under Annex IV would typically trigger CH requirements.
Hyla arborea	European Tree Frog	LC	NT	Out	This species is generally associated with open, well-illuminated broad-leaved and mixed forests, bush and shrublands, meadows, gardens, vineyards, orchards, parks, lake shores and low riparian vegetation. Dark and dense forests are avoided. This species was recorded during the 2025 surveys.	In	EBRD CH	This species does not meet critical habitat thresholds under IFC PS6 or EBRD ESR6 based on global or regional criteria. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, species protected under Annex IV would typically trigger CH requirements.
REPTILIA								
Testudo hermanni	Hermann's Tortoise	VU	VU	In	This species can be considered a typical inhabitant of Mediterranean maquis and shrublands. It prefers open patchy evergreen Mediterranean Oak forest, but in its absence inhabits maquis, garrigue, dune scrub and maritime grasslands, as well as agricultural and railway edge habitats. In the temperate area of the Balkan	In	PBF	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 2,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					Peninsula preferred habitat systems are Oak forests intersected with meadows and agricultural land - orchards and vineyards. This species was confirmed in the AoI in 2025.			
Testudo graeca	Greek Tortoise / Spur-thighed Tortoise	VU (Europe)	VU	In	This species inhabits a variety of dry, open scrubby habitats, meadows and pastures, sand dunes, forests, heathlands, and open habitats through its wide range, generally on a sandy-calcareous substrate. It is also found in more open, rocky areas and areas of strongly salty substrate and sparse vegetation, as well as accumulations of large rocks. It is a generalist vegetarian, feeding on a wide variety of leaves, buds, flowers, seeds and fruits of grasses, herbs and shrubs, as well as small invertebrates such as snails, arthropods. This species was confirmed in the AoI in 2025.	In	PBF	The global population size of *Testudo graeca* is not quantified, but the species is widespread across North Africa, southern Europe and Southwest Asia; in the most recent 2024 IUCN Red List assessment it is classified Near Threatened at the global scale and Vulnerable at European scale due to continuing habitat degradation and other pressures. Based on the field survey data and literature review for the Project's EAAA, *T. graeca* is unlikely to meet Critical Habitat thresholds under IFC PS6 or EBRD ESR6 for threatened-species concentration criteria i.e., areas supporting globally important concentrations of Red-listed species at levels where loss would plausibly change global status to EN or CR, as set out in GN6. However, because the species is assessed as Vulnerable in Europe and nationally in North Macedonia and occurs within

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								the EAAA, a precautionary approach has been taken and this species does meet Priority Biodiversity Feature requirements under EBRD ESR6.
Zootoca vivipara	Viviparous Lizard	LC	EN	In	This is the most widespread reptile species in the world however, isolated subpopulations occur in the extreme northeastern and northwestern Macedonia. This species can be found in a wide variety of habitats including grassland, meadows, humid scrubland, hedgerows, open woodland, woodland edges, peat bogs, stream edges, coastal areas (sea cliffs and sand dunes) and rural gardens. It is generally associated with high humidity and rich herbaceous vegetation. This species is highly dependent on humidity and water availability. It is considered unlikely that this species will be regularly occurring in the AoI given its dependence on water availability.	Out		
Lacerta agilis	Sand Lizard	LC	EN	In	The species can be found in meadows, heathland, coastal dunes, grassland, steppe, subalpine and alpine meadows, shrubland, hedgerows, open woodland, in alpine areas,	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					traditionally managed agricultural land and rural gardens. Sometimes it is present in sandy semi-desert areas. It is frequently found in drier and more open habitats than related species, including roadsides, hedgerows and quarries. In the forest zone, typical biotopes are mainly forest edges, clearings, floodplain forests, floodplain meadows, watershed meadows and coastal slopes, and only to a small extent anthropogenic biotopes. The most preferred natural biotopes are still the slopes of ravines, gullies, coastal slopes and other natural depressions, where the agile lizard reaches its greatest abundance. In the semi-desert zone, the population density of lizards is not very high. The biotopes preferred in the steppe zone, belong to the biotopes of open spaces: floodplain meadows, slopes and other natural depressions. It is considered unlikely that this species will be regularly occurring in the AoI given its habitat preferences.			

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Eryx jaculus	Javelin Sand Boa	LC	EN	In	In Europe, this species has been recorded from Romania, through Bulgaria, Albania, North Macedonia, Greece. It can be found inhabiting open dry steppes and semi-deserts. It appears to prefer clay and stony soils, and is more rarely encountered on stabilised sands, in vineyards and gardens. It can be found in arable land with sufficiently loose soil for burrowing. Its habitats everywhere are associated with arid landscapes. This species' upper elevation limit is 1700m above sea level. This species could occur in the AoI given suitable arable land and elevation ranges are present.	In	No	The global conservation status of *Eryx jaculus* is Least Concern on the IUCN Red List, reflecting its wide distribution; nationally in North Macedonia it is assessed as Endangered under IUCN criteria. Under EBRD ESR6, species protected under Annex IV of the EU Habitats Directive typically trigger Critical Habitata requiremends under EBRD ESR6. The species was not recorded during project surveys, and given its ecology and the absence of evidence of regular occurrence within the EAAA, it is unlikely to meet Critical Habitat (CH) thresholds under IFC PS6 or EBRD ESR6. While *E. jaculus* is nationally threatened, the lack of confirmed, regular presence in the EAAA means the site does not meet PBF requirements for this species in this context.
Zamenis situla	European ratsnake	LC	NT	Out	This is a thermophilic species often found in scrubland, macchia, karst habitats, field edges, marshes, stream edges, vineyards, olive groves, on stone walls, and in rural gardens and buildings, as well as in a variety of temperate and Mediterranean montane forest types. This	In	PBF & CH under updated EBR	This species meets the thresholds for CH under EBRD ESR6 as is considered a priority species under Annex II of the Habitats Directive and is found in the EAAA. This species does not meet the thresholds for Critical Habitat under IFC PS6 . Whilst this species was

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					species was confirmed in the AoI during the 2025 surveys.		D ESR 6 due to bein g a prior ity spec ies unde r Habi tats Dire ctive	recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 24,900,000.
Elaphe quatuorlinea ta	Four-lined Snake	LC	NT	Out	It is found in hedgerows, close to woodland edges, in open woodland, rocky overgrown areas and traditionally cultivated land. This species was confirmed in the AoI during the 2025 surveys.	In	EBR D CH	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex II and IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occurring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.

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Lacerta viridis	Green Lizard	LC	LC	Out	This species occurs in a variety of habitats. It is usually found in damp areas with dense vegetation and warm basking opportunities. Preferred habitats range from south-facing vineyards and forest edges in the north of the range to open woodland, shrubland, overgrown fields and gardens, and hedgerows further south. This species was confirmed in the AoI during the 2025 surveys.	In	EBRD CH	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
Podarcis muralis	Common Wall Lizard	LC	LC	Out	It can occur in rocky and scree areas, scrubland, deciduous and coniferous woodland, orchards, vineyards, fields, stone walls, and on buildings. It is often found in human settlements including large cities and villages, and along railway lines which may be routes of dispersal. This species was confirmed in the AoI during the 2025 surveys.	In	EBRD CH	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
Vipera ammodytes	Nose-horned Viper	LC	LC	Out	It typically occurs in areas that are relatively drier than surrounding vegetation, including open woodland, scrub, sandy areas, hillsides, screes, stone walls, but also traditionally cultivated land, gardens and vineyards with some complex microstructure. This	In	EBRD CH	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					species was confirmed in the AoI during the 2025 surveys.			regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
Natrix tessellata	Dice Snake	LC	NT	Out	This is a largely aquatic species associated with rivers, coasts, streams, lakes, ponds and the surrounding terrestrial habitat, including those in agricultural and other disturbed areas. It may be the most aquatic snake in Europe, with a preference for larger waterbodies than the related viperine snake. This species was confirmed in the AoI during the 2025 surveys.	In	EBRD CH	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
Zamenis longissimus	Aesculapian Ratsnake	LC	LC	Out	It can be found along riverbanks, in marshland, in clearings, in areas of dense scrub and along hedgerows in farming areas, as well as around abandoned buildings, dry stone walls or disused quarries. This species was not recorded during the 2025 surveys. However, it could be present given suitable habitats.	In	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. This species does not meet the requirements of Critical Habitat under EBRD ESR6 as this species is not regularly occuring within the EAAA.
Platyceps najadum	Dahl's Whip Snake	LC	NT	Out	In general, this species is associated with dry or xerophytic landscapes. It is found on the open parts of stony semi-desert	In	No	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					and wermuth steppe, among rocky outcrops and stones. There is suitable habitat for this species within the AoI.			within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. This species does not meet the requirements of Critical Habitat under EBRD ESR6 as this species is not regularly occuring within the EAAA.
Coronella austriaca	Smooth Snake	LC	LC	Out	The species is found in moorland, rocky coastlines, open woodland (deciduous, coniferous and mixed) and scrubland, hedgerows, woodland edges, heathland, sandy coastal sites, rocky areas, screes, subalpine and open areas with sparse vegetation. Although the species swims well, it avoids damp places. This species was recorded during the 2025 surveys.	In	EBRD CH	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
Podarcis erhardii	Erhard's Wall Lizard	LC	LC	Out	It inhabits mesic areas: it avoids the driest habitats within its range, and is often replaced by the Common Wall Lizard. This species was recorded during the 2025 surveys.	In	EBRD CH	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Lacerta trilineata	Balkan Green Lizard	LC	LC	Out	Members of the Aegean green lizard group are generally found in dense vegetation, including hedgerows, bramble thickets, open woodland, vegetated dunes and overgrown meadows. This species was recorded during the 2025 surveys.	In	EBRD CH	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
Natrix natrix	Grass Snake	LC	LC	Out	This snake is typically found in damp places, such as wet meadows, around standing water and along the banks of streams. It is sometimes found a long way from any standing water and can often be found in wooded localities and in heathland. It is tolerant of heavily-modified lansdcapes where suitable water sources are present, and can live in domestic gardens and urban parkland. This species was recorded during surveys in 2025.	In	EBRD CH	This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occuring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
ACTINOPTERYGII								
Anguilla anguilla	European Eel	CR	NE	In	There are no permanent waterbodies within the AoI of the Project	Out	No	

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Salmo pelagonicus	Pelagonian Trout	VU	NE	In	There are no permanent waterbodies within the AoI of the Project	Out	No	This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 10,000,000.
Alburnus alburnus	Common Bleak	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Leuciscus aspius	Eurasian Asp	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Barbus barbus	Common Barbel	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Chondrostoma nasus	Nase	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Leuciscus leuciscus	Common Dace	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Rutilus rutilus	Common Roach	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Sander lucioperca	Eurasian Pikeperch	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Thymallus thymallus	European Grayling	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Vimba vimba	Vimba Bream	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Blicca bjoerkna	White Bream	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Squalius cephalus	European Chub	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Rutilus heckelii		LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Ballerus ballerus	Blue Bream	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Ballerus sapa	White-Eye Bream	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Salmo labrax	Black Sea Trout	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Abramis brama	Common Bream	LC	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
Salmo macedonicus	Macedonian Trout	DD	NE	In	There are no permanent waterbodies within the AoI of the Project	Out		
GASTROPODA								
Carinigera drenovoensis		CR	NE	In	This species occurs within a small region in southwestern Macedonia: the areas of Drenovo, Raets and Mariovo between 200 and 1200masl. The species inhabits limestone rocks (in crevices, under stones or among rock vegetation) and in oak forests (under stones and among leaf litter). Whilst there is degraded oak forest at 850masl is present within the AoI near WTG 39,40 and 41. The global range of this species does not overlap with the Project AoI and therefore it is unlikely to be regularly occuring within the AoI.	Out	No	

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Theodoxus transversalis	Striped Nerite	EN	NE	In	This is a fluvial species, it occurs in rivers associated with solid surface. There are no permanent rivers within the AoI of the Project	Out	No	
Carinigera lophauchena		EN	NE	In	The species occurs in a relatively small region in southwestern Macedonia – Vardar River Valley, Demir Kapija Gorge, Valandovo, and the region of Amatovsko marsh. This species inhabits open limestone areas, where it is found on limestone rocks, in rock crevices, under stones or among rock vegetation. It's range does not overlap with the Project AoI and therefore it is unlikely to be regularly occuring within the AoI.	Out		
Carinigera octava		VU	NE	In	This species occurs within a small region in central Macedonia, around Veles town. It is known from three localities. The present species is found in open limestone areas, particularly on limestone rocks, in crevices, under stones or among rock vegetation and is unlikely to be regularly occurring within the Project AoI.	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 101,000,000.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Gyralina velkovrhi		VU	NE	In	This species is not aquatic and likely found in subterranean environments, in rock debris and crevices. It is known from only two locations in Southern Macedonia. The Project AoI is not located within its known geographic range and the habitats within the AoI are unsuitable for this species (i.e. there are no rock debris and crevices).	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 48,000,000.
Carinigera septima		VU	NE	In	This species is known from a single locality in the Vardar River Valley where it inhabits open limestone areas. It is particularly found on limestone rocks, in crevices, under stones, and among rock vegetation. It is has an upper elevation limit of 300m. It is unlikely to be present within the Project AoI	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 600,000. However, as this species is listed under Annex I of the Birds Directive, it is considered to be a Priority Biodiversity Features under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Vitrea mikuskai		NT	NE	In	This species is endemic to Macedonia, where it is known from a very restricted area in Demir Kapiya, Vardar River Valley. It occurs at a single location inhabiting limestone rocky areas. It is not present within the Project AoI.	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 15,000,000.
INSECTA								
Dasypoda frieseana		EN	NE	In	This species is known to forage pollen only on Cephalaria and Scabiosa plants (Caprifoliaceae). The species lives in Mediterranean-type shrubby vegetation with many of these plants present. This type of habitat is decreasing in Europe. It is considered unlikely that this species is present in the AoI given that no Cephalaria or Scabiosa plants were identified during the field surveys.	Out		
Bradyporus macrogaster	Big-Bellied Glandular Bush-Cricket	EN	NE	In	The species inhabits steppe-like habitats dominated by xeric grasses and sparse scrub, in some areas like the Eastern Rhodopes in Bulgaria and the Aegean coast of Anatolia it enters	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					Mediterranean vegetation, such as sparse xerothermic oak forests or scrub or mesoxeric grass associations. At the edge of its range, it is strongly affiliated with limestone areas with grass-scrub vegetation, probably microclimatically resembling Mediterranean habitats. This species is considered to be possibly extinct within Northern Macedonia and therefore unlikely to be present within the AoI.			>0.5% or >1% of the global population estimated to be 16000.
Ammobates melectoides		EN	NE	In	The species prefers various grasslands, steppe or forest steppe biotopes with abundant areas with bare soil. This species is unlikely to occur within the Project AoI as it is considered possibly extinct in Northern Macedonia.	Out		This species does not meet Critical Habitat thresholds under IFC PS6 as the area is not known for roosts with significant numbers of VU species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet subsequent thresholds for CR/EN species. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occurring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Paragus majoranae		EN	NE	In	The preferred environment for this species is open forest ground, open grassy areas, both humid and semi-arid, along brooks and rivers in warm-dry Oak (Quercus) forest, and upwards through Beech (Fagus) forest into the Spruce (Picea) zone up to 1,500 metres In the Balkan countries, it is largely confined to relict areas of unmodified forest. It's area of occupancy (AOO) is 196 km2 in Europe. It has a patchy distribution which does not overlap with the Project AoI and therefore is unlikely to be present.	Out		Myotis species have been recorded within the Project AoI. This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and could regularly occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Taking a precautionary approach, the EAAA is considered Critical Habitat under EBRD ESR6.
Merodon kozufensis		EN	NE	In	The habitat of this species is inside, or very close to beech forests. Considered unlikely to be present in the AoI due to lack of suitable habitats.	Out		This species does not meet Critical Habitat thresholds under IFC PS6. However, it is listed under Annex IV of the EU Habitats Directive and occurs within the EAAA. Under EBRD ESR6, areas where Annex IV species regularly occur can be assessed as Critical Habitat. Given this species is regularly occurring in the EAAA, the EAAA is considered Critical Habitat under EBRD ESR6.
Anax ephippiger	Vagrant Emperor	LC	NE	In	The main range of *Anax ephippiger* is found in Africa and the Arabian Peninsula and extends eastwards to India. It	Out		

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
					typically occurs in arid and semi-arid areas and from its main range, it regularly migrates northwards. It is one of the most common and widespread species present in its main range. It is a wetland species and its upper elevation limit is 500m. The Project elevation is 500-900masl. It is unlikely to be regularly occurring in the Project AoI given its widespread and prefers wetland habitats.			
Pantala flavescens	Wandering Glider	LC	NE	In	Pantala flavescens is a circumtropical species known from all continents except Antarctica. It is an obligate migrant, its migrations linked to the monsoon front. It is mainly found in savanna, shrubland, grassland, wetlands (inland), artificial/aquatic & marine. the Ecological conditions within the AoI of the Project are unlikely to support this species.	Out		
MALACOSTRACA								

Scientific name	Common name	Category	National status	Initial CH Screening (IN/OUT)	Likelihood in AoI	Step 2 Screening (IN/OUT)	CH/ PBF (Yes /No)	Assessment/ Justification
Atyaephyra strymonensis		VU	NE	In	The species lives in the marginal areas of rivers. There are no permanent rivers within the AoI of the Project.	Out		This species does not meet the thresholds for Critical Habitat under IFC PS6 or EBRD ESR6. Whilst this species was recorded in the Project AoI, the EAAA is unlikely to support >1% of the global population estimated to be 62,800,000.

11 Natural capital and ecosystem services

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Abbreviations

Abbreviation	
AoI	Area of Influence
BAP	Biodiversity Action Plan
BMEP	Biodiversity Monitoring and Evaluation Plan
BMP	Biodiversity Management Plan
CBD	Convention on Biological Diversity
CICES	Common International Classification of Ecosystem Services
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ESIA	Environmental and Social Impact Assessment
ESS	Environmental and Social Standard
EU	European Union
EUNIS	European Nature Information System
IFC PS6	International Finance Corporation Performance Standard 6
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
LRP	Livelihood Restoration Package
NBSAP	National Biodiversity Strategy and Action Plan
RM	Republic of Macedonia
UN SEEA	United Nations System of Environmental-Economic Accounting
WTG	Wind Turbine Generator

11 Natural capital and ecosystem services

11.1 Overview

This chapter presents the natural capital and ecosystem services assessment for the proposed Project. The assessment considers the effects of the Project on natural capital stocks and associated ecosystem services.

Ecosystem services are provided by stocks of natural capital assets. The ecosystem services assessment methodology included mapping expected changes in natural capital stocks resulting from the Project, then qualitatively assessing how those changes would likely impact upon the provision of ecosystem services.

This section provides a brief overview of natural capital and ecosystem services concepts relevant to the baseline and impact assessment. Subsequent sections set out how the baseline has been determined, a description of baseline conditions, and the identification of sensitive receptors. Following a description of the baseline, this chapter presents an assessment of the potential impacts anticipated during the construction and operational phases of the Project, and sets out the proposed mitigation, management, and monitoring measures. The evaluation of residual impacts following the implementation of mitigation is then presented.

11.1.1 Overview of natural capital and ecosystem services

Natural capital is a way of describing the stocks of renewable and non-renewable natural resources that combine to yield flows of benefits to people, as shown in Figure 11.1 (Capitals Coalition, 2016). The term ‘ecosystem services’ describes the flows that result in benefits, which provide value. Natural capital includes the ‘nature’ element in the Conceptual Framework of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2025) but also emphasises abiotic elements of nature such as minerals and water.

Figure 11.1: Delivery of value from natural capital through ecosystem services

Source: Capitals Coalition, Natural Capital Protocol, 2016

Up to three types of ecosystem services are broadly recognised, as follows:

- “Provisioning services” describes the products people obtain from ecosystems, such as food, freshwater, timber, fibres, and medicinal plants
- “Regulating services” describes the ways in which natural capital stocks mediate, moderate and maintain the ambient environment, for example by regulating climate, land degradation, and disease

- “Cultural services” describes non-material outputs of ecosystems that affect the physical and mental conditions of people, for example providing recreation, spiritual enrichment, and cognitive development.

Biotic ecosystem services arise directly from the living components of ecosystems or their interactions. Abiotic ecosystem services do not depend directly on ecological processes in the short term but arise from geological processes and include the supply of minerals, metals, and oil and gas, as well as geothermal heat, wind, tides, and the annual seasons.

Biodiversity is the variety in the living component of natural capital stocks. As well as being an asset that delivers direct value, biodiversity supports the condition of other stocks and can contribute to the quantity and quality of the ecosystem services they deliver. Furthermore, biodiversity contributes to the resilience of natural capital stocks and the stability of ecosystem service provision.

The value added by including ecosystem services approaches in decision making is increasingly recognised; ecosystem services assessments enable an enhanced and systematic understanding of the relationship between nature and peoples’ health and wellbeing. They can demonstrate where interventions from the policy- to Project-scale positively or negatively affect the dependencies that society has on nature, helping to guide decisions that result in better social outcomes.

The IPBES Global Assessment Report on Biodiversity and Ecosystem Services (IPBES, 2019), among other studies, has documented the ongoing decline in delivery of ecosystem services associated with environmental degradation at a global scale (Figure 11.2). Bringing ecosystem services into Project-scale decision, planning and assessment processes helps to build understanding of the consequences of environmental impacts for human wellbeing. As such, it assists design of Projects that safeguard people’s security, health, social relations, and material needs.

Figure 11.2: Global trends in the capacity of nature to sustain contributions to good quality of life from 1970 to the present

Source: IPBES, 2019. The global assessment report on biodiversity and ecosystem services summary for policymakers. Nature's contributions to people, as used in this figure, represents all the contributions (both positive and negative) of living nature to the quality of life of people, incorporating the concept of ecosystem services which focuses on the flows of positive contributions.

11.1.2 Structure of this chapter

This chapter is organised to provide a clear, systematic assessment of natural capital and ecosystem services related risks and opportunities associated with the Project.

1. **Overview** Outlines the overview of the chapter
2. **Applicable Standards:** Summarises relevant national legislation in North Macedonia and international guidance related to natural capital and ecosystem services

3. **Methodology:** Describes the approach used to assess natural capital and ecosystem services, including:
   - **Area of Influence**: Area in which natural capital stocks may be directly or indirectly affected
   - **Field Surveys and natural capital mapping**: On-site ecological surveys conducted to capture habitat mapping which partially informed the natural capital mapping
   - **Desktop review**: Review of Project mapping and relevant Project documents
   - **Assessment Criteria**: Application of the mitigation hierarchy and significance evaluation methods
   - **Sensitive receptors**: Extent to which ecosystem services with changes to natural capital stocks
   - **Limitations and assumptions**: Outlines key limitations and assumptions
4. **Baseline natural capital stocks and ecosystem services:** Presents the baseline natural capital stocks and ecosystem services provided
5. **Assessment of impacts:** Assesses potential impacts on natural capital stocks and ecosystem services during the construction phase, such as habitat clearance, noise, and disturbance; and during the operation phase such as noise, vibration, disturbance, and visual impacts
6. **Mitigation and enhancement:** Details proposed measures to avoid and minimise loss of natural capital stocks and ecosystem services
7. **Monitoring:** Details proposed monitoring measures
8. **Residual impacts:** Assesses the significance of remaining impacts after mitigation and outlines a framework for monitoring and adaptive management strategies, including:
   - **Conclusion:** Summarises key findings and provides recommendations for Project design and implementation
   - **References:** List of all sources used in the assessment, including scientific literature, documents, and survey reports.

11.1.3 Link to other ESIA chapters

The multiple specialist chapters of the Environmental and Social Impact Assessment (ESIA), available at the time of writing, were drawn on to determine potential impacts from other assessments that may impact upon natural capital stocks and ecosystem services. These chapters include Socio-Economic and Cultural, Noise and Vibration, Biodiversity and Landscape and Visual, and Waste and Material Management.

11.2 Applicable standards

11.2.1 National legislation

North Macedonia does not have dedicated legislation setting out requirements to safeguard natural capital stocks. However, there is wider legislation and policies in place to protect biodiversity and ensure sustainable land use. Laws protecting these aspects of the environment will have benefits for protecting natural capital stocks and ensuring ecosystem service provision. Table 11.1 below outlines relevant legislation and outlines how it relates to the protection of natural capital stocks and ecosystem services. A review of legislation was also undertaken in the Biodiversity Chapter (Volume II - ESIA, Chapter 8 – Biodiversity), so the review here will not detail the legislation in full but will focus on how the legislation is relevant for natural capital.

Table 11.1: Relevant legislation relating to the protection of natural capital stocks and ecosystem services.

Legislation	Scope	Relevance for natural capital stocks and ecosystem services
Law on Nature Protection (Official Gazette of the Republic of Macedonia (RM) no. 67/2004)	Regulates the protection of biological diversity and landscape diversity. Protects natural heritage within and outside protected areas. Declares nature protection as an act of public interest. Mandates avoidance of critical habitats and requires biodiversity assessments for Projects near sensitive areas.	By supporting ecological connectivity and species protection, the legislation protects the extent and condition of natural capital stocks, safeguarding the flow of ecosystem services from these stocks. By declaring nature an act of public interest, it identifies that protecting nature, and therefore natural capital stocks, has direct benefit to humans. By mandating avoidance of critical habitats, the legislation protects the highest quality natural capital stocks.
Law on Environment (2010) (Official Gazette of the Republic of Macedonia (RM) no. 53/2005)	Provides the framework for environmental protection and improvement, to ensure that citizens can exercise their rights to a healthy environment. Wind farms require full Environmental Impact Assessment (EIA). Biodiversity impacts must be assessed and mitigated. Public consultation is mandatory.	Requiring protection and improvement of the environment safeguards natural capital stocks and ecosystem service provision. Identifies the importance of a healthy environment for providing benefits to humans. By making public consultation mandatory, ensures that the socio-economic and cultural benefits derived from ecosystem service flows are fully considered and protected, reinstated, and/or compensated for, with local nuance.
Energy Law (2025) (Official Gazette of the Republic of Macedonia (RM) no. 101)	Regulates renewable energy development and permitting. Wind farms must be included in the Annual Plan for Energy Facilities.	Requires environmental approvals before construction
National Biodiversity Strategy and Action Plan (NBSAP) 2018–2023	Strategic biodiversity and ecosystem conservation policy aligned with Convention on Biological Diversity (CBD) and EU directives. Makes direct links between biodiversity, functioning ecosystems, and ecosystem service provision. Encourages biodiversity mainstreaming in energy planning. Promotes avoidance of high biodiversity value areas. Supports monitoring and adaptive management.	Identifies that impacts to biodiversity and habitats affect the functioning of ecosystems and therefore impacts human well-being.

11.2.2 International guidance

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) provides an overarching Conceptual Framework (IPBES 2025) for the relationship between nature and human good quality of life, which guides the approach to natural capital and ecosystem services adopted in this assessment. IPBES is an independent intergovernmental body with nearly 147 member states established to strengthen the science-policy interface for biodiversity and ecosystem services, for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development. It is recognised as a leading authority in collating decision-relevant information on biodiversity and ecosystem services at a global scale.

The classification of natural capital stocks and ecosystem services used in the baseline assessment follows international best practice standards and literature, with natural capital classified according to the framework in Leach et al., (2019, pg. 5) and ecosystem services according to the latest version (version 5.2) of the Common International Classification of Ecosystem Services (CICES, 2025). Leach et al., (2019) provides a systematic and transparent framework for classifying natural capital assets to use as the basis of assessments, for example following best practice guidance such as the Natural Capital Protocol. CICES is designed to help measure, account for, and assess ecosystem services, to standardise the way ecosystem services are described. It was originally developed in the context of work on the United Nations System of Environmental-Economic Accounting (UN SEEA) and has been widely adopted in ecosystem services research and practice.

The International Finance Corporation's Performance Standard 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources (IFC PS6) (IFC, 2019) is a key driver for development Projects adopting ecosystem services approaches. IFC PS6 is seen as a leading development finance biodiversity safeguarding standard, and compliance is often required for development Projects to access finance. One of the three objectives of IFC PS6 is to maintain the benefits from ecosystem services, noting that ecosystem services are often underpinned by biodiversity. Where ecosystem services are likely to be impacted by a Project, IFC PS6 requires a systematic review of priority ecosystem services considering Project impacts and dependencies. The methodology set out by IFC PS6 has informed the review of ecosystem services presented in this assessment.

Furthermore, this assessment is informed by European Bank for Reconstruction and Development (EBRD) Environmental and Social Requirement (ESR) 6: Biodiversity conservation and sustainable management of living natural resources (EBRD, 2025) and the European Investment Bank (EIB) Environmental and Social Standard (ESS) 3: Biodiversity and Ecosystems (EIB, 2018). EBRD ESR 6 (EBRD, 2025) places emphasis on conserving ecosystem services and the natural capital that generates those services. EIB ESS 3 requires development Projects to identify and assess risks and impacts on ecosystem services during Project design and appraisal.

11.3 Methodology

A natural capital baseline was developed to identify existing natural capital stocks within the Project's Area of Influence (AoI). A baseline of the associated ecosystem services was then established based on the presence of natural capital stocks, and evidence that the specific stocks present within the Project AoI contribute to delivery of specific ecosystem services. The baseline assessment predominantly focused on benefits provided to the local population. Further information on the methodology for establishing the natural capital and ecosystem services baseline is provided below.

11.3.1 Area of influence (AoI)

The natural capital baseline assessment adopted an Area of Influence (AoI) comprised of the Project components (temporary land take for crane pads and platforms, and permanent land take for foundations, roads, the transmission line, and a car park and substation) for consideration of impacts. A 500m buffer has been considered for direct and indirect impacts anticipated on natural capital stocks. A buffer was applied for considering the direct impacts of linear components of the Project, such as the proposed roads and transmission line.

The consideration impacts to natural capital stocks aligns with the AoI adopted in the biodiversity assessment for habitats, flora, mammals and herpetofauna (see Chapter 8 Biodiversity of the ESIA). The buffer reflects the area where temporary and permanent impacts are anticipated for the identified stocks.

The AoI for the natural capital and ecosystem services assessment is based on the spatial extent of impacts to natural capital stocks, which determines changes in ecosystem service provision. However, the resulting effects on ecosystem services may extend beyond the AoI, influencing beneficiaries and receptors located outside this boundary. For example, the Project may cause visual and landscape impacts and could impact remote community receptors or the migratory activities of birds. Depending on the ecosystem service, beneficiaries affected can range from local communities and businesses in the surrounding built-up areas (including within the 3km radius of all Project features) to society at a global scale.

11.3.2 Field surveys and natural capital baseline

To inform the biodiversity assessment, field surveys were conducted in May, June, and September 2025, considering the entire Project site and extending 500m beyond the site boundary (Volume II - ESIA, Chapter 8 – Biodiversity). Surveys were used to identify flora and habitat types, with a focus on priority habitats such as grasslands and woodlands and fauna (mammals, herpetofauna, bats and birds).

The extent of field surveys was supplemented by additional opensource mapping through satellite imagery using the European Nature Information System (EUNIS) habitat classification (European Environment Agency, 2019) and the EU Habitats Directive Annex I (European Union, 1992) habitat types within 500m of the Project components.

The habitats identified with the field survey data and additional opensource mapping partially informed the natural capital baseline map. No further field surveys were carried out for the ecosystem services baseline assessment.

11.3.3 Desktop review

The natural capital baseline was derived from the field survey data and opensource mapping. The EUNIS habitat classification (European Environment Agency, 2019) and the EU Habitats Directive Annex I (European Union, 1992) habitat types used for the biodiversity habitat survey were re-classified to a common framework (Leach, et al., 2019) for classifying natural capital stocks for use in public and private sector decision making summarised in Table 11.2.

Table 11.2: Classification of natural capital stocks in the baseline assessment

Leach et al. Level 1 classification	Leach et al. Level 2 classification	Leach et al. Level 3 classification	Leach et al. Level 4 classification	Biodiversity habitats/species
Abiotic	Functional	Atmosphere	Atmospheric processes - wind	N/A
Abiotic	Physical	Land geomorphology	Mountains	N/A
Abiotic	Physical	Land geomorphology	Plains	N/A
Abiotic	Physical	Land geomorphology	Plateaus	N/A
Abiotic	Physical	Land geomorphology	Valleys	N/A
Biotic	Biodiversity	Habitats	Inland surface waters	Temporary running water
Biotic	Biodiversity	Habitats	Grasslands	Helleno-Balkanic [Satureja montana] steppes
Biotic	Biodiversity	Habitats	Heathland and scrub	Abandoned arable land with ruderal vegetation
Biotic	Biodiversity	Habitats	Agriculture and croplands	Arable land Fruit orchards Vineyards

Biotic	Biodiversity	Habitats	Woodland and forests	Native conifer plantations Eastern Quercus pubescens woods Lines of trees; Hedgerows
Biotic	Biodiversity	Habitats	Urban and developed areas	Rural industrial and commercial sites still in active use Road network
Biotic	Biodiversity	Habitats	Unvegetated or sparsely vegetated habitat	Bare/sparse vegetation
Biotic	Biodiversity	Genetic resources, and plant, animal, fungal, and algal species	Wildlife	Birds Bats
Biotic	Biodiversity	Genetic resources, and plant, animal, fungal, and algal species	Domestic, commercial	N/A

Source: Adapted from Leach *et al.* 2019.

Following reclassification of the habitats to align with Leach et al., the baseline natural capital stocks were mapped for the 500m AoI. Ecosystem services were scoped into the baseline assessment based on the natural capital stocks present within the Project's AoI and their potential to deliver associated ecosystem services. Ecosystem services were classified according to the Common International Classification of Ecosystem Services (CICES) version 5.2 (CICES, 2025). CICES has been designed to help measure, account for, and assess ecosystem services.

A sequential process was followed to establish the link between baseline natural capital stocks and ecosystem services, with the following steps:

- A high-level review of ecosystem services known to be provided by the stocks present at the site, and provided at a regional/global level using CICES, and expert judgement
- A detailed review of the Project documentation to identify the ecosystem services of relevance within the Project's AoI, focusing on benefits provided to the local population (for example nutrition and livelihoods from farming) but also considering benefits to people at large spatial scales (for example climate change mitigation from carbon sequestration)

The sequential approach ensured the assessment of ecosystem services was robust while focusing on the services most relevant to the Project. An overview of the ecosystem services scoped into the assessment is provided in section 11.4.

11.3.4 Assessment criteria

The general methodology for the impact assessment for this ESIA is presented in Chapter 6 - Process and Methodology (ESIA – Vol II, Chapter 6 - Process and Methodology). For the purposes of natural capital and ecosystem services assessment, the methodology for determining receptor sensitivity is summarised in the following section.

11.3.4.1 Identification of impacts

Using the natural capital baseline map, a spatial overlay was conducted in GIS to identify the area of each natural capital stock from the baseline that:

- fell within the footprint of constructed Project components (foundations, areas of road widening, new roads, the transmission line, and a car park and substation) and so would be permanently lost
- fell within the footprint of temporary Project components (crane pads and platforms) and so would be temporarily lost

Those stocks that fell within the 500m buffer were also mapped because whilst there will be no direct impacts, they might be temporarily or permanently impacted through indirect construction or operation impacts.

Impacts on ecosystem services as a result of changes to the coverage of natural capital stocks were identified through the links between natural capital stocks and ecosystem services identified in the baseline assessment and qualitative analysis of Project documentation.

11.3.4.2 Determination of significance

Significance considers the interaction between magnitude criteria and sensitivity criteria as presented in the significance matrix in Table 11.3. Impacts that are evaluated as being 'Moderate' or 'Major' are considered significant effects and identified as such. Consequently, impacts that are 'Minor' or 'Negligible' are considered not significant.

Table 11.3: Effect evaluation matrix

		Magnitude						
		Adverse			Negligible	Beneficial		
		Major	Moderate	Minor		Minor	Moderate	Major
Sensitivity	High	Major	Major	Moderate	Negligible	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Negligible	Minor	Moderate	Major
	Low	Moderate	Minor	Negligible	Negligible	Negligible	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Source: Mott MacDonald, 2025

All impacts will be mitigated through following the mitigation hierarchy. Where impacts are still considered to be significant after mitigation (significant residual impacts), these will require further management and monitoring.

11.3.4.3 Criteria for determining impact magnitude

The magnitude of impact is defined by taking into account the degree of change to the natural capital and ecosystem services baseline in terms of how permanent or reversible the impact is likely to be, its spatial scale (local, regional, national, international) and the ease with which mitigation measures can be put in place to return it to the baseline state.

The criteria used to determine the magnitude of the changes which have been created by the Project is defined in Table 11.4.

Table 11.4: Criteria for determining impact magnitude

Magnitude (positive or adverse)	Description (considers probability of impact occurring, duration of the impact, spatial extent, reversibility and ability to comply with legislation)
Major	Fundamental change to critical natural capital stocks and associated ecosystem services, resulting in long term or permanent change, typically widespread in nature (regional, national and international). Would require significant intervention to return to baseline.

Magnitude (positive or adverse)	Description (considers probability of impact occurring, duration of the impact, spatial extent, reversibility and ability to comply with legislation)
Moderate	Detectable change to the natural capital stocks and associated ecosystem services, resulting in non-fundamental temporary or permanent change typically affecting the local area.
Minor	Detectable but minor change to natural capital stocks and associated ecosystem services that is temporary in nature, with high capacity to return to the baseline conditions.
Negligible/No change	No perceptible change to natural capital stocks and associated ecosystem services

Source: Mott MacDonald, 2025

The magnitude of natural capital and ecosystem services impacts are, to an extent, subjective. The determination of the magnitude will therefore be based upon professional judgement considering the perceived sensitivity of the receiving environment.

11.3.5 Sensitive receptors

Delivery of ecosystem services from the baseline natural capital stocks within the Project's AoI will change with changes to these stocks through temporary and permanent construction impacts. Sensitivity of ecosystem services represents the extent to which they are likely to change with changes to the underpinning natural capital stocks. This in turn depends on the sensitivity of the natural capital stock, including ability to withstand and recover from changes.

The impact assessment considered ecosystem services as the final receptors that may change because of the Project, but through the direct receptor of natural capital stocks. All natural capital stocks identified in the baseline have the potential to change because of the Project, and stocks in the terrestrial environment are expected to be permanently lost.

The sensitivity of ecosystem services to changes in natural capital stocks because of the Project was assessed qualitatively. Two key aspects were considered:

- The ability of natural capital stocks to withstand and recover from changes
- The importance of the natural capital stocks in the locations impacted by the Project for providing the ecosystem service, and the extent to which it could be provided by displaced stocks and/or the level of provision maintained to the same beneficiaries by the same types of stock in surrounding locations

The most sensitive ecosystem services were those provided by the most vulnerable stocks and for which the specific stocks impacted by the Project were important in provision of the service. For most ecosystem services, the amount (area) of the stock strongly affects the level of service provision, and so the area of stock impacted by the Project is an important aspect in consideration of importance of the stock. However, even impacts on stocks where there is a very small area of a certain type may have important ecosystem service implications, particularly if the change is significant in the context of remaining stock in the wider landscape.

11.3.6 Limitations and assumptions

The natural capital stocks baseline has been derived from primary data collected on site e.g. field survey data and developed using GIS from Project information provided by the client. The field survey data verified on-the-ground habitats at a sample of survey points only within 500m of the Project's AoI. There is high confidence in the accuracy of natural capital stocks mapped within 500m of the Project AoI.

The ecosystem services baseline is based on a qualitative linking of natural capital stocks to ecosystem services. This has been undertaken using desktop reviews of Project documentation. The Project documentation included findings from consultation with local people at the site, which has informed the identification of the ecosystem services. However, the

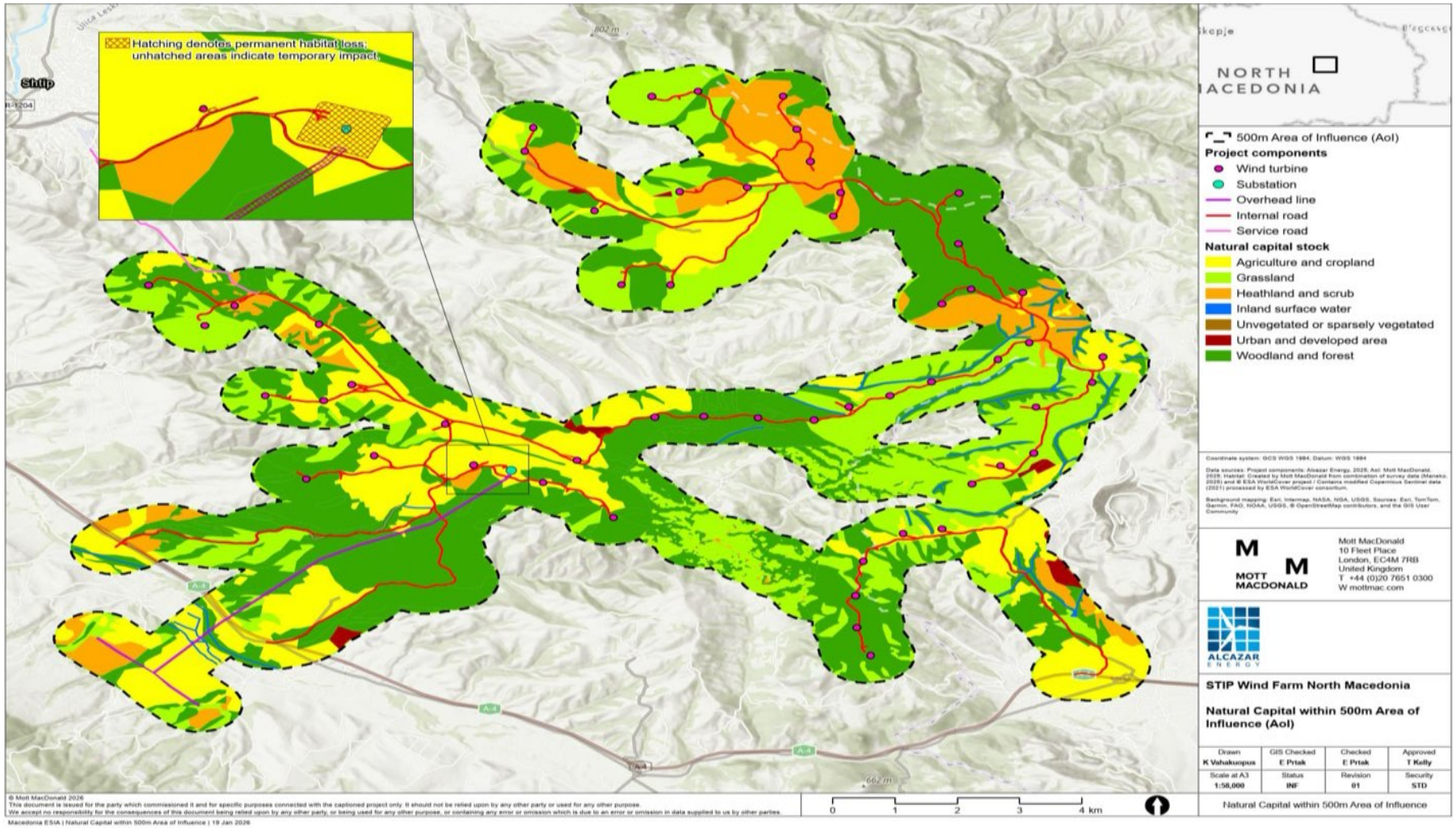
ecosystem services highlighted in this baseline assessment have not subsequently been verified with those people who benefit from them. A precautionary approach has been taken scoping in ecosystem services that may be provided outside 500m of the Project AoI due to the directional flow of ecosystem services. Expert judgement has been used to identify the potential extent to which ecosystem services will be impacted by the associated impacts to stocks.

Ecosystem services as a concept considers benefits that people receive from ecosystems and not dis-benefits or dis-services. While frameworks for these benefits (such as CICES) are well established, the consequences for people from ecosystem processes and functions are often more nuanced and location-specific, and what is in one circumstance a benefit may in others be disadvantageous (for example a species may be commercially valuable but also present a physical threat to people). The ecosystem services baseline assessment has favoured use of Project and local data over more general/global sources to understand the ecosystem services provided from natural capital stocks in a local context. However, only benefits have been considered, and not dis-benefits that people receive from ecosystems.

11.4 Baseline

The baseline natural capital stocks within the Project AoI have been assessed using the baseline natural capital map shown in Figure 11.3 and summarised in Table 11.5.

Figure 11.3: Baseline natural capital stocks within the AoI



Source: Mott MacDonald 2025

Table 11.5: Baseline natural capital stocks within the AoI for the ecosystem services assessment

Natural capital stock	Total area within the footprint of the development (ha)	Area of temporary impact (ha)	Area of permanent impact (ha)	Total area within 500m AoI (ha)
Grasslands	20.40	12.49	7.91	1,430.79
Heathland and scrub	12.34	6.19	6.15	684.57
Agriculture and croplands	30.95	12.73	18.22	1,585.52
Woodland and forests	16.23	5.89	10.34	2,840.43
Urban and developed areas	25.34	6.35	18.99	51.08
Inland surface waters	0.00	0.00	0.00	5.75
Unvegetated or sparsely vegetated habitat	0.00	0.00	0.00	0.00
TOTAL	**105.26**	**43.65**	**61.61**	**6,598.14**

Based on the baseline natural capital stocks and the scoping process outlined in the methodology section (section 11.3), Table 11.6 presents the baseline ecosystem services identified in the Project AoI, and their importance to the local area.

Table 11.6: Baseline ecosystem services identified in the Project AoI (classified following CICES v5.2) and their importance to the local area

Division	Group	Class	Code	Associated natural capital stocks	Importance to local area
Provisioning (Biotic/Biophysical)					
Biomass	Cultivated terrestrial plants for nutrition, materials or energy	Cultivated terrestrial plants (including fungi, algae) grown for nutritional purposes	1.1.1.1	Agriculture and croplands	Pockets of agriculture and cropland including cereals, fruit orchards, and vineyards are being cultivated, providing a potential source of livelihood and income for the local population.
	Cultivated terrestrial plants for nutrition, materials or energy	Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct use or processing (excluding genetic materials)	1.1.1.2	Agriculture and croplands	Pockets of agriculture and cropland including native conifer plantations and some tobacco being cultivated providing a potential source of livelihood and income for the local population.
	Reared animals for nutrition, materials or energy	Animals reared for nutritional purposes	1.1.3.1	Domestic, commercial livestock, Grassland, Heathland and scrub, Unvegetated or sparsely vegetated habitat	Livestock grazing and breeding form an important component of the local economy. Local dairy companies facilitate the daily collection of milk from sheep, cows and goats from villages across the area, ensuring a steady supply for market distribution. Additionally, beekeeping for household and commercial purposes is present in Ljuboten, Dolani and Buchim villages, further contributing to rural livelihoods.

Division	Group	Class	Code	Associated natural capital stocks	Importance to local area
	Reared animals for nutrition, materials or energy	Fibres and other materials from reared animals for direct use or processing (excluding genetic materials)	1.1.3.2	Domestic, commercial livestock, Grassland, Heathland and scrub, Unvegetated or sparsely vegetated habitat	Livestock grazing and breeding form an important component of the local economy with secondary outputs such as materials from livestock, e.g. wool hides, potentially supplementing local livelihoods.
	Wild plants (terrestrial and aquatic) for nutrition, materials or energy	Wild plants (terrestrial and aquatic, including fungi, algae) used for nutrition	1.1.5.1	Grasslands, Woodlands and Forests, Unvegetated or sparsely vegetated habitat, Heathland and scrub	Terrestrial ecology mapping and focus group discussions (FGD) indicate that pockets of woodland and forests, heathland and scrub, grasslands and unvegetated or sparsely vegetated habitat produce a collection of forest products and herbs for daily use by residents.
	Wild animals (terrestrial and aquatic) for nutrition, materials or energy	Wild animals (terrestrial and aquatic) used for nutritional purposes	1.1.6.1	Grasslands, Woodland and forests	Terrestrial ecology mapping and FGDs indicate pockets of grasslands and woodland and forests are used by residents for hunting wild animals.
Regulation & Maintenance (Biotic/Biophysical)					
Transformation of biochemical or physical inputs to ecosystems	Reduction of nutrient loads and mediation of wastes or toxic substances of anthropogenic origin by living processes	Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals	2.1.1.2	All stocks apart from urban and developed areas present within AoI	Dust filtration services provided by current habitats (grasslands, woodlands, agriculture and cropland) through trapping airborne particles on leaves and stems reduce particulate matter in the air, leading to better air quality in the area.
	Mediation of nuisances of anthropogenic origin	Noise attenuation	2.1.2.2	Grasslands, Woodland and forests, Agriculture and croplands	Habitats (woodlands, grasslands, agriculture and cropland) and topography (mountainous and hilly terrains) provide a physical barrier that absorbs and scatters sound waves. Additionally, dense habitats dampen noise by creating friction and turbulence, which lowers sound intensity.
	Mediation of nuisances of anthropogenic origin	Visual screening	2.1.2.3	Grasslands, Woodland and forests, Agriculture and croplands, Heathland and scrub	Habitats (woodlands, grasslands, agriculture and cropland, heathland and scrub) and topography (mountainous and hilly terrains, Gramada Plateau) reduce the visual impact of human structures for nearby sensitive receptors.
Regulation of baseline flows and extreme events	Erosion control	Control of water erosion rates	2.2.1.1	Grasslands, Woodland and forests, Agriculture and croplands	Habitats (woodlands, grasslands, agriculture and cropland) and topography (mountainous and hilly terrains, Gramada Plateau) provide erosion control and soil loss through root network across large areas.
	Erosion control	Control of wind erosion rates	2.2.1.2	Grasslands, Woodland and forests, Agriculture and croplands	Habitats (woodlands, grasslands) and topography (mountainous and hilly terrains) reduce the speed of wind across the landscape, acting as a wind break to mitigate or prevent potential damage to nearby sensitive receptors. Habitats also improve soil

Division	Group	Class	Code	Associated natural capital stocks	Importance to local area
					quality, reducing soil erosion by wind. This service is particularly important as water is in short supply in the area and habitats help to increase water infiltration into the soil, reducing risk of erosion.
	Hydrological cycle and water flow regulation	Regulation runoff and base flows	2.2.2.1	Grasslands, Woodland and forests, Agriculture and croplands, Heathlands and scrub	Habitats (woodlands, grasslands, agriculture and cropland, heathlands and scrub) and topography (mountainous and hilly terrains) provide water retention and drainage pathways between rain fall events, helping to regulate runoff and base flows.
	Hydrological cycle and water flow regulation	Regulation of peak flows	2.2.2.2	Grasslands, Woodland and forests, Agriculture and croplands, Heathlands and scrub	Habitats (woodlands, grasslands, agriculture and cropland) and topography (mountainous and hilly terrains) provide water retention and drainage pathways between rain fall events, helping to regulate floods and excess water levels in rivers or lakes.
	Hazard mitigation	Buffering and attenuation of mass movement	2.2.3.1	Woodland and forests, Mountains	Habitats (woodlands) and topography (mountainous and hilly terrains) provide hazard mitigation from landslides and avalanches. Habitats slow down the flow of water and enhances soil infiltration, reducing surface runoff and flood intensity whereas the topography complements this by directing water into natural depressions and channels, preventing accumulation in vulnerable areas.
	Hazard mitigation	Wind protection	2.2.3.3	Woodland and forests	Habitats (woodlands) and topography (mountainous and hilly terrains) provide wind erosion control through reducing wind speed across the landscape, acting as a wind break to mitigate or prevent potential damage to nearby sensitive receptors.
Regulation of physical, chemical, biological conditions	Lifecycle maintenance, habitat and gene pool protection	Pollination (or 'gamete' dispersal in a marine context)	2.3.2.1	Grasslands, Woodland and forests, Agriculture and croplands	Habitats (woodlands, grasslands, agriculture and cropland) provides habitats for pollinators such as birds and bees, with beekeeping undertaken as an economic activity in the area. Fruit orchards, vineyards, and arable land are all present with the AoI, and birds and bees provide pollination services for these cultivated plants. Their pollination services contribute to the yield of these crops.
	Lifecycle maintenance, habitat and gene pool protection	Seed dispersal	2.3.2.2	Birds, Habitats for birds e.g. Grasslands, Woodland and	Habitats (woodlands, grasslands, agriculture and cropland) provides habitats for birds which can aid in seed dispersal.

Division	Group	Class	Code	Associated natural capital stocks	Importance to local area
				forests, Agriculture and croplands	Fruit orchards, vineyards, and arable land, as well as natural habitats, are all present with the AoI. Birds provide seed dispersal services for these cultivated plants and natural habitats, contributing to habitat regeneration capabilities within and outside the AoI.
	Lifecycle maintenance, habitat and gene pool protection	Maintaining or regulating nursery populations and habitats or breeding grounds (Includes gene pool protection)	2.3.2.3	Grasslands, Woodland and forests	Habitats (woodlands, grasslands) provides habitats for wild plants and animals in the area. Local populations forage and hunt in these areas.
	Pest and disease control	Pest control (including invasive species)	2.3.3.1	Wild animals (birds and bats)	Birds and bats can provide pest and invasive species control. Arable land, as well as native conifer plantations and orchards, make up a large portion of the land use within and around the AoI, so this service can be important for reducing pest and invasive species damage to cultivated crops.
	Regulation of soil quality	Biologically mediated weathering processes and their effect on soil quality	2.3.4.1	Grasslands, Woodland and forests, Agriculture and croplands	Habitats present within the AoI (woodlands, grasslands, agriculture and cropland) support and promote soil formation and development.
	Atmospheric composition and conditions	Regulation of chemical composition of atmosphere and oceans, and the maintenance of continental atmospheric/oceanic circulation patterns	2.3.6.1	All stocks apart from urban and developed areas present within AoI	Carbon sequestration and storage benefits provided by habitats (woodlands, grasslands, agriculture and cropland) with benefits locally, regionally and globally.
Cultural (Biotic/Biophysical)					
Physical and experiential interactions with natural environment	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting, i.e. broadly recreational activities	Elements of living systems that that enable activities promoting health, recuperation or enjoyment through active or immersive interactions	3.1.1.1	All stocks apart from urban and developed areas present within AoI	The mountainous area (mountainous and hilly terrains, inland surface waters) and the Gramada plateau are used for social and recreational activities e.g. festivities celebrated by the younger generation such as Gjurgjovden (St George's day). Habitats (woodlands, grasslands, agriculture and cropland) promotes health and recuperation for local population through interactions with the environment.
	Direct, in-situ and outdoor interactions with living systems that depend on presence in the	Elements of living systems that enable activities promoting health, recuperation or enjoyment through	3.1.1.2	Grasslands, Woodland and forests, Mountains	The mountainous area (mountainous and hilly terrains, inland surface waters) may be used for bird watching and other passive recreational activities. Habitats (woodlands, grasslands, agriculture

Division	Group	Class	Code	Associated natural capital stocks	Importance to local area
	environmental setting, i.e. broadly recreational activities	passive or observational interactions			and cropland) may also provide eco-tourism opportunities through interactions with the environment, although it is noted that the areas is not generally recognised as an area for tourism or recreation.
Intellectual and representative interactions with natural environment	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Elements of living systems that enable education and training, including the importance of between and within species genetic diversity	3.2.1.2	All stocks apart from urban and developed areas present within AoI	The AoI contains large areas of Critical Habitat for Eastern Quercus pubescens woods which is a Critical Habitat. There are also areas of Helleno-Balkanic [Satureja montana] steppes, which is a Priority Biodiversity Feature.
	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Elements of living systems that are resonant in terms of culture or heritage	3.2.1.3	All stocks apart from urban and developed areas present within AoI	Local populations draw cultural and spiritual identity from various aspects of the natural environment in and around the AoI. For example, there are areas of the Gramada plateau used for social activities, annual festivities, and cultural and heritage events. Within the AoI, there is an area that has been used by younger generations to celebrate Gjurgjovden (St George's day) for hundreds of years. This location is also noted as being important for older generations who wish this area to be available for use by their children in the future. There is a livestock fountain in the AoI where local people gather to celebrate and cook food on a grill. There is a cemetery within the planned site boundary, which is important to current residents.
	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Elements of living systems that enable aesthetic experiences	3.2.1.4	All stocks apart from urban and developed areas present within AoI	The characteristics and qualities of natural capital stocks in the AoI can provide inherent aesthetic value, inspiration and experiences, including biotic elements such as habitats and species.
Spiritual, symbolic and other cultural interactions with natural environment	Elements of living systems that are indirectly appreciated and have significance for people without their presence in the environmental setting.	Elements of living systems that have symbolic meaning, capture the distinctiveness of settings or their sense of place	3.4.1.1	All stocks apart from urban and developed areas present within AoI	Local populations draw cultural identity from various aspects of the natural environment in and around the AoI. For example, there are areas of the Gramada plateau used for social activities, annual festivities, and cultural and heritage events. Within the AoI, there is an area that has been used by younger generations to celebrate Gjurgjovden (St George's day) for hundreds of years. There is a livestock fountain in the AoI where local people gather to celebrate and cook food on a grill.
	Other biophysical	Elements or features of living	3.4.2.2	All stocks apart from urban and	Local populations draw cultural and spiritual identity from various aspects

Division	Group	Class	Code	Associated natural capital stocks	Importance to local area
	characteristics of species or ecosystems that are appreciated in their own right by people	systems whose inter-generational existence or conservation is important to people, including the importance of between and within species genetic diversity		developed areas present within AoI	of the natural environment in and around the AoI. The characteristics and qualities of natural capital stocks in the AoI can provide inherent aesthetic value, inspiration and experiences, that bequest values to future generations. Locations within the AoI are noted as being important for older generations who wish the area to be available for use by their children in the future.
Provisioning (Abiotic/geophysical)					
Water	Surface water used for nutrition, materials or energy	Surface water used as a material (non-drinking purposes)	4.1.1.2	Inland surface waters	With water in short supply in the local area, the presence of inland surface waters (temporary running waters) used for non-drinking purposes, such as agricultural irrigation, is of importance to the local population.
Non-aqueous natural abiotic ecosystem outputs	Non-mineral substances or ecosystem properties used for nutrition, materials or energy	Wind energy	4.2.2.3	Wind	Building the wind farm will harness the natural capital stock to provide renewable energy.
Cultural (Abiotic/geophysical)					
Intellectual and representative interactions with geophysical environment	Direct, in-situ and outdoor interactions with geophysical systems that depend on presence in the environmental setting	Elements of geophysical systems that enable aesthetic experiences	6.2.1.4	Mountainous terrain and steppes	The area is characterised by mountainous areas and wide, flat open spaces. Whilst the area is not nationally recognised for its scenic beauty, it is valued locally and is largely without settlement and activity and therefore is considered an area of high tranquillity.

11.4.1 Ecosystem services provided by natural capital stocks

The ecosystem services provided by the natural capital stocks within the Project's AoI (see Table 11.6) are associated with stocks in these fixed locations. Delivery of the ecosystem services is therefore sensitive to any changes in land use that affect the quantity, quality or resilience of the stocks. While this ecosystem services baseline assessment is only qualitative, and changes in ecosystem service provision associated with changes in natural capital stocks have not been quantified or modelled, expected changes and sensitive services have been qualitatively identified.

The major land covers within the Project's AoI are woodland and forest, agriculture and cropland, and grassland stocks (see Table 11.5). Ecosystem services provided by other natural capital stocks present within the Project's AoI (including heathland and scrub and inland surface waters) will be sensitive to changes in these natural capital stocks. If a natural capital stock is completely removed the resulting complete loss of associated ecosystem service provision may be highly detrimental for local beneficiaries.

11.5 Assessment of impacts

11.5.1 Construction phase

11.5.1.1 Overview

The footprint of the Project includes approximately 80ha of buried cables, 7ha of overhead transmission cables and 68km of internal roads (ESIA Vol II, Chapter 6 – Project Description) with the wind turbines situated in clusters on the east and west of the substation and internal roads situated in a north-south orientation as shown in Figure 11.3.

The major construction activities for delivering the Project include temporary land take for crane pads and platforms, and permanent land take for foundations, access roads, the transmission line, a substation and car park. Adverse impacts to natural capital stocks will be both temporary and permanent in nature.

Temporary construction facilities, including crane pads and platforms will be based mainly immediately adjacent to permanent elements. Habitat clearance may be required for the temporary construction access and construction of employee facilities.

11.5.1.2 Construction impacts – qualitative assessment

The identified impacts on ecosystem services from the construction phase of the Project are presented in Table 11.7.

Table 11.7: Potential construction phase impacts on ecosystem services identified within the AoI

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
Provisioning (Biotic/Biophysical)			
1.1.1.1	Cultivated terrestrial plants (including fungi, algae) grown for nutritional purposes	Agriculture and croplands	Habitats will be temporarily cleared to facilitate construction activities and store construction equipment, reducing the provision of this service. Construction activities will generate dust which could settle on nearby natural capital stocks of agriculture and cropland within the AoI. This could result in adverse impacts on photosynthesis efficiency, crop growth and yield. Permanent loss of agriculture and cropland due to construction activities will result in the loss of this ecosystem service provision. The permanent loss of croplands will adversely impact livelihoods dependent on the produce.
1.1.1.2	Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct use or processing (excluding genetic materials)	Agriculture and croplands	Habitats will be temporarily cleared to facilitate construction activities and store construction equipment, reducing the provision of this service. Construction activities will generate dust which could settle on nearby natural capital stocks of agriculture and cropland within the AoI. This could result in adverse impacts on the photosynthesis efficiency, growth and overall yield. Permanent loss of agriculture and cropland due to construction activities will result in the loss of this ecosystem service provision. The permanent loss of cropland will adversely impact livelihoods dependent on the produce.
1.1.3.1	Animals reared for nutritional purposes	Domestic, commercial livestock, Grassland, Heathland and scrub, Unvegetated	Habitats will be temporarily cleared to facilitate construction activities and store construction equipment, reducing the provision of this service. Construction activities will generate dust which could settle on nearby natural capital stocks such as heathland and scrub, unvegetated or sparsely vegetated habitat and grassland used

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
		or sparsely vegetated habitat	by livestock for grazing within the AoI. This could result in adverse impacts on the photosynthesis efficiency, growth and overall yield of nearby natural capital stocks, therefore impacting materials for grazing livestock to eat. Noise generated during construction activities may deter grazing practices. The permanent loss of grassland will have an impact for livelihoods dependant on the grazing potential from this land.
1.1.3.2	Fibres and other materials from reared animals for direct use or processing (excluding genetic materials)	Domestic, commercial livestock, Grassland, Heathland and scrub, Unvegetated or sparsely vegetated habitat	Habitats will be temporarily cleared to facilitate construction activities and store construction equipment, reducing the provision of this service. Construction activities will generate dust which could settle on nearby natural capital stocks such as heathland and scrub, unvegetated or sparsely vegetated habitat and grassland used by livestock for grazing within the AoI. This could result in adverse impacts on the photosynthesis efficiency, growth and overall yield, potentially reducing grazing potential which may reduce production of fibres from wool and hides. Noise generated during construction activities may deter grazing practices, in turn, potentially reducing production of fibres from wool and hides. The permanent loss of grassland will have an impact for livelihoods dependant on the grazing potential from this land.
1.1.5.1	Wild plants (terrestrial and aquatic, including fungi, algae) used for nutrition	Grasslands, Woodlands and Forests, Unvegetated or sparsely vegetated habitat, Heathland and scrub	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. These activities are likely to reduce the availability of harvestable materials from wild plants within the footprint of the construction activities, as vegetation providing such resources will be removed or disturbed. While the impact is localised and largely reversible in temporarily cleared areas following reinstatement, permanent infrastructure will lead to a long-term reduction in provisioning services within those areas. While the construction of new access roads across the AoI may improve access to the undisturbed remote habitats within the region, the permanent loss of these habitats will have an adverse impact for livelihoods dependant on the produce from this land. Construction activities will generate dust which could settle on nearby natural capital stocks such as grasslands, woodland and forests, unvegetated or sparsely vegetated habitat and heathland and scrub, that provide herbs and other forest products by local populations within the AoI. This could have an adverse impact on the photosynthesis efficiency, growth and yield of herbs and other forest products.
1.1.6.1	Wild animals (terrestrial and aquatic) used for nutritional purposes	Grasslands, Woodland and forests	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Habitat loss and fragmentation will displace wild animals. Construction activities will generate noise which could impact nearby woodland and forests and grassland that provide hunting grounds for use by local populations within the AoI. Overall, habitat loss and fragmentation, as well as noise impact will disturb and displace wild animals, having an adverse impact on availability of game for local populations for sustaining livelihoods.
Regulation & Maintenance (Biotic/Biophysical)			
2.1.1.2	Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals	All stocks apart from urban and developed areas present within AoI	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment, which will reduce the air quality regulation capabilities of the landscape. The temporary and permanent loss of grassland, woodland, and agricultural land will have an

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
			impact on the capacity of the habitats to mitigate poor air quality such as dust created during and after construction. Construction activities will generate ground disturbance and dust which could settle on nearby natural capital stocks such as grasslands, woodland, and agricultural and cropland within the AoI. If a large amount of dust is generated, this could have an adverse impact on the dust filtration and air quality regulation capabilities provided by all habitats within the AoI.
2.1.2.2	Noise attenuation	Grasslands, Woodland and forests, Agriculture and croplands	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment, which could have an adverse impact on the noise attenuation capabilities provided by these habitats. Construction activities will also generate noise which may impact local population within the AoI. The temporary and permanent loss of these land parcels will have an adverse impact on the noise attenuation services provided by the habitats.
2.1.2.3	Visual screening	Grasslands, Woodland and forests, Agriculture and croplands, Heathland and scrub	Construction activities will introduce manufactured elements into the landscape, reducing its natural condition and scenic quality, adversely impacting the local population, especially those that undertake walking, bird watching and cycling. Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Vegetation clearance will result in reduced visual screening of construction elements. The temporary and permanent loss of the habitats will have an impact on visual screening of construction, particularly at daytime.
2.2.1.1	Control of water erosion rates	Grasslands, Woodland and forests, Agriculture and croplands	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment (such as turbine platforms, trenching for cables and foundations). The loss of vegetation will disrupt natural slopes which mean that areas of bare soil will be more vulnerable to erosion, and the permanent loss of some habitats will reduce the overall capability of the area to control soil erosion. Construction activities will generate ground disturbance which would impact natural capital stocks nearby such as grasslands, woodland and forests and agriculture and cropland within the AoI. This could have an adverse impact on the soil erosion control capabilities provided by strong root networks provided by grasslands, woodland and forests and agriculture and cropland.
2.2.1.2	Control of wind erosion rates	Grasslands, Woodland and forests, Agriculture and croplands	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Once construction elements are removed, these areas of bare earth will be vulnerable to wind erosion due to the loss of the above-mentioned habitats. Permanent loss of these stocks will reduce the overall capacity of the immediate landscape to reduce soil erosion by wind, particularly in drier periods. Construction activities including vehicular movement will generate ground disturbance which would impact natural capital stocks nearby such as grasslands, woodland and forests and agriculture and cropland within the AoI. This could have an adverse impact on the ability of the habitats to control wind erosion rates.
2.2.2.1	Regulation runoff and base flows	Grasslands, Woodland and forests, Agriculture and croplands, Heathlands and scrub	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Construction activities will increase areas of sealed surfaces, impacting infiltration capabilities of nearby natural capital stocks. Permanent loss of these stocks will reduce the overall capacity of the immediate landscape to regulate runoff and base flows. Additionally, construction activities such as soil compaction and trenching for cables and foundations will generate ground disturbance which could impact natural capital stocks nearby such as grasslands, woodland and

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
			forests and agriculture and cropland and disrupt natural slopes within the AoI. Disturbance and clearance of these habitats could have an adverse impact on the water regulation capabilities provided, particularly near inland surface waters, impacting runoff regulation.
2.2.2.2	Regulation of peak flows	Grasslands, Woodland and forests, Agriculture and croplands, Heathlands and scrub	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Additionally, construction activities such as trenching for cables and foundations will generate ground disturbance, increase areas of sealed surfaces which could impact infiltration capabilities of natural capital stocks nearby such as grasslands, woodland and forests and agriculture and cropland and disturb natural slopes within the AoI. Disturbance and clearance of these habitats could have an adverse impact on the water retention and drainage capabilities provided, particularly near inland surface waters, impacting runoff regulation.
2.2.3.1	Buffering and attenuation of mass movement	Woodland and forests, Mountains	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Additionally, road construction activities on slopes such as trenching for cables and foundations, crane pads and laydown areas created will generate ground disturbance which would impact nearby habitats on slopes within the AoI. This will reduce the hazard mitigation services provided by these habitats, such as landslide mitigation on slopes and disrupt natural slope stability. Disturbance and permanent loss of these habitats will result in a reduction of this ecosystem service provision.
2.2.3.3	Wind protection	Woodland and forests	Woodlands will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Additionally, construction activities will generate ground disturbance which could impact nearby woodlands. Disturbance and clearance of woodlands could have an adverse impact on the wind protection and wind barrier capabilities provided by the woodlands.
2.3.2.1	Pollination (or 'gamete' dispersal in a marine context)	Grasslands, Woodland and forests, Agriculture and croplands	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Pollinators like birds and bees rely on these habitats, and their removal could have a moderate impact on native pollinators. Impact on these populations could reduce habitat regeneration capabilities and fruit yields within the AoI and outside it, and lead to potential habitat fragmentation impacting local populations relying on these habitats and produce for livelihoods.
2.3.2.2	Seed dispersal	Birds, Habitats for birds e.g. Grasslands, Woodland and forests, Agriculture and croplands	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Birds rely on these habitats, and the removal of the habitats could have a minor impact on native species. Impact on these populations could reduce habitat regeneration capabilities and crop yields within the AoI and outside it, and lead to potential habitat fragmentation impacting local populations relying on these habitats for livelihoods, such as farmers and beekeepers.
2.3.2.3	Maintaining or regulating nursery populations and habitats or breeding grounds (Includes gene pool protection)	Grasslands, Woodland and forests,	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. These habitats provide wild plants for forage and animals for hunting by local populations within the AoI. Habitat clearance and disturbance could have a moderate impact on nursey grounds/habitats/breeding grounds for wild plants and animals. The permanent loss of these habitats could have long term impacts on the availability of wild plants and animals in the area, having a moderate impact for livelihoods dependant on the ecosystem service provision from this land.
2.3.3.1	Pest control (including invasive species)	Wild animals (birds and bats)	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
			equipment. Furthermore, there will be temporary disturbance from noise and vibration due to construction activities. Habitat clearance and disturbance from construction activities may lead to potential habitat fragmentation, cause displacement of bird populations and may disrupt foraging/commuting for bats. Impacts to bird and bat populations may reduce the pest control service within and around the Project AoI.
2.3.4.1	Biologically mediated weathering processes and their effect on soil quality	Grasslands, Woodland and forests, Agriculture and croplands	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment, which will result in a reduction in soil quality due to disturbance of strong root networks which provide soil forming capabilities.
2.3.6.1	Regulation of chemical composition of atmosphere and oceans, and the maintenance of continental atmospheric/oceanic circulation patterns	All stocks apart from urban and developed areas present within AoI	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment, which will have an impact on the carbon sequestration and storage capabilities provided from this land. Some impacts may be positive as arable land can be a source of carbon emissions, but the large amount of woodland lost will have a negative impact on sequestration capabilities. Construction activities, especially vehicular movements, will generate ground disturbance and dust which that could settle on nearby natural capital stocks such as grasslands, woodland and forests, and agriculture and cropland within the AoI. This could have an adverse impact on the photosynthesis efficiency, growth and yield thereby adversely impacting carbon sequestration and storage capabilities provided by all habitats within the AoI.
Cultural (Biotic/Biophysical)			
3.1.1.1	Elements of living systems that that enable activities promoting health, recuperation or enjoyment through active or immersive interactions	All stocks apart from urban and developed areas present within AoI	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. The lack of access to these areas, temporarily and permanently, will result in the loss of this ecosystem service provision with impacts to local populations that use it for recreation, exercise, and relaxation.
3.1.1.2	Elements of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions	Grasslands, Woodland and forests, Mountains	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. The lack of access to these areas, temporarily and permanently, will result in the loss of this ecosystem service provision with impacts to local populations that use it for recreation such as bird watching or relaxing in nature. Additionally, construction activities will generate visual and landscape disturbance, dust, noise and ground disturbance which will impact the visual amenity of the landscape. This could have an adverse impact on the local populations that interact with the environment for passive recreation and improving mental health. Any impacts to tourist experience could also have an adverse impact to local populations through reduced visitor numbers, although it is noted that the area is not generally recognised as an area for tourism or recreation.
3.2.1.2	Elements of living systems that enable education and training, including the importance of between and within species genetic diversity	All stocks apart from urban and developed areas present within AoI	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Additionally, construction will generate dust and ground disturbance. The temporary and permanent clearance of a large area of Eastern Quercus pubescens woods (an EU Habitats Directive priority habitat type and a Critical Habitat for 30 species) and areas of Helleno-Balkanic [Satureja montana] steppes will mean that these habitats and the species they host will no longer be available for study for educational purposes. However, the impact to education services is judged to be minor as higher education is undertaken in larger cities and towns.

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
3.2.1.3	Elements of living systems that are resonant in terms of culture or heritage	All stocks apart from urban and developed areas present within AoI	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. This will result in the loss of this ecosystem service provision with a major impact to local populations that draw cultural and heritage importance from the landscape, particularly as the area used for annual St George's Day celebrations is in close proximity to permanent built elements (identified in the Socio-economic and Cultural chapter, figure 7.9). Construction activities will generate visual and landscape disturbance, dust, noise and ground disturbance which will impact all natural capital stocks nearby. This could have an adverse impact on the local populations that draw cultural and spiritual importance from the natural environment.
3.2.1.4	Elements of living systems that enable aesthetic experiences	All stocks apart from urban and developed areas present within AoI	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. The temporary and permanent losses of habitats and addition of permanent manufactured elements in the landscape will affect the provision of this ecosystem service, with a moderate impact to local populations and visitors who interact with the landscape and enjoy the aesthetic benefits of the landscape. Additionally, construction activities will generate visual and landscape disturbance which could have an adverse impact on the natural beauty of these habitats.
3.4.1.1	Elements of living systems that have symbolic meaning, capture the distinctiveness of settings or their sense of place	All stocks apart from urban and developed areas present within AoI	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Additionally, construction activities will generate visual and landscape disturbance, dust, noise and ground disturbance which would impact all nearby habitats. This could have an adverse impact on areas used for social cohesion e.g. recreational community cooking activities at Gramada plateau or used for eco-tourism e.g. bird watching by local populations. Construction activities will generate visual and landscape disturbance, dust, noise and ground disturbance which would impact all natural capital stocks nearby such as grasslands, agriculture and cropland, inland surface waters, heathland and scrub, unvegetated and sparsely vegetated habitat within the AoI. This could have an adverse impact on the habitats used for social cohesion e.g. recreational community cooking activities at Gramada plateau or used for eco-tourism e.g. bird watching by local populations.
3.4.2.2	Elements or features of living systems whose inter-generational existence or conservation is important to people, including the importance of between and within species genetic diversity	All stocks apart from urban and developed areas present within AoI	Habitats will be permanently and temporarily cleared to facilitate construction activities and store construction equipment. Permanent loss of habitats that older generations wish to be maintained for future generations may have impacts on moral wellbeing of local populations.
Provisioning (Abiotic/geophysical)			
4.1.1.2	Surface water used as a material (non-drinking purposes)	Inland surface waters	Construction activities such as earthworks, road drainage installation will generate dust and ground disturbance which could impact natural capital stocks nearby such as inland surface waters that are used for irrigation purposes due to contamination from dust and sediment deposition in waterbodies within the AoI. Furthermore, temporary storage of oils, fuel and other construction elements could impact inland surface waters that are used for irrigation purposes due to contamination from potential leakage This could have an adverse impact, such as contamination, on the water quality available to local populations to use for non-drinking purposes.

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
			Mapping indicates the permanent loss of a small area of inland surface waters, which will reduce ecosystem service provision.
4.2.2.3	Wind energy	Wind	During construction, there will be no impacts on provision of this ecosystem service.
Cultural (Abiotic/geophysical)			
6.2.1.4	Elements of geophysical systems that enable aesthetic experiences	Mountainous terrain and steppes	Construction activities will disturb the character and tranquillity of the landscape, changing the aesthetic experience of those interacting with the landscape due to a reduction in the natural beauty of the area.

The Project will result in the temporary loss of approximately 44ha and permanent loss of approximately 62ha of natural capital stocks during construction of the turbines and associated infrastructure. The stocks that will be permanently lost within the Project AoI include 0approximately 18ha of agriculture and croplands, 8ha of grasslands, 10ha of woodland and forest, and 6ha of heathland and scrub.

The most severely impacted ecosystem services because of Project construction activities are likely to include:

- agriculture and cropland used for nutritional purposes (CICES code 1.1.1.1 and 1.1.3.1);
- woodland and forests and grasslands for provisioning (CIES codes 1.1.5.1 and 1.1.6.1) and regulating (CICES codes 2.1.1.2 and 2.3.6.1) services;
- cultural ecosystem services associated with biotic natural capital stocks (CICES code 3),

This is due to habitat loss and temporary amenity impacts to the landscape. Restricted access of local people to construction areas surrounding the turbines will have implications for the beneficiaries of cultural ecosystem services provided by both biotic and abiotic elements, although the capacity of stocks to provide cultural services in the wider area is expected to be less affected.

11.5.2 Operational phase

11.5.2.1 Overview

Operational impacts include permanent manufactured elements in the landscape and habitat disturbance from dust and noise from operational activities. Operational activities will include standard testing of electrical infrastructure and routine inspection. Routine maintenance of wind turbines will be undertaken for 40 hours per year. Non-routine maintenance may be of a similar order. The Project is expected to remain operational for 25 to 30 years.

11.5.2.2 Operation impacts – qualitative assessment

The identified qualitative impacts on ecosystem services from the operational phase of the Project are presented in Table 11.8.

Table 11.8: Potential operational phase impacts on ecosystem services identified within the AoI

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
Provisioning (Biotic/Biophysical)			
1.1.1.1	Cultivated terrestrial plants (including fungi, algae) grown for nutritional purposes	Agriculture and croplands	Operation activities will generate minimal levels of dust which could settle on nearby natural capital stocks such as agriculture and cropland within the AoI. This could result in minor impacts on the photosynthesis efficiency, crop growth and yield due to vulnerability to disturbance from operational activities. Overall, operational impacts on agriculture and cropland production are likely to be minimal.
1.1.1.2	Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct use or processing (excluding genetic materials)	Agriculture and croplands	Operation activities will generate minimal levels of dust which could settle on nearby natural capital stocks such as agriculture and cropland within the AoI. This could result in minor impacts on the photosynthesis efficiency, growth and overall yield of nearby natural capital stocks due to vulnerability to disturbance from operational activities. Overall, operational impacts on agriculture and cropland production are likely to be minimal.
1.1.3.1	Animals reared for nutritional purposes	Domestic, commercial livestock, Grassland, Heathland and scrub, Unvegetated or sparsely vegetated habitat	The level of noise expected to be generated by wind turbine generation is likely to result in minimal impacts on livestock grazing activities. Operation activities will generate minimal levels of dust which could settle on nearby natural capital stocks such as grassland within the AoI. This could result in adverse impacts on the photosynthesis efficiency, growth and overall yield of nearby natural capital stocks. New roads may improve access which may support livestock management. Overall, operational impacts on grazing land are likely to be minimal.
1.1.3.2	Fibres and other materials from reared animals for direct use or processing (excluding genetic materials)	Domestic, commercial livestock, Grassland, Heathland and scrub, Unvegetated or sparsely vegetated habitat	Operation activities will generate minimal levels of dust which could settle on nearby natural capital stocks such as grassland within the AoI. This could result in minor impacts on the photosynthesis efficiency, growth and overall yield of nearby natural capital stocks due to vulnerability to disturbance from operational activities. Additionally minimal noise is expected to be generated during wind turbine operations which will have minor impacts on the grazing potential of nearby natural capital stocks. Overall, operation may have minor impacts on photosynthesis efficiency and minimal noise production which may reduce grazing potential and potentially reduce production of fibres from wool and hides from livestock.
1.1.5.1	Wild plants (terrestrial and aquatic, including fungi, algae) used for nutrition	Grasslands, Woodlands and Forests, Unvegetated or sparsely vegetated habitat, Heathland and scrub	Fragmentation of habitats and reduced access due to roads may have an adverse impact on local populations seeking to forage these areas. Operation activities will generate minimal levels of dust which could settle on nearby natural capital stocks such as grasslands, woodland and forests, heathland and scrub within the AoI. This could have an adverse impact on the photosynthesis efficiency, growth and yield of herbs and other forest products. Overall, operational impacts on habitats providing wild plants for forage are likely to be minimal.
1.1.6.1	Wild animals (terrestrial and aquatic) used for nutritional purposes	Grasslands, Woodland and forests	Fragmentation of habitats and edge effects will alter food availability, adversely impacting terrestrial mammals during operation. Persistent noise and human activity will cause displacement, whilst roads act as barriers to movement and increase mortality risk. These factors will lower the hunting potential for nearby local populations within the AoI. This could result in moderate impacts on the availability of land for game production due to vulnerability to disturbance from operational activities. Overall, adverse impacts on wild animals in the

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
			areas surrounding the turbines are likely to lower hunting potential in the area.
Regulation & Maintenance (Biotic/Biophysical)			
2.1.1.2	Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals	All stocks apart from urban and developed areas present within AoI	Operation activities will generate minor levels of dust from road use which will impact all natural capital stocks such as agricultural and cropland, woodland and forests, and grassland, that provide dust filtration and air quality services within the AoI. This could result in minor impacts on the overall air quality levels due to vulnerability to disturbance from operational activities. Overall, operational impacts on grassland, agricultural and cropland and woodland in the area are likely to be minimal.
2.1.2.2	Noise attenuation	Grasslands, Woodland and forests, Agriculture and croplands	Operation activities will generate minor levels of noise, which will be within allowed limits during daytime. Operational noise at night-time has been assessed to be above limits in some areas, however, with mitigation, the night-time impacts will be minor. The permanent clearance of habitats which previously would have provided noise attenuation services means that the ability of the landscape to 'absorb' the noise will be reduced. There will be no other operational impacts on habitats providing noise attenuation services, so the operational impact is judged to be minor.
2.1.2.3	Visual screening	Grasslands, Woodland and forests, Agriculture and croplands, Heathland and scrub	The permanent presence of manufactured elements within the AoI will impact the visual amenity of the area, reducing provision of the ecosystem service. Overall, operation will have a moderate impact on the amenity experience of local populations.
2.2.1.1	Control of water erosion rates	Grasslands, Woodland and forests, Agriculture and croplands	The permanent presence of manufactured elements within the AoI during the operational phase will have minor impacts on the soil erosion control capabilities provided by natural capital stocks such as grasslands, woodland and forests, agriculture and cropland due to increased runoff from areas of hardstanding. There will also be soil compaction from, for example, maintenance traffic. This could result in minor impacts on overall soil erosion. Operational impacts on soil erosion are judged to be negligible because activities will be constrained to the roads and built elements
2.2.1.2	Control of wind erosion rates	Grasslands, Woodland and forests, Agriculture and croplands	Operational activities will have minor impacts on the wind erosion control capabilities provided by natural capital stocks such as grasslands, woodland and forests, agriculture and cropland due to the permanent presence of manufactured elements within the AoI. This could result in minor impacts on overall wind erosion incidents due to the vulnerability of the landscape to disturbance from operational activities. Overall, operational impacts on grasslands, woodland and forests, agriculture and cropland in the area will be minor.
2.2.2.1	Regulation runoff and base flows	Grasslands, Woodland and forests, Agriculture and croplands, Heathlands and scrub	Operational activities will have minor impacts on the water regulation capabilities over the landscape. Roads permanently alter drainage paths and can act as runoff conduits. Poor management of the new/expanded road network could lead to increased runoff.
2.2.2.2	Regulation of peak flows	Grasslands, Woodland and forests, Agriculture and croplands, Heathlands and scrub	Operational activities will have minor impacts on the water regulation capabilities over the landscape. Roads permanently alter drainage paths and can act as runoff conduits. Poor management of the new/expanded road network could lead to increased runoff and therefore flooding.

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
2.2.3.1	Buffering and attenuation of mass movement	Woodland and forests, Mountains	Operational activities will have minor impacts on the hazard mitigation capabilities provided by natural capital stocks such as grasslands, woodland and forests, agriculture and cropland on slopes due to the permanent presence of manufactured elements within the AoI. There will be reduced erosion control where slopes have been permanently modified. This could result in minor impacts on the overall hazard mitigation services.
2.2.3.3	Wind protection	Woodland and forests	Negligible impacts expected from operational activities.
2.3.2.1	Pollination (or 'gamete' dispersal in a marine context)	Grasslands, Woodland and forests, Agriculture and croplands	Birds face potential death or barotrauma from collision with wind turbines during operation. Additionally, birds may be displaced due to impacts from artificial light and noise associated with operation. Impacts to bird populations may reduce habitat regeneration capabilities and fruit yields within the AoI and outside it, impacting local populations relying on these habitats and produce for livelihoods
2.3.2.2	Seed dispersal	Birds, Habitats for birds e.g. Grasslands, Woodland and forests, Agriculture and croplands	Birds face potential death or barotrauma from collision with wind turbines during operation. Additionally, birds may be displaced due to impacts from artificial light and noise associated with operation. Impacts to bird populations may reduce habitat regeneration capabilities and crop yields within the AoI and outside it, impacting local populations relying on these habitats and produce for livelihoods.
2.3.2.3	Maintaining or regulating nursery populations and habitats or breeding grounds (Includes gene pool protection)	Grasslands, Woodland and forests,	Operation activities will generate moderate levels of noise at nighttime at some locations such as Buchim, Chiflik and Ljuboten which will impact local animal populations in the surrounding habitats. This will have minor impacts on the local population relying on hunting to supplement their livelihoods.
2.3.3.1	Pest control (including invasive species)	Wild animals (birds and bats)	Bats and birds face potential death or barotrauma from collision with wind turbines during operation. Additionally, birds may be displaced due to impacts from artificial light and noise associated with operation. Impacts to bird and bat populations may reduce the pest control service within and around the Project AoI.
2.3.4.1	Biologically mediated weathering processes and their effect on soil quality	Grasslands, Woodland and forests, Agriculture and croplands	Negligible impacts expected from operational activities.
2.3.6.1	Regulation of chemical composition of atmosphere and oceans, and the maintenance of continental atmospheric/oceanic circulation patterns	All stocks apart from urban and developed areas present within AoI	Operation activities will generate minor levels of dust which will impact natural capital stocks such as agriculture and cropland, woodland and forests, and grassland, that provide carbon sequestration and storage capabilities within the AoI. This could result in minor impacts on the overall carbon sequestration and storage levels due to vulnerability to disturbance from operational activities. Overall, operational impacts on grasslands, woodland and forests, agriculture and cropland in the area will be minor. The wind turbines will make a large contribution to global climate regulation via the generation of renewable energy.
3.1.1.1	Elements of living systems that that enable activities promoting health, recuperation or enjoyment through active or immersive interactions	All stocks apart from urban and developed areas present within AoI	There will be adverse impacts from noise and visual and landscape changes due to the permanent presence of manufactured elements within the AoI. This could result in an adverse impact on the overall area and quality of natural beauty available to local populations to enjoy and use for cultural practices.

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
			Additionally, operational activities will generate dust, with some adverse impacts to the surrounding natural capital stock. Overall, operation will have adverse impacts on the provision of this ecosystem service.
3.1.1.2	Elements of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions	Grasslands, Woodland and forests, Mountains	Operational activities will generate dust, with minor impacts to the surrounding natural capital stock. However, there will be moderate impacts from noise from turbines and visual and landscape changes due to the permanent presence of manufactured elements within the AoI and aviation lighting. This could result in a moderate impact on the overall area and quality of natural beauty available, such as reduced tranquillity, to local populations for eco-tourism, mental and emotional wellbeing. Overall, operation will have moderate impacts on the provision of this ecosystem service.
3.2.1.2	Elements of living systems that enable education and training, including the importance of between and within species genetic diversity	All stocks apart from urban and developed areas present within AoI	There will be moderate impacts from noise and visual and landscape changes due to the permanent presence of manufactured elements within the AoI. This could result in a minor impact on the habitats and species in the area available to local populations to study nature. Operational activities will also generate dust, with minor impacts to the surrounding natural capital stock. Overall, operation will have minor impacts on the provision of this ecosystem service.
3.2.1.3	Elements of living systems that are resonant in terms of culture or heritage	All stocks apart from urban and developed areas present within AoI	There will be moderate impacts from noise and visual and landscape changes due to the permanent presence of manufactured elements within the AoI. This could result in a moderate impact on the overall area and quality of natural beauty of the area, as well as restricting access to and/or impacting the character of areas of cultural importance to local populations such as the cemetery and the area used for St George's Day celebrations. Overall, operation will have moderate impacts on the provision of this ecosystem service. Operational activities will generate dust, with minor impacts to the surrounding natural capital stock.
3.2.1.4	Elements of living systems that enable aesthetic experiences	All stocks apart from urban and developed areas present within AoI	Operational activities will have moderate impacts on the visual and landscape character such as alteration to the mountain skyline due to the permanent presence of manufactured elements within the AoI. This could result in a moderate impact on the overall quality of natural beauty available to local populations to enjoy and impact the overall sense of remoteness. Overall, operation will have moderate impacts on the provision of this ecosystem service.
3.4.1.1	Elements of living systems that have symbolic meaning, capture the distinctiveness of settings or their sense of place	All stocks apart from urban and developed areas present within AoI	Operational activities will generate dust, with minor impacts to the surrounding natural capital stock. However, there will be moderate impacts from noise and visual and landscape changes due to the permanent presence of manufactured elements within the AoI. Perceived industrialisation of the landscape could result in a moderate impact on the overall area and quality of natural beauty. Overall, operation will have moderate impacts on the provision of this ecosystem service.
3.4.2.2	Elements or features of living systems whose inter-generational existence or conservation is important to people, including the importance of between and within species genetic diversity	All stocks apart from urban and developed areas present within AoI	Operational activities will generate dust, with minor impacts to the surrounding natural capital stock. However, there will be moderate impacts from noise and visual and landscape changes due to the permanent presence of manufactured elements within the AoI. The long-term change in the character of the landscape will mean that areas of importance to the local population will not be maintained for future generations.

CICES v5.2 code	Class	Associated natural capital stocks	Project impacts on ecosystem services
Provisioning (Abiotic/geophysical)			
4.1.1.2	Surface water used as a material (non-drinking purposes)	Inland surface waters	Negligible impacts expected from operational activities.
4.2.2.3	Wind energy	Wind	The operation of the windfarm will increase the area's provision of wind energy ecosystem services. The generation of renewable energy will provide greater benefits locally and may contribute to global environmental benefits, reducing dependence on fossil fuels and reducing greenhouse gas emissions.
Cultural (Abiotic/geophysical)			
6.2.1.4	Elements of geophysical systems that enable aesthetic experiences	Mountainous terrain and steppes	The presence of permanent manufactured elements in the landscape will impact the character of the mountains terrain. Maintenance activity and operation noise of the turbine will also have an impact, changing the aesthetic experience of those interacting with the landscape due to a reduction in the natural beauty of the area.

The most severely impacted ecosystem services as a result of Project operation activities are likely to include cultural ecosystem services associated with biotic and abiotic natural capital stocks (CICES code 3). This is due to introducing permanent manufactured elements in the landscape, loss of access to areas, impacts to the aesthetic experience of those interacting with the landscape due to a reduction in the natural beauty of the area, and noise and dust impacts. There will also be reduced access to areas immediately surrounding the turbines, which will have an impact on cultural services, as areas used for cultural events will be inaccessible, and on provisioning services as habitats used for hunting and wild plant gathering by local populations may also be reduced. There will also be impacts to agricultural provisioning services due to potential habitat fragmentation from creation of new roads and reduction of grazing areas near turbines. There may also be impacts to wild animals used for nutritional purposes (1.1.6.1) due to operational noise. Livestock management may benefit from improved access provided by new roads, but this may increase pressure on sensitive grassland. The impact of dust on the regulating services of surrounding natural capital stocks is judged to be minimal. The biodiversity chapter has identified impacts to bird and bat populations due to increased death and barotrauma risk from operation of the turbines.

The Project will result in beneficial effects through the production of wind energy (CICES code 4.2.2.3) by harnessing wind as a natural capital stock to generate renewable electricity. During operation, the windfarm will enhance the area's provision of wind energy as an ecosystem service, with the wind turbines contributing greater benefits locally to climate regulation through renewable energy generation. These benefits may be realised at a global scale by reducing reliance on fossil fuels and contributing to lower greenhouse gas emissions.

11.6 Mitigation and enhancement

11.6.1 Mitigation measures

The mitigation measures identified by other chapters within the Project ESIA, especially those measures identified for biodiversity, socio-economic and cultural impacts, and noise and vibration impacts will also mitigate the impacts on natural capital and ecosystem services identified for both the construction phase and operation phase of the Project.

At the time of writing, no mitigation measures have been detailed in the Landscape and Visual chapter.

Construction phase measures to avoid and minimise impacts to agricultural livelihoods from land clearance, identified in the Socio-economic and Cultural chapter, will result in avoided impacts on provisioning ecosystem services. These include:

- Allowing harvest of crops before land clearance
- Where possible, retain trees for agricultural production in-situ
- Avoiding construction during calving/lambing/kidding seasons

Consultations with residents of Buchim to find a satisfactory resolution to concerns around significant site near WTG 28 (the cemetery and area used for annual St George's Day celebrations), required by the Socio-economic and Cultural assessment, will reduce impacts. As will the proposed action to avoid cultural heritage features and sites of local interest by Project infrastructure. This will in turn reduce adverse impacts on cultural ecosystem services.

Operation phase measures to mitigate impacts to local livelihoods, required by the Socio-economic and Cultural chapter include Livelihood Restoration Packages (LRPs). LRPs will be provided to those affected by permanent loss of agricultural land. Compensation provided will be in line with stated preferences by affected parties and identified livelihood needs. The LRPs will also support individuals whose primary source of livelihood is informal natural resource collection, such as herb gathering. These individuals will be supported in securing alternative land for these activities or encouraged to participate in one of the livelihood packages, enabling them to transition to other types of livelihoods of their choice.

Construction phase measures to avoid and minimise impacts to habitats and species from land clearance, identified in the Biodiversity and Noise and Vibration chapters, will result in avoided impacts on various natural capital stocks and associated ecosystem services. These include:

- Minimising loss of/disturbance to habitats by using existing roads and tracks where possible and by using fencing to make sure activity is restricted to the Project footprint.
- Speed limits to reduce dust.
- Habitat reinstatement on temporarily cleared areas.
- Use quieter equipment and avoid unnecessary idling.
- Schedule noisy activities for daytime and minimise evening or night works.

Operation phase measures to avoid and minimise impacts to habitats and species from land clearance and noise and light, identified in the biodiversity chapter, will result in avoided impacts on various natural capital stocks and associated ecosystem services. These include:

- Revegetation using native species to restore ground cover and prevent erosion.
- Compensatory planting for any loss of woodland or scrub, ideally at a restoration ratio of at least 1:10 (lost: restored), particularly for sensitive habitats.
- Creation of nature networks or wildlife corridors to improve landscape-scale connectivity and facilitate species movement.
- Careful management of artificial lighting

The required Biodiversity Management Plan (BMP), Biodiversity Action Plan (BAP), and Biodiversity Monitoring and Evaluation Plan (BMEP) will also provide more detailed mitigation measures that will result in avoided impacts on natural capital stocks. There is a net gain requirement for Eastern Quercus pubescens woods.

Reinstatement of habitats, plus net gain requirements, will mitigate or improve current provisioning of ecosystem services. For example, net gain requirements for Eastern Quercus pubescens woods and scrub will provide additional carbon sequestration and cultural services once mature.

11.7 Monitoring

Long-term monitoring is a crucial component of effective environmental policy and management. In terms of natural capital and ecosystem services, long-term monitoring is often needed to measure change in stocks, such as a population of species or the condition of an ecosystem, but also to measure how those entities change in response to management intervention, such as habitat enhancement or degradation. Long-term monitoring is essential to determine if actions taken to manage the environment are effective, and therefore whether decisions made to invest in particular actions are justified.

As with natural capital mitigation measures, monitoring actions for natural capital should also reflect those suggested in other chapters. These measures will assess habitat restoration measures (restoration of lost natural capital stocks), measures to protect birds and bats, and measures to reduce noise impacts: all actions are important for monitoring impacts to natural capital stocks and ecosystem services also. These include:

- Actions outlined in the Biodiversity chapter which will monitor the implementation of mitigation plans for habitat restoration and for birds and bats. The monitoring plan covers compliance-based checks and ecological performance indicators that will demonstrate the effectiveness of measures. Data collected will guide effective environmental decisions and adaptive management will be informed by monitoring, ensuring that the mitigation plans remain effective.
- Monitoring required by the Socio-economic chapter which includes internal and external assessment of implementation. Internal monitoring will take place monthly, monitoring and evaluating implementation of the LRP and indicating where corrective actions are necessary. Quarterly external monitoring will assess the implementation of the LRP and evaluate the return of economically displaced households to pre-existing or improved livelihood restoration.
- Actions outlined in the Noise and Vibration chapter which will monitor noise levels over a period of at least 2 weeks with all turbines operating as normal.

11.8 Residual impacts

A summary of expected residual impacts on ecosystem service provision after the application of mitigation measures is provided in Table 11.9 and

Table **11.10** below**.**

Table 11.9: Evaluation of impacts on ecosystem services from the Project construction phase

CICES v5.2 code	Receptor (ecosystem service class)	Summary of impact	Impact magnitude	Receptor sensitivity	Evaluation of effect
Provisioning (Biotic/Biophysical)					
1.1.1.1	Cultivated terrestrial plants (including fungi, algae) grown for nutritional purposes	Loss of croplands and impacts to crop yield due to dust.	Moderate (adverse)	Low	Minor – the loss of income from clearance of cropland will be compensated through the LRPs, reducing the magnitude of impact. Food production services can be provided in surrounding locations.
1.1.1.2	Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct	Loss of croplands and impacts to crop yield due to dust.	Moderate (adverse)	Low	Minor – the loss of income from clearance of cropland will be compensated through the LRPs. Fibre

CICES v5.2 code	Receptor (ecosystem service class)	Summary of impact	Impact magnitude	Receptor sensitivity	Evaluation of effect
	use or processing (excluding genetic materials)				production services can be provided in surrounding locations.
1.1.3.1	Animals reared for nutritional purposes	Displacement of livestock from land clearance and noise. Adverse impacts to quality of grazing land due to dust.	Moderate (adverse)	Low	Minor – the loss of income from clearance of agricultural land will be compensated through the LRPs. Livestock will be displaced but can be grazed in surrounding areas.
1.1.3.2	Fibres and other materials from reared animals for direct use or processing (excluding genetic materials)	Displacement of livestock from land clearance and noise. Adverse impacts to quality of grazing land due to dust.	Minor (adverse)	Low/ negligible	Negligible – impacts to fibre production from displacement and quality of grazing land are likely to be minor.
1.1.5.1	Wild plants (terrestrial and aquatic, including fungi, algae) used for nutrition	Loss of foraging habitats supporting livelihoods. Adverse impacts to yields due to dust.	Moderate (adverse)	Low	Minor – the LRPs will support individuals who rely on wild plants for their livelihoods by identifying alternative locations or offering alternative livelihoods.
1.1.6.1	Wild animals (terrestrial and aquatic) used for nutritional purposes	Disturbance and displacement of wild animals, with adverse impacts on availability of game for hunting to support local livelihoods.	Moderate (adverse)	Low	Minor – displaced wild animals can be supported by surrounding habitats.
Regulation & Maintenance (Biotic/Biophysical)					
2.1.1.2	Filtration/ sequestration/ storage/accumulation by micro-organisms, algae, plants, and animals	Reduced air quality due to loss of habitats providing filtration services and due to dust created by construction activities.	Minor (adverse)	Medium	Minor – best practice measures to be implemented for controlling dust and associated impacts to nearby habitats during construction.
2.1.2.2	Noise attenuation	Reduced noise attenuation capabilities due to habitat clearance. Increased noise during construction.	Minor (adverse)	Low/ negligible	Negligible - with mitigation, night-time noise impacts will be minor. The significance of habitat loss for noise attenuation will be minor as noise will be minor.
2.1.2.3	Visual screening	Visual amenity impacts due to temporary manufactured elements in the landscape.	Moderate (adverse)	Low	Minor – temporary activities likely to result in visual impacts during construction.
2.2.1.1	Control of water erosion rates	Reduction in extent and condition of habitats – increased water erosion.	Minor (adverse)	Medium	Minor – woodland habitats will be reinstated but grasslands and agriculture/croplands will be lost.
2.2.1.2	Control of wind erosion rates	Reduction in extent and condition of habitats – increased wind erosion.	Minor (adverse)	Medium	Minor – woodland habitats will be reinstated but grasslands and agriculture/croplands will be lost.
2.2.2.1	Regulation runoff and base flows	Reduction in extent and condition of habitats – reduced regulation of flows.	Minor (adverse)	Medium	Minor – woodland habitats will be reinstated but grasslands and agriculture/croplands will be lost.
2.2.2.2	Regulation of peak flows	Reduction in extent and condition of habitats – increased risk of flooding.	Minor (adverse)	Medium	Minor – woodland habitats will be reinstated but grasslands and agriculture/croplands will be lost.

CICES v5.2 code	Receptor (ecosystem service class)	Summary of impact	Impact magnitude	Receptor sensitivity	Evaluation of effect
2.2.3.1	Buffering and attenuation of mass movement	Clearance of vegetation – increased landslide risk.	Minor (adverse)	Low/ negligible	Negligible – most habitat loss will not be on steep slopes so will not significantly reduce hazard mitigation services.
2.2.3.3	Wind protection	Reduction in extent of woodlands – reduced protection from wind for crops.	Minor (adverse)	Low/ negligible	Negligible – habitat loss will be of both woodlands and cropland, so areas requiring wind protection will also be lost.
2.3.2.1	Pollination (or 'gamete' dispersal in a marine context)	Displacement of pollinators due to habitat clearance, reducing pollination and impacting habitat regeneration and crop yield.	Minor (adverse)	Medium	Minor – pollinator populations may be displaced or reduced, impacting pollination.
2.3.2.2	Seed dispersal	Displacement of birds due to habitat clearance, reducing seed dispersal and impacting habitat regeneration and crop yield.	Minor (adverse)	Medium	Minor – bird populations may be displaced or reduced, impacting seed dispersal.
2.3.2.3	Maintaining or regulating nursery populations and habitats or breeding grounds (Includes gene pool protection)	Reduction in extent and condition of habitats acting as nursey grounds/ habitats/ breeding grounds for wild plants and animals.	Minor (adverse)	Medium	Minor – woodland habitats will be reinstated but grasslands will be lost.
2.3.3.1	Pest control (including invasive species)	Displacement and disturbance of bats and birds providing pest control services.	Minor (adverse)	Medium	Minor – bird and bat populations may be displaced or reduced, impacting pest control.
2.3.4.1	Biologically mediated weathering processes and their effect on soil quality	Reduction in extent of habitats, reducing soil quality due to disturbance of strong root networks.	Minor (adverse)	Medium	Minor – impact localised to areas of habitat lost, so the wider area will not be impacted.
2.3.6.1	Regulation of chemical composition of atmosphere and oceans, and the maintenance of continental atmospheric/oceanic circulation patterns	Reduction in extent and condition of habitats, reducing carbon sequestration potential of the area.	Moderate (adverse)	Low/ negligible	Minor – Permanent loss of woodland and grassland habitats will impact carbon sequestration but habitats in the wider area exist that will continue to sequester carbon. Reinstated woodland will sequester carbon as it matures but grassland and grazing areas will not be reinstated.
Cultural (Biotic/Biophysical)					
3.1.1.1	Elements of living systems that that enable activities promoting health, recuperation or enjoyment through active or immersive interactions	Reduction in extent and condition of habitats supporting activity and health for locals and tourists.	Moderate (adverse)	Low	Minor – activities can be hosted in surrounding areas
3.1.1.2	Elements of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions	Reduction in extent and condition of habitats supporting activity and health for locals and tourists.	Moderate (adverse)	Low	Minor – activities can be hosted in surrounding areas

CICES v5.2 code	Receptor (ecosystem service class)	Summary of impact	Impact magnitude	Receptor sensitivity	Evaluation of effect
3.2.1.2	Elements of living systems that enable education and training, including the importance of between and within species genetic diversity	Loss of critical habitats (woodlands and steppes), making them unavailable for education purposes.	Minor (adverse)	Low	Negligible - Woodland critical habitat will be cleared but is present elsewhere in the area and will be reinstated.
3.2.1.3	Elements of living systems that are resonant in terms of culture or heritage	Areas that hold cultural and heritage important will be impacted by the scheme and could be inaccessible during construction.	Moderate (adverse)	Low	Minor - Engagement with local populations will ensure that an acceptable solution is reached.
3.2.1.4	Elements of living systems that enable aesthetic experiences	Habitat loss will have visual impacts.	Moderate (adverse)	Low	Minor – most habitats lost will be reinstated
3.4.1.1	Elements of living systems that have symbolic meaning, capture the distinctiveness of settings or their sense of place	Habitat loss will have visual impacts.	Moderate (adverse)	Low	Minor – most habitats lost will be reinstated
3.4.2.2	Elements or features of living systems whose inter-generational existence or conservation is important to people, including the importance of between and within species genetic diversity	Permanent loss of habitats that older generations wish to be maintained for future generations.	Moderate (adverse)	Low	Minor - Engagement with local populations will ensure that an acceptable solution is reached.
Provisioning (Abiotic/geophysical)					
4.1.1.2	Surface water used as a material (non-drinking purposes)	Impacts from dust and ground disturbance during construction.	Moderate	Low	Minor – water is in short supply in the area, so impacts to water sources have negative implications for local populations using water sources for farming.
4.2.2.3	Wind energy	No impacts during construction	Negligible	Negligible	Negligible
Cultural (Abiotic/geophysical)					
6.2.1.4	Elements of geophysical systems that enable aesthetic experiences	Construction activities will disturb the character and tranquillity of the landscape, adversely impacting aesthetic experiences	Moderate (adverse)	Low	Minor - temporary manufactured elements in the landscape and construction activities will not have lasting impacts.

Table 11.10: Evaluation of impacts on ecosystem services from the Project operational phase

CICES v5.2 code	Receptor (ecosystem service class)	Summary of impact	Impact magnitude	Receptor sensitivity	Evaluation of effect
Provisioning (Biotic/Biophysical)					
1.1.1.1	Cultivated terrestrial plants (including fungi, algae)	Adverse impacts to crop yield due to dust.	Minor (adverse)	Low	Negligible – minimal dust expected to be created by operation activities.

CICES v5.2 code	Receptor (ecosystem service class)	Summary of impact	Impact magnitude	Receptor sensitivity	Evaluation of effect
	grown for nutritional purposes				
1.1.1.2	Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct use or processing (excluding genetic materials)	Adverse impacts to crop yield due to dust.	Minor (adverse)	Low	Negligible – minimal dust expected to be created by operation activities.
1.1.3.1	Animals reared for nutritional purposes	Displacement of livestock due to noise. Impacts to quality of grazing land due to dust.	Minor (adverse)	Medium	Minor – livestock will be displaced but can be grazed in surrounding areas.
1.1.3.2	Fibres and other materials from reared animals for direct use or processing (excluding genetic materials)	Displacement of livestock due to noise. Impacts to quality of grazing land due to dust.	Moderate (adverse)	Low/ negligible	Negligible – impacts to fibre production from displacement are not likely to be significant.
1.1.5.1	Wild plants (terrestrial and aquatic, including fungi, algae) used for nutrition	Fragmentation of habitats and reduced access to habitats, impacting access for foraging livelihoods.	Moderate (adverse)	Low	Minor – the LRPs will support individuals who rely on wild plants for their livelihoods by identifying alternative locations or offering alternative livelihoods.
1.1.6.1	Wild animals (terrestrial and aquatic) used for nutritional purposes	Displacement of wild animals that support local livelihoods through hunting.	Moderate (adverse)	Low	Minor – displaced wild animals can be supported by surrounding habitats.
Regulation & Maintenance (Biotic/Biophysical)					
2.1.1.2	Filtration/sequestration/ storage/accumulation by micro-organisms, algae, plants, and animals	Reduced air quality due to increased dust from operational activities.	Minor (adverse)	Low/ negligible	Negligible – minimal dust is expected from operation activities.
2.1.2.2	Noise attenuation	Turbine operation will produce noise.	Minor (adverse)	Low/ negligible	Negligible - with mitigation, night-time noise impacts will be minor.
2.1.2.3	Visual screening	Visual amenity impacts due to permanent manufactured elements in the landscape.	Moderate (adverse)	Medium	Moderate – no mitigation has been suggested for visual impacts of the wind turbines.
2.2.1.1	Control of water erosion rates	Reduction in condition of habitats due to soil compaction – increased water erosion.	Minor (adverse)	Low	Negligible – woodland habitats will be reinstated but grasslands and agriculture/croplands will be lost.
2.2.1.2	Control of wind erosion rates	Reduction in condition of habitats due to soil compaction – increased wind erosion.	Minor (adverse)	Low	Negligible – woodland habitats will be reinstated but grasslands and agriculture/croplands will be lost.
2.2.2.1	Regulation runoff and base flows	Reduction in condition of habitats due to soil compaction – reduced regulation of flows.	Minor (adverse)	Low	Negligible – woodland habitats will be reinstated but grasslands and agriculture/croplands will be lost.
2.2.2.2	Regulation of peak flows	Roads permanently alter drainage paths and can act as runoff conduits – increased risk of flooding.	Minor (adverse)	Low	Negligible – Many roads already exist in the landscape, additional roads not expected to substantively decrease flood regulation services.
2.2.3.1	Buffering and attenuation of mass movement	Clearance of vegetation – increased landslide risk.	Minor (adverse)	Low/ negligible	Negligible – most habitat loss will not be on steep slopes so will not significantly reduce hazard mitigation services.

CICES v5.2 code	Receptor (ecosystem service class)	Summary of impact	Impact magnitude	Receptor sensitivity	Evaluation of effect
2.2.3.3	Wind protection	No impact expected from operation	Negligible	Negligible	Negligible
2.3.2.1	Pollination (or 'gamete' dispersal in a marine context)	Displacement of pollinators due to light and noise from operation. Potential risk of death or barotrauma from turbines. Reduction in pollination services.	Minor (adverse)	Medium	Minor – pollinator populations may be displaced or reduced, impacting pollination.
2.3.2.2	Seed dispersal	Displacement of birds due to habitat clearance and light and noise from operation, reducing seed dispersal and impacting habitat regeneration and crop yield.	Minor (adverse)	Medium	Minor – bird populations may be displaced or reduced, impacting seed dispersal.
2.3.2.3	Maintaining or regulating nursery populations and habitats or breeding grounds (Includes gene pool protection)	Operational noise may disturb or displace wild animals from their habitats or breeding grounds impacting game available for hunting by local populations.	Minor (adverse)	Low	Negligible – no significant impact expected on breeding grounds.
2.3.3.1	Pest control (including invasive species)	Displacement and disturbance of bats and birds providing pest control services.	Minor (adverse)	Medium	Minor – bird and bat populations may be displaced or reduced, impacting pest control.
2.3.4.1	Biologically mediated weathering processes and their effect on soil quality	No operational impact expected on this service	Negligible	Negligible	Negligible
2.3.6.1	Regulation of chemical composition of atmosphere and oceans, and the maintenance of continental atmospheric/oceanic circulation patterns	Operational dust may impact carbon sequestration ability of the surrounding habitats. Renewable energy generation will make a major contribution to this service.	Minor (adverse) Moderate (beneficial)	Low Medium	Negligible (adverse) – impact of dust unlikely to be significant. Moderate (beneficial)
Cultural (Biotic/Biophysical)					
3.1.1.1	Elements of living systems that that enable activities promoting health, recuperation or enjoyment through active or immersive interactions	Adverse impacts from noise and lighting and permanent visual impacts reducing amenity of the area.	Minor (adverse)	Medium	Minor – activities can be undertaken in surrounding areas
3.1.1.2	Elements of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions	Permanent visual impacts reducing amenity of the area.	Minor (adverse)	Medium	Minor – activities can be undertaken in surrounding areas
3.2.1.2	Elements of living systems that enable education and training, including the importance of between and within species genetic diversity	Species may be displaced due to noise and light, meaning they are unavailable for study.	Minor (adverse)	Low	Negligible – species can be studied in surrounding area.

CICES v5.2 code	Receptor (ecosystem service class)	Summary of impact	Impact magnitude	Receptor sensitivity	Evaluation of effect
3.2.1.3	Elements of living systems that are resonant in terms of culture or heritage	Areas that hold cultural and heritage importance will be impacted by the scheme and could be inaccessible during operation.	Moderate (adverse)	Low	Minor - Engagement with local populations will ensure that an acceptable solution is reached.
3.2.1.4	Elements of living systems that enable aesthetic experiences	Turbines will alter the mountain skyline and the sense of remoteness.	Moderate (adverse)	Medium	Moderate - No mitigation measures are suggested for the permanent presence of manufactured elements in the landscape
3.4.1.1	Elements of living systems that have symbolic meaning, capture the distinctiveness of settings or their sense of place	Operational noise and permanent visual impacts will have impacts on the overall area and quality of natural beauty of the area due to perceived industrialisation.	Moderate (adverse)	Low	Minor - No mitigation measures are suggested for the temporary and permanent presence of manufactured elements in the landscape
3.4.2.2	Elements or features of living systems whose inter-generational existence or conservation is important to people, including the importance of between and within species genetic diversity	Permanent visual impacts to areas of importance to the local population that they wished to be preserved for future generations.	Moderate (adverse)	Low	Minor - Engagement with local populations will ensure that an acceptable solution is reached.
Provisioning (Abiotic/geophysical)					
4.1.1.2	Surface water used as a material (non-drinking purposes)	No impacts expected from construction	Negligible	Negligible	Negligible
4.2.2.3	Wind energy	Windfarm will increase provision of wind energy ecosystem services locally and may contribute to global environmental benefits.	Minor (beneficial)	Medium	Minor – windfarm will enable the delivery of ecosystem service benefits to the local community.
Cultural (Abiotic/geophysical)					
6.2.1.4	Elements of geophysical systems that enable aesthetic experiences	Permanent manufactured elements in the landscape will impact the character of the mountains terrain. Operation will change the aesthetic experience of those interacting with the landscape due to a reduction in the natural beauty of the area.	Moderate (adverse)	Low	Minor - No mitigation measures are suggested for the temporary and permanent presence of manufactured elements in the landscape.

11.8.1 Conclusion

11.8.1.1 Overview

Sections 11.5 to 11.8 of this chapter have assessed the likely natural capital and ecosystem service impacts resulting from the Project against the baseline set out in Section 11.4. Mitigation and management measures identified in the Biodiversity, Socio-Economic, and Noise and Vibration chapters will largely be suitable for mitigating the impacts to ecosystem service provision.

The main sources of potential impacts will arise from temporary and permanent habitat clearance, introduction of temporary and permanent manufactured elements in the landscape, and dust and noise impacts during construction and operation. The construction and operational activities of the Project will lead to permanent loss of substantive areas of ‘woodland and forest’ and ‘agriculture and cropland’ natural capital stocks. Based on the anticipated impacts and the methodology outlined in Section 11.3, priority ecosystem services were identified to determine where project operations are likely to affect service provision and where the project depends on these services, informed by the IFC PS6 definition of priority ecosystem services. The most substantive ecosystem services implication identified by the assessment will be reduced provision of ‘cultivated terrestrial plants grown for nutritional purposes’ (CICES code 1.1.1.1) and ‘animals reared for nutritional purposes’ (CICES code 1.1.3.1), reducing availability of this source of nutrition and leading to potential displacement of livelihoods. The residual impacts identified in Table 11.9 and Table 11.10 associated with these priority services, in particular, are dependent on the effective implementation of the proposed mitigation. Alcazar has a commitment to provide local affected communities and individuals with fair and adequate compensation for loss of livelihood arising from the Project through livelihood restoration programmes, which will likely address the impacts from economic displacement but cannot fully reconcile any impacts on local people associated with loss of traditional sources of livelihood and links with cultural and personal identity. Other implications of the loss of natural capital stocks include the carbon sequestration (CICES code 2.3.6.1) services provided by these stocks. Mitigation measures will be applied to reinstate habitat loss due to the Project; however some permanent loss of grassland is expected.

A substantive implication of the Project is the introduction of permanent manufactured elements in the landscape, which will impact the provision of multiple ecosystem services, both biotic and abiotic, particularly those services relating to aesthetic and amenity experiences and sense of place, such as CICES codes 2.1.2.3, 3.2.1.4, 3.4.1.1, and 6.2.1.4.

The main source of beneficial impact from the Project is the provision of wind energy (CICES code 4.2.2.3). The operation of the windfarm will increase the area’s provision of wind energy ecosystem services, with global environmental benefits, reducing dependence on fossil fuels and reducing greenhouse gases.

11.8.1.2 Recommendations

To ensure that natural capital stocks and the provision of ecosystem services in the area are able to recover post-construction, it is recommended that mitigation and monitoring measures outlined in the Biodiversity, Socio-Economic, and Noise and Vibration chapters.

Development and implementation of a BMP to include habitat restoration strategies for temporary impact areas and a BAP to demonstrate net gain of critical habitat will ensure alignment with international standards such as IFC PS6. Data collection will allow adaptive management, ensuring mitigation measures continue to be effective.

Continued engagement with impacted communities should be undertaken, as identified in the Socio-economic chapter, will ensure that mitigation is properly implemented and targeted.

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12 Noise and vibration

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12 Noise and vibration

12.1 Overview

This chapter presents an assessment of the potential noise and vibration impacts of the Project. The assessment considers effects due to noise and vibration associated with the construction and operation activities of the Project on the nearby sensitive receptors. This assessment considers noise and vibration impacts on sensitive receptors that are associated with human occupants of buildings within the study area (residential and commercial buildings).

12.2 Applicable standards

12.2.1 National

The Law on the Protection against Environmental Noise (Official Gazette (OG) of the Republic of Macedonia (RM) no. 79/2007[1]) defines noise in the environment as noise caused by undesired or harmful outdoor sound generated by human activities and causing nuisance and annoyance. It includes noise emitted by transportation sources such as roads, railways and air traffic, and industrial activities.

Source of noise include construction plant and equipment or the operation/activity or use of which causes permanent or temporary noise impacts.

Nuisance is the annoyance caused by sound emission which prevents or disturbs normal human activity and work, concentration, rest and sleeping.

A noise indicator is a physical scale for describing environmental noise, which is related to harmful effect. The following indicators are defined in OG of RM no. 107/2008[2]:

- L_D – noise indicator during the daytime (07:00 to 19:00)
- L_E – noise indicator during the evening (19:00 to 23:00)
- L_N – noise indicator during the night (23:00 to 07:00)
- L_{DEN} – noise through day-evening-night as an average noise level

OG of RM no. 107/2008 also defines the methods for calculation of industrial noise (various ISO methods), as well as methods for calculation of noise from different types of traffic.

Limit values for the basic environmental noise indicators are determined in OG of RM no. 147/2008[3]. In accordance with the level of protection against noise, the limit values for the basic noise indicators should not be higher than shown in the next table.

Table 12.1: National ambient noise limit values for environmental noise

Area, defined in relation to the degree of protection from noise	Ambient noise level limit [dB(A)]		
	L_D (07:00 to 19:00)	L_E (19:00 to 23:00)	L_N (23:00 to 07:00)
Area with first-degree protection	50	50	40

[1] Official Gazette of Republic of Macedonia (2007), OG of RM no. 79/2007 Protection against environmental noise.

[2] Official Gazette of Republic of Macedonia (2008), OG of RM no. 107/2008 Ordinance for use of noise indicators, additional noise indicators, manner for noise measurement and methods for assessment of the environmental noise indicators.

[3] Official Gazette of Republic of Macedonia (2008), OG of RM no. 147/2008 Ordinance on environmental noise level limit values.

Area, defined in relation to the degree of protection from noise	Ambient noise level limit [dB(A)]		
	L_D (07:00 to 19:00)	L_E (19:00 to 23:00)	L_N (23:00 to 07:00)
Area with second-degree protection	55	55	45
Area with third-degree protection	60	60	55
Area with fourth-degree protection	70	70	60

Source: Official Gazette of Republic of Macedonia No. 147/2008

The degree of protection against noise for the given area types are determined in OG of RM no. 120/2008[4]:

- Area with first degree of protection from noise is touristic and recreational area, an area in immediate vicinity to health-care institutions and areas in natural protected areas;
- Area with second degree of protection from noise is an area which primary purpose is accommodation - residential area, area around educational buildings and buildings for social care and health care, area around playgrounds and public parks and public green areas;
- Area with third degree of protection from noise is business - trade area, area with public buildings for administrative, trade, service and similar purposes and an agricultural area; and,
- Area with fourth degree of protection from noise is an area without residential buildings, an area for industrial and other production activities, transport activities, storage and other service activities and communal activities which produce significant noise.

Cases as well as the conditions when it is considered that the peace of the citizens is disturbed by noise are defined OG of RM no. 01/2009[5].

12.2.2 International

12.2.2.1 IFC WBG Environmental, Health and Safety Guidelines

The compliance of a project's environment impacts with the International Finance Corporation (IFC) Performance Standards is assessed in accordance with the IFC World Bank Group (WBG) Environmental, Health and Safety (EHS) Guidelines. Furthermore, IFC Performance Standard 1 states that:

"*When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternative performance level is protective of human health and the environment*."

The IFC General EHS Guidelines[6] state:

"*Noise impacts should not exceed the levels presented in Table 1.7.1* (Table 12.2 below)*, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off site*."

The guidelines values are far field values measured outdoors and more than 3m from reflective surfaces (e.g. walls) and are therefore 'free field' values.

[4] Official Gazette of Republic of Macedonia (2008), OG of RM no. 120/2008 Ordinance for locations of the measuring stations and measuring spots.

[5] Official Gazette of Republic of Macedonia (2009), OG of RM no. 01/2009 Governmental decision no. 19-6920/1.

[6] International Finance Corporation and World Bank Group (2007), Environmental, Health and Safety Guidelines. General Guidelines. Noise Management. Section 1.7 – Noise.

Table 12.2: International noise level guidelines for environmental noise

Receptor	One-hour noise level $L_{Aeq,1hour}$ [dB]	
	Daytime (07:00 to 22:00)	Night-time (22:00 to 07:00)
Residential, institutional and educational	55	45
Industrial and commercial	70	70

Source: IFC General EHS Guidelines, Table 1.7.1.

The IFC EHS Guidelines require "*Noise monitoring should be carried out using a Type 1 or 2 sound level meter meeting all appropriate IEC standards*".

The IEC standard is not referenced in the IFC EHS Guidelines but is certain to be IEC 60651:1994/AMD2:2000[7]. This was withdrawn and IEC 61672-1:2013[8] defines the specifications for the Class 1 and Class 2 standards for accuracy.

The IFC EHS Guideline does not specifically clarify whether the sound level meter should be configured to use the fast or slow time-weighting for environmental noise measurements. The choice of weighting will mainly affect the measurement of the $L_{A(max)}$ parameter. Table 2.3.1 'Noise limits for various working environments' within the IFC EHS Section 2.0 'Occupational Noise' section indicates that the limits on maximum sound pressure levels are assessed using measurement with the fast time weighting. Therefore, it is assumed that the fast time weighting is used throughout for consistency.

The IFC General EHS Guidelines state:

"*Noise monitoring programs should be designed and conducted by trained specialists*."

12.2.2.2 WBG Wind Energy Guidelines

The WBG EHS Guidelines for Wind Energy[9] do not provide specific assessment criteria for operational noise and states that:

"*If noise criteria based on ambient noise levels are to be used, it is necessary to measure the background noise in the absence of any wind turbines. This should be done at one or more noise-sensitive receptors. Often the critical receptors will be those closest to the wind energy facility, but if the nearest receptor is also close to other significant noise sources, an alternative receptor may need to be chos*en."

Under 'Performance Indicators Monitoring' it states that:

"*Noise impacts should not exceed the levels presented in the General EHS Guidelines. Noise generated from wind energy facilities tends to increase with the speed of the wind. The application of noise guideline values and assessment of background levels should therefore take these factors into consideration*."

Therefore, the noise limits prescribed under the General EHS Guidelines are required to be sensitive to the variation of background noise levels as a function of wind speed. This is similar in approach to the methodology of the United Kingdom (UK) guidance ETSU-R-97[10], which is referenced by the EHS Guidelines for Wind Energy.

[7] International Electrotechnical Commission (2000), IEC 60651:1994/AMD2:2000 Standard for Sound Level Meters – Amendment 2.

[8] International Electrotechnical Commission (2013), IEC 61672-1:2013 Electroacoustics – Sound level meters – Part 1: Specifications.

[9] World Bank Group (2015), Environmental, Health and Safety Guidelines – Wind Energy.

[10] ETSU Working Group on Noise from Wind Turbines (1996), ETSU-R-97 The assessment and rating of noise from wind farms, September 1996.

12.3 Assessment methodology

The construction and operation of the Project is expected to generate temporary and permanent noise and vibration impacts which may result in effects at nearby sensitive receptors. This section presents the methodology for assessing key noise and vibration impacts in order to identify any potential significant effects, and so that the scope to mitigate them can be considered.

There are no other wind turbine facilities in the vicinity of the Project, so the impact of the cumulative operational noise due to neighbouring wind turbines has not been considered further in this assessment.

Temporary noise and vibration impacts during the construction phase are expected to arise due to:

- Excavation and ground works
- Activities within laydown areas
- Additional road traffic in moving materials and site personnel to and from the site

Permanent noise and vibration impacts of the Project once it is operational are expected to be primarily associated with the installed wind turbines. The following have been identified as the main noise-emitting sources:

- Mechanical and electrical noise from the wind turbine generators
- Aerodynamic noise from the spinning wind turbine blades

Impacts due to changes in road traffic during construction, operation and decommissioning are considered in Chapter 7 that focusses on socio-economic and cultural impacts. Traffic nuisance is not considered further in this noise and vibration chapter.

12.3.1 Magnitude of change

The assessment of magnitude will be undertaken in two steps. Firstly, the magnitude of potential impacts associated with the Project have been categorised as beneficial or adverse.

Secondly, the beneficial or adverse impacts have been categorised as major, moderate, minor or negligible based on consideration of the parameters such as:

- Duration of the impact – ranging from beyond decommissioning to temporary with no detectable impact
- Spatial extent of the impact – for instance, within the site, boundary to regional, national, and international
- Reversibility – ranging from permanent requiring significant intervention to return to baseline to no change
- Likelihood – ranging from occurring regularly under typical conditions to unlikely to occur
- Compliance with legal standards and established professional criteria – ranging from substantially exceeds national standards and limits / international guidance to meets or exceeds minimum standards or international guidance

Table 12.3 provides an example of generic criteria applied for determining magnitude.

Table 12.3 Criteria for determining magnitude of change

Magnitude (beneficial or adverse)	Description
Major	Fundamental change to the specific conditions assessed resulting in long term or permanent change, typically widespread in nature, and requiring significant intervention to return to baseline; exceeds national standards and limits.
Moderate	Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change.
Minor	Detectable but minor change to the specific condition assessed.
Negligible	No perceptible change to the specific condition assessed.

Source: Mott MacDonald

12.3.2 Sensitivity of receptors and impacts

A sensitive receptor is defined as a location associated buildings occupied by humans that are most sensitive to or likely to be adversely affected by noise and vibration associated with the Project. All assessment locations described here are representative of sensitive receptors, which may be individual buildings or a group of buildings.

The significance of effects due to noise is a function of the magnitude of impact and the sensitivity of the receptor. Sensitivity is generally specific to the type/use of the receptor. Sensitivity criteria for the assessment of noise impacts affecting types of sensitive receptors are assigned in Table 12.4.

Table 12.4 Criteria for determining sensitivity

Sensitivity	Type of receptor
High	Residential area, hospitals, schools, colleges or universities, places of worship, designated environmental areas, nature areas, high value amenity areas, cemeteries
Medium	Offices, commercial property, recreational areas, agricultural land
Low	Public open spaces, industrial areas, car parks
Negligible	Derelict land

Source: Mott MacDonald

12.3.3 Significance

Table 12.5 presents the significance criteria matrix to be used in this assessment that will take into account the interaction between magnitude criteria and sensitivity criteria. Impacts that have been evaluated as being ‘Moderate’ or ‘Major’ are classified as significant effects. Consequently, impacts that are ‘Minor’ or ‘Negligible’ are not significant.

Table 12.5 Determining significance matrix

		Magnitude						
		Adverse			Negligible	Beneficial		
		Major	Moderate	Minor		Minor	Moderate	Major
Sensitivity	High	Major	Major	Moderate	Negligible	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Negligible	Minor	Moderate	Major
	Low	Moderate	Minor	Negligible	Negligible	Negligible	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Source: Mott MacDonald

12.3.4 Study area and area of influence

The rated power and locations of the 54 wind turbine generators (WTGs) of the Project are summarised in Table 12.6.

Table 12.6: Rated power and locations of wind turbine generators

Wind turbine ID	Rated power [MW]	Location	
		X easting*	Y northing*
01	6.25	600978.26	4618916.41
02	6.25	601664.50	4618127.18
03	6.25	602014.60	4618527.32
04	6.25	603031.94	4618171.24
05	6.25	602406.78	4616744.77
06	6.25	603111.01	4616657.76
07	6.25	603442.95	4616980.53
08	6.25	604574.49	4616210.66
09	6.25	602925.00	4615096.26
10	6.25	603732.82	4615572.46
11	6.25	604930.62	4615401.42
12	6.25	605768.53	4615065.50
13	6.25	606622.19	4614385.14
14	6.25	606169.02	4615513.49
15	6.25	607064.05	4616469.38
16	6.25	607677.52	4616411.06
17	6.25	608326.68	4616391.83
18	6.25	609001.89	4616357.84
19	6.25	609417.01	4616626.94
20	6.25	609905.16	4616855.03
21	6.25	610398.31	4617138.13
22	8.0	611188.55	4617594.30
23	8.0	611557.66	4617934.42
24	8.0	612448.95	4617665.36
25	8.0	612326.92	4617156.20
26	8.0	611660.73	4616658.02
27	8.0	611649.27	4615741.72
28	8.0	611252.99	4615482.70
29	8.0	610914.72	4615117.12
30	8.0	610568.83	4614219.82
31	8.0	610103.90	4614119.83
32	8.0	609633.55	4613563.96
33	8.0	609553.17	4612875.75
34	8.0	609577.20	4612243.55
35	8.0	609751.79	4611692.70
36	8.0	611467.60	4618927.74
37	8.0	610846.40	4618984.74
38	8.0	610500.30	4618684.63
39	8.0	610679.35	4619884.48

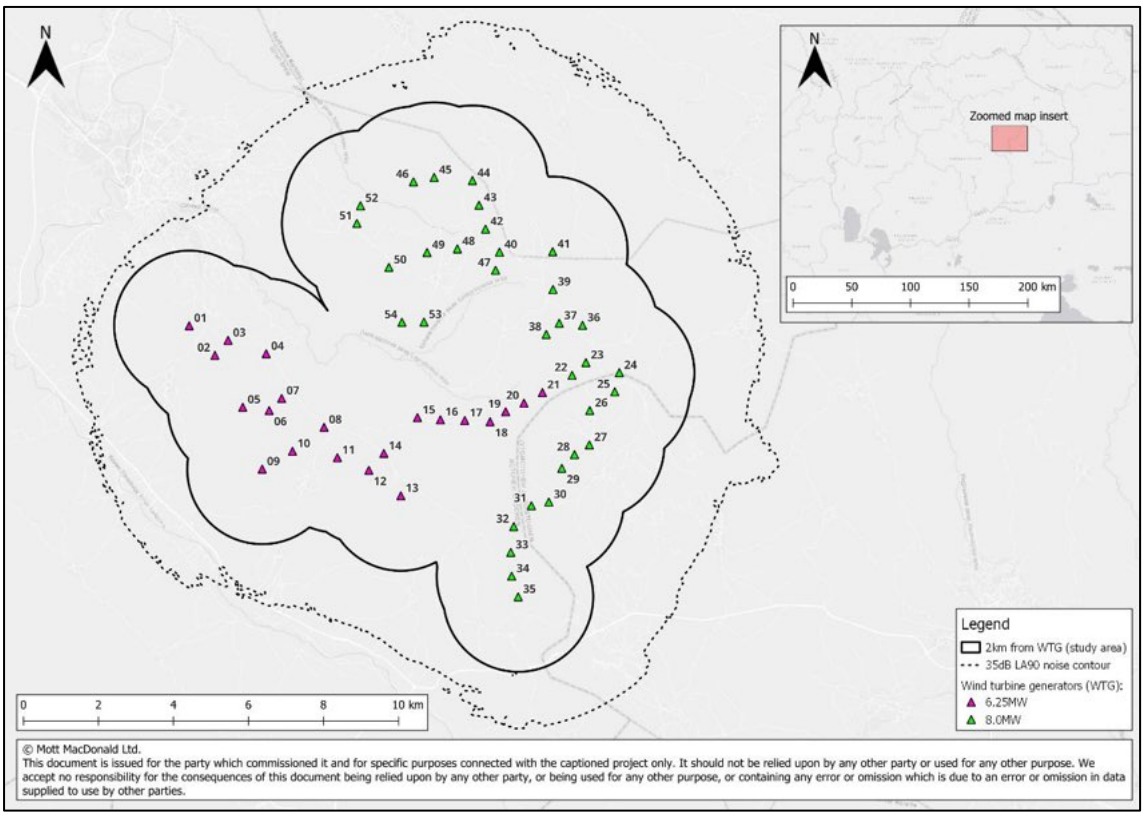
Wind turbine ID	Rated power [MW]	Location	
		X easting*	Y northing*
40	8.0	609252.63	4620879.08
41	8.0	610670.28	4620891.34
42	8.0	608879.29	4621492.34
43	8.0	608706.62	4622128.67
44	8.0	608532.55	4622784.87
45	8.0	607510.22	4622866.87
46	8.0	606958.05	4622753.82
47	8.0	609149.07	4620395.51
48	8.0	608129.27	4620964.61
49	8.0	607321.29	4620867.03
50	8.0	606303.91	4620473.07
51	8.0	605450.34	4621643.35
52	8.0	605546.03	4622114.20
53	8.0	607239.28	4619013.91
54	8.0	606651.64	4619009.50

Note:
* Coordinate reference system (CRS) EPSG:6204

Source: Mott MacDonald

In accordance with the WBG EHS Guidelines for Wind Energy, the extent of the assessment study area includes the area enclosed within 2,000m of any of the WTGs of the Project. The WBG EHS Guidelines also recommends that detailed operational noise modelling, with the inclusion of background ambient noise measurements, should be carried out if preliminary modelling suggests that the turbine operational noise would likely be above 35 dB L_{A90} at any sensitive receptors within the assessment study area at a wind speed of 10m/s at 10m height during day and night. The assessment study area is presented in Map 12.1.

Map 12.1: Assessment study area



Source: Mott MacDonald

Map 12.1 illustrates the proposed locations of the 54 WTGs, the extent of the study area and the 35 dB L_{A90} noise contour at 10m height above ground level for the proposed WTGs based on preliminary modelling. Since the entire study area (2,000m from the WTGs) is within the 35 dB L_{A90} noise contour, a detailed assessment of the operational wind turbine noise should be undertaken at assessment locations that are representative of noise-sensitive receptors to analyse the noise impact.

12.3.5 Identification of assessment locations containing sensitive receptors

Table 12.7 summarises the selected 14 assessment locations, with their noise protection limit in accordance with OG of RM No. 147/2008 and its nearest WTG. Map 12.2 shows these 14 assessment locations within the study area.

Most of the residential assessment locations (requiring second degree noise protection) listed in Table 12.7 are representative of multiple sensitive receptors with permanent residents. The exceptions to this are the sensitive receptors in the villages of Nikoman (AL3) and Chiflik (AL9), where site inspections revealed that the residential buildings were generally vacant during the weekdays and used as weekend homes. Chiflik (AL9) is regarded as abandoned but is considered by the assessment on a precautionary basis. The commercial facility (AL14) has been assigned third degree noise protection, as it consists of commercial buildings.

Table 12.7: Assessment locations and their nearest corresponding wind turbine

Assessment location		X easting*	Y northing*	Most stringent noise protection limit†			Nearest wind turbine	
ID	Name			Degree	Day $L_{Aeq,T}$ [dB]	Night $L_{Aeq,T}$ [dB]	ID	Distance [m]
AL1	Shashavarlija	607616.67	4620055.44	Second	55	45	49	867
AL2	Kalapetrovci	609389.54	4618784.45	Second	55	45	38	1,115
AL3	Nikoman	607774.47	4621623.03	Second	55	45	48	748
AL4	Golem Gaber	608897.60	4623843.53	Second	55	45	44	1,120
AL5	Koshevo	612607.01	4618573.30	Second	55	45	24	922
AL6	Buchim	611871.82	4615009.48	Second	55	45	27	765
AL7	Shopur	608778.68	4610995.32	Second	55	45	35	1,197
AL8	Tanatarci	607037.24	4612718.45	Second	55	45	13	1,718
AL9	Chflik	606503.71	4614852.36	Second	55	45	13	482
AL10	Ljuboten	604214.04	4614926.06	Second	55	45	10	806
AL11	Dolani	600670.56	4617782.95	Second	55	45	02	1,052
AL12	Resurrection of Christ Monastery	604231.22	4622613.23	Second	55	45	52	1,406
AL13	Lipov Dol	604020.97	4618823.34	Second	55	45	04	1,185
AL14	Commercial facility	606486.23	4616117.30	Third	60	55	15	677

Note:

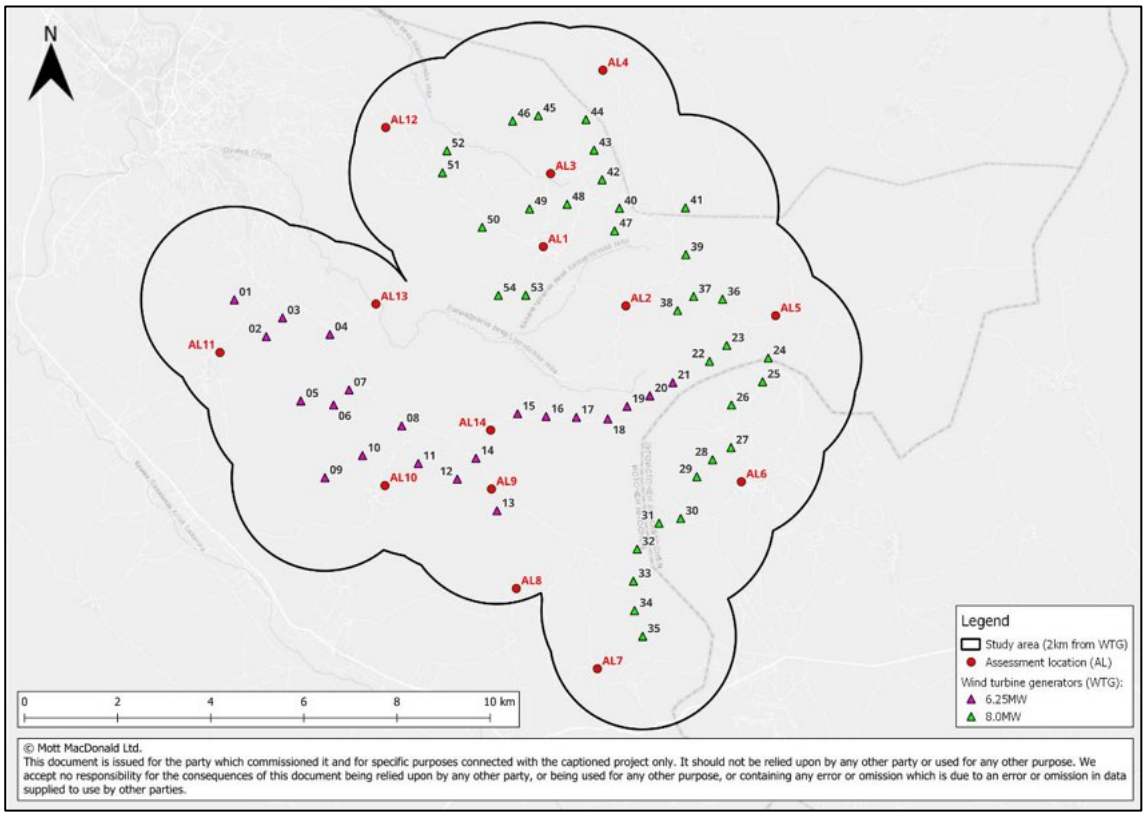
* Coordinate reference system (CRS) EPSG:6204

† In accordance with Official Gazette of Republic of Macedonia No. 147/2008 (see Table 12.1)

Source: Mott MacDonald

Further details on the identified villages, households and building uses are provided in Chapter 7 socio-economic.

Map 12.2: Assessment locations within the study area



Source: Mott MacDonald

12.3.6 Assessment methodology

12.3.6.1 Construction noise and vibration

The British Standard (BS) 5228:2009+A1:2014 provides comprehensive guidance on construction noise (Part 1) [11] and vibration (Part 2) [12] including details of typical noise levels associated with various items of plant or activities, prediction methods and measures and procedures that have been found to be most effective in reducing impacts. The guidance forms the basis for the majority of construction noise assessments in the UK and is widely recognised internationally. There are no national standards that specifically consider temporary noise impacts arising during construction activities. Therefore, the methodology described in BS 5228 been adopted for this assessment.

Construction work is transient in nature and generally includes both stationary and moving sources of noise. Stationary sources include construction plant positioned at a given location on a temporary basis while moving sources normally comprise mobile plant and vehicles.

The first stage of the construction noise assessment involves the identification of activities that have the potential to generate high levels of noise. It is necessary to consider the contribution of all noise sources involved in a particular construction activity in order to predict the likely impact.

The second stage of the construction noise assessment involves identifying and ranking the nearest sensitive receptors to the construction areas in terms of sensitivity of the receptor. The

[11] British Standards Institution (2014), BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 1: Noise.

[12] British Standards Institution (2014), BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration.

predicted impact will depend primarily on the levels of noise emitted and the distance between sources and the receivers. However, the degree and nature of incorporated mitigation measures are also of importance.

The third stage of the construction noise assessment involves the prediction of noise level at the receptor position in order to assess the magnitude of impact. Annex E of BS 5228-Part 1: Noise presents example methods for assessing the significance of construction noise levels at noise sensitive receptors and 'Example method 2 – 5 dB(A) change' method has been adopted here. In accordance with the BS 5228 'Example method 2 – 5 dB(A) change' method, construction noise levels are deemed to be significant if the ambient noise levels during construction (pre-construction ambient plus construction noise) exceed the pre-construction ambient noise by 5 dB(A) or more subject to lower cut-off values of:

- 65 dB L_{Aeq} during the daytime 07:00 to 19:00 Monday to Friday, and Saturdays 07:00 to 13:00;
- 55 dB L_{Aeq} during evenings and weekends 19:00 to 23:00 Monday to Friday, 13:00 to 23:00 on Saturdays and 07:00 to 23:00 on Sundays; and,
- 45 dB L_{Aeq} during the night-time 23:00 to 07:00 on any day.

These conditions would need to prevail for one month or more unless works of a shorter duration are expected to result in significant impacts. Based on these criteria, the magnitude of impact of noise due to general construction noise will be assessed using the scales presented in Table 12.8, which are based on the Code of Practice adopted in the UK and commonly applied in international projects.

Table 12.8 Assessment of construction noise impacts

Definition	Construction noise level L_{Aeq} [dB]		
	Daytimes	**Duration**	**Magnitude of impact**
Potentially perceptible but non-significant change in conditions	<55	Months	Negligible
	<60	Weeks	
	<65	Days	
Perceptible but restricted change in conditions	55 - 60	Months	Minor
	60 - 65	Weeks	
	65 - 70	Days	
Material but non-significant change in conditions	60 - 65	Months	Moderate
	65 - 70	Weeks	
	70 - 75	Days	
Significant change in conditions	>65	Months	Major
	>70	Weeks	
	>75	Days	

Source: Mott MacDonald

Ground-borne vibration from construction activities has the potential to affect the occupiers of buildings or the structure itself. This is mainly associated with construction activities such as percussive piling or vibratory equipment used in demolition.

Ground-borne vibration generally has an adverse impact on receptors when the distance between the vibration source and receptor is within 100m. Given that the minimum distance between the wind turbines and a sensitive receptor position is greater than 400m, the effects due to vibration during construction works, and during operation, are expected to be insignificant and are not assessed further in this chapter.

12.3.6.2 Operational noise from wind turbines

The operational noise limits prescribed under the General EHS Guidelines for Wind Energy are required to be sensitive to the variation of background sound levels as a function of wind speed at a standardised height of 10m above ground. This is similar in approach to the methodology of the UK guidance ETSU-R-97, which is referenced by the EHS Guidelines for Wind Energy.

Based on this, the criteria for this assessment have been derived from the baseline noise measurements at five locations that have been selected to represent groups of receptors within the study area. The derivation of criteria has also used wind speeds measured concurrently with the noise measurements and by anemometers installed on the wind mast on site.

The magnitude criteria for operational noise impacts presented in Table 12.9 have been developed based on the more stringent aspects of the North Macedonian Standards and the IFC/WBG guidelines. For sensitive receptors with high baseline noise levels that are above the daytime and night-time noise criteria, the cumulative noise level (found by taking the logarithmic summation of the operational noise level and baseline noise level) should not be more than 3 dB above the baseline noise level.

Table 12.9 Assessment of magnitude of impact of operational noise from wind turbines

Criteria	Definition	Magnitude of impact
Baseline noise level is below the noise criteria limit: The operational noise level should not exceed the daytime and night-time noise criteria limits given below:	Operational noise level below criterion	Negligible
Residential receptors (areas with second degree protection) - Daytime 55 dB L_{Aeq} (07:00-23:00) - Night-time 45 dB L_{Aeq} (23:00-07:00)	Operational noise level less than 3 dB L_{Aeq} over the criterion	Minor
Commercial receptors (areas with third degree protection) - Daytime 60 dB L_{Aeq} (07:00-23:00) - Night-time 55 dB L_{Aeq} (23:00-07:00)	Operational noise level less than 5 dB L_{Aeq} over the criterion	Moderate
Baseline noise level is above the noise criteria limit: The cumulative noise level (found by taking the logarithmic summation of the operational noise level and baseline noise level) should not be more than 3 dB above the baseline noise level	Operational noise level 5 dB L_{Aeq} or more above the criterion	Major

Source: Mott MacDonald

12.3.7 Baseline survey

A baseline survey was conducted from May to July 2025 to monitor the existing baseline noise levels at positions that are representative of the sensitive receptors near the proposed WTGs. Five noise measurement positions were selected to represent the closest sensitive receptors to the proposed WTGs. Table 12.10 shows the site descriptions for the five selected noise measurement positions for the baseline survey.

Table 12.10 Site descriptions of the baseline noise measurement positions

Position label	Site description	Representative assessment locations
MP1 Buchim	The position is representative of the residential house opposite MP1 in AL6. The data collected at this position provides the basis criteria for the assessing operational noise at AL5 and AL6.	AL5 and AL6
MP2 Buchim	The position is representative of the residential houses opposite MP2 and other neighbouring noise-sensitive receptors at AL6. The	AL5 and AL6

Position label	Site description	Representative assessment locations
	data collected at this position provides the basis criteria for the assessing operational noise at AL5 and AL6.	
MP3 Chiflik	The position is representative of the residential house next to MP3 and other neighbouring r noise-sensitive receptors at AL9. The data collected at this position provides the basis criteria for the assessing operational noise at locations AL7 to AL9 inclusive and AL14.	AL7, AL8, AL9 and AL14
MP4 Ljuboten	The position representative of the residential houses next to MP4 and other neighbouring noise-sensitive receptors at AL10. The data collected at this position provides the basis criteria for the assessing operational noise at locations AL10, AL11 and AL13.	AL10, AL11 and AL13
MP5 Shashavarlija	The position is representative of the residential house next to MP5 and other neighbouring noise-sensitive receptors at AL1. The data collected at this position provides the basis criteria for the assessing operational noise at locations AL1 to AL4 inclusive and AL12.	AL1, AL2, AL3, AL4 and AL12

Source: Mott MacDonald

Weather station masts fitted with instruments to monitor the wind speed (anemometer), wind direction (wind vane), temperature, humidity and air pressure (barometer) were erected by the Project for the wind monitoring campaign at four positions near the proposed locations of the WTGs. Meteorological parameters are monitored with weather station masts continuously every 10 minutes and logged using a wireless datalogger. The multiple assessment locations identified in Table 12.7 were within 1,500m of the positions of the weather station masts. The masts are also positioned close to the highest elevation points near the local assessment locations in order to monitor the highest wind speeds near the proposed WTG. Table 12.11 describes the meteorological data that has been obtained by the Project and provided to inform the noise assessment.

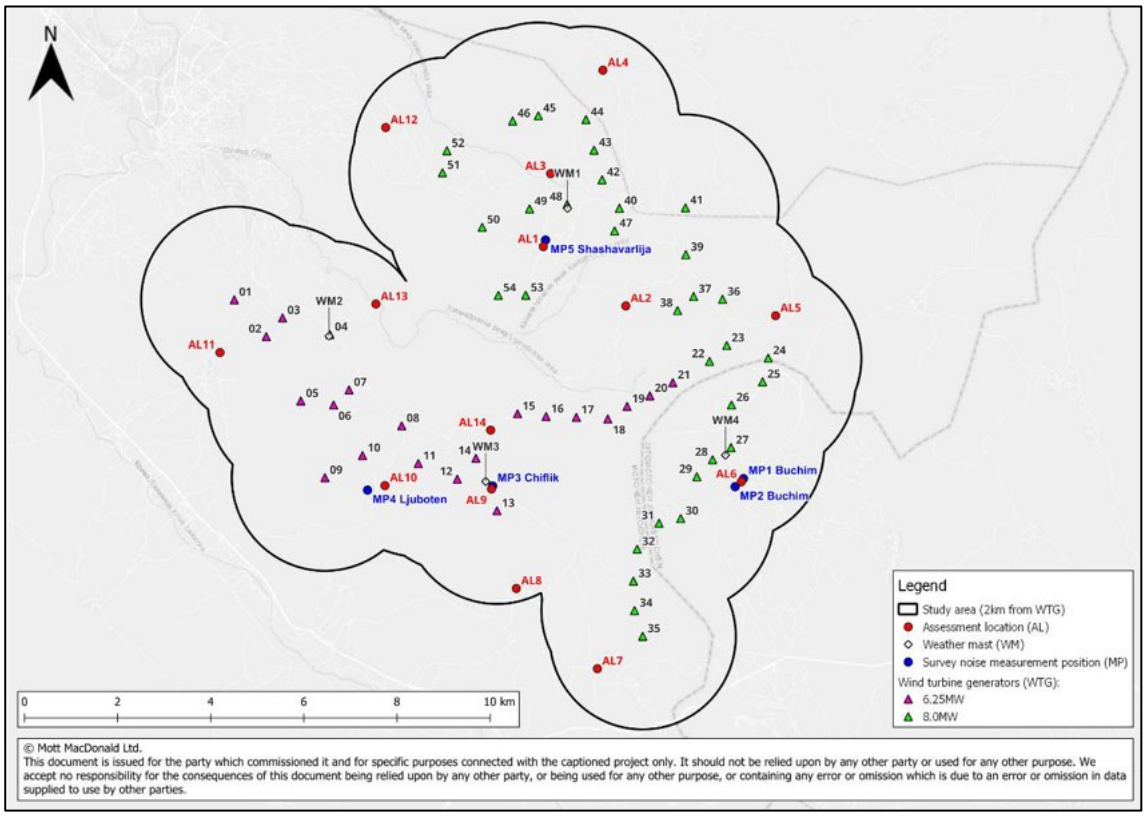
Table 12.11 Baseline survey timeline at the weather station mast positions

Position label	Measurement type	Start date	End date	Duration
WM1	Continuous, unattended	06 September 2024	16 July 2025	~10 months
WM2	Continuous, unattended	25 August 2024	16 July 2025	~10 months
WM3	Continuous, unattended	09 December 2024	16 July 2025	~7 months
WM4	Continuous, unattended	07 August 2024	16 July 2025	~11 months

Source: Mott MacDonald

Map 12.3 shows the locations of the five noise measurement positions (labelled as MP) and the locations of the four weather station masts (labelled at WM) used during the baseline survey.

Map 12.3: Location of noise measurements and weather station masts in baseline survey



Source: Mott MacDonald

To assess the impact of the operational noise on the sensitive receptors, the baseline noise levels monitored at each measurement position are correlated with concurrent wind parameters measured at its nearest weather mast. The methodology for the analysis of data is the guidance issued by the UK Institute of Acoustics (IoA) Good Practice Guide (GPG)[13], which is referenced by the WBG Wind Energy Guidelines. Key aspects of the methodology are summarised below:

- Taking account of instantaneous wind shear effects so that standardised wind speeds at 10m height (v_{10}) that are used as a reference in the correlation with noise is proportional to hub height wind speed, which corresponds with the generation of turbine noise.
- Appropriate filtering of collected noise data:
  - Remove extraneous noise noting that the derivation of noise limits is required to be related to wind-generated noise in the environment. Filtering has been used to remove noise sources which are not typical of the environment can occur during the survey. The presence of noise sources which are not common to the representative measurement locations and neighbouring noise sensitive properties should be removed from the data, using a review of time histories and scatter plots.
  - Remove the dawn chorus which is seen as a marked increase in noise due to birds which can occur at sunrise. This has been found to be a significant source of noise for some measurement locations. If present, it is apparent in time histories of the measured levels. It is related to sunrise which will vary for time of year and location. Therefore, consideration needs to be given to when this may occur for the noise survey data under analysis and removed where appropriate, typically between 03:30 and 05:30.

[13] Institute of Acoustics (2013). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise.

– Divide the data into daytime and night-time periods as defined by the national noise standards as 07:00 to 23:00 and 23:00 to 07:00, respectively.

The wind speeds at the turbine hub height (121m) have been determined using Method B (Calculations from other heights) in the Institute of Acoustics Good Practice Guide, in which measurements are taken from anemometers at two different heights below the hub height. The upper anemometer is at a height of 97.4m, and the lower anemometer is at height of 47.2m. These anemometer heights satisfy the two conditions in Method B: (1) the upper anemometer is at a height not less than 60% of the hub height of the proposed turbine, and (2) the lower anemometer is at least 15m below the upper anemometer. The following two relationships have been used to extrapolate the wind speed at hub height (v_{hh}) from the measured wind speed readings:

$$v_{hh} = v_1 \left(\frac{hh}{h_1}\right)^m \qquad \text{Equation 1}$$

$$m = \ln\left(\frac{v_2}{v_1}\right) / \ln\left(\frac{h_2}{h_1}\right) \qquad \text{Equation 2}$$

where the parameters are defined as:

- hh is the hub height (m);
- v_{hh} is the hub height wind speed (m/s);
- v_1 and v_2 are the wind speeds (m/s) at the (1) lower and (2) upper anemometers;
- h_1 and h_2 are the heights (m) of the (1) lower and (2) upper anemometers; and,
- m is the wind shear exponent.

Note that when the wind speed at the lower anemometer (v_1) is higher than the upper anemometer (v_2), the wind shear exponent (m) is assumed to be zero (to avoid a negative wind shear value).

The extrapolated wind speeds at hub height are then corrected to the standardised 10m-height wind speeds used in the operational noise assessment by using the following relationship:

$$v_{10} = v_{hh}\left[\ln\left(\frac{10}{z_0}\right) / \ln\left(\frac{hh}{z_0}\right)\right] \qquad \text{Equation 3}$$

where the parameters are defined as:

- v_{10} is the standardised 10m-height wind speed (m/s); and,
- z_0 is the standard ground roughness length of 0.05m.

The filtered data points, with each noise level $L_{Aeq,T}$ corresponding to a standardised 10m-height particular wind speed v_{10}, are plotted on a scatter plot. The $L_{Aeq,T}$ is plotted on the vertical axis, while the v_{10} is plotted on the horizontal axis. From this scatter plot, the baseline noise characteristics for the daytime and night-time periods are derived by evaluating a polynomial of best fit that closely matches the trend of the filtered data points. The baseline noise characteristics are compared against the predicted noise levels at each assessment location, following the methodology presented in ETSU-R-97, to evaluate the impact of operational noise.

12.3.8 Limitations and assumptions

12.3.8.1 Construction phase

Construction noise is inherently variable in nature and strongly dependent on the proximity and duration of noise sources relative to receptors, and the simultaneous use of multiple items of

equipment. It is not possible to accurately predict the distribution of equipment and the utilisation. Consequently, the assessment of construction noise impacts is based on an assumed usage of equipment based on the most recent plant inventory and site layout.

12.3.8.2 Operational phase

For a worse-case scenario, it has been assumed that the operational noise propagates in a downwind direction from the hub of each WTG (source) to an assessment location (receiver). The following series of industry standard assumptions have been made in the generation of the three-dimensional acoustic model to predict the operational noise propagation:

- The calculations apply the procedures of the ISO 9613-2:2024[14] standard implemented within DataKustik CadnaA software version 2025;
- Barrier attenuation due to screening by elevated ground is restricted to no more than 3 dB following the methodology in ISO 9613-2:2024 Appendix D.3;
- Ground correction due to concave ground profiles has been accounted following the methodology in ISO 9613-2:2024 Appendix D.5;
- Ground absorption G=0.5 is applied in general for the surrounding ground conditions;
- Ground effects and shielding effects are based on downwind sound propagation between a source and receiver;
- Air temperature and humidity have been assumed to be 10°C and 70%, respectively, which are considered typical annual average weather conditions for the area under consideration, based on ISO 9613-1:1993[15];
- Land topography data with an elevation resolution of 25m from has been incorporated in the noise model; and,
- All receptor points have been set at a standard height of 4.0m above local ground levels to calculate representative noise levels at sensitive receptors.

Table 12.12 presents the three different operating modes (N01, N02 and N03) of the proposed 6.25MW and 8.0MW WTGs from the manufacturer's technical specifications. The table also presents the maximum sound power level of each turbine at the different operating modes and the standardised wind speeds at which this maximum sound power level occurs. A factor of 2 dB(A) has been added to the sound power levels presented in Table 12.12 to account for calculation uncertainty when predicting the operational noise propagation in the acoustic model. This is consistent with the guidance provided for design uncertainty in Sections 4.2 and 4.3 of the IoA GPG for the assessment and rating of wind turbine noise.

Table 12.12: Maximum sound power level of the proposed WTGs

WTG technical specification reference	Phase	Operating mode	Maximum sound power level L_{wA} [dB]	Standardised wind speed, v_{10} [m/s]
182-6.25MW WTG	1	N01 - Standard rated power (6.25MW) and standard blade configuration	114.0	≥7
		N02 - Standard rated power (6.25MW) and serrated blade configuration	112.5	≥7

[14] International Organization of Standardisation (2024), ISO 9613-2:2024 Acoustics – Attenuation of sound during propagation outdoors, Part 2: Engineering method for the prediction of sound pressure levels outdoors.

[15] International Organization of Standardisation (1993), ISO 9613-1:1993 Acoustics – Calculation of the absorption of sound by the atmosphere.

WTG technical specification reference	Phase	Operating mode	Maximum sound power level L_{wA} [dB]	Standardised wind speed, v_{10} [m/s]
		N03 - Reduced rated power (6.0MW) and serrated blade configuration	110.9	≥7
EN 182-8.0MW WTG	2 and/or 3	N01 - Standard rated power (8.0MW) and standard blade configuration	114.2	≥7
		N02 - Standard rated power (8.0MW) and serrated blade configuration	112.7	≥7
		N03 - Reduced rated power (7.458MW) and serrated blade configuration	111.7	≥7

Source: Provided by the Alcazar Energy Partners based on manufacturer documentation

Table 12.13 presents the unweighted sound power spectra of the proposed 6.25MW and 8.0MW WTGs when operating at a standardised wind speed of 7m/s or higher. Similar sound power spectra are available in the manufacturer's technical specifications when the WTG is operating at lower standardised wind speeds between 2m/s and 7m/s.

Table 12.13: Maximum sound power spectra of the proposed WTGs

WTG technical specification reference	Maximum sound power level [dB L_{wA}]	Unweighted octave band sound power spectrum [dB L_{wZ}]							
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
182-6.25MW WTG. Mode N01.	114.0	118.3	115.1	116.7	116.8	112.8	107.5	102.2	95.0
182-6.25MW WTG. Mode N02.	112.5	116.8	113.6	115.2	115.3	111.3	106.0	100.7	93.5
182-6.25MW WTG. Mode N03.	110.9	115.2	112.1	113.7	113.8	109.8	104.5	99.2	92.0
182-8.0MW WTG. Mode N01.	114.2	118.5	115.4	116.9	117.0	113.1	107.8	102.5	95.3
182-8.0MW WTG. Mode N02.	112.7	117.0	113.9	115.4	115.5	111.6	106.3	101.0	93.8
182-8.0MW WTG. Mode N03	111.7	116.0	112.9	114.4	114.5	110.6	105.3	100.0	92.8

Source: As provided by the Client based on manufacturer documentation

12.4 Baseline

12.4.1 Outline

The noise level measurements have been made in the outdoor area of the selected noise-sensitive receptors. All the measurements were unattended, and acoustic parameters were acquired over contiguous 10-minute intervals. At each position, the measurements lasted two weeks to obtain noise levels under conditions that covered a sufficient range of wind speeds.

An expert team, competent in undertaking environmental noise monitoring, conducted noise level measurements over two weeks from 30 May 2025 to 16 June 2025 at three measurement points: 2 measurement points in the village of Buchim (MP1 and MP2) and one measurement point in village of Chiflik (MP3). From 16 June 2025 to 01 July 2025, the same team conducted noise level measurements at the other two measurement locations: one location in the village of

Ljuboten (MP4) and the other in the village of Shashavarlija (MP5). Table 12.14 provides a summary of the five different baseline noise monitoring locations.

The noise measurements were performed at a height of 1.5m above ground level at nearby noise-sensitive receptors and on most exposed façade of buildings at a distance of at least 3m (free-field noise measurement) from the building's walls and other reflective surfaces.

Table 12.14 Baseline survey timeline at the noise measurement positions

Position label	Measurement type	Start date and time	End date and time	Duration
MP1 Buchim	Continuous, unattended	Friday, 30 May 18:50	Monday, 16 June 10:00	Two weeks
MP2 Buchim	Continuous, unattended	Friday, 30 May 18:00	Monday, 16 June 08:30	Two weeks
MP3 Chiflik	Continuous, unattended	Friday, 30 May 19:50	Monday, 16 June 09:30	Two weeks
MP4 Ljuboten	Continuous, unattended	Monday, 16 June 10:50	Tuesday, 01 July 09:50	Two weeks
MP5 Shashavarlija	Continuous, unattended	Monday, 16 June 14:10	Tuesday, 01 July 10:50	Two weeks

Source: Mott MacDonald

12.4.2 Equipment

The inventory of the noise measurement equipment used in the survey is shown in Table 12.15.

Table 12.15 Noise measurement equipment details

Item	Make and model	Serial Number	Calibration due date
Field calibrator	Circus Research 515	50876	11 October 2025
Sound level meter (SLM) 1	Circus Research 171B	G056722	29 February 2026
SLM 2	Circus Research 171C	G068799	11 October 2026
SLM 3	01dB Fusion	11687	15 May 2027

Source: Goce Delcev University of Stip (2025), Environmental noise measurement report (baseline noise survey)

The sound level meters (SLM) used in the acoustic survey were configured to record the A-weighted equivalent continuous sound level (dB $L_{Aeq,10\ minutes}$), the A-weighted maximum sound level (dB $L_{A(max)F,10\ minutes}$), and statistical sound level indicators, such as the background sound level (dB $L_{A90,10\ minutes}$) and the sound level exceeded for 10% of the sampling period (dB $L_{A10,10\ minutes}$), which is commonly used to describe road traffic noise.

Inevitably, there is a degree of variation in measured noise levels. Contributory factors to this variation include tolerances in instrumentation readings, and the inherent difference in the acoustic environment during the course of the day and indeed over longer time periods, as the noise sources influencing a given location can vary. The following efforts were made to minimise the uncertainty in the reported measurements:

- All measurements were undertaken by a suitably qualified acoustician in environmental noise monitoring and completed in accordance with the principles of ISO 1996-2:2017[16]
- All sound level meters/measurement systems used during the acoustic survey were designed to be in conformance with IEC 61672-1:2013 to the requirements of the Class 1 standard
- All field calibrators used acoustic survey were designed to be in conformance with the IEC 60942:2017[17] to the requirements of the Class 1 standard

[16] International Organization for Standardization (2017), ISO 1996-2:2017 Acoustics – Description, measurement and assessment of environmental noise. Part 2: Determination of sound pressure levels.

[17] International Electrotechnical Commission (2017), IEC 60942:2017 Electroacoustics - Sound calibrators.

- All meters and field calibrators used held current calibration certificates obtained under laboratory conditions traceable to International Standards
- Analysing the data to notice trends and anomalies, ensuring the data is representative of the location

Before and after the measurement session, the reference calibration level of the sound level meter was checked using a field calibrator. The calibration drift over any given measurement period was no greater than 0.5 dB, so no significant changes were noted.

12.4.3 Site conditions and discussion of baseline noise results

The following sections provide a summary of the observed site conditions and discuss the derived baseline noise characteristic curves at each noise measurement position.

12.4.3.1 Position MP1 Buchim (41°40'18.29"N, 22°20'19.52"E)

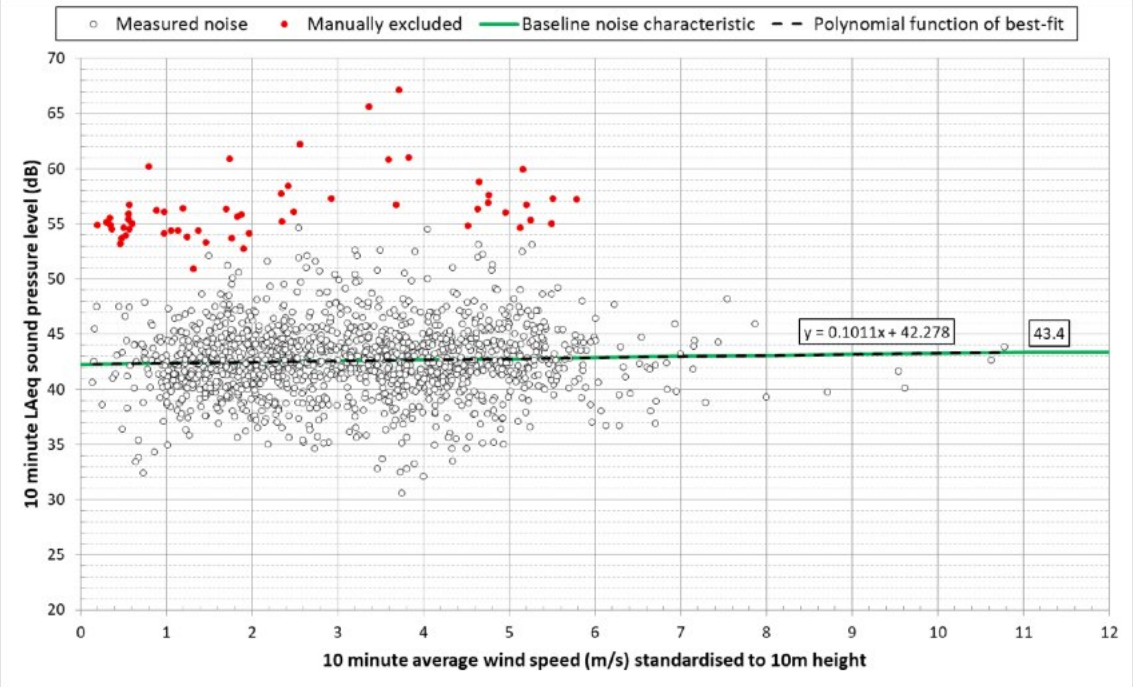
Position MP1 Buchim was selected for long-term unattended noise monitoring over a period of two and a half weeks in the village of Buchim. The position is representative of a residential receptor. Photo 12.1shows photographs of position MP1 Buchim. The dominant noise sources at the site were identified as nature sounds, such as vegetation rustling in the wind and birdsong. The weather conditions during the measurement period (30 May 2025 to 16 June 2025) were mostly sunny, dry and without rainfall.

Photo 12.1: MP1 Buchim baseline noise measurement position

Source: Goce Delcev University of Stip / Mott MacDonald

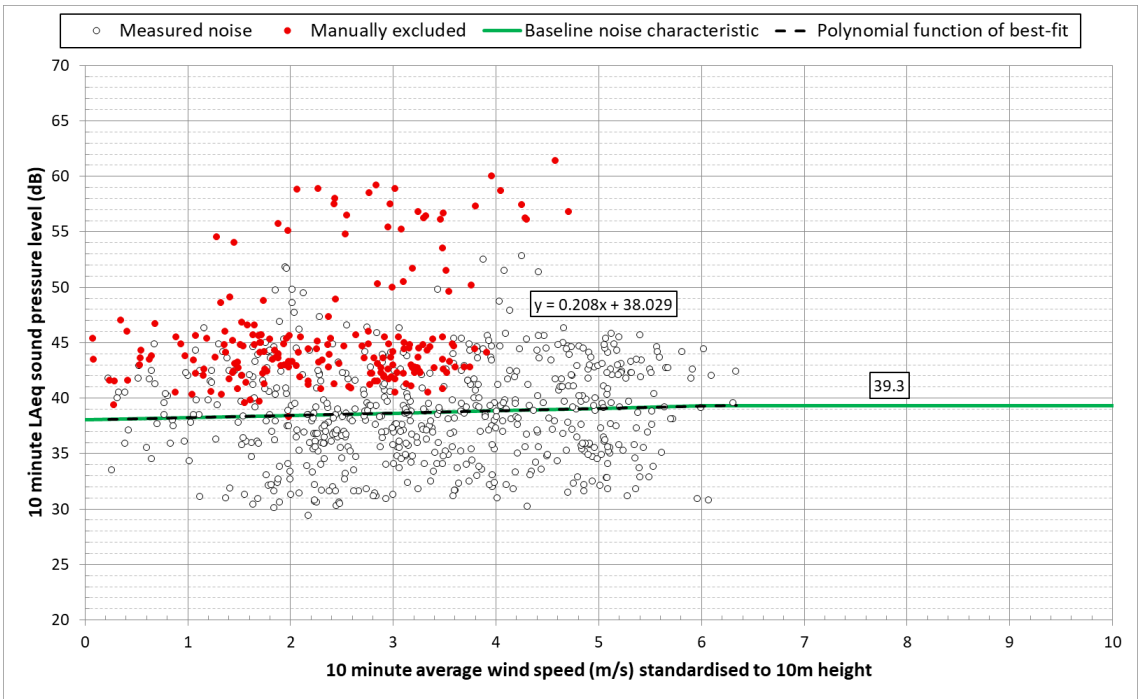
Figure 12.1 and Figure 12.2 present scatter plots of the measured filtered 10-minute noise levels (dB $L_{Aeq,10min}$) during the daytime and night-time periods, respectively, against the contiguous 10-minute averaged wind speeds (v_{10} m/s) at the standardised height of 10m.

Figure 12.1: Scatter plot of the contiguous 10-minute noise levels and standardised wind speeds, with the derived baseline noise characteristic in the daytime – MP1 Buchim



Source: Mott MacDonald

Figure 12.2: Scatter plot of the contiguous 10-minute noise levels and standardised wind speeds, with the derived baseline noise characteristic in the night-time – MP1 Buchim



Source: Mott MacDonald

The scatter plots have been used to derive the baseline characteristics for the day and night-time periods, which represent a 'polynomial function of best-fit' through the filtered measured data. Lower and upper bounds have been applied where appropriate to the baseline

characteristics based on the wind speed range and local minimum of the polynomial function. The derived baseline characteristics are described as follows:

- Daytime baseline noise characteristic:

  $L_{Aeq,10min}$ dB = [0.1011 x v_{10}] + 42.2780 for $1.0 \leq v_{10} < 11.0$

  $L_{Aeq,10min}$ dB = 43.4 for $v_{10} \geq 11.0$

- Night-time baseline noise characteristic:

  $L_{Aeq,10min}$ dB = [0.2080 x v_{10}] + 38.0290 for $1.0 \leq v_{10} < 6.0$

  $L_{Aeq,10min}$ dB = 39.3 for $v_{10} \geq 6.0$

Table 12.16 presents the reference baseline noise levels derived using the characteristics for day and night periods as a function of standardised wind speed.

Table 12.16: Derived baseline noise characteristics for daytime and night-time as a function of standardised wind speed – MP1 Buchim

Standardised average wind speed v_{10} [m/s]	3	4	5	6	7	8	9	10	11	12	13	14	15
Daytime $L_{Aeq,10min}$ [dB]	42.6	42.7	42.8	42.9	43.0	43.1	43.2	43.3	43.4	43.4	43.4	43.4	43.4
Night-time $L_{Aeq,10min}$ [dB]	38.7	38.9	39.1	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3

Source: Mott MacDonald

At standardised wind speeds between 3m/s and 15m/s, the daytime and night-time baseline noise characteristics in Table 12.16 are more than 3 dB(A) below the respective ambient noise level limits for areas with second-degree protection in OG of RM no. 147/2008 (see Table 12.1). Therefore, under the IFC General EHS Guidelines, the operational noise levels generated by the proposed WTGs at AL5 and AL6 should not exceed the daytime and night-time noise level limits for second-degree protection presented in OG of RM no. 147/2008.

12.4.3.2 Position MP2 Buchim (41°40'12.72"N, 22°20'11.58"E)

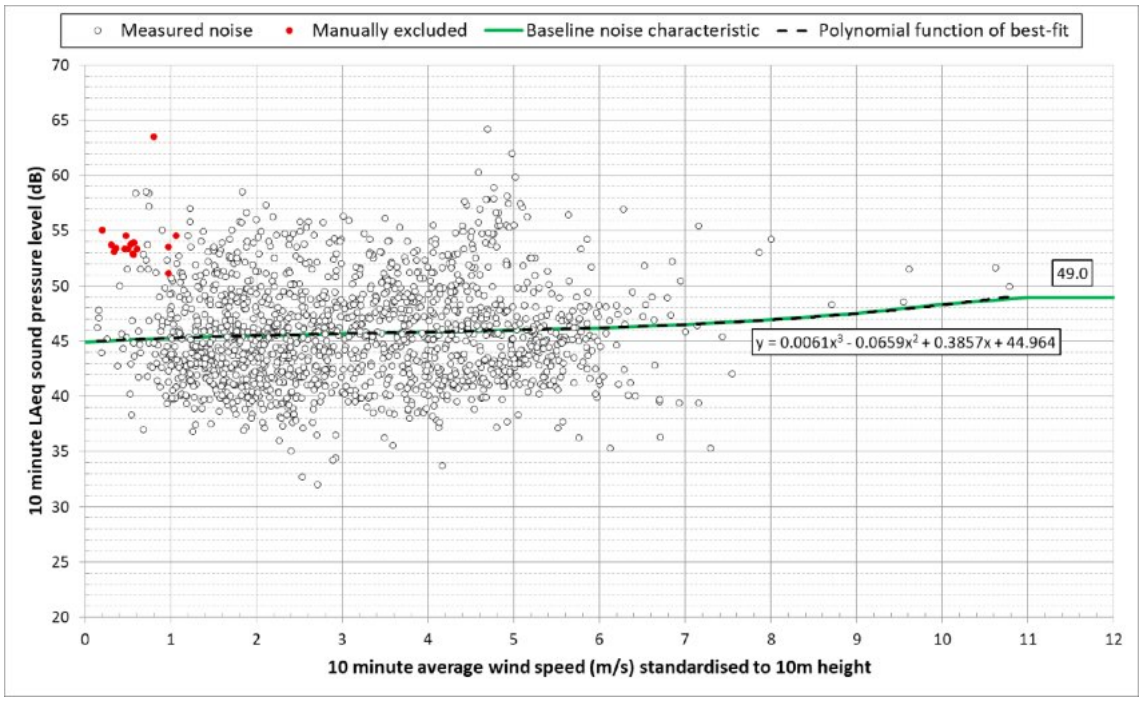
Position MP2 Buchim was selected for long-term unattended noise monitoring over a period of two and a half weeks in the village of Buchim. The position is representative of a residential receptor. Photo 12.2 shows photographs of position MP2 Buchim. The dominant noise sources at the site were identified as nature sounds, such as vegetation rustling in the wind and birdsong. The weather conditions during the measurement period (30 May 2025 to 16 June 2025) were mostly sunny, dry and without rainfall.

Photo 12.2: MP2 Buchim baseline noise measurement position

Source: Goce Delcev University of Stip / Mott MacDonald

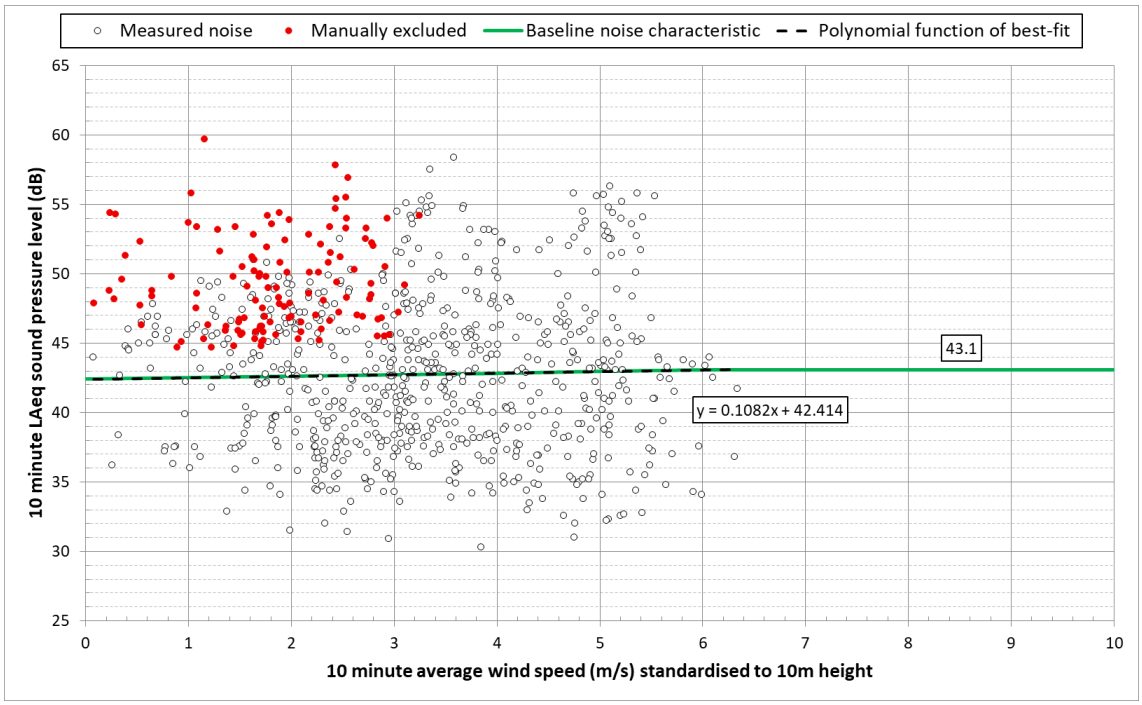
Figure 12.3 and Figure 12.4 present scatter plots of the measured filtered 10-minute noise levels (dB $L_{Aeq,10min}$) during the daytime and night-time periods, respectively, against the concurrent 10-minute averaged wind speeds (v_{10} m/s) at the standardised height of 10m.

Figure 12.3: Scatter plot of the contiguous 10-minute noise levels and standardised wind speeds, with the derived baseline noise characteristic in the daytime – MP2 Buchim



Source: Mott MacDonald

Figure 12.4: Scatter plot of the contiguous 10-minute noise levels and standardised wind speeds, with the derived baseline noise characteristic in the night-time – MP2 Buchim



Source: Mott MacDonald

The scatter plots have been used to derive the baseline characteristics for the day and night-time periods, which represent a 'polynomial function of best-fit' through the filtered measured data. Lower and upper bounds have been applied where appropriate to the baseline characteristics based on the wind speed range and local minimum of the polynomial function. The derived baseline characteristics are described as follows:

- Daytime baseline noise characteristic:

  $L_{Aeq,10min}$ dB = [0.0061 x $(v_{10})^3$] + [−0.0659 x $(v_{10})^2$] + [0.3857 x v_{10}] + 44.9640 for $1.0 \leq v_{10} < 11.0$

  $L_{Aeq,10min}$ dB = 49.0 for $v_{10} \geq 11$

- Night-time baseline noise characteristic:

  $L_{Aeq,10min}$ dB = [0.1082 x v_{10}] + 42.4140 for $1.0 \leq v_{10} < 6.0$

  $L_{Aeq,10min}$ dB = 43.1 for $v_{10} \geq 6.0$

Table 12.17 presents the reference baseline noise levels derived using the characteristics for day and night periods as a function of standardised wind speed.

Table 12.17: Derived baseline noise characteristics for daytime and night-time as a function of standardised wind speed – MP2 Buchim

Standardised average wind speed v_{10} (m/s)	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Daytime $L_{Aeq,10min}$ [dB]	45.7	45.8	46.0	46.2	46.5	47.0	47.5	48.3	49.0	49.0	49.0	49.0	49.0

Standardised average wind speed v_{10} (m/s)	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Night-time $L_{Aeq,10min}$ [dB]	42.7	42.8	43.0	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1

Source: Mott MacDonald

At standardised wind speeds between 3m/s and 15m/s, the daytime baseline noise characteristic in Table 12.17 is more than 3 dB(A) below the respective ambient noise level limits for areas with second-degree protection in OG of RM no. 147/2008 (see Table 12.1). Similarly, the night-time baseline noise characteristic in Table 12.17 is less than the night-time noise limits for second- and third-degree protection. Therefore, under the IFC General EHS Guidelines, the operational noise levels generated by the proposed WTGs at AL5 and AL6 should not exceed the daytime and night-time noise level limits for second-degree protection presented in OG of RM no. 147/2008.

12.4.3.3 Position MP3 Chiflik (41°40'15.77"N, 22°16'26.44"E)

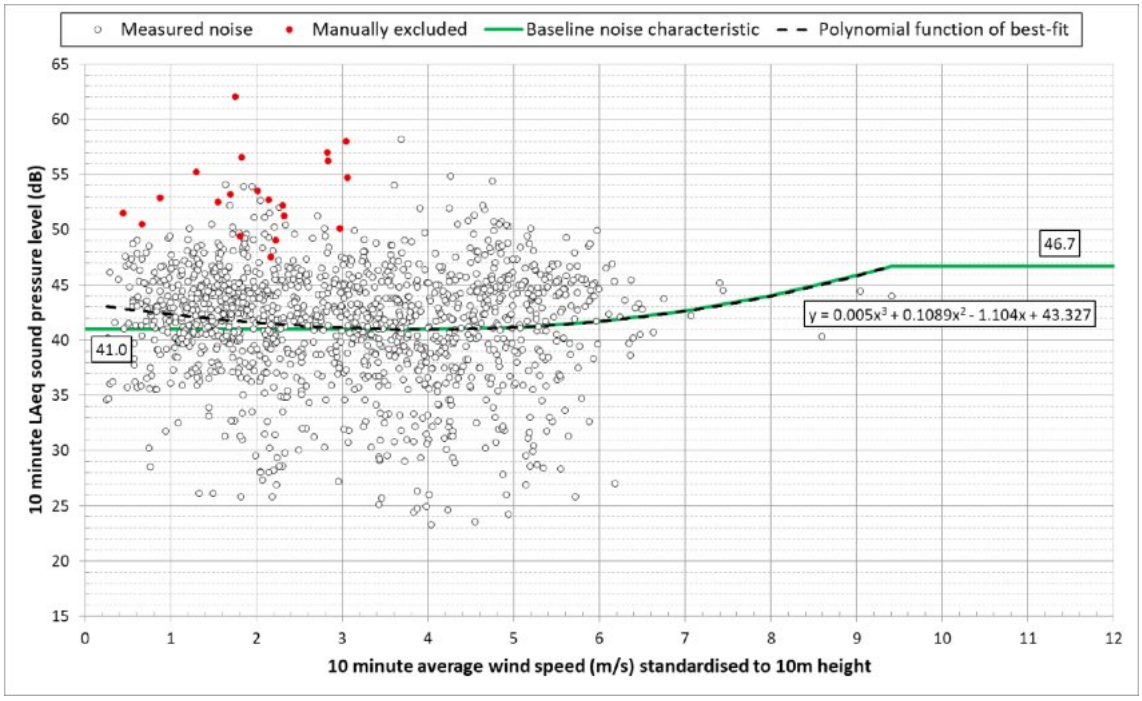
Position MP3 Chiflik was selected for long-term unattended noise monitoring over a period of two and a half weeks in the village of Chiflik. The position is representative of a former residential receptor, which is now abandoned. Photo 12.3 shows photographs of position MP3 Chiflik. The dominant noise sources at the site were identified as nature sounds, such as vegetation rustling in the wind and birdsong. The weather conditions during the measurement period (30 May 2025 to 16 June 2025) were mostly sunny, dry and without rainfall.

Photo 12.3: MP3 Chiflik baseline noise measurement position

Source: Goce Delcev University of Stip / Mott MacDonald

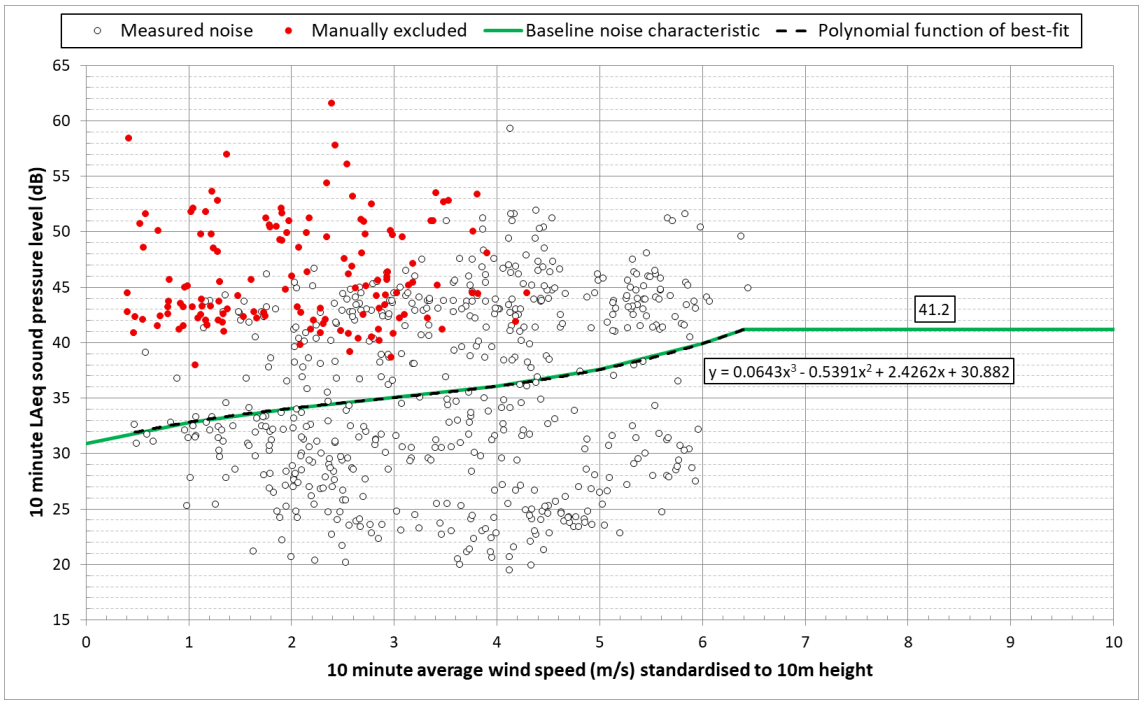
Figure 12.5 and Figure 12.6 present scatter plots of the measured filtered 10-minute noise levels (dB $L_{Aeq,10min}$) during the daytime and night-time periods, respectively, against the concurrent 10-minute averaged wind speeds (v_{10} m/s) at the standardised height of 10m.

Figure 12.5: Scatter plot of the contiguous 10-minute noise levels, standardised wind speeds and derived baseline noise characteristic in the daytime – MP3 Chiflik



Source: Mott MacDonald

Figure 12.6: Scatter plot of the contiguous 10-minute noise levels, standardised wind speeds and derived baseline noise characteristic in the night-time – MP3 Chiflik



Source: Mott MacDonald

The scatter plots have been used to derive the baseline characteristics for the day and night-time periods, which represent a 'polynomial function of best-fit' through the filtered measured data. Lower and upper bounds have been applied where appropriate to the baseline

characteristics based on the wind speed range and local minimum of the polynomial function. The derived baseline characteristics are described as follows:

- Daytime baseline noise characteristic:

$L_{Aeq,10min}$ dB = 41.0 for $1.0 \leq v_{10} < 4.0$

$L_{Aeq,10min}$ dB = [−0.0050 x $(v_{10})^3$] + [0.1089 x $(v_{10})^2$] + [−1.1040 x v_{10}] + 43.327 for $4.0 \leq v_{10} < 9.4$

$L_{Aeq,10min}$ dB = 46.7 for $v_{10} \geq 9.4$

- Night-time baseline noise characteristic:

$L_{Aeq,10min}$ dB = [0.0643 x $(v_{10})^3$] + [−0.5391 x $(v_{10})^2$] + [2.4262 x v_{10}] + 30.8820 for $1.0 \leq v_{10} < 6.4$

$L_{Aeq,10min}$ dB = 41.2 for $v_{10} \geq 6.4$

Table 12.18 presents the reference baseline noise levels derived using the characteristics for day and night periods as a function of standardised wind speed.

Table 12.18: Derived baseline noise characteristics for daytime and night-time as a function of standardised wind speed – MP3 Chiflik

Standardised average wind speed v_{10} (m/s)	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Daytime $L_{Aeq,10min}$ [dB]	41.0	41.0	41.2	41.7	42.7	44.0	45.9	46.7	46.7	46.7	46.7	46.7	46.7
Night-time $L_{Aeq,10min}$ [dB]	35.0	36.1	37.6	39.9	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2

Source: Mott MacDonald

At standardised wind speeds between 3m/s and 15m/s, the daytime and night-time baseline noise characteristics in Table 12.18 are more than 3 dB(A) below the respective ambient noise level limits for areas with second- and third-degree protection in OG of RM no. 147/2008 (see Table 12.1). Therefore, under the IFC General EHS Guidelines, the operational noise levels generated by the proposed WTGs at AL7, AL8 and AL9 should not exceed the daytime and night-time noise level limits for second-degree protection presented in OG of RM no. 147/2008. Similarly, the operational noise levels at AL14 should not exceed the daytime and night-time noise level limits for third-degree protection presented in OG of RM no. 147/2008.

12.4.3.4 Position MP4 Ljuboten (41°40'14.20"N, 22°14'30.22"E)

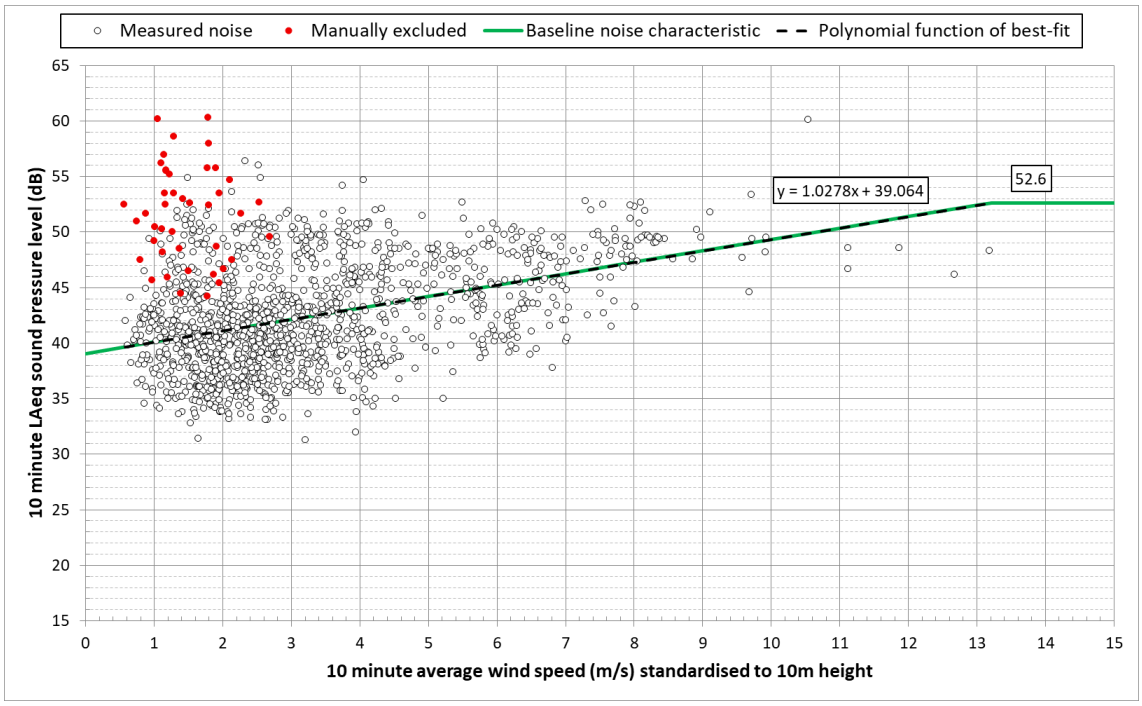
Position MP4 Ljuboten was selected for long-term unattended noise monitoring over a period of two weeks in the village of Ljuboten. The position is representative of a residential receptor. Photo 12.4 shows photographs of position MP4 Ljuboten. The dominant noise sources at the site were identified as nature sounds, such as vegetation rustling in the wind and birdsong. There was also some distant road traffic noise from vehicles using the main asphalt road running through Ljuboten. The weather conditions during the measurement period (16 June 2025 to 01 July 2025) were mostly sunny, dry and without rainfall.

Photo 12.4: MP4 Ljuboten baseline noise measurement position

Source: Goce Delcev University of Stip / Mott MacDonald

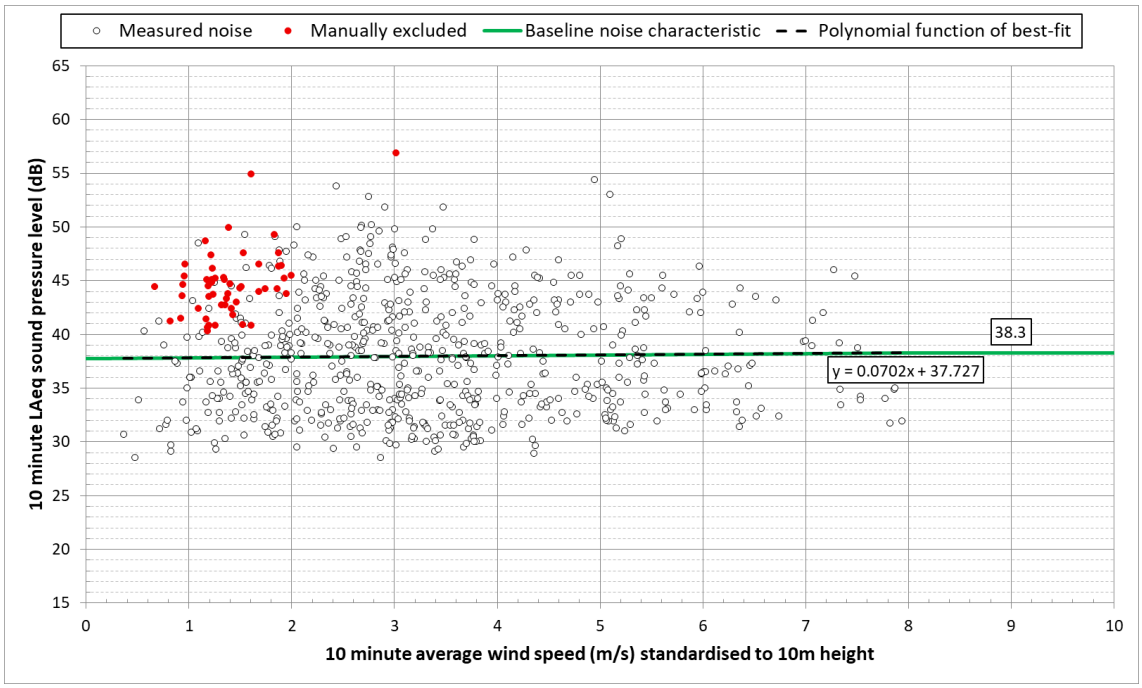
Figure 12.7 and Figure 12.8 present scatter plots of the measured filtered 10-minute noise levels (dB $L_{Aeq,10min}$) during the daytime and night-time periods, respectively, against the concurrent 10-minute averaged wind speeds (v_{10} m/s) at the standardised height of 10m.

Figure 12.7: Scatter plot of the contiguous 10-minute noise levels, standardised wind speeds and derived baseline noise characteristic in the daytime – MP4 Ljuboten



Source: Mott MacDonald

Figure 12.8: Scatter plot of the contiguous 10-minute noise levels, standardised wind speeds and derived baseline noise characteristic in the night-time – MP4 Ljuboten



Source: Mott MacDonald

The scatter plots have been used to derive the baseline characteristics for the day and night-time periods, which represent a 'polynomial function of best-fit' through the filtered measured data. Lower and upper bounds have been applied where appropriate to the baseline characteristics based on the wind speed range and local minimum of the polynomial function. The derived baseline characteristics are described as follows:

- Daytime baseline noise characteristic:

  $L_{Aeq,10min}$ dB = [1.0278 x v_{10}] + 39.0640 for $1.0 \leq v_{10} < 13.2$

  $L_{Aeq,10min}$ dB = 52.6 for $v_{10} \geq 13.2$

- Night-time baseline noise characteristic:

  $L_{Aeq,10min}$ dB = [0.0702 x v_{10}] + 37.7270 for $1.0 \leq v_{10} < 7.9$

  $L_{Aeq,10min}$ dB = 38.3 for $v_{10} \geq 7.9$

Table 12.19 presents the reference baseline noise levels derived using the characteristics for day and night periods as a function of standardised wind speed.

Table 12.19: Derived baseline noise characteristics for daytime and night-time as a function of standardised wind speed – MP4 Ljuboten

Standardised average wind speed v_{10} (m/s)	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Daytime $L_{Aeq,10min}$ [dB]	42.1	43.2	44.2	45.2	46.3	47.3	48.3	49.3	50.4	51.4	52.4	52.6	52.6
Night-time $L_{Aeq,10min}$ [dB]	37.9	38.0	38.1	38.1	38.2	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3

Source: Mott MacDonald

At the standardised wind speeds between 3m/s and 15m/s, the daytime and night-time baseline noise characteristics in Table 12.19 are more than 3 dB(A) below the respective ambient noise level limits for areas with second-degree protection in OG of RM no. 147/2008 (see Table 12.1). Therefore, under the IFC General EHS Guidelines, the operational noise levels generated by the proposed WTGs at AL10, AL11 and AL13 should not be higher than the daytime and night-time noise level limits for second-degree protection presented in OG of RM no. 147/2008.

12.4.3.5 Position MP5 Shashavarlija (41°43'6.33"N, 22°17'18.99"E)

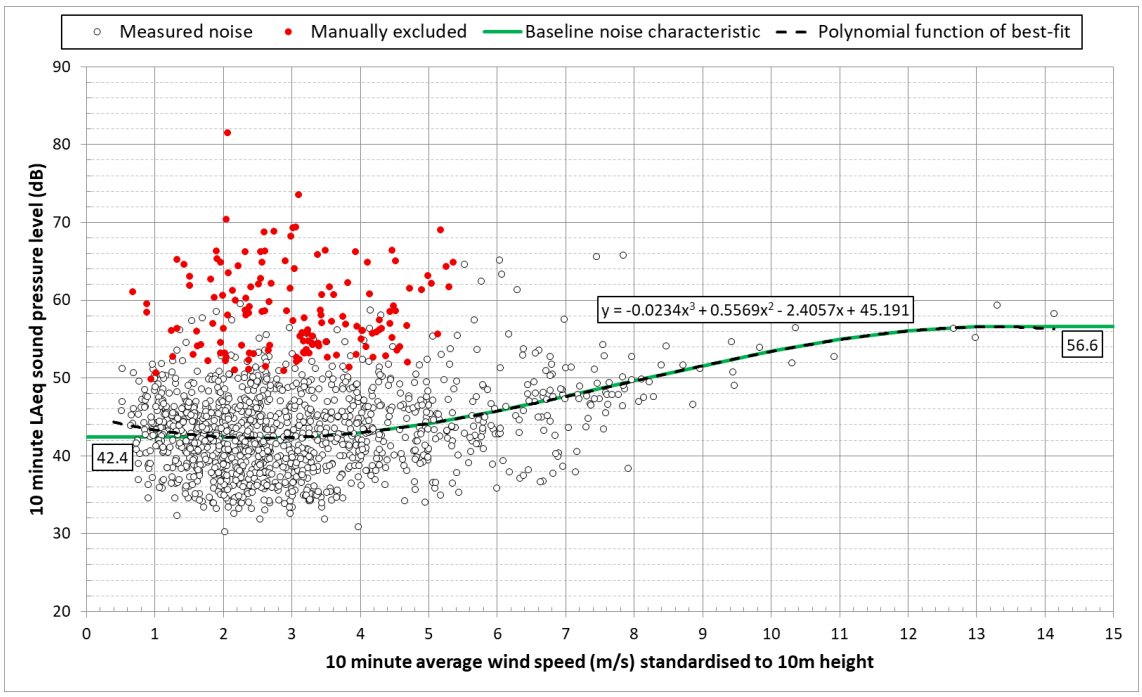
Position MP5 Shashavarlija was selected for long-term unattended noise monitoring over a period of two weeks in the village of Shashavarlija. The position is representative of a residential receptor. Photo 12.5 shows photographs of position MP5 Shashavarlija. The dominant noise sources at the site were identified as nature sounds, such as vegetation rustling in the wind and birdsong. There was also some road traffic noise from vehicles using the main asphalt road running through Shashavarlija. The weather conditions during the measurement period (16 June 2025 to 01 July 2025) were mostly sunny, dry and without rainfall.

Photo 12.5: MP5 Shashavarlija baseline noise measurement position

Source: Goce Delcev University of Stip / Mott MacDonald

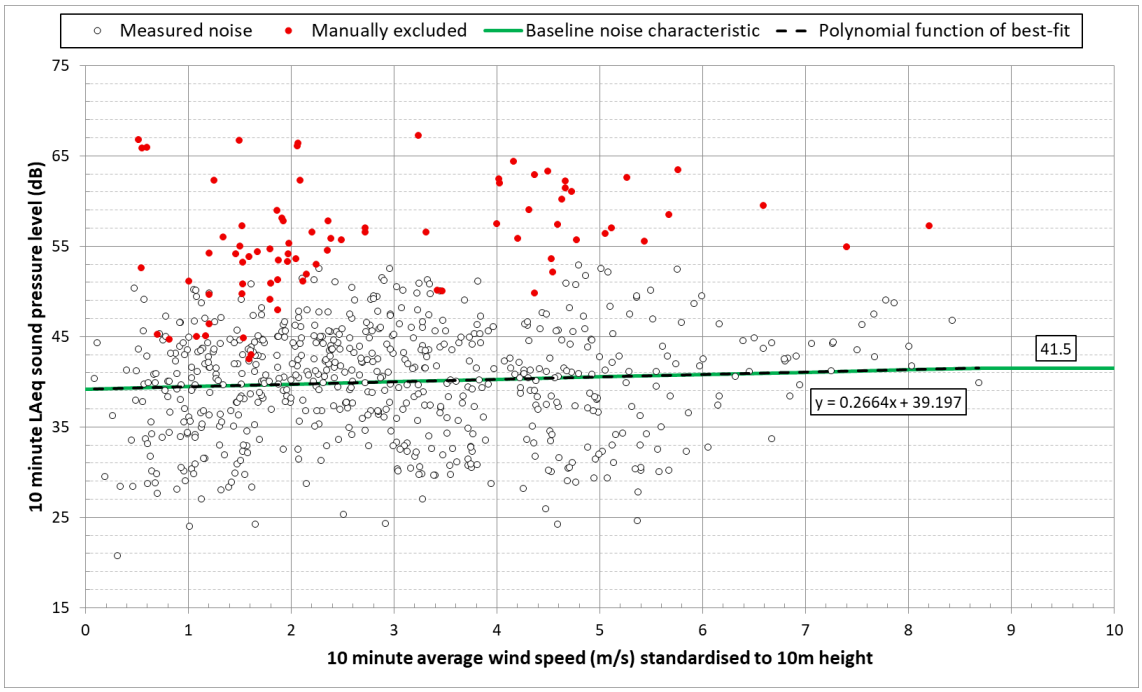
Figure 12.9 and Figure 12.10 present scatter plots of the measured filtered 10-minute noise levels (dB $L_{Aeq,10min}$) during the daytime and night-time periods, respectively, against the concurrent 10-minute averaged wind speeds (v_{10} m/s) at the standardised height of 10m.

Figure 12.9: Scatter plot of the contiguous 10-minute noise levels, standardised wind speeds and derived baseline noise characteristic in the daytime – MP5 Shashavarlija



Source: Mott MacDonald

Figure 12.10: Scatter plot of the contiguous 10-minute noise levels, standardised wind speeds and derived baseline noise characteristic in the night-time – MP5 Shashavarlija



Source: Mott MacDonald

The scatter plots have been used to derive the baseline characteristics for the day and night-time periods, which represent a 'polynomial function of best-fit' through the filtered measured data. Lower and upper bounds have been applied where appropriate to the baseline

characteristics based on the wind speed range and local minimum of the polynomial function. The derived baseline characteristics are described as follows:

- Daytime baseline noise characteristic:

$L_{Aeq,10min}$ dB = 42.4 for $1.0 \leq v_{10} < 3.0$

$L_{Aeq,10min}$ dB = [−0.0234 x $(v_{10})^3$] + [0.5569 x $(v_{10})^2$] + [−2.4057 x v_{10}] + 45.1910 for $3.0 \leq v_{10} < 13.0$

$L_{Aeq,10min}$ dB = 56.6 for $v_{10} \geq 13.0$

- Night-time baseline noise characteristic:

$L_{Aeq,10min}$ dB = [0.2664 x v_{10}] + 39.1970 for $1.0 \leq v_{10} < 8.7$

$L_{Aeq,10min}$ dB = 41.5 for $v_{10} \geq 8.7$

Table 12.20 presents the reference baseline noise levels derived using the characteristics for day and night periods as a function of standardised wind speed.

Table 12.20: Derived baseline noise characteristics for daytime and night-time as a function of standardised wind speed – MP5 Shashavarlija

Standardised average wind speed v_{10} (m/s)	3	4	5	6	7	8	9	10	11	12	13	14	15
Daytime $L_{Aeq,10min}$ [dB]	42.4	43.0	44.2	45.8	47.6	49.6	51.6	53.4	55.0	56.1	56.6	56.6	56.6
Night-time $L_{Aeq,10min}$ [dB]	40.0	40.3	40.5	40.8	41.1	41.3	41.5	41.5	41.5	41.5	41.5	41.5	41.5

Source: Mott MacDonald

At standardised wind speeds between 3m/s and 9m/s, the daytime and night-time baseline noise characteristics in Table 12.20 are more than 3 dB(A) below the respective ambient noise level limits for areas with second- and third-degree protection in OG of RM no. 147/2008 (see Table 12.1). Therefore, under the IFC General EHS Guidelines, the operational noise levels generated by the proposed WTGs at AL1, AL2, AL3, AL4 and AL12 should not exceed the daytime and night-time noise level limits for second-degree protection presented in OG of RM no. 147/2008.

12.4.4 Annual average baseline noise level

The baseline noise characteristics for each of the five measurement positions are used to predict the annual average baseline noise level for the daytime and night-time periods. The annual average baseline noise level was predicted by averaging the respective baseline noise characteristic at each whole number interval of the v_{10} wind speed over the distribution of v_{10} wind speeds monitored at the four weather station masts. The annual average baseline noise levels are used in the assessment of operational phase impacts in Section 12.5.2.

Table 12.21 summarises the annual average baseline noise levels predicted during the daytime and night-time at the five measurements positions. Table 12.22 summarises the baseline noise levels used for the fourteen assessment locations (based on Table 12.10) and their corresponding noise criteria limit for the daytime and night-time. Note that, as Buchim has two baseline noise monitoring positions (MP1 and MP2), the lower of the two predicted baseline noise levels (at MP1) has been used to represent the baseline conditions at the assessment locations in Buchim (AL6) and Koshevo (AL5) because this a worst-case scenario for the assessment.

Table 12.21: Predicted annual average baseline noise level at measurement positions

Measurement position		Annual average baseline noise level [dB $L_{Aeq,10min}$]	
ID	**Name**	**Daytime (07:00-23:00)**	**Night-time (23:00-07:00)**
MP1	Buchim	42.7	38.8
MP2	Buchim	45.9	42.8
MP3	Chiflik	41.7	37.5
MP4	Ljuboten	44.2	38.0
MP5	Shashavarlija	45.8	40.3

Source: Mott MacDonald

Table 12.22: Summary of annual baseline noise levels and noise criteria limits at assessment locations

Assessment location		OG of RM no. 147/2008 noise limit [dB $L_{Aeq,T}$]			Annual average baseline noise level [dB $L_{Aeq,10min}$]*	
ID	**Name**	**Degree of protection**	**Daytime (07:00-23:00)**	**Night-time (23:00-07:00)**	**Daytime (07:00-23:00)**	**Night-time (23:00-07:00)**
AL1	Shashavarlija	Second	55	45	45.8 (MP5)	40.3 (MP5)
AL2	Kalapetrovci	Second	55	45	45.8 (MP5)	40.3 (MP5)
AL3	Nikoman	Second	55	45	45.8 (MP5)	40.3 (MP5)
AL4	Golem Gaber	Second	55	45	45.8 (MP5)	40.3 (MP5)
AL5	Koshevo	Second	55	45	42.7 (MP1)	38.8 (MP1)
AL6	Buchim	Second	55	45	42.7 (MP1)	38.8 (MP1)
AL7	Shopur	Second	55	45	41.7 (MP3)	37.5 (MP3)
AL8	Tanatarci	Second	55	45	41.7 (MP3)	37.5 (MP3)
AL9	Chiflik	Second	55	45	41.7 (MP3)	37.5 (MP3)
AL10	Ljuboten	Second	55	45	44.2 (MP4)	38.0 (MP4)
AL11	Dolani	Second	55	45	44.2 (MP4)	38.0 (MP4)
AL12	Resurrection of Christ Monastery	Second	55	45	45.8 (MP5)	40.3 (MP5)
AL13	Lipov Dol	Second	55	45	44.2 (MP4)	38 (MP4)
AL14	Commercial facility	Third	60	55	41.7 (MP3)	37.5 (MP3)

Note:
* The measurement position used to represent the baseline noise level at each assessment location is shown in parentheses in the two rightmost columns

Source: Mott MacDonald

Note that all the daytime and night-time baseline noise levels in Table 12.22 are at least 3 dB below the respective noise criteria limits. Therefore, in accordance with the operational noise assessment criteria detailed in Table 12.9, the operational noise level from the WTGs should not exceed the daytime and night-time criteria limits in Table 12.22, as defined in OG of RM no. 147/2008.

12.5 Assessment of impacts

12.5.1 Analysis of construction impacts

The main activities of the construction phase that are expected to generate environmental noise include:

- Construction of access roads
- Borrow pit drilling (if needed)
- Construction of crane hard-standings (if needed)
- Construction of turbine foundations
- Construction of cabling routes
- Erection of turbines
- Reinstatement and clearance works

Blasting at borrow pits to provide materials for construction may be required but the need for this and borrow pit locations are not known at this stage. There are no widely accepted methods to calculate air overpressure noise and vibration impacts due to blasting.

It is assumed that the majority of works will be undertaken during standard daytime working hours (07:00 to 19:00 on weekdays and 07:00 to 13:00 on Saturdays) and that any working outside these times will be by exception only. Some aspects of the delivery and installation of turbine components may require activity is undertaken outside standard working hours to minimise disruption to road traffic or to avoid adverse weather conditions. However, this is expected to be limited.

The noise impacts due to the above activities have been calculated based on an assumed inventory of equipment and are summarised in Table 12.23. The distance from the works within which the daytime threshold value of 65 dB(A) is exceeded has been calculated.

Table 12.23: Summary of construction calculations

Activity	Plant item	BS 5228 reference	$L_{Aeq,10m}$ [dB]	Activity $L_{Aeq,10m}$ [dB]	Distance to the 65dB(A) buffer [m]
Access track	Dozer	C5-12	77	86	83
	Tipper	D3-112	85		
	Vibrating roller	C5-25	75		
	Dumper (idling)	C4-4	63		
Borrow pit drilling	Tracked mobile drilling rig	C9-2	92	95	192
	Dumper (idling)	C4-4	63		
	Wheeled loader	C9-7	88		
	Tracked semi-mobile crusher	C9-14	90		
Crane hard standing	Excavator	C5-18	80	85	77
	Concrete mixer	C4-20	80		
	Batching plant	D6-11	80		
	Dumper (idling)	C4-4	63		
	Vibratory roller	C5-25	75		
Turbine foundation (gravity base)	Excavator	C5-18	80	88	100
	Tipper	D3-112	85		
	Concrete mixer	C4-20	80		
	Batching plant	D6-11	80		
	Compressor	C5-5	65		
	Water pump	C2-46	62		
	Vibratory poker	C4-34	69		
Cabling	Excavator	C5-18	80	80	48

Activity	Plant item	BS 5228 reference	$L_{Aeq,10m}$ [dB]	Activity $L_{Aeq,10m}$ [dB]	Distance to the 65dB(A) buffer [m]
	Dumper (idling)	C4-4	63		
Erect turbines	Tower crane	C4-48	76	76	33
	Generator	C4-77	60		
Reinstatement / clearance	Dozer	C2-13	78	82	56
	Dump truck (tipping fill)	C2-30	79		
	Wheeled backhoe loader	C2-8	68		
	Dumper (idling)	C4-4	63		

Source: Mott MacDonald

The buffer sizes for activities that would be undertaken at turbine locations (foundations, crane hard-standing and turbine erection) are much smaller than the distances between turbines and the closest assessment locations (see Table 12.7), the closest of which is the abandoned assessment location Chiflik at 482m. Consequently, no assessment locations would fall within the buffers centred on the turbine locations. It is concluded that the noise impacts due to these activities are predicted to be not significant.

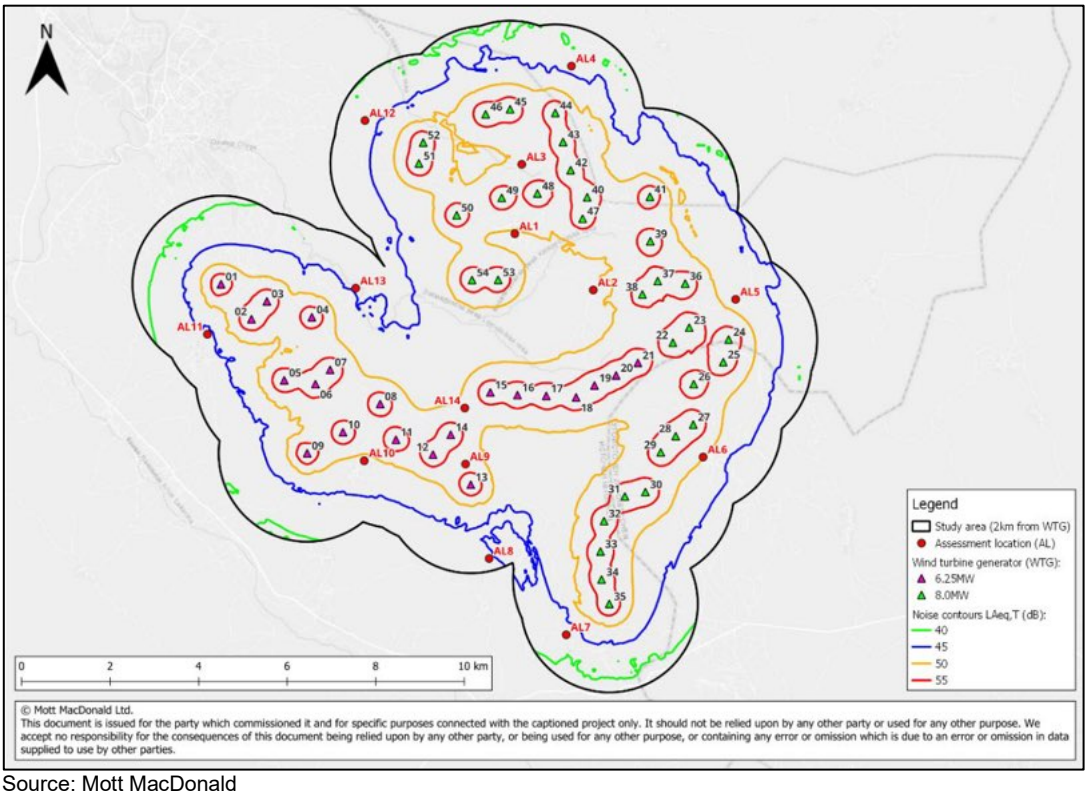
The reconditioning of existing access tracks, short access spurs and cable routes are mobile activities. Mobile construction teams typically progress at up to an estimated rate of 50m per day. Consequently, the duration of exposure of individual receptors will be relatively short. It is concluded that the noise impacts associated with these works are predicted to be not significant.

12.5.2 Analysis of operational phase impacts

To assess the impact of operational noise on sensitive receptors, the annual average noise exposure at each of the thirteen assessment locations due to the proposed WTGs was predicted and compared against the noise limits for daytime and night-time presented in Table 12.7. The annual average noise exposure was predicted by calculating the noise levels when the WTGs operated at the wind speeds monitored at the four weather station masts. The wind speeds are divided into daytime and night-time intervals. The noise exposure took into account the duration of exposure to turbine noise based on the distribution of wind speeds in the range between cut-in and cut-out operating speeds of the turbines (3m/s to 25m/s at hub height, which is approximately equivalent to 2.0m/s to 17.0m/s at the standardised height of 10m above ground level).

A noise contour plot of the predicted operational noise levels from the unmitigated (mode N01) WTGs operating at a standardised wind speed of 10m/s is presented in Map 12.4.

Map 12.4: Noise contour plot of the predicted operational noise assessment for unmitigated WTGs operating at a standardised wind speed of 10m/s



Source: Mott MacDonald

Table 12.24 presents a summary of the results of the predicted operational noise levels, which are based on the measured annual weather conditions, when the proposed WTGs are operating in mode N01 (unmitigated). Shading in the table indicates periods of the day (daytime or night-time) where the predicted noise level has exceeded the noise limit. The level of exceedance, to the nearest 0.1 dB, is shown in parentheses in the table. Yellow shading indicates minor impacts (exceedance of 0 dB to 3 dB above noise limit), orange shading indicates moderate impacts (exceedance of 3 dB to 5 dB above noise limit) and red shading is used for major impacts (exceedance of 5 dB or more above noise limit). No shading is used for negligible impacts (no exceedance above noise limit).

Table 12.24: Summary of operational noise assessment results with unmitigated WTGs

Assessment location		OG of RM no. 147/2008 noise limit [dB $L_{Aeq,T}$]			Predicted annual average operational noise level [dB $L_{Aeq,T}$] *†	
ID	**Name**	**Degree of protection**	**Daytime (07:00-23:00)**	**Night-time (23:00-07:00)**	**Daytime (07:00-23:00)**	**Night-time (23:00-07:00)**
AL1	Shashavarlija	Second	55	45	45.5 (-9.5)	46.0 (+1.0)
AL2	Kalapetrovci	Second	55	45	44.2 (-10.8)	44.6 (-0.4)
AL3	Nikoman	Second	55	45	46.8 (-8.2)	47.3 (+2.3)
AL4	Golem Gaber	Second	55	45	39.6 (-15.4)	40.1 (-4.9)
AL5	Koshevo	Second	55	45	44.0 (-11.0)	44.3 (-0.7)
AL6	Buchim	Second	55	45	45.9 (-9.1)	46.2 (+1.2)
AL7	Shopur	Second	55	45	37.5 (-17.5)	37.6 (-7.4)
AL8	Tanatarci	Second	55	45	40.5 (-14.5)	40.7 (-4.3)

Assessment location		OG of RM no. 147/2008 noise limit [dB $L_{Aeq,T}$]			Predicted annual average operational noise level [dB $L_{Aeq,T}$] *†	
ID	Name	Degree of protection	Daytime (07:00-23:00)	Night-time (23:00-07:00)	Daytime (07:00-23:00)	Night-time (23:00-07:00)
AL9	Chiflik	Second	55	45	48.5 (-6.5)	48.7 (+3.7)
AL10	Ljuboten	Second	55	45	45.3 (-9.7)	45.6 (+0.6)
AL11	Dolani	Second	55	45	40.4 (-14.6)	40.7 (-4.3)
AL12	Resurrection of Christ Monastery	Second	55	45	38.6 (-16.4)	39.1 (-5.9)
AL13	Lipov Dol	Second	55	45	40.8 (-14.2)	41.1 (-3.9)
AL14	Commercial facility	Third	60	55	47.1 (-12.9)	47.4 (-7.6)

Note:

* The difference in the noise limit compared to the predicted noise level is presented in parentheses. A negative difference means that the predicted noise level is below the noise limit, whereas a positive difference means that the predicted noise level is above the noise limit.

† The following colour shades are used to represent the different impacts at the assessment location IDs: negligible (no shading), minor (yellow shading), moderate (orange shading) and major (red shading).

Source: Mott MacDonald

In general, all the assessment locations are compliant with the daytime noise limits, whereas this only true for some of the assessment locations in the night-time. Table 12.24 shows that there are five worst affected assessment locations (AL1, AL3, AL6, AL9 and AL10), which are predicted to exceed the night-time limit. This is because these assessment locations are close to some of the proposed WTGs. AL1 (Shashavarlija), AL3 (Nikoman), AL6 (Buchim) and AL10 (Ljuboten) have minor impacts as the operational noise level exceeds the noise limit by less than 3 dB. AL9 (Chiflik) is predicted to be exposed to moderate impacts as the operational noise level exceeds the noise limit by more than 3 dB. As noted above, the receptor at the assessment location is abandoned.

Table 12.25 presents the cumulative noise level at each assessment location, which is the logarithmic summation of the baseline noise and operational noise levels. The increase in the baseline noise levels due to the operation of the unmitigated WTGs is presented in parentheses in the right-most columns.The results show:

- the baseline noise levels for daytime and night-time are below the noise criteria limit at all assessment locations.
- the cumulative noise levels for the daytime are below noise criteria limit of 55 dB(A) at all assessment locations and therefore all daytime impacts are assessed as negligible and Not Significant
- the cumulative noise levels are below the night-time noise criteria limit at AL4, AL7, AL8, AL11, AL12 and AL13 and the impacts are therefore assessed as negligible and Not Significant
- the cumulative noise levels exceed the night-time threshold value of 45 dB(A) at the following assessment locations
  - Minor impacts: AL1, AL2, AL5, AL6, AL10
  - Moderate impacts: AL3, AL9 (abandoned)

With reference to the significance matrix, it is concluded that cumulative impacts are predicted to be not significant except in the case of assessment locations AL1, AL2, AL3, AL5, AL6 and AL10 during the night time only.

Table 12.25: Summary of cumulative noise level results with unmitigated WTGs

Assessment location		Annual average baseline noise level [dB $L_{Aeq,10min}$]		Annual average operational noise level [dB $L_{Aeq,T}$]		Annual average cumulative noise level [dB $L_{Aeq,T}$] *	
ID	**Name**	**Daytime (07:00-23:00)**	**Night-time (23:00-07:00)**	**Daytime (07:00-23:00)**	**Night-time (23:00-07:00)**	**Daytime (07:00-23:00)**	**Night-time (23:00-07:00)**
AL1	Shashavarlija	45.8	40.3	45.5	46.0	48.7 (+2.9)	47.0 (+6.7)
AL2	Kalapetrovci	45.8	40.3	44.2	44.6	48.1 (+2.3)	46.0 (+5.7)
AL3	Nikoman	45.8	40.3	46.8	47.3	49.4 (+3.5)	48.1 (+7.8)
AL4	Golem Gaber	45.8	40.3	39.6	40.1	46.7 (+0.9)	43.2 (+2.9)
AL5	Koshevo	42.7	38.8	44.0	44.3	46.4 (+3.7)	45.4 (+6.5)
AL6	Buchim	42.7	38.8	45.9	46.2	47.6 (+4.9)	46.9 (+8.1)
AL7	Shopur	41.7	37.5	37.5	37.6	43.1 (+1.4)	40.6 (+3.1)
AL8	Tanatarci	41.7	37.5	40.5	40.7	44.1 (+2.5)	42.4 (+4.9)
AL9	Chiflik	41.7	37.5	48.5	48.7	49.3 (+7.6)	49.0 (+11.5)
AL10	Ljuboten	44.2	38.0	45.3	45.6	47.8 (+3.6)	46.3 (+8.3)
AL11	Dolani	44.2	38.0	40.4	40.7	45.7 (+1.5)	42.6 (+4.5)
AL12	Resurrection of Christ Monastery	45.8	40.3	38.6	39.1	46.6 (+0.8)	42.7 (+2.4)
AL13	Lipov Dol	44.2	38.0	40.8	41.1	45.8 (+1.6)	42.8 (+4.8)
AL14	Commercial facility	41.7	37.5	47.1	47.4	48.2 (+6.6)	47.9 (+10.4)

Note:
* The increase in the baseline noise level due to the operational noise level is presented in parentheses next to the cumulative noise level.

Source: Mott MacDonald

Mitigation measures can be applied to reduce the number of minor and moderate impacts. These measures are explored in further detail in Section 12.6.2 for operational noise.

12.5.3 Discussion regarding residual significant impacts

No residual significant effects due to construction activities in the vicinity of the Project have been identified in the current assessment.

However, the operational noise assessment has shown that without mitigation significant residual impacts are predicted at the assessment locations AL1, AL3, AL6, AL9 and AL10 for annual predicted operational night-time noise level.

12.6 Mitigation and enhancement

12.6.1 Construction phase

The assessment of predicted construction noise impacts has indicated that no specific mitigation measures are required for noise levels at receptors to remain below the adopted daytime threshold value of 65 dB(A). However, it is good practice to control and minimise noise to limit the exposure of site personnel to occupational noise.

Please note that the recommendations below are not exhaustive but are the ones that are most applicable. All sites benefit from general best practice during construction:

- Engagement with communities with sensitive receptors providing Project updates in accordance with the Stakeholder Engagement Plan
- All construction plant used onsite should be the quietest model available and where needed silenced according to the manufacturer's recommendations;
- Where practicable construction plant should not be left operating at idle
- When in use any directional aspects to the plant should be directed away from the nearest properties
- Undertaking of the noisier activities during daytime hours and minimising and avoiding where possible any noisier work during the evening
- If undertaking noisy activities at night or in close proximity to a residence is unavoidable consider screening or enclosing the equipment
- Arrange for deliveries of equipment and transport of staff during daytime, avoid where possible the sensitive night-time hours

If blasting is required, the measures to control air overpressure noise and vibration shall be set out within a blasting management plan prepared by the blasting contractor and based on their blasting method. Measures are expected to include:

- The consideration of drilling and excavation methods rather than blasting
- Minimise noise and vibration disturbance to fauna and avifauna through best practice and timing of such works (construction traffic movements, ground clearance, excavation, etc.)
- Prior notification to receptors within 200m at least 24 hours in advance
- Restrict blasting events to set times during the daytime
- Condition monitoring of affected buildings and structures
- Blasting records
- Monitoring

12.6.2 Operational phase

The proposed WTGs have two operating modes (N02 and N03) that can be used to mitigate the operational noise impacts. In mode N02, the standard blade configuration of the WTG is replaced with serrated blades, and it operates at the standard rated power. In mode N03, the WTGs with a serrated blade configuration are curtailed to operate at a lower rated power.

With all turbines operating in either mode N02 or N03, it was found that the night-time noise limit of 45 dB $L_{Aeq,T}$ was still exceeded at AL3 (Nikoman) and AL9 (Chiflik). Although these operating modes alone are not sufficient to completely eliminate the impacts at Nikoman and Chiflik, the margins of exceedance above the noise limit are small and are therefore considered not significant. Furthermore, the assessment location at Chiflik represents a relatively small number receptors that are currently abandoned.

A mitigation methodology was adopted to remove the minor impacts at AL1, AL6 and AL10, while also reducing the minor and moderate impacts at AL3 and AL9, respectively, as far as reasonably possible by using a combination of mode N02 and N03 operating turbines. Three mitigation options (denoted A, B and C) have been considered. Table 12.26 summarises the operating modes of each WTG for the three mitigation options and Table 12.27 presents the total number of WTGs at each operating mode for the mitigation options. The last column in Table 12.26 also highlights the assessment locations that are benefitted by the mitigation.

Mitigation option A uses a combination of mode N01 and N02 operating turbines to remove the night-time exceedance at AL1 (Shashavarlija) and AL10 (Ljuboten) compared with the unmitigated case. The turbine IDs operating in mode N02 in option A were selected such that the increase in night-time noise level compared to the case when all WTGs were operating in

mode N02 was within 0.4 dB for the five worst affected receptors (AL1, AL3, AL6, AL9 and AL10) in the unmitigated case. This ensures that the number of WTGs operating in mode N02 is kept to a minimum, while being as close as possible to the best achievable (lowest) noise levels at the assessment locations.

Mitigation option B uses a combination of mode N01, N02 and N03 operating WTGs to remove the night-time exceedance at AL6 (Buchim) compared to mitigation option A. The turbine IDs operating in mode N03 in option B were selected by switching the turbines contributing to the highest noise levels in option A from mode N02 to N03. This switching process has been optimised to minimise the number of WTGs operating at mode N03 by ensuring that the increase in night-time noise level compared to the case when all WTGs were operating in mode N03 was within 0.4 dB of the best achievable case for the three worst affected receptors (AL3, AL6 and AL9) in option A.

Mitigation option C is similar to option A, but eight of the WTGs operating in mode N03 (No. 12, 13, 14, 27, 42, 43, 48 and 49) have been curtailed from mode N02 to mode N03 when the wind speed at hub height is greater than 9m/s (equivalent to standardised wind speed of 6.1m/s).

Table 12.26: Summary of the WTG operating modes in the mitigation options

Wind turbine ID	Rated power [MW]	Mitigation options			Assessment location IDs that are mitigated
		A	B	C	
01	6.25	N01	N01	N01	-
02	6.25	N01	N01	N01	-
03	6.25	N01	N01	N01	-
04	6.25	N01	N01	N01	-
05	6.25	N01	N01	N01	-
06	6.25	N01	N01	N01	-
07	6.25	N01	N01	N01	-
08	6.25	N01	N01	N01	-
09	6.25	N01	N01	N01	-
10	6.25	N02	N02	N02	AL10
11	6.25	N02	N02	N02	AL10
12	6.25	N02	N03 (curtailed at all speeds)	N02 (curtailed to N03 when hub height wind speed >9m/s)	AL10
13	6.25	N02	N03 (curtailed at all speeds)	N02 (curtailed to N03 when hub height wind speed >9m/s)	AL10
14	6.25	N02	N03 (curtailed at all speeds)	N02 (curtailed to N03 when hub height wind speed >9m/s)	AL10
15	6.25	N02	N02	N02	AL10
16	6.25	N02	N02	N02	AL10
17	6.25	N01	N01	N01	-
18	6.25	N01	N01	N01	-
19	6.25	N01	N01	N01	-
20	6.25	N01	N01	N01	-
21	6.25	N01	N01	N01	-
22	8.0	N01	N01	N01	-
23	8.0	N01	N01	N01	-
24	8.0	N01	N01	N01	-
25	8.0	N01	N01	N01	-

Wind turbine ID	Rated power [MW]	Mitigation options			Assessment location IDs that are mitigated
		A	B	C	
26	8.0	N02	N02	N02	AL6
27	8.0	N02	N03 (curtailed at all speeds)	N02 (curtailed to N03 when hub height wind speed >9m/s)	AL6
28	8.0	N02	N02	N02	AL6
29	8.0	N02	N02	N02	AL6
30	8.0	N02	N02	N02	AL6
31	8.0	N01	N01	N01	-
32	8.0	N01	N01	N01	-
33	8.0	N01	N01	N01	-
34	8.0	N01	N01	N01	-
35	8.0	N01	N01	N01	-
36	8.0	N01	N01	N01	-
37	8.0	N01	N01	N01	-
38	8.0	N01	N01	N01	-
39	8.0	N01	N01	N01	-
40	8.0	N02	N02	N02	AL1
41	8.0	N01	N01	N01	-
42	8.0	N02	N03 (curtailed at all speeds)	N02 (curtailed to N03 when hub height wind speed >9m/s)	AL3
43	8.0	N02	N03 (curtailed at all speeds)	N02 (curtailed to N03 when hub height wind speed >9m/s)	AL3
44	8.0	N02	N02	N02	AL3
45	8.0	N02	N02	N02	AL3
46	8.0	N02	N02	N02	AL3
47	8.0	N02	N02	N02	AL1
48	8.0	N02	N03 (curtailed at all speeds)	N02 (curtailed to N03 when hub height wind speed >9m/s)	AL1 and AL3
49	8.0	N02	N03 (curtailed at all speeds)	N02 (curtailed to N03 when hub height wind speed >9m/s)	AL1 and AL3
50	8.0	N02	N02	N02	AL1
51	8.0	N01	N01	N01	-
52	8.0	N01	N01	N01	-
53	8.0	N02	N02	N02	AL1
54	8.0	N01	N01	N01	-

Source: Mott MacDonald

Table 12.27: Total number of WTGs operating in each mode for the mitigation options

Mode	Mitigation option A	Mitigation option B	Mitigation option C
N01	31	31	31
N02	23	15	15
N03 (curtailed at all wind speeds)	0	8	0
N02 (curtailed to N03 when hub height wind speed >9m/s)	0	0	8

Source: Mott MacDonald

Table 12.28 presents a summary of the results of the predicted operational noise levels, which are based on the measured annual weather conditions, when the WTGs are operating in the

three different mitigation options (A, B and C). An uncertainty correction of +2 dB is applied to the sound power levels of the turbines as advised in the manufacturers data. Shading in the table indicates periods of the day (daytime or night-time) where the predicted noise level has exceeded the noise limit. The level of exceedance, to the nearest 0.1 dB, is shown in parentheses in the table. Yellow shading indicates minor impacts (exceedance of 0 dB to 3 dB above noise limit), orange shading indicates moderate impacts (exceedance of 3 dB to 5 dB above noise limit) and red shading is used for major impacts (exceedance of 5 dB or more above noise limit). No shading is used for negligible impacts (no exceedance above noise limit).

Noise contour plots of the predicted operational noise levels from mitigation options A, B and C when the WTGs are operating at a standardised wind speed of 10m/s are presented in Map 12.5, Map 12.6 and Map 12.7, respectively.

Table 12.28: Summary of operational noise assessment results with mitigated WTGs

Assessment location		Predicted annual average operational noise level [dB $L_{Aeq,T}$] *†					
		Mitigation option A		Mitigation option B		Mitigation option C	
ID	Name	Daytime (07:00-23:00)	Night-time (23:00-07:00)	Daytime (07:00-23:00)	Night-time (23:00-07:00)	Daytime (07:00-23:00)	Night-time (23:00-07:00)
AL1	Shashavarlija	44.3 (-10.7)	44.8 (-0.2)	44.2 (-10.8)	44.6 (-0.4)	44.2 (-10.8)	44.6 (-0.4)
AL2	Kalapetrovci	43.6 (-11.4)	44.1 (-0.9)	43.6 (-11.4)	44.1 (-0.9)	43.6 (-11.4)	44.1 (-0.9)
AL3	Nikoman	45.5 (-9.5)	46.0 (+1.0)	45.2 (-9.8)	45.6 (+0.6)	45.3 (-9.7)	45.7 (+0.7)
AL4	Golem Gaber	38.3 (-16.7)	38.8 (-6.2)	38.2 (-16.8)	38.6 (-6.4)	38.2 (-16.8)	38.7 (-6.3)
AL5	Koshevo	43.9 (-11.1)	44.2 (-0.8)	43.9 (-11.1)	44.2 (-0.8)	43.9 (-11.1)	44.2 (-0.8)
AL6	Buchim	44.7 (-10.3)	45.0 (+0.0)	44.6 (-10.4)	44.9 (-0.1)	44.6 (-10.4)	44.9 (-0.1)
AL7	Shopur	37.3 (-17.7)	37.4 (-7.6)	37.2 (-17.8)	37.4 (-7.6)	37.2 (-17.8)	37.4 (-7.6)
AL8	Tanatarci	39.8 (-15.2)	40.0 (-5.0)	39.5 (-15.5)	39.6 (-5.4)	39.6 (-15.4)	39.8 (-5.2)
AL9	Chiflik	47.1 (-7.9)	47.2 (+2.2)	46.2 (-8.8)	46.4 (+1.4)	46.7 (-8.3)	46.9 (+1.9)
AL10	Ljuboten	44.3 (-10.7)	44.6 (-0.4)	44.2 (-10.8)	44.5 (-0.5)	44.2 (-10.8)	44.5 (-0.5)
AL11	Dolani	40.2 (-14.8)	40.5 (-4.5)	40.2 (-14.8)	40.5 (-4.5)	40.2 (-14.8)	40.5 (-4.5)
AL12	Resurrection of Christ Monastery	38.3 (-16.7)	38.8 (-6.2)	38.3 (-16.7)	38.7 (-6.3)	38.3 (-16.7)	38.7 (-6.3)
AL13	Lipov Dol	40.4 (-14.6)	40.7 (-4.3)	40.4 (-14.6)	40.7 (-4.3)	40.4 (-14.6)	40.7 (-4.3)
AL14	Commercial facility	45.9 (-14.1)	46.2 (-8.8)	45.5 (-14.5)	45.8 (-9.2)	45.7 (-14.3)	46.0 (-9.0)

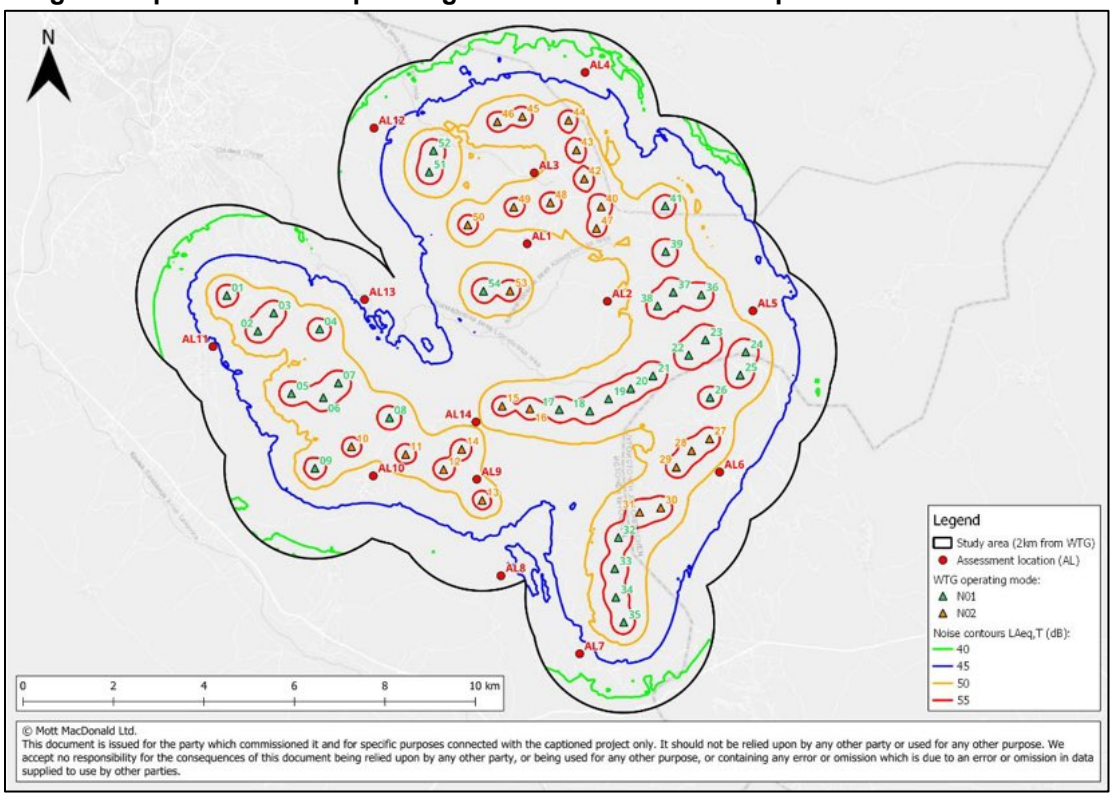
Note:

* The difference in the noise limit compared to the predicted noise level is presented in parentheses. A negative difference means that the predicted noise level is below the noise limit, whereas a positive difference means that the predicted noise level is above the noise limit.

† The following colour shades are used to represent the different impacts at the assessment location IDs: negligible (no shading), minor (yellow shading), moderate (orange shading) and major (red shading).

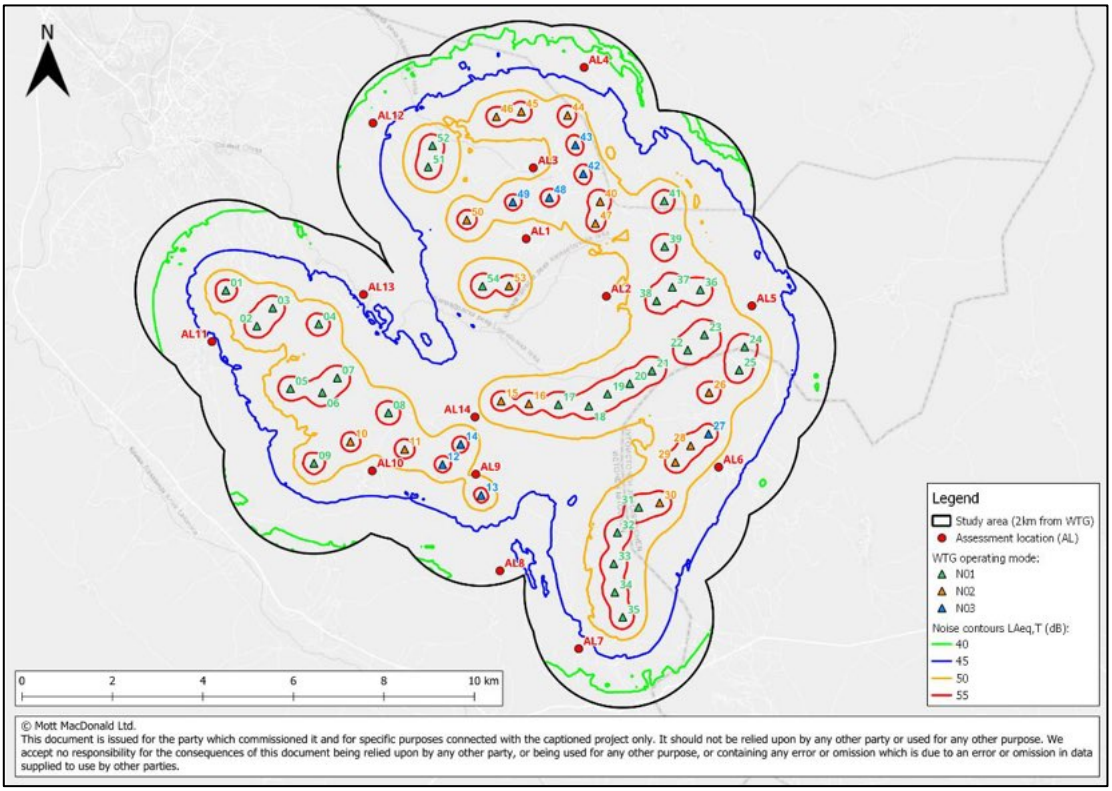
Source: Mott MacDonald

Map 12.5: Noise contour plot of the predicted operational noise assessment for mitigation option A WTGs operating at a standardised wind speed of 10m/s



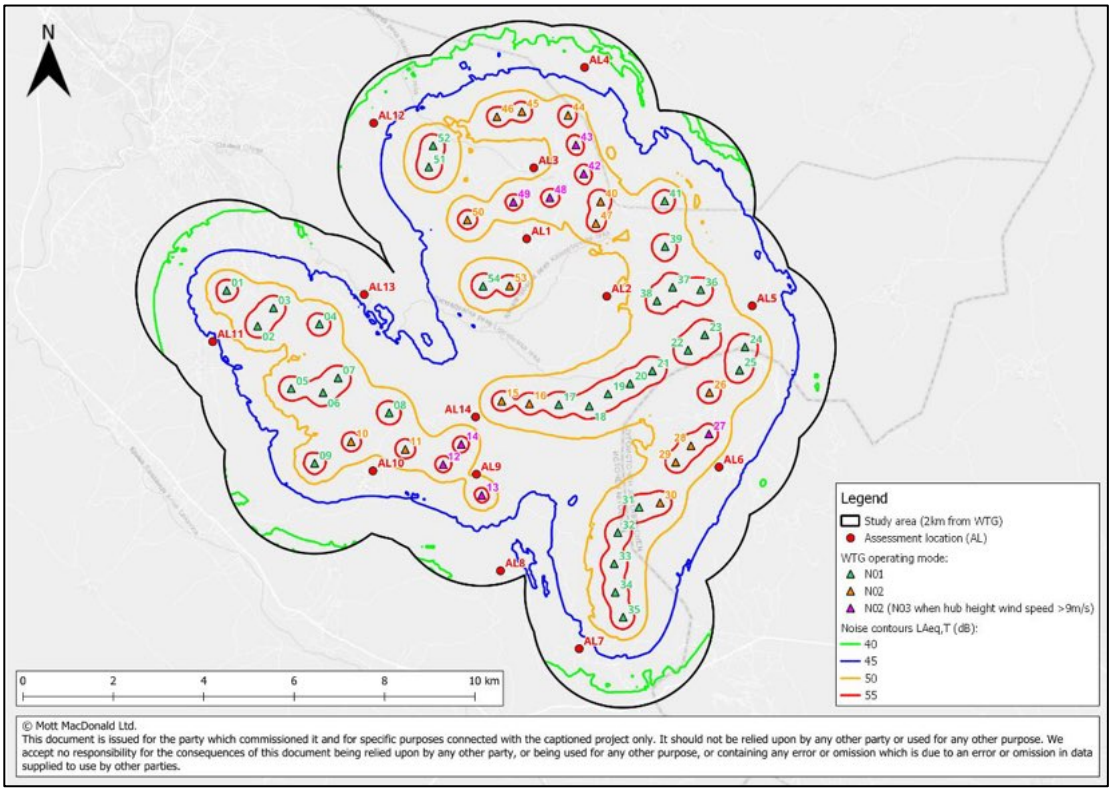
Source: Mott MacDonald

Map 12.6: Noise contour plot of the predicted operational noise assessment for mitigation option B WTGs operating at a standardised wind speed of 10m/s



Source: Mott MacDonald

Map 12.7: Noise contour plot of the predicted operational noise assessment for mitigation option C WTGs operating at a standardised wind speed of 10m/s



Source: Mott MacDonald

Compared with the unmitigated case, all three mitigation options (A, B and C) reduce the moderate night-time impacts at AL9 (Chiflik – currently abandoned) to minor night-time impacts and reduce the minor night-time impacts at AL1 (Shashavarlija) and AL10 (Ljuboten) to negligible night-time impacts. When the WTGs with serrated blades are curtailed using mitigation options B and C, the minor night-time impacts at AL6 (Buchim) can be reduced to negligible night-time impacts compared to option A and the unmitigated case. The minor impacts at AL3 (Nikoman) remain in all three mitigation options compared to the unmitigated case, but the amount of noise level exceedance can be decreased, particularly with mitigation options B and C.

The minor night-time impacts observed in Table 12.28 with noise mitigation are deemed to be not significant.

12.6.3 Cumulative operational noise impacts

Table 12.9 present the unmitigated cumulative noise impacts and the residual cumulative noise impacts with the three mitigation options. This shows that the mitigation options remove the major impact at AL3. Minor adverse impacts remain at AL1, AL2, AL3, AL5, AL6, AL9 and AL10 in the night period.

Table 12.29: Cumulative operational noise impacts with mitigation

Assessment location	Unmitigated		Option A		Option B		Option C	
	Day	Night	Day	Night	Day	Night	Day	Night
AL1	48.7	47.0	48.1	46.1	48.1	46.0	48.1	46.0
AL2	48.1	46.0	47.8	45.6	47.8	45.6	47.8	45.6

Assessment location	Unmitigated		Option A		Option B		Option C	
AL3	49.3	48.1	48.7	47.0	48.5	46.7	48.6	46.8
AL4	46.7	43.2	46.5	42.6	46.5	42.5	46.5	42.6
AL5	46.4	45.4	46.4	45.3	46.4	45.3	46.4	45.3
AL6	47.6	46.9	46.8	45.9	46.8	45.9	46.8	45.9
AL7	43.1	40.6	43.0	40.5	43.0	40.5	43.0	40.5
AL8	44.2	42.4	43.9	41.9	43.7	41.7	43.8	41.8
AL9 (abandoned)	49.3	49.0	48.2	47.6	47.5	46.9	47.9	47.4
AL10	47.8	46.3	47.3	45.5	47.2	45.4	47.2	45.4
AL11	45.7	42.6	45.7	42.4	45.7	42.4	45.7	42.4
AL12	46.6	42.8	46.5	42.6	46.5	42.6	46.5	42.6
AL13	45.8	42.8	45.7	42.6	45.7	42.6	45.7	42.6
AL14 (commercial)	48.2	47.8	47.3	46.7	47.0	46.4	47.2	46.6

12.7 Monitoring

Monitoring of operational noise levels shall be undertaken to verify that the measured noise impacts do not exceed the noise limits of 55 dB L_{Aeq} daytime and 45 dB L_{Aeq} night-time, and the predicted values presented in Table 12.24 or in Table 12.28 depending on the mitigation option selected. It should be noted that the predicted values are based on annual average exposure therefore some allowance for annual average wind speeds should be taken into account. It is proposed that noise monitoring is undertaken within six months of the start of operation and then in response to reasonable complaint thereafter (the number of survey locations can be reduced to consider the area relevant to the complaint).

It is recommended that noise monitoring is performed at the same measurement positions that were used during the baseline noise survey. The noise monitoring should be covered over a period of at least 2 weeks with all turbines operating as normal. Measurements of noise and wind speeds need to be taken concurrently, and the noise data needs to be filtered in the same way as described in Section 12.3.7 for the baseline survey. Filtering requires the removal of data within intervals affected by rainfall, high wind speed and extraneous noise events. The change in the noise levels compared to the baseline noise conditions (30 May 2025 to 16 June 2025) needs to be commented and reported. Wind measurement equipment and locations may differ to those used during the baseline survey. Monitoring during operational phase shall use a method that allows precise measurement of wind speed at hub height as described in the IoA GPG.

12.8 Residual impacts

No residual adverse significant effects due to construction and operational activities in the vicinity of the proposed works have been identified in the current assessment with mitigation.

13 Shadow flicker

Issue and Revision Record

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13 Shadow flicker

13.1 Overview

This chapter presents the shadow flicker assessment that has been undertaken as a part of the Project. The area is dotted with a few small villages and a few isolated dwellings. 13 of these locations were identified by our environmental team as sensitive land uses that may require assessment of shadow flicker impact. All of these locations are situated within the Area of Influence (AoI), defined by a 10RD (1820m) buffer distance from any of the nearest WTGs, and therefore all were retained for further examination.

13.1.1 Theoretical basis

The term 'shadow flicker' is related to the intermittent shadow that is cast by the rotating blades of a WTG. This phenomenon, when impacting sensitive built-up areas, must be examined as part of detailed environmental impact assessment of wind farm Projects. The original study of shadow flicker influence on human beings is strictly related to enclosed spaces within buildings, where the shadow flicker penetrates through windows and openings; However, various local regulations have been expanded since to include also examination of shadow flicker in the open air.

Two necessary conditions for having a shadow flicker impact at a certain point are – rotor turning, and the point of interest being inside the theoretical shadow envelope of the affecting WTGs, which is determined by the following factors:

- Existence of unobstructed line of sight,
- Latitude and longitude of the area,
- Position of the point of interest (distance and bearing) relative to the affecting WTGs,
- Topography,
- Geometry of the WTG – mostly rotor diameter and hub height.

Timewise, flicker most significantly occurs shortly after sunrise and before sunset, when the sun is low enough to cast long enough shadows. The theoretical possibility of having a shadow flicker impact during a certain time of the day depends on the exact time and date. The shadow flicker pattern that is Projected on the ground is moving during the day, and also from one day to the next.

A shadow flicker calculation that takes into account only pure geographical and geometrical factors as mentioned above is termed 'Worst Case scenario' or 'Astronomical scenario'. This kind of scenario does not consider possible preclusion of shadow flicker due to visibility and sunlight conditions (such as cloud cover or fog that prevent direct sunlight) or any stoppage of the WTGs (due to low winds or other technical reasons). Likewise, it does not consider any reduction of the Projected area of the rotor disk in the direction of the line of sight due to actual yaw position of the rotor (which is determined by the actual wind direction). Therefore, this scenario will always result in a conservative estimate of the maximum possible shadow flicker time.

If enough information on site conditions is given, a real case estimate is possible, considering one or more of the following factors:

- Visibility and sunlight conditions – determined by the cloud cover, fog and possibly other limiting factors,
- Actual rotor orientation – determined by the wind direction,

- Actual operational state – determined by the wind speed and possibly other operational considerations,
- Existence of line of sight – determined by obstructions such as vegetation and buildings, as well as position, size and orientation of windows and openings, in case of enclosed spaces.

Lastly, accounting for only pure geometrical considerations will ostensibly lead to cast shadows extending large distance behind a WTG before it is diffused. Diffusion of light makes shadows increasingly undetectable at large distances and therefore a certain cut-off distance is defined by the local jurisdictions.

13.2 Applicable standards

There are no universally accepted criteria or shadow flicker limits for assessing the impact of WTGs on their neighbouring receptors. Existing guidelines and recommendations[1] vary among countries, states and occasionally also among jurisdictions within the same country or state.

Per the agreed Compliance Framework, in this assessment we have adhered to the World Bank guidelines[2] (hereafter WBG) where possible. In cases where the WBG do not provide guidance, such as the consideration of a real case scenario, we referred additionally to the German guidelines[3,4] (hereafter DE), that are well-substantiated and form the basis for most of the existing worldwide common practice regarding shadow flicker impact assessment. According to the above guidelines, the applicable limits for shadow flicker at receptors are:

- Worst case (astronomical) scenario annual accumulated shadow flicker duration shall not exceed 30 hours/year;
- Worst case (astronomical) scenario maximum daily accumulated shadow flicker duration at any single day of the year shall not exceed 30 minutes/day;
- Real case (considering realistic weather and operational conditions) scenario annual accumulated shadow flicker duration (modelled or measured) shall not exceed eight (8) hours/year.

The considered guidelines do not stipulate explicitly a shadow flicker cutoff distance. In this assessment we considered a cutoff distance of 10RD which is most commonly accepted as the practical limit, beyond which shadow flicker effect is considered negligible. This cutoff distance defines the Area of Influence (AoI) considered throughout this assessment.

In the context of this assessment, the applicable shadow flicker limits apply only to the built environment (essentially dwellings and community buildings), and not to surrounding outdoor areas.

13.3 Assessment methodology

Key concepts of the methodology employed in this assessment are:

- **Evaluation scenarios and respective normative limits**
    - ‘Worst case’ scenario (pure astronomical calculation, disregarding in-situ conditions such as cloud cover and wind climate) – stipulated limit of 30 accumulated hours per year and maximum 30 minutes per any single day of the year,

[1] “Update of UK Shadow Flicker Evidence Base”, Parsons Brinckerhoff, 2011

[2] “Environmental, Health, and Safety Guidelines for Wind Energy”, World Bank Group, 07 August 2015

[3] “Schattenwurf von Windkraftanlagen: Erläuterung zur Simulation”, Bayerisches Landesamt für Umwelt, 2016

[4] “Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windkraftanlagen” (Guideline for Identification and Evaluation of the Optical Emissions of Wind Turbines), Bund-Länder-Arbeitsgemeinschaft für Immissionsschutz (LAI), 21 January 2022

- ‘Real case’ scenario (calculation accounting for in-situ conditions such as cloud cover and wind climate) – stipulated limit of eight (8) accumulated hours per year.

- **Type of receptors in the modelling of the shadow flicker**
  - Point-receptors at specified assessment locations,
- **Cut-off distance at which shadow flicker calculation is defined**
  - Standard shadow flicker limit cutoff distance of 10RD from WTGs. This limit defines the Area of Influence.

13.3.1 Assumptions

- The current assessment is based on a desktop study only, using digital inputs and information made available by the Client, or obtained from publicly available open sources.
- Detailed survey of the assessment locations in order to identify possible mitigating factors (for example, exposure and obstructions, window position, height, size and orientation) is out of scope of the current assessment.
- This assessment assumed a conservative curtailment plan in which affecting WTGs will be shut down when shadow flicker conditions occur and impact receptors.
- Only WTG-specific properties considered are the hub height and the rotor diameter.
- No optimization exercise of the curtailment plan for energy loss has been carried out.

13.3.2 Inputs and general settings

The Client provided the following inputs:

- A list of coordinates representing a layout of 54 WTG locations (reproduced in Appendix B),
- A specification of indicative WTG model and hub height to be examined (6.25MW/8.0MW, 182 RD, hub height 120m),

Additionally, for the terrain the 25m-resolution Digital Elevation Model (DEM) EU-DEM (based on a fusion of SRTM1 and ASTER) was sourced from the Windpro repository.

Shadow flicker calculations were carried out using Windpro version 4.1.273. Shadow flicker levels were evaluated considering the settings presented in Table 13.1 below.

Table 13.1: Shadow flicker calculation settings

Parameter	Setting
Shadow flicker cut-off distance	Standard calculation – 10RD (1820m)
Cut-off distance according to blade width partial cover of the sun	No
Minimum angle of sun above horizon	3º
Reference year	2025
Resolution – calculation at receptors	1 day, 1 minute
Resolution – maps	3 minutes, 7 days, 50m
Line of sight check (ZVI)	ZVI and topographic shadow checks enabled

Source: Mott MacDonald

13.3.3 Assessment locations and receptors

13 locations were identified to require assessment of shadow flicker impact; all of them are situated within the 10RD Area of Influence. Most of the identified locations are villages or hamlets. One point-receptor is assigned per each location and placed at a representative location. Where the location is a hamlet, a receptor is placed at a central representative location. In the cases of the larger villages Buchim (AL6), Ljuboten (AL10) and Dolani (AL11), the receptors are placed in the outskirts towards the planned wind farm, where the highest shadow flicker impact is expected. Receptor locations are provided in Table 13.2 below and are also depicted in Figure 13.1 below.

Table 13.2: Shadow flicker receptors (Macedonian Gauss–Krüger grid, EPSG 6204)

Receptor ID	Name	Assessment location type and receptor placement	Easting (m)	Northing (m)	Ground elevation ASL (m)	Nearest WTG	Distance to nearest WTG (m)	Distance in RD
AL1	Shashavarlija	Village, representative location	607617	4620055	740	49	864	4.7
AL2	Kalapetrovci	Hamlet, representative location	609390	4618784	751	38	1115	6.1
AL3	Nikoman	Hamlet, representative location	607774	4621623	778	48	748	4.1
AL4	Golem Gaber	Hamlet, representative location	608898	4623844	554	44	1120	6.2
AL5	Koshevo	Hamlet, representative location	612607	4618573	784	24	922	5.1
AL6	Buchim	Village, representative location	611872	4615010	658	27	765	4.2
AL7	Shopur	Hamlet, representative location	608779	4610995	504	35	1197	6.6
AL8	Tanatarci	Hamlet, representative location	607037	4612718	589	13	1718	9.4
AL9	Chflik	Hamlet, representative location	606504	4614852	651	13	482	2.6
AL10	Ljuboten	Village, representative location	604214	4614926	568	10	806	4.4
AL11	Dolani	Village, representative location	600671	4617783	439	2	1051	5.8
AL12	Resurrection of Christ Monastery	Single building	604231	4622613	547	52	1406	7.7
AL13	Lipov Dol	Hamlet, representative location	604021	4618823	477	4	1185	6.5

Source: Mott MacDonald

The following settings were used uniformly for all of the receptors. These are typical assumptions in the context of a standard Shadow Flicker Impact Assessment.

Table 13.3: Receptor types

Receptor type	Properties
Point-receptor	'Greenhouse mode' (omnidirectional), vertical, size 1m by 1m, sill height 1m above ground

Source: Mott MacDonald

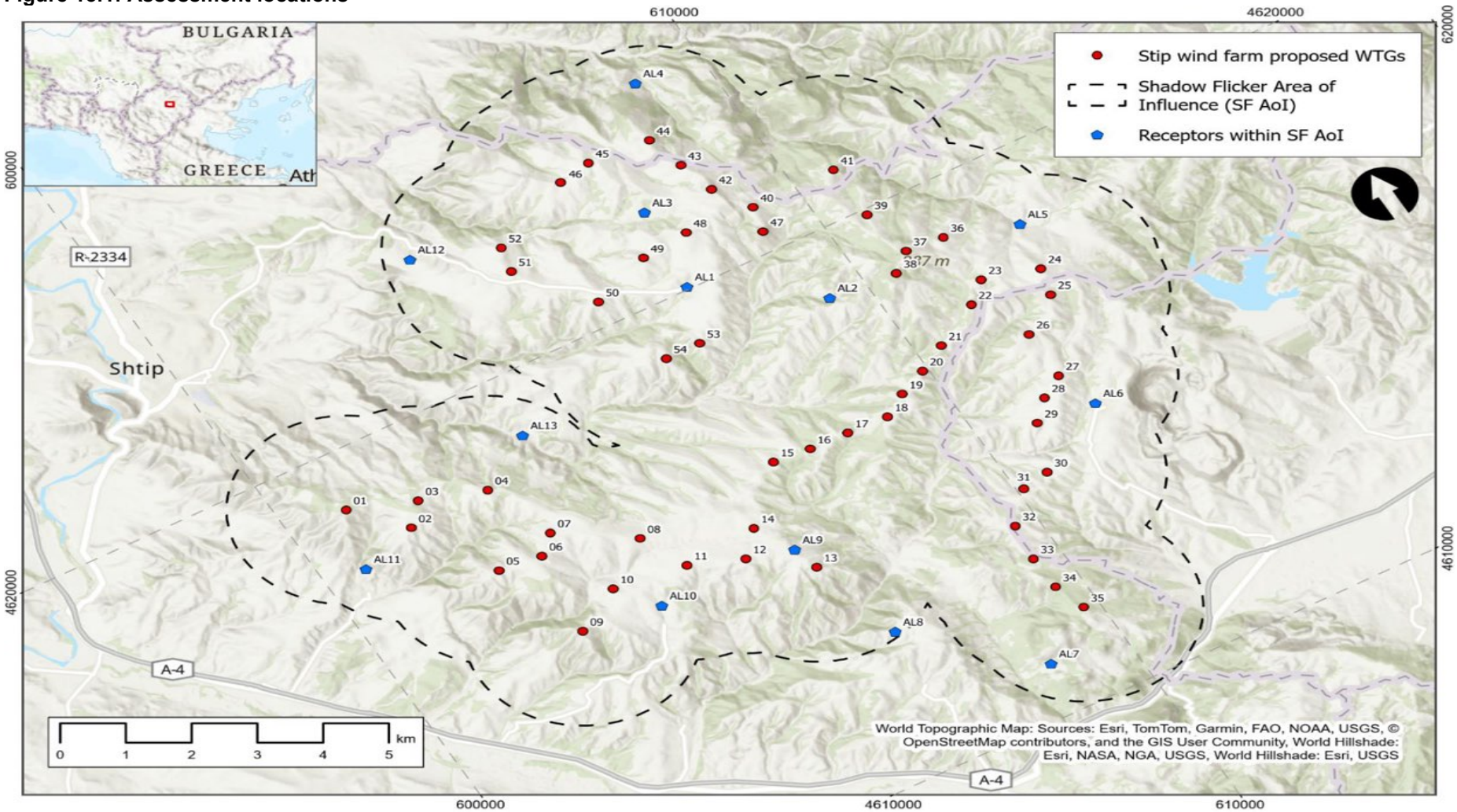
The following applicable shadow flicker limits, as detailed above in this Section, were considered:

Table 13.4: Shadow flicker limits

Criterion	Receptor type	Worst case scenario	Real case scenario
Accumulated hours per year	Point-receptor	30 (WBG[2])	8 (DE[3,4])
Max minutes per day	Point-receptor	30 (WBG[2])	N/A

Source: Mott MacDonald

Figure 13.1: Assessment locations



Source: The Client, ESRI ArcGIS, Mott MacDonald

13.3.4 Worst case scenario

Considering solely the inputs and settings detailed above would result in a conservative 'worst case' scenario which assumes:

- The rotor is always turning,
- The sun is always shining,
- The rotor disk is always perpendicular to the line of sight between the WTGs and point of interest.

A number of factors which may reduce the impact of shadow flicker are not taken into account in this scenario. These are:

- Visibility and sunlight conditions – determined by the cloud cover, fog and possible other limiting factors,
- Actual rotor orientation – determined by the wind direction,
- Actual operational hours – determined by the wind speed,
- Existence of line of sight – determined by obstructions such as vegetation and buildings, as well as position, size and orientation of windows and openings, in case of enclosed spaces,
- Reduced shadow flicker intensity due to partial coverage of the sun by the blades[5],
- Reduced shadow flicker intensity due to partial or full coverage of the sun by static parts of the WTG structure such as nacelle and tower,
- Shutdown time due to any other reasons such as maintenance, wind sector management, or curtailment for any reason.

13.3.5 Real case scenario

For this scenario the following shadow flicker reduction factors have been quantified based on reliable data and considered in addition to the worst case scenario values:

- Visibility and sunlight conditions due to cloud cover,
- Wind direction distribution.

The following factors were *not* considered:

- Reduction due to the wind speed distribution, as it only amounts to a small value, especially at high-wind sites.
- Possible existence of elements limiting the line of sight (vegetation and buildings), as well as position, size and orientation of windows and other openings, in the case of enclosed spaces. Taking this into account mandates a comprehensive survey of the in-situ conditions and is out of scope of the current assessment.
- Possible shutdown time of any reason, as information does not exist at this preliminary stage.

13.3.5.1 Reduction factor due to cloud cover

Mean daily sunshine duration observational data was sourced from the available sources in the built-in Windpro database. From the available data sources, Bitola and Sofia are deemed to be the closest and most representative for the Project, which is located approximately equidistant in similar terrain and elevation. Furthermore, the available observation periods for these two locations are longer than available from other stations in the region. Monthly statistics from these

[5] Generally can be applied to both worst case and real case scenarios, however not used in the current assessment.

stations is depicted in Figure 13.2 below, and also available in tabulated form in Table C.1 in Appendix C.

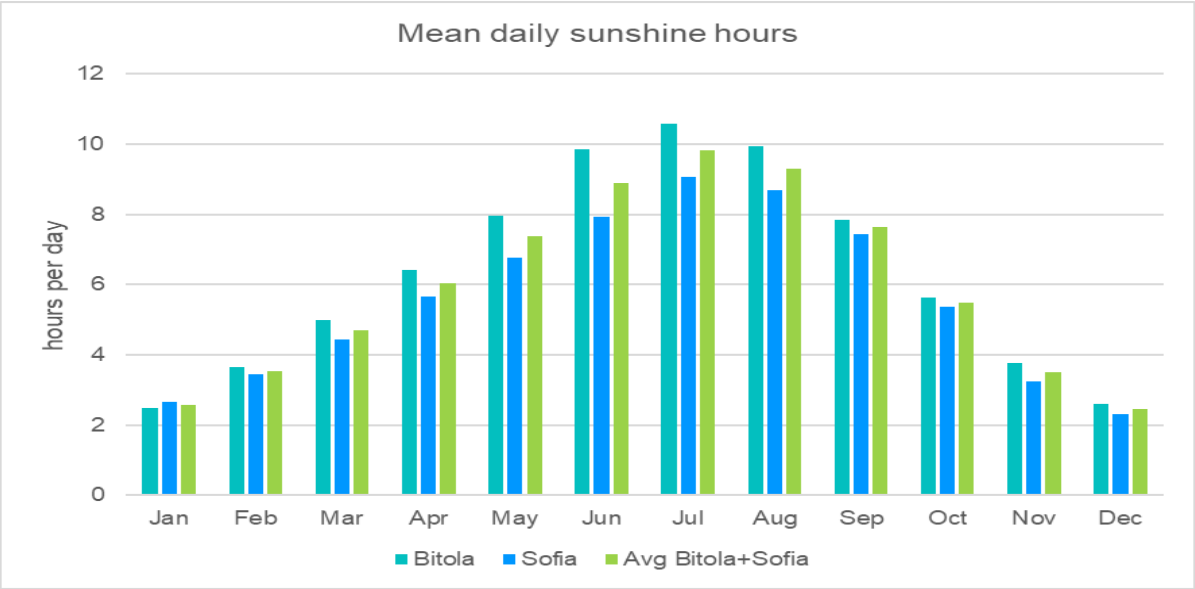
Table 13.5: Meteorological stations

Name	Lat	Lon	Elevation (m)	Distance to the Site (km)	Period
Bitola, North Macedonia	41.05° N	21.37° E	586	105	1969-1991
Sofia observatory, Bulgaria	42.65° N	23.38° E	586	139	1969-1993

Source: Windpro, Mott MacDonald

It was concluded to use an average of daily sunshine hours between Bitola and Sofia datasets to which a factor of +10% was applied to account for the expected trend of increased number of sunshine hours in southern Europe observed over the last decades[6]. The resulting monthly average of daily sunshine hours dataset was then used as an input to Windpro, to facilitate calculation of statistical reduction factor due to cloud cover.

Figure 13.2: Mean daily sunshine hours statistics



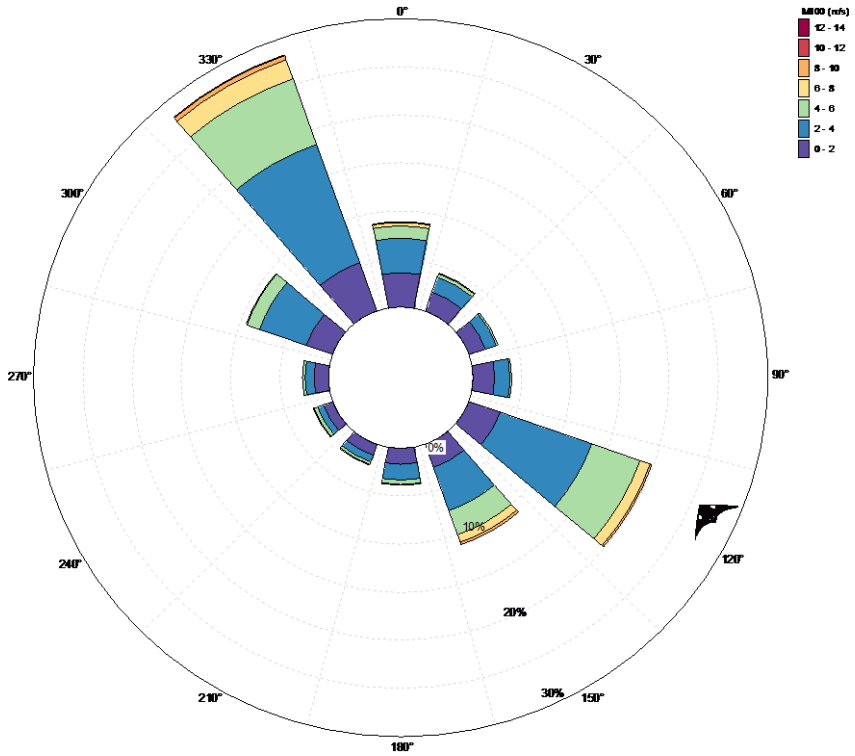
Source: Windpro, Mott MacDonald

13.3.5.2 Reduction factor due to wind conditions

ECMWF ERA5 Global Reanalysis data corresponding to the approximate site centre (based on interpolation of the nearest nodes), a period of 25 years (2000-2024) and a height of 100m AGL was sourced. The corresponding wind direction distribution in 12 sectors (depicted below in Figure 13.3) was calculated and used to derive an estimate of the number of operational hours in each wind direction sector per year. It is provided in tabulated form in Table C.2 in Appendix C. The resulting operational hours dataset was then used as an input to Windpro, to facilitate calculation of statistical reduction factor due to wind conditions.

[6] Sunshine duration and clouds | Copernicus, accessed 25 July 2025

Figure 13.3: Wind rose – ERA5-100m Reanalysis data 2000-2024



Source: Windographer, Mott MacDonald

13.4 Baseline

Currently there are no existing or known planned wind farms in the immediate vicinity of the Project within a distance significant to shadow flicker impact. Therefore, in the baseline state there is no shadow flicker impact in the area.

13.5 Assessment of impacts

Detailed results per each receptor group are provided below in Table 13.7. For ease of reading, results in the tables below are colour-coded as explained below in Table 13.6. Generally, a receptor can be affected by several WTGs, and vice versa; The affected or affecting periods can overlap; therefore, the net total durations may not be equal to the arithmetic sum of individual durations.

Detailed shadow flicker maps for the worst case and real case scenarios are provided separately and are also presented in Appendix D. These maps are indicative and are less accurate than the at-receptor calculations in Table 13.7 below, as they are calculated using a relatively coarse spatial and temporal resolution necessitated by the large extents of the Project.

Table 13.6: Classification of results

Colour coding	Meaning
(no colour)	No shadow flicker impact from WTGs up to 10RD away
	Shadow flicker within respective limits
	Shadow flicker exceeds accumulated hours per year limits
	Shadow flicker exceeds maximum minutes per day limits

Source: Mott MacDonald

13.5.1 Shadow flicker duration per receptor

The following table details the shadow flicker durations affected at the receptors. It is noted that receptors can receive shadow flicker from several WTGs. The real case scenario pertains only to the hours per year limit, as the statistical reduction is meaningful only in the context of annul accumulated duration; it cannot be applied to extreme (maximum) events. Therefore, a real case prediction of minutes of shadow flicker per day is not possible.

Table 13.7: Shadow flicker duration per receptor

Receptor ID	Affecting WTGs	Accumulated hours per year		Max minutes per day
		Worst case (hours/y) Limit 30 hours (WBG[2])	Real case (hours/y) Limit 8 hours (DE[3,4])	Worst case (minutes) Limit 30 minutes (WBG[2])
AL1	47, 50	32:49	15:09	45
AL2	37, 38	38:18	16:23	36
AL3	40, 42, 43, 48	42:04	15:32	37
AL4	44	19:13	2:32	33
AL5	22, 23, 36, 37	70:13	30:09	37
AL6	29, 30	47:09	18:03	44
AL7		0:00	0:00	0
AL8		0:00	0:00	0
AL9	11, 12, 13	113:50	53:33	65
AL10	9, 12	31:00	13:45	56
AL11		0:00	0:00	0
AL12	51	4:49	1:22	10
AL13	4	22:29	4:39	35
Total exceeding receptors		**7**	**7**	**9**

Source: Mott MacDonald

From examination of publicly availably satellite imagery it is evident that some of the assessment locations are surrounded by what seems to be substantial patches of vegetation or other obstructions; accounting for this can effectively reduce shadow flicker times or eliminate shadow flicker altogether. It is therefore recommended to carry out a detailed survey of all locations identified in this assessment as affected by excessive shadow flicker to reevaluate if actual conditions at these locations may practically preclude occurrence of shadow flicker.

13.6 Mitigation and enhancement measures

Preliminary measures to mitigate possible shadow flicker impact during the Project's design phase include micro-siting specific WTGs identified as affecting excessive flicker, or selecting WTGs with smaller rotor diameter or lower hub height to be used at specific WTG locations currently identified as affecting excessive flicker.

Given that the layout has been frozen and WTG model selected, shadow flicker mitigation can be applied in the following ways:

- Landscaping and/or planting vegetation in vicinity of relevant locations that may be affected by excessive shadow flicker. This is typically a viable solution to localised problems. It can be complex to agree and subject to operational risks, such as interference or weather damage.
- Shutdown of affecting WTGs during periods of potential shadow flicker. This is the most likely method to be used, and most trusted, at the cost of total production loss for those WTGs shut down at the times of shadow flicker effects. This can be addressed in two ways:

- Shutdown according to pre-programmed schedule, which can be made readily available in the form of detailed potential (worst case scenario) shadow flicker timetable.
- Implementation of shadow flicker protection systems, that are readily available either from WTG suppliers or as a 3rd party retrofit. These systems typically also take into account operational data from the WTGs and light sensors, such that WTG shutdown occurs only at times when suitable conditions prevail.

13.6.1 Shadow flicker duration per WTG and shutdown schedule

Mitigation by curtailment of affecting WTGs has been studied by assuming a conservative curtailment plan, in which affecting WTGs will be shut down when shadow flicker conditions occur and impact receptors. No optimisation exercise of the curtailment plan for energy loss has been carried out. It is estimated that under real conditions, the actual curtailment duration can be reduced considerably.

The following Table 13.8 details the shadow flicker durations affected by individual WTGs (only WTGs inflicting nonzero durations at any receptors are shown). Following our assumptions for this assessment, WTG shutdown will be scheduled when WTGs inflict shadow flicker at any of the receptors during each of the shadow flicker durations. Thus, Table 13.8 can be considered as the result of shutdown schedule for zero shadow flicker at the receptors. A more detailed analysis would be required to study a shadow flicker below limits, which is a more realistic scenario. The corresponding detailed curtailment schedule is provided in Appendix A.

It is noted that a WTG can lead to flicker at more than one receptor simultaneously, and a receptor may receive flicker from more than one WTG simultaneously. Hence, the expected shadow flicker duration at a given receptor might deviate from the individual shadow flicker duration inflicted by each WTG. It is also noted that the ratio between the real case and worst case durations is not constant across WTGs, as it is a function of the individual WTG positions relative to the corresponding receptors affected by it.

Table 13.8: Shadow flicker duration per WTG

WTG ID	Affected receptors	Worst case (hours/y)	Real case (hours/y)
4	AL13	22:29	4:39
9	AL10	19:35	9:05
11	AL9	10:29	5:26
12	AL10, AL9	107:07	53:46
13	AL9	15:53	3:14
22	AL5	0:50	0:07
23	AL5	18:49	3:36
29	AL6	34:25	15:52
30	AL6	12:44	2:11
36	AL5	46:05	23:58
37	AL2, AL5	27:51	12:32
38	AL2	22:04	9:39
40	AL3	13:06	4:08
42	AL3	22:30	9:30
43	AL3	3:45	1:16
44	AL4	19:13	2:32
47	AL1	13:41	5:21
48	AL3	2:43	0:37
50	AL1	19:08	9:47

WTG ID	Affected receptors	Worst case (hours/y)	Real case (hours/y)
51	AL12	4:49	1:22
Total required shutdown time (hours/y)		**437:16**	**178:38**
Wind farm average shutdown time (hours/y)		**8:05**	**3:18**
Wind farm average shutdown time per year (%)		**0.09**	**0.03**

Source: Mott MacDonald

13.7 Monitoring

Monitoring of shadow flicker is typically not necessary. Bespoke site visits and monitoring may take place in case of specific localised complaints.

13.8 Residual impacts

Applying the curtailment plan described above will result in no residual shadow flicker impact at the identified assessment locations. In principle it is possible to derive a more energy-optimised curtailment plan that would allow for some nonzero shadow flicker impact to occur, however still below the allowed limits.

Appendices

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A. Curtailment schedule

All schedules are given with respect to time zone Skopje – UTC+1. DST included. Times are calculated for reference year 2025. Small deviations may occur between years.

Table A.1: Curtailment schedule – WTG 4

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
02-Feb	06:42	16:44	15:27	15:33	00:06
03-Feb	06:41	16:46	15:23	15:36	00:13
04-Feb	06:40	16:47	15:21	15:38	00:17
05-Feb	06:38	16:48	15:20	15:40	00:20
06-Feb	06:37	16:50	15:19	15:42	00:23
07-Feb	06:36	16:51	15:18	15:44	00:26
08-Feb	06:35	16:52	15:16	15:45	00:29
09-Feb	06:34	16:53	15:16	15:46	00:30
10-Feb	06:33	16:55	15:15	15:47	00:32
11-Feb	06:31	16:56	15:15	15:48	00:33
12-Feb	06:30	16:57	15:14	15:48	00:34
13-Feb	06:29	16:58	15:14	15:49	00:35
14-Feb	06:28	17:00	15:14	15:49	00:35
15-Feb	06:26	17:01	15:14	15:49	00:35
16-Feb	06:25	17:02	15:14	15:49	00:35
17-Feb	06:24	17:03	15:15	15:49	00:34
18-Feb	06:22	17:05	15:15	15:48	00:33
19-Feb	06:21	17:06	15:16	15:48	00:32
20-Feb	06:19	17:07	15:16	15:47	00:31
21-Feb	06:18	17:08	15:17	15:47	00:30
22-Feb	06:17	17:10	15:17	15:45	00:28
23-Feb	06:15	17:11	15:19	15:45	00:26
24-Feb	06:14	17:12	15:20	15:42	00:22
25-Feb	06:12	17:13	15:22	15:41	00:19
26-Feb	06:11	17:14	15:25	15:38	00:13
16-Oct	06:41	17:48	15:58	16:09	00:11
17-Oct	06:42	17:47	15:54	16:12	00:18
18-Oct	06:43	17:45	15:52	16:13	00:21
19-Oct	06:44	17:44	15:51	16:16	00:25
20-Oct	06:46	17:42	15:49	16:16	00:27
21-Oct	06:47	17:41	15:47	16:17	00:30
22-Oct	06:48	17:39	15:46	16:17	00:31
23-Oct	06:49	17:38	15:46	16:18	00:32
24-Oct	06:50	17:36	15:45	16:19	00:34
25-Oct	06:51	17:35	15:44	16:18	00:34

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
26-Oct	05:53	16:33	14:44	15:18	00:34
27-Oct	05:54	16:32	14:44	15:19	00:35
28-Oct	05:55	16:31	14:44	15:19	00:35
29-Oct	05:56	16:29	14:44	15:18	00:34
30-Oct	05:57	16:28	14:43	15:17	00:34
31-Oct	05:58	16:27	14:44	15:18	00:34
01-Nov	06:00	16:25	14:45	15:17	00:32
02-Nov	06:01	16:24	14:45	15:16	00:31
03-Nov	06:02	16:23	14:46	15:16	00:30
04-Nov	06:03	16:22	14:47	15:14	00:27
05-Nov	06:05	16:20	14:48	15:12	00:24
06-Nov	06:06	16:19	14:49	15:10	00:21
07-Nov	06:07	16:18	14:51	15:09	00:18
08-Nov	06:08	16:17	14:53	15:08	00:15
09-Nov	06:09	16:16	14:55	15:06	00:11

Source: Mott MacDonald

Table A.2: Curtailment schedule – WTG 9

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
08-Apr	06:03	19:01	18:28	18:41	00:13
09-Apr	06:01	19:02	18:25	18:43	00:18
10-Apr	05:59	19:03	18:22	18:43	00:21
11-Apr	05:58	19:04	18:21	18:45	00:24
12-Apr	05:56	19:05	18:20	18:45	00:25
13-Apr	05:54	19:06	18:19	18:47	00:28
14-Apr	05:53	19:07	18:18	18:48	00:30
15-Apr	05:51	19:08	18:16	18:48	00:32
16-Apr	05:50	19:10	18:16	18:48	00:32
17-Apr	05:48	19:11	18:15	18:48	00:33
18-Apr	05:47	19:12	18:16	18:48	00:32
19-Apr	05:45	19:13	18:15	18:47	00:32
20-Apr	05:43	19:14	18:15	18:48	00:33
21-Apr	05:42	19:15	18:15	18:47	00:32
22-Apr	05:40	19:16	18:16	18:46	00:30
23-Apr	05:39	19:17	18:16	18:45	00:29
24-Apr	05:37	19:18	18:17	18:45	00:28
25-Apr	05:36	19:19	18:17	18:43	00:26
26-Apr	05:35	19:20	18:18	18:42	00:24
27-Apr	05:33	19:22	18:19	18:41	00:22
28-Apr	05:32	19:23	18:20	18:39	00:19
29-Apr	05:30	19:24	18:23	18:37	00:14
30-Apr	05:29	19:25	18:27	18:33	00:06

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
14-Aug	05:35	19:32	18:31	18:43	00:12
15-Aug	05:36	19:31	18:28	18:45	00:17
16-Aug	05:37	19:29	18:26	18:47	00:21
17-Aug	05:38	19:28	18:25	18:48	00:23
18-Aug	05:39	19:26	18:23	18:49	00:26
19-Aug	05:40	19:25	18:22	18:50	00:28
20-Aug	05:41	19:23	18:21	18:50	00:29
21-Aug	05:42	19:22	18:20	18:51	00:31
22-Aug	05:43	19:20	18:20	18:51	00:31
23-Aug	05:45	19:19	18:19	18:51	00:32
24-Aug	05:46	19:17	18:19	18:51	00:32
25-Aug	05:47	19:16	18:18	18:51	00:33
26-Aug	05:48	19:14	18:18	18:51	00:33
27-Aug	05:49	19:13	18:18	18:50	00:32
28-Aug	05:50	19:11	18:18	18:50	00:32
29-Aug	05:51	19:09	18:18	18:49	00:31
30-Aug	05:52	19:08	18:18	18:47	00:29
31-Aug	05:53	19:06	18:19	18:46	00:27
01-Sep	05:54	19:05	18:19	18:44	00:25
02-Sep	05:55	19:03	18:20	18:43	00:23
03-Sep	05:56	19:01	18:22	18:41	00:19
04-Sep	05:57	19:00	18:23	18:39	00:16
05-Sep	05:58	18:58	18:26	18:36	00:10

Source: Mott MacDonald

Table A.3: Curtailment schedule – WTG 11

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
01-May	05:27	19:26	19:02	19:05	00:03
02-May	05:26	19:27	19:01	19:06	00:05
03-May	05:25	19:28	19:00	19:07	00:07
04-May	05:24	19:29	19:00	19:09	00:09
05-May	05:22	19:30	18:58	19:09	00:11
06-May	05:21	19:31	18:58	19:10	00:12
07-May	05:20	19:32	18:58	19:11	00:13
08-May	05:19	19:33	18:58	19:12	00:14
09-May	05:17	19:34	18:58	19:13	00:15
10-May	05:16	19:35	18:58	19:14	00:16
11-May	05:15	19:36	18:58	19:15	00:17
12-May	05:14	19:38	18:58	19:16	00:18
13-May	05:13	19:39	18:58	19:17	00:19
14-May	05:12	19:40	18:59	19:18	00:19

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
15-May	05:11	19:41	18:59	19:19	00:20
16-May	05:10	19:42	19:00	19:20	00:20
17-May	05:09	19:43	19:00	19:21	00:21
18-May	05:08	19:44	19:01	19:20	00:19
19-May	05:07	19:45	19:02	19:19	00:17
20-May	05:06	19:46	19:03	19:18	00:15
21-May	05:05	19:47	19:04	19:16	00:12
22-May	05:04	19:47	19:07	19:15	00:08
22-Jul	05:13	19:58	19:18	19:24	00:06
23-Jul	05:14	19:57	19:15	19:27	00:12
24-Jul	05:14	19:56	19:13	19:28	00:15
25-Jul	05:15	19:55	19:12	19:29	00:17
26-Jul	05:16	19:54	19:11	19:30	00:19
27-Jul	05:17	19:53	19:10	19:31	00:21
28-Jul	05:18	19:52	19:10	19:30	00:20
29-Jul	05:19	19:51	19:09	19:30	00:21
30-Jul	05:20	19:50	19:09	19:29	00:20
31-Jul	05:21	19:49	19:09	19:28	00:19
01-Aug	05:22	19:48	19:08	19:27	00:19
02-Aug	05:23	19:47	19:08	19:26	00:18
03-Aug	05:24	19:46	19:08	19:25	00:17
04-Aug	05:25	19:45	19:08	19:24	00:16
05-Aug	05:26	19:44	19:08	19:23	00:15
06-Aug	05:27	19:42	19:08	19:22	00:14
07-Aug	05:28	19:41	19:08	19:20	00:12
08-Aug	05:29	19:40	19:07	19:18	00:11
09-Aug	05:30	19:39	19:08	19:17	00:09
10-Aug	05:31	19:37	19:08	19:16	00:08
11-Aug	05:32	19:36	19:09	19:15	00:06
12-Aug	05:33	19:35	19:10	19:13	00:03
13-Aug	05:34	19:33	19:11	19:12	00:01

Source: Mott MacDonald

Table A.4: Curtailment schedule – WTG 12

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
03-Apr	06:11	18:55	06:43	06:51	00:08
04-Apr	06:09	18:56	06:42	06:53	00:11
05-Apr	06:07	18:57	06:41	06:55	00:14
06-Apr	06:06	18:58	06:39	06:56	00:17
07-Apr	06:04	19:00	06:37	06:56	00:19
08-Apr	06:02	19:01	06:37	06:57	00:20

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
09-Apr	06:01	19:02	06:35	06:57	00:22
10-Apr	05:59	19:03	06:33	06:57	00:24
11-Apr	05:58	19:04	06:32	06:57	00:25
12-Apr	05:56	19:05	06:31	06:56	00:25
13-Apr	05:54	19:06	06:30	06:56	00:26
14-Apr	05:53	19:07	06:30	06:55	00:25
15-Apr	05:51	19:08	06:30	06:54	00:24
16-Apr	05:50	19:09	06:31	06:53	00:22
17-Apr	05:48	19:10	06:31	06:51	00:20
18-Apr	05:46	19:12	06:33	06:50	00:17
19-Apr	05:45	19:13	06:34	06:48	00:14
20-Apr	05:43	19:14	06:37	06:45	00:08
22-Apr	05:40	19:16	18:44	18:50	00:06
23-Apr	05:39	19:17	18:37	18:55	00:18
24-Apr	05:37	19:18	18:34	18:58	00:24
25-Apr	05:36	19:19	18:30	18:59	00:29
26-Apr	05:34	19:20	18:29	19:00	00:31
27-Apr	05:33	19:21	18:27	19:01	00:34
28-Apr	05:32	19:22	18:25	19:02	00:37
29-Apr	05:30	19:24	18:24	19:03	00:39
30-Apr	05:29	19:25	18:23	19:04	00:41
01-May	05:27	19:26	18:21	19:05	00:44
02-May	05:26	19:27	18:20	19:06	00:46
03-May	05:25	19:28	18:20	19:07	00:47
04-May	05:24	19:29	18:19	19:09	00:50
05-May	05:22	19:30	18:18	19:09	00:51
06-May	05:21	19:31	18:18	19:10	00:52
07-May	05:20	19:32	18:17	19:11	00:54
08-May	05:19	19:33	18:17	19:12	00:55
09-May	05:17	19:34	18:17	19:12	00:55
10-May	05:16	19:35	18:17	19:12	00:55
11-May	05:15	19:36	18:16	19:13	00:57
12-May	05:14	19:37	18:16	19:13	00:57
13-May	05:13	19:39	18:16	19:13	00:57
14-May	05:12	19:40	18:16	19:13	00:57
15-May	05:11	19:41	18:16	19:13	00:57
16-May	05:10	19:42	18:16	19:13	00:57
17-May	05:09	19:43	18:16	19:13	00:57
18-May	05:08	19:44	18:16	19:13	00:57
19-May	05:07	19:45	18:16	19:12	00:56
20-May	05:06	19:45	18:16	19:12	00:56
21-May	05:05	19:46	18:16	19:12	00:56

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
22-May	05:04	19:47	18:17	19:12	00:55
23-May	05:03	19:48	18:17	19:12	00:55
24-May	05:03	19:49	18:17	19:12	00:55
25-May	05:02	19:50	18:18	19:12	00:54
26-May	05:01	19:51	18:18	19:12	00:54
27-May	05:01	19:52	18:18	19:11	00:53
28-May	05:00	19:53	18:19	19:12	00:53
29-May	04:59	19:54	18:19	19:11	00:52
30-May	04:59	19:54	18:20	19:11	00:51
31-May	04:58	19:55	18:20	19:11	00:51
01-Jun	04:58	19:56	18:21	19:11	00:50
02-Jun	04:57	19:57	18:21	19:10	00:49
03-Jun	04:57	19:58	18:22	19:10	00:48
04-Jun	04:56	19:58	18:23	19:11	00:48
05-Jun	04:56	19:59	18:22	19:10	00:48
06-Jun	04:56	20:00	18:23	19:10	00:47
07-Jun	04:55	20:00	18:24	19:10	00:46
08-Jun	04:55	20:01	18:25	19:10	00:45
09-Jun	04:55	20:02	18:24	19:09	00:45
10-Jun	04:55	20:02	18:25	19:09	00:44
11-Jun	04:54	20:03	18:26	19:10	00:44
12-Jun	04:54	20:03	18:26	19:10	00:44
13-Jun	04:54	20:04	18:27	19:10	00:43
14-Jun	04:54	20:04	18:27	19:10	00:43
15-Jun	04:54	20:05	18:27	19:10	00:43
16-Jun	04:54	20:05	18:28	19:10	00:42
17-Jun	04:54	20:05	18:28	19:10	00:42
18-Jun	04:54	20:06	18:28	19:10	00:42
19-Jun	04:54	20:06	18:28	19:10	00:42
20-Jun	04:54	20:06	18:29	19:10	00:41
21-Jun	04:54	20:07	18:30	19:11	00:41
22-Jun	04:55	20:07	18:30	19:11	00:41
23-Jun	04:55	20:07	18:30	19:11	00:41
24-Jun	04:55	20:07	18:29	19:11	00:42
25-Jun	04:55	20:07	18:30	19:12	00:42
26-Jun	04:56	20:07	18:30	19:12	00:42
27-Jun	04:56	20:08	18:30	19:12	00:42
28-Jun	04:56	20:08	18:30	19:13	00:43
29-Jun	04:57	20:08	18:30	19:13	00:43
30-Jun	04:57	20:08	18:31	19:14	00:43
01-Jul	04:58	20:07	18:30	19:14	00:44
02-Jul	04:58	20:07	18:31	19:15	00:44

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
03-Jul	04:59	20:07	18:30	19:14	00:44
04-Jul	04:59	20:07	18:30	19:15	00:45
05-Jul	05:00	20:07	18:30	19:15	00:45
06-Jul	05:00	20:06	18:30	19:16	00:46
07-Jul	05:01	20:06	18:29	19:16	00:47
08-Jul	05:02	20:06	18:29	19:17	00:48
09-Jul	05:02	20:06	18:30	19:18	00:48
10-Jul	05:03	20:05	18:29	19:17	00:48
11-Jul	05:04	20:05	18:29	19:18	00:49
12-Jul	05:04	20:04	18:29	19:19	00:50
13-Jul	05:05	20:04	18:28	19:19	00:51
14-Jul	05:06	20:03	18:28	19:19	00:51
15-Jul	05:07	20:03	18:28	19:20	00:52
16-Jul	05:07	20:02	18:28	19:21	00:53
17-Jul	05:08	20:01	18:28	19:21	00:53
18-Jul	05:09	20:01	18:27	19:21	00:54
19-Jul	05:10	20:00	18:27	19:21	00:54
20-Jul	05:11	19:59	18:27	19:22	00:55
21-Jul	05:12	19:59	18:27	19:22	00:55
22-Jul	05:13	19:58	18:27	19:23	00:56
23-Jul	05:13	19:57	18:27	19:23	00:56
24-Jul	05:14	19:56	18:26	19:22	00:56
25-Jul	05:15	19:55	18:26	19:22	00:56
26-Jul	05:16	19:54	18:26	19:23	00:57
27-Jul	05:17	19:53	18:26	19:23	00:57
28-Jul	05:18	19:52	18:26	19:23	00:57
29-Jul	05:19	19:51	18:26	19:23	00:57
30-Jul	05:20	19:50	18:26	19:23	00:57
31-Jul	05:21	19:49	18:26	19:23	00:57
01-Aug	05:22	19:48	18:26	19:23	00:57
02-Aug	05:23	19:47	18:27	19:23	00:56
03-Aug	05:24	19:46	18:27	19:23	00:56
04-Aug	05:25	19:45	18:27	19:22	00:55
05-Aug	05:26	19:44	18:27	19:22	00:55
06-Aug	05:27	19:42	18:27	19:22	00:55
07-Aug	05:28	19:41	18:28	19:20	00:52
08-Aug	05:29	19:40	18:27	19:18	00:51
09-Aug	05:30	19:39	18:28	19:17	00:49
10-Aug	05:31	19:37	18:28	19:16	00:48
11-Aug	05:32	19:36	18:29	19:15	00:46
12-Aug	05:33	19:35	18:29	19:13	00:44
13-Aug	05:34	19:33	18:30	19:12	00:42

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
14-Aug	05:35	19:32	18:31	19:11	00:40
15-Aug	05:36	19:31	18:32	19:09	00:37
16-Aug	05:37	19:29	18:33	19:08	00:35
17-Aug	05:38	19:28	18:34	19:07	00:33
18-Aug	05:39	19:26	18:36	19:05	00:29
19-Aug	05:40	19:25	18:38	19:04	00:26
20-Aug	05:41	19:23	18:41	19:02	00:21
21-Aug	05:42	19:22	18:45	18:57	00:12
23-Aug	05:44	19:19	06:44	06:45	00:01
24-Aug	05:45	19:17	06:38	06:50	00:12
25-Aug	05:46	19:16	06:36	06:52	00:16
26-Aug	05:47	19:14	06:34	06:53	00:19
27-Aug	05:49	19:13	06:33	06:54	00:21
28-Aug	05:50	19:11	06:32	06:55	00:23
29-Aug	05:51	19:09	06:31	06:55	00:24
30-Aug	05:52	19:08	06:30	06:56	00:26
31-Aug	05:53	19:06	06:30	06:56	00:26
01-Sep	05:54	19:04	06:30	06:56	00:26
02-Sep	05:55	19:03	06:31	06:55	00:24
03-Sep	05:56	19:01	06:32	06:55	00:23
04-Sep	05:57	18:59	06:33	06:54	00:21
05-Sep	05:58	18:58	06:34	06:53	00:19
06-Sep	05:59	18:56	06:34	06:52	00:18
07-Sep	06:00	18:54	06:35	06:51	00:16
08-Sep	06:01	18:53	06:36	06:49	00:13
09-Sep	06:02	18:51	06:37	06:47	00:10
10-Sep	06:03	18:49	06:37	06:43	00:06

Source: Mott MacDonald

Table A.5: Curtailment schedule – WTG 13

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
01-Jan	06:56	16:08	10:14	10:44	00:30
02-Jan	06:56	16:09	10:16	10:43	00:27
03-Jan	06:56	16:10	10:18	10:41	00:23
04-Jan	06:56	16:11	10:21	10:39	00:18
05-Jan	06:56	16:12	10:24	10:36	00:12
08-Dec	06:42	15:59	10:11	10:25	00:14
09-Dec	06:43	15:58	10:09	10:29	00:20
10-Dec	06:44	15:58	10:07	10:32	00:25
11-Dec	06:45	15:59	10:05	10:33	00:28
12-Dec	06:46	15:59	10:04	10:35	00:31

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
01-Jan	06:56	16:08	10:14	10:44	00:30
13-Dec	06:46	15:59	10:04	10:37	00:33
14-Dec	06:47	15:59	10:04	10:39	00:35
15-Dec	06:48	15:59	10:04	10:40	00:36
16-Dec	06:49	15:59	10:03	10:41	00:38
17-Dec	06:49	16:00	10:03	10:42	00:39
18-Dec	06:50	16:00	10:04	10:43	00:39
19-Dec	06:51	16:00	10:03	10:43	00:40
20-Dec	06:51	16:01	10:04	10:45	00:41
21-Dec	06:52	16:01	10:04	10:45	00:41
22-Dec	06:52	16:02	10:05	10:46	00:41
23-Dec	06:53	16:02	10:05	10:46	00:41
24-Dec	06:53	16:03	10:06	10:47	00:41
25-Dec	06:54	16:03	10:06	10:46	00:40
26-Dec	06:54	16:04	10:07	10:46	00:39
27-Dec	06:55	16:04	10:08	10:47	00:39
28-Dec	06:55	16:05	10:09	10:47	00:38
29-Dec	06:55	16:06	10:10	10:46	00:36
30-Dec	06:55	16:07	10:11	10:46	00:35
31-Dec	06:56	16:07	10:12	10:45	00:33

Source: Mott MacDonald

Table A.6: Curtailment schedule – WTG 22

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
19-Jan	06:52	16:27	15:40	15:41	00:01
20-Jan	06:52	16:28	15:40	15:42	00:02
21-Jan	06:51	16:29	15:42	15:44	00:02
22-Jan	06:50	16:30	15:42	15:45	00:03
23-Jan	06:50	16:31	15:43	15:46	00:03
24-Jan	06:49	16:33	15:44	15:48	00:04
25-Jan	06:48	16:34	15:46	15:50	00:04
26-Jan	06:47	16:35	15:48	15:52	00:04
27-Jan	06:47	16:36	15:50	15:53	00:03
15-Nov	06:16	16:10	15:25	15:26	00:01
16-Nov	06:18	16:09	15:22	15:25	00:03
17-Nov	06:19	16:08	15:20	15:23	00:03
18-Nov	06:20	16:07	15:19	15:23	00:04
19-Nov	06:21	16:06	15:18	15:22	00:04
20-Nov	06:22	16:05	15:17	15:20	00:03
21-Nov	06:24	16:05	15:18	15:20	00:02
22-Nov	06:25	16:04	15:17	15:19	00:02

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
23-Nov	06:26	16:03	15:17	15:18	00:01
24-Nov	06:27	16:03	15:16	15:17	00:01

Source: Mott MacDonald

Table A.7: Curtailment schedule – WTG 23

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
21-Jan	06:51	16:29	15:43	15:44	00:01
22-Jan	06:50	16:30	15:42	15:45	00:03
23-Jan	06:50	16:31	15:41	15:46	00:05
24-Jan	06:49	16:33	15:40	15:48	00:08
25-Jan	06:48	16:34	15:40	15:50	00:10
26-Jan	06:47	16:35	15:39	15:52	00:13
27-Jan	06:47	16:36	15:39	15:53	00:14
28-Jan	06:46	16:38	15:38	15:54	00:16
29-Jan	06:45	16:39	15:38	15:56	00:18
30-Jan	06:44	16:40	15:37	15:57	00:20
31-Jan	06:43	16:41	15:37	15:59	00:22
01-Feb	06:42	16:43	15:37	16:01	00:24
02-Feb	06:41	16:44	15:37	16:02	00:25
03-Feb	06:40	16:45	15:37	16:04	00:27
04-Feb	06:39	16:47	15:38	16:06	00:28
05-Feb	06:38	16:48	15:38	16:07	00:29
06-Feb	06:37	16:49	15:37	16:08	00:31
07-Feb	06:36	16:50	15:38	16:10	00:32
08-Feb	06:35	16:52	15:39	16:12	00:33
09-Feb	06:33	16:53	15:39	16:12	00:33
10-Feb	06:32	16:54	15:40	16:12	00:32
11-Feb	06:31	16:55	15:41	16:10	00:29
12-Feb	06:30	16:57	15:42	16:10	00:28
13-Feb	06:29	16:58	15:43	16:09	00:26
14-Feb	06:27	16:59	15:44	16:07	00:23
15-Feb	06:26	17:01	15:47	16:05	00:18
16-Feb	06:25	17:02	15:50	16:03	00:13
26-Oct	05:52	16:33	15:20	15:31	00:11
27-Oct	05:53	16:32	15:17	15:34	00:17
28-Oct	05:54	16:30	15:14	15:36	00:22
29-Oct	05:56	16:29	15:13	15:38	00:25
30-Oct	05:57	16:28	15:12	15:39	00:27
31-Oct	05:58	16:26	15:10	15:39	00:29
01-Nov	05:59	16:25	15:10	15:41	00:31
02-Nov	06:00	16:24	15:09	15:41	00:32
03-Nov	06:02	16:22	15:08	15:41	00:33

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
04-Nov	06:03	16:21	15:08	15:40	00:32
05-Nov	06:04	16:20	15:08	15:39	00:31
06-Nov	06:05	16:19	15:08	15:38	00:30
07-Nov	06:07	16:18	15:07	15:36	00:29
08-Nov	06:08	16:17	15:08	15:35	00:27
09-Nov	06:09	16:15	15:08	15:34	00:26
10-Nov	06:10	16:14	15:08	15:32	00:24
11-Nov	06:11	16:13	15:09	15:31	00:22
12-Nov	06:13	16:12	15:09	15:30	00:21
13-Nov	06:14	16:11	15:09	15:28	00:19
14-Nov	06:15	16:10	15:10	15:28	00:18
15-Nov	06:16	16:10	15:11	15:26	00:15
16-Nov	06:18	16:09	15:11	15:25	00:14
17-Nov	06:19	16:08	15:12	15:23	00:11
18-Nov	06:20	16:07	15:14	15:23	00:09
19-Nov	06:21	16:06	15:15	15:22	00:07
20-Nov	06:22	16:05	15:16	15:20	00:04
21-Nov	06:24	16:05	15:18	15:20	00:02

Source: Mott MacDonald

Table A.8: Curtailment schedule – WTG 29

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
04-Apr	06:09	18:56	18:22	18:37	00:15
05-Apr	06:07	18:57	18:18	18:37	00:19
06-Apr	06:06	18:58	18:16	18:39	00:23
07-Apr	06:04	18:59	18:14	18:39	00:25
08-Apr	06:02	19:00	18:12	18:40	00:28
09-Apr	06:01	19:02	18:11	18:41	00:30
10-Apr	05:59	19:03	18:09	18:42	00:33
11-Apr	05:57	19:04	18:07	18:42	00:35
12-Apr	05:56	19:05	18:07	18:44	00:37
13-Apr	05:54	19:06	18:06	18:44	00:38
14-Apr	05:52	19:07	18:06	18:45	00:39
15-Apr	05:51	19:08	18:05	18:46	00:41
16-Apr	05:49	19:09	18:04	18:46	00:42
17-Apr	05:48	19:10	18:04	18:47	00:43
18-Apr	05:46	19:11	18:03	18:47	00:44
19-Apr	05:45	19:12	18:04	18:47	00:43
20-Apr	05:43	19:14	18:03	18:46	00:43
21-Apr	05:42	19:15	18:04	18:46	00:42
22-Apr	05:40	19:16	18:03	18:45	00:42
23-Apr	05:39	19:17	18:04	18:45	00:41

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
24-Apr	05:37	19:18	18:05	18:45	00:40
25-Apr	05:36	19:19	18:05	18:44	00:39
26-Apr	05:34	19:20	18:06	18:43	00:37
27-Apr	05:33	19:21	18:06	18:41	00:35
28-Apr	05:31	19:22	18:07	18:41	00:34
29-Apr	05:30	19:23	18:08	18:40	00:32
30-Apr	05:29	19:24	18:09	18:38	00:29
01-May	05:27	19:26	18:11	18:36	00:25
02-May	05:26	19:27	18:13	18:34	00:21
03-May	05:25	19:28	18:14	18:31	00:17
04-May	05:23	19:29	18:18	18:28	00:10
09-Aug	05:30	19:38	18:29	18:35	00:06
10-Aug	05:31	19:37	18:24	18:40	00:16
11-Aug	05:32	19:36	18:22	18:42	00:20
12-Aug	05:33	19:34	18:19	18:44	00:25
13-Aug	05:34	19:33	18:18	18:45	00:27
14-Aug	05:35	19:32	18:16	18:47	00:31
15-Aug	05:36	19:30	18:15	18:48	00:33
16-Aug	05:37	19:29	18:14	18:48	00:34
17-Aug	05:38	19:27	18:12	18:49	00:37
18-Aug	05:39	19:26	18:11	18:50	00:39
19-Aug	05:40	19:25	18:11	18:50	00:39
20-Aug	05:41	19:23	18:10	18:51	00:41
21-Aug	05:42	19:22	18:09	18:51	00:42
22-Aug	05:43	19:20	18:08	18:51	00:43
23-Aug	05:44	19:19	18:08	18:51	00:43
24-Aug	05:45	19:17	18:07	18:51	00:44
25-Aug	05:46	19:15	18:07	18:51	00:44
26-Aug	05:47	19:14	18:07	18:50	00:43
27-Aug	05:48	19:12	18:06	18:49	00:43
28-Aug	05:49	19:11	18:06	18:48	00:42
29-Aug	05:50	19:09	18:06	18:47	00:41
30-Aug	05:51	19:07	18:06	18:45	00:39
31-Aug	05:52	19:06	18:07	18:44	00:37
01-Sep	05:53	19:04	18:07	18:43	00:36
02-Sep	05:54	19:03	18:07	18:41	00:34
03-Sep	05:55	19:01	18:08	18:40	00:32
04-Sep	05:56	18:59	18:09	18:38	00:29
05-Sep	05:57	18:58	18:10	18:37	00:27
06-Sep	05:58	18:56	18:11	18:35	00:24
07-Sep	05:59	18:54	18:12	18:34	00:22
08-Sep	06:01	18:52	18:15	18:33	00:18

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
09-Sep	06:02	18:51	18:18	18:30	00:12

Source: Mott MacDonald

Table A.9: Curtailment schedule – WTG 30

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
09-Jan	06:56	16:16	15:51	15:52	00:01
10-Jan	06:55	16:17	15:51	15:53	00:02
11-Jan	06:55	16:18	15:51	15:55	00:04
12-Jan	06:55	16:19	15:50	15:55	00:05
13-Jan	06:55	16:20	15:50	15:57	00:07
14-Jan	06:54	16:21	15:51	15:58	00:07
15-Jan	06:54	16:22	15:50	15:59	00:09
16-Jan	06:54	16:23	15:51	16:01	00:10
17-Jan	06:53	16:24	15:50	16:01	00:11
18-Jan	06:53	16:26	15:50	16:02	00:12
19-Jan	06:52	16:27	15:50	16:04	00:14
20-Jan	06:52	16:28	15:50	16:05	00:15
21-Jan	06:51	16:29	15:51	16:07	00:16
22-Jan	06:50	16:30	15:51	16:08	00:17
23-Jan	06:50	16:32	15:51	16:09	00:18
24-Jan	06:49	16:33	15:51	16:10	00:19
25-Jan	06:48	16:34	15:51	16:11	00:20
26-Jan	06:47	16:35	15:53	16:13	00:20
27-Jan	06:47	16:37	15:53	16:15	00:22
28-Jan	06:46	16:38	15:54	16:16	00:22
29-Jan	06:45	16:39	15:54	16:17	00:23
30-Jan	06:44	16:40	15:55	16:19	00:24
31-Jan	06:43	16:42	15:56	16:19	00:23
01-Feb	06:42	16:43	15:58	16:18	00:20
02-Feb	06:41	16:44	15:59	16:17	00:18
03-Feb	06:40	16:45	16:01	16:16	00:15
04-Feb	06:39	16:47	16:04	16:13	00:09
07-Nov	06:07	16:18	15:36	15:40	00:04
08-Nov	06:08	16:17	15:33	15:45	00:12
09-Nov	06:09	16:16	15:30	15:47	00:17
10-Nov	06:10	16:15	15:29	15:48	00:19
11-Nov	06:11	16:14	15:28	15:50	00:22
12-Nov	06:13	16:13	15:27	15:51	00:24
13-Nov	06:14	16:12	15:26	15:49	00:23
14-Nov	06:15	16:11	15:26	15:48	00:22
15-Nov	06:16	16:10	15:26	15:48	00:22
16-Nov	06:18	16:09	15:26	15:47	00:21

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
17-Nov	06:19	16:08	15:25	15:45	00:20
18-Nov	06:20	16:07	15:26	15:45	00:19
19-Nov	06:21	16:06	15:26	15:44	00:18
20-Nov	06:22	16:06	15:26	15:43	00:17
21-Nov	06:24	16:05	15:26	15:42	00:16
22-Nov	06:25	16:04	15:27	15:42	00:15
23-Nov	06:26	16:04	15:27	15:41	00:14
24-Nov	06:27	16:03	15:27	15:40	00:13
25-Nov	06:28	16:02	15:28	15:39	00:11
26-Nov	06:29	16:02	15:29	15:40	00:11
27-Nov	06:30	16:01	15:29	15:39	00:10
28-Nov	06:32	16:01	15:30	15:38	00:08
29-Nov	06:33	16:00	15:31	15:38	00:07
30-Nov	06:34	16:00	15:31	15:37	00:06
01-Dec	06:35	16:00	15:32	15:37	00:05
02-Dec	06:36	15:59	15:33	15:36	00:03
03-Dec	06:37	15:59	15:34	15:36	00:02

Source: Mott MacDonald

Table A.10: Curtailment schedule – WTG 36

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
05-May	05:22	19:30	18:41	18:43	00:02
06-May	05:21	19:31	18:37	18:45	00:08
07-May	05:19	19:32	18:34	18:46	00:12
08-May	05:18	19:33	18:32	18:46	00:14
09-May	05:17	19:34	18:30	18:48	00:18
10-May	05:16	19:35	18:29	18:49	00:20
11-May	05:15	19:36	18:29	18:50	00:21
12-May	05:14	19:37	18:28	18:52	00:24
13-May	05:12	19:38	18:27	18:53	00:26
14-May	05:11	19:39	18:27	18:54	00:27
15-May	05:10	19:40	18:26	18:55	00:29
16-May	05:09	19:41	18:26	18:56	00:30
17-May	05:08	19:42	18:25	18:57	00:32
18-May	05:07	19:43	18:25	18:58	00:33
19-May	05:07	19:44	18:26	19:00	00:34
20-May	05:06	19:45	18:25	19:01	00:36
21-May	05:05	19:46	18:25	19:02	00:37
22-May	05:04	19:47	18:25	19:02	00:37
23-May	05:03	19:48	18:26	19:02	00:36
24-May	05:02	19:49	18:26	19:02	00:36

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
25-May	05:02	19:50	18:25	19:02	00:37
26-May	05:01	19:51	18:26	19:03	00:37
27-May	05:00	19:52	18:26	19:02	00:36
28-May	05:00	19:53	18:26	19:02	00:36
29-May	04:59	19:53	18:27	19:02	00:35
30-May	04:58	19:54	18:27	19:02	00:35
31-May	04:58	19:55	18:28	19:02	00:34
01-Jun	04:57	19:56	18:27	19:01	00:34
02-Jun	04:57	19:57	18:28	19:02	00:34
03-Jun	04:56	19:57	18:29	19:02	00:33
04-Jun	04:56	19:58	18:29	19:01	00:32
05-Jun	04:56	19:59	18:30	19:02	00:32
06-Jun	04:55	20:00	18:30	19:02	00:32
07-Jun	04:55	20:00	18:30	19:01	00:31
08-Jun	04:55	20:01	18:31	19:01	00:30
09-Jun	04:54	20:01	18:31	19:01	00:30
10-Jun	04:54	20:02	18:32	19:01	00:29
11-Jun	04:54	20:03	18:33	19:01	00:28
12-Jun	04:54	20:03	18:33	19:01	00:28
13-Jun	04:54	20:04	18:34	19:02	00:28
14-Jun	04:54	20:04	18:34	19:02	00:28
15-Jun	04:54	20:05	18:34	19:02	00:28
16-Jun	04:54	20:05	18:35	19:02	00:27
17-Jun	04:54	20:05	18:35	19:02	00:27
18-Jun	04:54	20:06	18:35	19:02	00:27
19-Jun	04:54	20:06	18:36	19:02	00:26
20-Jun	04:54	20:06	18:36	19:02	00:26
21-Jun	04:54	20:07	18:36	19:02	00:26
22-Jun	04:54	20:07	18:36	19:02	00:26
23-Jun	04:54	20:07	18:37	19:03	00:26
24-Jun	04:55	20:07	18:37	19:03	00:26
25-Jun	04:55	20:07	18:36	19:03	00:27
26-Jun	04:55	20:07	18:37	19:04	00:27
27-Jun	04:56	20:07	18:37	19:04	00:27
28-Jun	04:56	20:07	18:36	19:04	00:28
29-Jun	04:56	20:07	18:37	19:05	00:28
30-Jun	04:57	20:07	18:37	19:05	00:28
01-Jul	04:57	20:07	18:37	19:05	00:28
02-Jul	04:58	20:07	18:37	19:05	00:28
03-Jul	04:58	20:07	18:37	19:06	00:29
04-Jul	04:59	20:07	18:36	19:06	00:30
05-Jul	04:59	20:07	18:37	19:07	00:30

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
06-Jul	05:00	20:06	18:36	19:07	00:31
07-Jul	05:01	20:06	18:36	19:08	00:32
08-Jul	05:01	20:06	18:37	19:09	00:32
09-Jul	05:02	20:05	18:36	19:08	00:32
10-Jul	05:03	20:05	18:36	19:09	00:33
11-Jul	05:03	20:05	18:36	19:10	00:34
12-Jul	05:04	20:04	18:35	19:09	00:34
13-Jul	05:05	20:04	18:36	19:10	00:34
14-Jul	05:06	20:03	18:36	19:11	00:35
15-Jul	05:06	20:02	18:36	19:11	00:35
16-Jul	05:07	20:02	18:35	19:11	00:36
17-Jul	05:08	20:01	18:35	19:11	00:36
18-Jul	05:09	20:01	18:35	19:12	00:37
19-Jul	05:10	20:00	18:36	19:12	00:36
20-Jul	05:10	19:59	18:36	19:12	00:36
21-Jul	05:11	19:58	18:35	19:11	00:36
22-Jul	05:12	19:58	18:35	19:12	00:37
23-Jul	05:13	19:57	18:35	19:12	00:37
24-Jul	05:14	19:56	18:35	19:11	00:36
25-Jul	05:15	19:55	18:36	19:10	00:34
26-Jul	05:16	19:54	18:36	19:10	00:34
27-Jul	05:17	19:53	18:36	19:09	00:33
28-Jul	05:18	19:52	18:37	19:08	00:31
29-Jul	05:19	19:51	18:37	19:06	00:29
30-Jul	05:20	19:50	18:38	19:05	00:27
31-Jul	05:21	19:49	18:37	19:03	00:26
01-Aug	05:22	19:48	18:38	19:02	00:24
02-Aug	05:23	19:47	18:39	19:01	00:22
03-Aug	05:24	19:46	18:39	19:00	00:21
04-Aug	05:25	19:45	18:40	18:58	00:18
05-Aug	05:26	19:43	18:42	18:57	00:15
06-Aug	05:27	19:42	18:43	18:56	00:13
07-Aug	05:28	19:41	18:45	18:54	00:09
08-Aug	05:29	19:40	18:49	18:53	00:04

Source: Mott MacDonald

Table A.11: Curtailment schedule – WTG 37

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
17-Apr	05:48	19:10	06:48	06:54	00:06
18-Apr	05:46	19:11	06:44	06:57	00:13
19-Apr	05:45	19:12	06:42	07:00	00:18

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
20-Apr	05:43	19:14	06:39	07:00	00:21
21-Apr	05:41	19:15	06:39	07:02	00:23
22-Apr	05:40	19:16	06:37	07:02	00:25
23-Apr	05:38	19:17	06:37	07:03	00:26
24-Apr	05:37	19:18	06:36	07:03	00:27
25-Apr	05:36	19:19	06:35	07:03	00:28
26-Apr	05:34	19:20	06:35	07:03	00:28
27-Apr	05:33	19:21	06:34	07:02	00:28
28-Apr	05:31	19:22	18:33	18:34	00:01
28-Apr	05:31	19:22	06:34	07:03	00:29
29-Apr	05:30	19:23	18:30	18:36	00:06
29-Apr	05:30	19:23	06:35	07:03	00:28
30-Apr	05:28	19:24	18:28	18:37	00:09
30-Apr	05:28	19:24	06:34	07:01	00:27
01-May	05:27	19:26	18:26	18:38	00:12
01-May	05:27	19:26	06:35	07:01	00:26
02-May	05:26	19:27	18:26	18:40	00:14
02-May	05:26	19:27	06:35	07:01	00:26
03-May	05:24	19:28	18:24	18:40	00:16
03-May	05:24	19:28	06:36	07:00	00:24
04-May	05:23	19:29	18:24	18:42	00:18
04-May	05:23	19:29	06:36	06:58	00:22
05-May	05:22	19:30	18:24	18:43	00:19
05-May	05:22	19:30	06:37	06:57	00:20
06-May	05:21	19:31	18:23	18:45	00:22
06-May	05:21	19:31	06:39	06:56	00:17
07-May	05:19	19:32	18:23	18:46	00:23
07-May	05:19	19:32	06:41	06:54	00:13
08-May	05:18	19:33	18:22	18:46	00:24
08-May	05:18	19:33	06:43	06:52	00:09
09-May	05:17	19:34	18:23	18:46	00:23
10-May	05:16	19:35	18:23	18:46	00:23
11-May	05:15	19:36	18:23	18:46	00:23
12-May	05:14	19:37	18:24	18:45	00:21
13-May	05:13	19:38	18:24	18:45	00:21
14-May	05:11	19:39	18:25	18:44	00:19
15-May	05:10	19:40	18:26	18:43	00:17
16-May	05:09	19:41	18:27	18:42	00:15
17-May	05:08	19:42	18:28	18:41	00:13
18-May	05:07	19:43	18:30	18:39	00:09
26-Jul	05:16	19:54	18:41	18:49	00:08
27-Jul	05:17	19:53	18:40	18:52	00:12

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
28-Jul	05:18	19:52	18:38	18:53	00:15
29-Jul	05:19	19:51	18:37	18:54	00:17
30-Jul	05:20	19:50	18:36	18:55	00:19
31-Jul	05:21	19:49	18:35	18:55	00:20
01-Aug	05:22	19:48	18:34	18:55	00:21
02-Aug	05:23	19:47	18:34	18:56	00:22
03-Aug	05:24	19:46	18:33	18:56	00:23
04-Aug	05:25	19:45	18:33	18:56	00:23
05-Aug	05:26	19:43	18:33	18:56	00:23
05-Aug	05:26	19:43	06:53	07:00	00:07
06-Aug	05:27	19:42	18:33	18:56	00:23
06-Aug	05:27	19:42	06:50	07:03	00:13
07-Aug	05:28	19:41	18:33	18:54	00:21
07-Aug	05:28	19:41	06:48	07:05	00:17
08-Aug	05:29	19:40	18:33	18:53	00:20
08-Aug	05:29	19:40	06:47	07:06	00:19
09-Aug	05:30	19:39	18:33	18:51	00:18
09-Aug	05:30	19:39	06:46	07:07	00:21
10-Aug	05:31	19:37	18:33	18:50	00:17
10-Aug	05:31	19:37	06:45	07:08	00:23
11-Aug	05:32	19:36	18:34	18:48	00:14
11-Aug	05:32	19:36	06:44	07:09	00:25
12-Aug	05:33	19:35	18:34	18:47	00:13
12-Aug	05:33	19:35	06:43	07:09	00:26
13-Aug	05:34	19:33	18:35	18:45	00:10
13-Aug	05:34	19:33	06:43	07:10	00:27
14-Aug	05:35	19:32	18:37	18:44	00:07
14-Aug	05:35	19:32	06:42	07:10	00:28
15-Aug	05:36	19:30	18:39	18:42	00:03
15-Aug	05:36	19:30	06:42	07:10	00:28
16-Aug	05:37	19:29	06:42	07:10	00:28
17-Aug	05:38	19:28	06:41	07:10	00:29
18-Aug	05:39	19:26	06:41	07:09	00:28
19-Aug	05:40	19:25	06:42	07:09	00:27
20-Aug	05:41	19:23	06:42	07:08	00:26
21-Aug	05:42	19:22	06:42	07:08	00:26
22-Aug	05:43	19:20	06:43	07:07	00:24
23-Aug	05:44	19:19	06:43	07:05	00:22
24-Aug	05:45	19:17	06:45	07:04	00:19
25-Aug	05:46	19:15	06:46	07:02	00:16
26-Aug	05:47	19:14	06:48	06:59	00:11

Source: Mott MacDonald

Table A.12: Curtailment schedule – WTG 38

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
27-Mar	05:22	17:47	06:36	06:49	00:13
28-Mar	05:21	17:48	06:33	06:52	00:19
29-Mar	05:19	17:50	06:30	06:53	00:23
30-Mar	06:17	18:51	07:28	07:54	00:26
31-Mar	06:16	18:52	07:27	07:56	00:29
01-Apr	06:14	18:53	07:25	07:56	00:31
02-Apr	06:12	18:54	07:23	07:56	00:33
03-Apr	06:11	18:55	07:23	07:57	00:34
04-Apr	06:09	18:56	07:22	07:57	00:35
05-Apr	06:07	18:57	07:21	07:56	00:35
06-Apr	06:06	18:58	07:21	07:57	00:36
07-Apr	06:04	18:59	07:21	07:56	00:35
08-Apr	06:02	19:00	07:20	07:55	00:35
09-Apr	06:01	19:02	07:20	07:55	00:35
10-Apr	05:59	19:03	07:20	07:54	00:34
11-Apr	05:57	19:04	07:20	07:53	00:33
12-Apr	05:56	19:05	07:21	07:52	00:31
13-Apr	05:54	19:06	07:21	07:51	00:30
14-Apr	05:52	19:07	07:22	07:50	00:28
15-Apr	05:51	19:08	07:22	07:48	00:26
16-Apr	05:49	19:09	07:24	07:47	00:23
17-Apr	05:48	19:10	07:25	07:44	00:19
18-Apr	05:46	19:11	07:27	07:41	00:14
25-Aug	05:46	19:15	07:32	07:42	00:10
26-Aug	05:47	19:14	07:29	07:45	00:16
27-Aug	05:48	19:12	07:27	07:47	00:20
28-Aug	05:49	19:11	07:25	07:49	00:24
29-Aug	05:50	19:09	07:23	07:50	00:27
30-Aug	05:51	19:08	07:22	07:51	00:29
31-Aug	05:52	19:06	07:21	07:52	00:31
01-Sep	05:53	19:04	07:20	07:52	00:32
02-Sep	05:54	19:03	07:19	07:52	00:33
03-Sep	05:55	19:01	07:18	07:53	00:35
04-Sep	05:56	18:59	07:18	07:53	00:35
05-Sep	05:57	18:58	07:17	07:53	00:36
06-Sep	05:58	18:56	07:17	07:53	00:36
07-Sep	05:59	18:54	07:17	07:52	00:35
08-Sep	06:01	18:52	07:17	07:52	00:35
09-Sep	06:02	18:51	07:17	07:51	00:34
10-Sep	06:03	18:49	07:17	07:50	00:33
11-Sep	06:04	18:47	07:17	07:49	00:32

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
12-Sep	06:05	18:46	07:18	07:48	00:30
13-Sep	06:06	18:44	07:19	07:47	00:28
14-Sep	06:07	18:42	07:20	07:45	00:25
15-Sep	06:08	18:40	07:21	07:43	00:22
16-Sep	06:09	18:39	07:23	07:41	00:18
17-Sep	06:10	18:37	07:26	07:37	00:11

Source: Mott MacDonald

Table A.13: Curtailment schedule – WTG 40

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
25-Jan	06:48	16:34	07:14	07:19	00:05
26-Jan	06:48	16:35	07:12	07:22	00:10
27-Jan	06:47	16:36	07:12	07:24	00:12
28-Jan	06:46	16:38	07:12	07:25	00:13
29-Jan	06:45	16:39	07:11	07:27	00:16
30-Jan	06:44	16:40	07:11	07:28	00:17
31-Jan	06:43	16:41	07:10	07:29	00:19
01-Feb	06:42	16:43	07:10	07:29	00:19
02-Feb	06:41	16:44	07:09	07:30	00:21
03-Feb	06:40	16:45	07:09	07:31	00:22
04-Feb	06:39	16:47	07:08	07:31	00:23
05-Feb	06:38	16:48	07:08	07:31	00:23
06-Feb	06:37	16:49	07:07	07:32	00:25
07-Feb	06:36	16:50	07:07	07:32	00:25
08-Feb	06:35	16:52	07:05	07:31	00:26
09-Feb	06:34	16:53	07:06	07:30	00:24
10-Feb	06:32	16:54	07:07	07:30	00:23
11-Feb	06:31	16:56	07:08	07:30	00:22
12-Feb	06:30	16:57	07:09	07:28	00:19
13-Feb	06:29	16:58	07:11	07:27	00:16
14-Feb	06:27	16:59	07:13	07:25	00:12
28-Oct	05:55	16:30	06:44	06:53	00:09
29-Oct	05:56	16:29	06:41	06:55	00:14
30-Oct	05:57	16:28	06:39	06:57	00:18
31-Oct	05:58	16:26	06:38	06:59	00:21
01-Nov	05:59	16:25	06:37	06:59	00:22
02-Nov	06:01	16:24	06:36	07:00	00:24
03-Nov	06:02	16:22	06:35	07:00	00:25
04-Nov	06:03	16:21	06:36	07:01	00:25
05-Nov	06:04	16:20	06:36	07:01	00:25
06-Nov	06:06	16:19	06:37	07:01	00:24

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
07-Nov	06:07	16:18	06:39	07:02	00:23
08-Nov	06:08	16:17	06:39	07:01	00:22
09-Nov	06:09	16:16	06:40	07:01	00:21
10-Nov	06:10	16:14	06:41	07:01	00:20
11-Nov	06:12	16:13	06:42	07:01	00:19
12-Nov	06:13	16:12	06:42	07:00	00:18
13-Nov	06:14	16:11	06:43	07:00	00:17
14-Nov	06:15	16:11	06:44	06:59	00:15
15-Nov	06:17	16:10	06:44	06:57	00:13
16-Nov	06:18	16:09	06:45	06:56	00:11
17-Nov	06:19	16:08	06:46	06:54	00:08

Source: Mott MacDonald

Table A.14: Curtailment schedule – WTG 42

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
16-Mar	05:41	17:35	06:28	06:42	00:14
17-Mar	05:40	17:36	06:25	06:46	00:21
18-Mar	05:38	17:37	06:23	06:47	00:24
19-Mar	05:36	17:39	06:20	06:48	00:28
20-Mar	05:34	17:40	06:20	06:50	00:30
21-Mar	05:33	17:41	06:18	06:50	00:32
22-Mar	05:31	17:42	06:17	06:50	00:33
23-Mar	05:29	17:43	06:15	06:50	00:35
24-Mar	05:28	17:44	06:15	06:51	00:36
25-Mar	05:26	17:45	06:14	06:51	00:37
26-Mar	05:24	17:46	06:14	06:50	00:36
27-Mar	05:23	17:47	06:14	06:51	00:37
28-Mar	05:21	17:48	06:14	06:50	00:36
29-Mar	05:19	17:50	06:13	06:49	00:36
30-Mar	06:17	18:51	07:13	07:48	00:35
31-Mar	06:16	18:52	07:14	07:48	00:34
01-Apr	06:14	18:53	07:14	07:46	00:32
02-Apr	06:12	18:54	07:14	07:45	00:31
03-Apr	06:11	18:55	07:16	07:44	00:28
04-Apr	06:09	18:56	07:16	07:42	00:26
05-Apr	06:07	18:57	07:17	07:39	00:22
06-Apr	06:06	18:58	07:20	07:37	00:17
07-Apr	06:04	18:59	07:23	07:33	00:10
06-Sep	05:59	18:56	07:17	07:31	00:14
07-Sep	06:00	18:54	07:14	07:34	00:20
08-Sep	06:01	18:53	07:12	07:36	00:24

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
09-Sep	06:02	18:51	07:10	07:37	00:27
10-Sep	06:03	18:49	07:09	07:38	00:29
11-Sep	06:04	18:47	07:07	07:38	00:31
12-Sep	06:05	18:46	07:06	07:39	00:33
13-Sep	06:06	18:44	07:05	07:39	00:34
14-Sep	06:07	18:42	07:04	07:40	00:36
15-Sep	06:08	18:41	07:04	07:40	00:36
16-Sep	06:09	18:39	07:03	07:40	00:37
17-Sep	06:10	18:37	07:03	07:39	00:36
18-Sep	06:11	18:35	07:02	07:39	00:37
19-Sep	06:12	18:34	07:02	07:38	00:36
20-Sep	06:13	18:32	07:02	07:38	00:36
21-Sep	06:14	18:30	07:02	07:37	00:35
22-Sep	06:15	18:28	07:03	07:36	00:33
23-Sep	06:16	18:27	07:03	07:35	00:32
24-Sep	06:17	18:25	07:04	07:33	00:29
25-Sep	06:18	18:23	07:05	07:32	00:27
26-Sep	06:19	18:21	07:06	07:30	00:24
27-Sep	06:20	18:20	07:07	07:27	00:20
28-Sep	06:21	18:18	07:10	07:24	00:14

Source: Mott MacDonald

Table A.15: Curtailment schedule – WTG 43

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
06-Jun	04:55	20:00	05:51	05:52	00:01
07-Jun	04:55	20:00	05:51	05:53	00:02
08-Jun	04:55	20:01	05:50	05:53	00:03
09-Jun	04:54	20:02	05:50	05:55	00:05
10-Jun	04:54	20:02	05:50	05:55	00:05
11-Jun	04:54	20:03	05:50	05:56	00:06
12-Jun	04:54	20:03	05:50	05:57	00:07
13-Jun	04:54	20:04	05:50	05:58	00:08
14-Jun	04:54	20:04	05:50	05:58	00:08
15-Jun	04:54	20:05	05:50	05:59	00:09
16-Jun	04:54	20:05	05:50	05:59	00:09
17-Jun	04:54	20:06	05:50	06:00	00:10
18-Jun	04:54	20:06	05:50	06:00	00:10
19-Jun	04:54	20:06	05:50	06:00	00:10
20-Jun	04:54	20:06	05:50	06:00	00:10
21-Jun	04:54	20:07	05:50	06:00	00:10
22-Jun	04:54	20:07	05:51	06:01	00:10

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
23-Jun	04:54	20:07	05:51	06:01	00:10
24-Jun	04:55	20:07	05:51	06:01	00:10
25-Jun	04:55	20:07	05:51	06:01	00:10
26-Jun	04:55	20:08	05:52	06:01	00:09
27-Jun	04:56	20:08	05:52	06:01	00:09
28-Jun	04:56	20:08	05:52	06:01	00:09
29-Jun	04:56	20:08	05:53	06:01	00:08
30-Jun	04:57	20:08	05:53	06:01	00:08
01-Jul	04:57	20:07	05:54	06:01	00:07
02-Jul	04:58	20:07	05:54	06:00	00:06
03-Jul	04:58	20:07	05:55	06:00	00:05
04-Jul	04:59	20:07	05:55	06:00	00:05
05-Jul	04:59	20:07	05:56	05:59	00:03
06-Jul	05:00	20:07	05:57	05:59	00:02
07-Jul	05:01	20:06	05:57	05:58	00:01

Source: Mott MacDonald

Table A.16: Curtailment schedule – WTG 44

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
01-Jan	06:56	16:08	12:43	13:12	00:29
02-Jan	06:56	16:09	12:43	13:12	00:29
03-Jan	06:56	16:10	12:44	13:12	00:28
04-Jan	06:56	16:11	12:45	13:12	00:27
05-Jan	06:56	16:12	12:45	13:11	00:26
06-Jan	06:56	16:12	12:47	13:11	00:24
07-Jan	06:56	16:13	12:48	13:11	00:23
08-Jan	06:56	16:14	12:49	13:11	00:22
09-Jan	06:56	16:15	12:51	13:11	00:20
10-Jan	06:56	16:16	12:52	13:09	00:17
11-Jan	06:56	16:18	12:55	13:09	00:14
12-Jan	06:55	16:19	12:58	13:07	00:09
30-Nov	06:34	16:00	12:43	12:45	00:02
01-Dec	06:35	16:00	12:39	12:50	00:11
02-Dec	06:36	15:59	12:37	12:52	00:15
03-Dec	06:37	15:59	12:35	12:54	00:19
04-Dec	06:38	15:59	12:35	12:55	00:20
05-Dec	06:39	15:59	12:34	12:56	00:22
06-Dec	06:40	15:58	12:33	12:57	00:24
07-Dec	06:41	15:58	12:33	12:58	00:25
08-Dec	06:42	15:58	12:33	12:59	00:26
09-Dec	06:43	15:58	12:33	13:00	00:27

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
10-Dec	06:44	15:58	12:33	13:01	00:28
11-Dec	06:45	15:58	12:33	13:02	00:29
12-Dec	06:46	15:58	12:32	13:02	00:30
13-Dec	06:47	15:58	12:33	13:03	00:30
14-Dec	06:47	15:59	12:33	13:04	00:31
15-Dec	06:48	15:59	12:34	13:05	00:31
16-Dec	06:49	15:59	12:33	13:05	00:32
17-Dec	06:50	15:59	12:34	13:06	00:32
18-Dec	06:50	16:00	12:35	13:07	00:32
19-Dec	06:51	16:00	12:34	13:07	00:33
20-Dec	06:51	16:00	12:35	13:08	00:33
21-Dec	06:52	16:01	12:35	13:08	00:33
22-Dec	06:53	16:01	12:36	13:09	00:33
23-Dec	06:53	16:02	12:36	13:09	00:33
24-Dec	06:54	16:02	12:37	13:10	00:33
25-Dec	06:54	16:03	12:37	13:10	00:33
26-Dec	06:54	16:03	12:38	13:10	00:32
27-Dec	06:55	16:04	12:39	13:11	00:32
28-Dec	06:55	16:05	12:39	13:11	00:32
29-Dec	06:55	16:05	12:40	13:11	00:31
30-Dec	06:56	16:06	12:40	13:11	00:31
31-Dec	06:56	16:07	12:41	13:11	00:30

Source: Mott MacDonald

Table A.17: Curtailment schedule – WTG 47

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
19-Apr	05:45	19:13	06:24	06:27	00:03
20-Apr	05:43	19:14	06:22	06:30	00:08
21-Apr	05:42	19:15	06:21	06:32	00:11
22-Apr	05:40	19:16	06:20	06:34	00:14
23-Apr	05:39	19:17	06:18	06:34	00:16
24-Apr	05:37	19:18	06:17	06:35	00:18
25-Apr	05:36	19:19	06:15	06:35	00:20
26-Apr	05:34	19:20	06:14	06:36	00:22
27-Apr	05:33	19:21	06:12	06:35	00:23
28-Apr	05:31	19:22	06:11	06:36	00:25
29-Apr	05:30	19:24	06:10	06:36	00:26
30-Apr	05:29	19:25	06:08	06:35	00:27
01-May	05:27	19:26	06:08	06:35	00:27
02-May	05:26	19:27	06:09	06:35	00:26
03-May	05:25	19:28	06:09	06:34	00:25

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
04-May	05:23	19:29	06:09	06:33	00:24
05-May	05:22	19:30	06:10	06:32	00:22
06-May	05:21	19:31	06:11	06:32	00:21
07-May	05:19	19:32	06:12	06:30	00:18
08-May	05:18	19:33	06:13	06:29	00:16
09-May	05:17	19:34	06:15	06:27	00:12
10-May	05:16	19:35	06:18	06:23	00:05
03-Aug	05:24	19:46	06:30	06:33	00:03
04-Aug	05:25	19:45	06:25	06:36	00:11
05-Aug	05:26	19:44	06:23	06:38	00:15
06-Aug	05:27	19:42	06:22	06:39	00:17
07-Aug	05:28	19:41	06:20	06:41	00:21
08-Aug	05:29	19:40	06:19	06:41	00:22
09-Aug	05:30	19:39	06:18	06:42	00:24
10-Aug	05:31	19:37	06:18	06:43	00:25
11-Aug	05:32	19:36	06:17	06:43	00:26
12-Aug	05:33	19:35	06:17	06:43	00:26
13-Aug	05:34	19:33	06:16	06:43	00:27
14-Aug	05:35	19:32	06:17	06:43	00:26
15-Aug	05:36	19:31	06:18	06:43	00:25
16-Aug	05:37	19:29	06:19	06:43	00:24
17-Aug	05:38	19:28	06:20	06:42	00:22
18-Aug	05:39	19:26	06:21	06:42	00:21
19-Aug	05:40	19:25	06:22	06:41	00:19
20-Aug	05:41	19:23	06:23	06:40	00:17
21-Aug	05:42	19:22	06:24	06:39	00:15
22-Aug	05:43	19:20	06:25	06:37	00:12
23-Aug	05:44	19:19	06:26	06:35	00:09
24-Aug	05:45	19:17	06:27	06:32	00:05

Source: Mott MacDonald

Table A.18: Curtailment schedule – WTG 48

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
15-Dec	06:48	15:59	09:18	09:20	00:02
16-Dec	06:49	15:59	09:15	09:23	00:08
17-Dec	06:49	15:59	09:14	09:25	00:11
18-Dec	06:50	16:00	09:14	09:26	00:12
19-Dec	06:51	16:00	09:13	09:27	00:14
20-Dec	06:51	16:00	09:14	09:28	00:14
21-Dec	06:52	16:01	09:14	09:28	00:14
22-Dec	06:53	16:01	09:15	09:29	00:14

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
23-Dec	06:53	16:02	09:15	09:29	00:14
24-Dec	06:53	16:02	09:16	09:30	00:14
25-Dec	06:54	16:03	09:16	09:30	00:14
26-Dec	06:54	16:04	09:17	09:29	00:12
27-Dec	06:55	16:04	09:19	09:30	00:11
28-Dec	06:55	16:05	09:21	09:28	00:07
29-Dec	06:55	16:06	09:24	09:26	00:02

Source: Mott MacDonald

Table A.19: Curtailment schedule – WTG 50

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
26-Apr	05:34	19:20	18:58	19:00	00:02
27-Apr	05:33	19:21	18:55	19:01	00:06
28-Apr	05:31	19:23	18:53	19:02	00:09
29-Apr	05:30	19:24	18:52	19:03	00:11
30-Apr	05:29	19:25	18:50	19:04	00:14
01-May	05:27	19:26	18:49	19:05	00:16
02-May	05:26	19:27	18:49	19:06	00:17
03-May	05:25	19:28	18:48	19:07	00:19
04-May	05:23	19:29	18:47	19:08	00:21
05-May	05:22	19:30	18:47	19:09	00:22
06-May	05:21	19:31	18:47	19:10	00:23
07-May	05:20	19:32	18:47	19:11	00:24
08-May	05:18	19:33	18:47	19:12	00:25
09-May	05:17	19:34	18:47	19:14	00:27
10-May	05:16	19:35	18:46	19:14	00:28
11-May	05:15	19:37	18:46	19:15	00:29
12-May	05:14	19:38	18:47	19:16	00:29
13-May	05:13	19:39	18:47	19:17	00:30
14-May	05:12	19:40	18:47	19:16	00:29
15-May	05:11	19:41	18:48	19:16	00:28
16-May	05:10	19:42	18:48	19:15	00:27
17-May	05:09	19:43	18:50	19:15	00:25
18-May	05:08	19:44	18:51	19:14	00:23
19-May	05:07	19:45	18:51	19:13	00:22
20-May	05:06	19:46	18:52	19:12	00:20
21-May	05:05	19:47	18:53	19:11	00:18
22-May	05:04	19:48	18:55	19:09	00:14
23-May	05:03	19:48	18:57	19:08	00:11
24-May	05:03	19:49	19:00	19:05	00:05
20-Jul	05:11	19:59	19:11	19:14	00:03

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
21-Jul	05:12	19:59	19:08	19:18	00:10
22-Jul	05:12	19:58	19:06	19:20	00:14
23-Jul	05:13	19:57	19:04	19:21	00:17
24-Jul	05:14	19:56	19:03	19:22	00:19
25-Jul	05:15	19:55	19:02	19:23	00:21
26-Jul	05:16	19:54	19:01	19:24	00:23
27-Jul	05:17	19:53	19:00	19:25	00:25
28-Jul	05:18	19:52	19:00	19:26	00:26
29-Jul	05:19	19:51	18:59	19:27	00:28
30-Jul	05:20	19:50	18:59	19:27	00:28
31-Jul	05:21	19:49	18:58	19:28	00:30
01-Aug	05:22	19:48	18:58	19:27	00:29
02-Aug	05:23	19:47	18:57	19:26	00:29
03-Aug	05:24	19:46	18:57	19:25	00:28
04-Aug	05:25	19:45	18:56	19:23	00:27
05-Aug	05:26	19:44	18:56	19:22	00:26
06-Aug	05:27	19:43	18:56	19:21	00:25
07-Aug	05:28	19:41	18:56	19:20	00:24
08-Aug	05:29	19:40	18:56	19:18	00:22
09-Aug	05:30	19:39	18:56	19:17	00:21
10-Aug	05:31	19:37	18:57	19:16	00:19
11-Aug	05:32	19:36	18:57	19:15	00:18
12-Aug	05:33	19:35	18:57	19:14	00:17
13-Aug	05:34	19:33	18:58	19:12	00:14
14-Aug	05:35	19:32	18:59	19:11	00:12
15-Aug	05:36	19:31	19:00	19:10	00:10
16-Aug	05:37	19:29	19:02	19:08	00:06
17-Aug	05:38	19:28	19:04	19:07	00:03

Source: Mott MacDonald

Table A.20: Curtailment schedule – WTG 51

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
10-Jan	06:56	16:17	08:12	08:13	00:01
11-Jan	06:56	16:18	08:12	08:13	00:01
12-Jan	06:55	16:19	08:12	08:14	00:02
13-Jan	06:55	16:20	08:12	08:15	00:03
14-Jan	06:55	16:21	08:11	08:15	00:04
15-Jan	06:54	16:22	08:12	08:16	00:04
16-Jan	06:54	16:23	08:11	08:16	00:05
17-Jan	06:54	16:24	08:11	08:17	00:06
18-Jan	06:53	16:26	08:10	08:17	00:07

Date	Sunrise	Sunset	Shutdown starts	Shutdown ends	Shutdown duration
19-Jan	06:52	16:27	08:10	08:17	00:07
20-Jan	06:52	16:28	08:10	08:17	00:07
21-Jan	06:51	16:29	08:09	08:17	00:08
22-Jan	06:51	16:30	08:09	08:17	00:08
23-Jan	06:50	16:32	08:09	08:18	00:09
24-Jan	06:49	16:33	08:08	08:17	00:09
25-Jan	06:49	16:34	08:08	08:17	00:09
26-Jan	06:48	16:35	08:07	08:17	00:10
27-Jan	06:47	16:37	08:06	08:16	00:10
28-Jan	06:46	16:38	08:06	08:15	00:09
29-Jan	06:45	16:39	08:05	08:14	00:09
30-Jan	06:44	16:40	08:04	08:13	00:09
31-Jan	06:43	16:42	08:04	08:12	00:08
11-Nov	06:12	16:14	07:35	07:41	00:06
12-Nov	06:13	16:13	07:35	07:43	00:08
13-Nov	06:14	16:12	07:37	07:46	00:09
14-Nov	06:15	16:11	07:38	07:47	00:09
15-Nov	06:17	16:10	07:38	07:48	00:10
16-Nov	06:18	16:09	07:40	07:50	00:10
17-Nov	06:19	16:08	07:41	07:50	00:09
18-Nov	06:20	16:07	07:41	07:51	00:10
19-Nov	06:22	16:06	07:43	07:52	00:09
20-Nov	06:23	16:06	07:44	07:52	00:08
21-Nov	06:24	16:05	07:44	07:53	00:09
22-Nov	06:25	16:04	07:45	07:53	00:08
23-Nov	06:26	16:04	07:47	07:54	00:07
24-Nov	06:27	16:03	07:48	07:54	00:06
25-Nov	06:29	16:02	07:48	07:54	00:06
26-Nov	06:30	16:02	07:49	07:54	00:05
27-Nov	06:31	16:01	07:50	07:54	00:04
28-Nov	06:32	16:01	07:51	07:55	00:04
29-Nov	06:33	16:00	07:52	07:55	00:03
30-Nov	06:34	16:00	07:53	07:55	00:02
01-Dec	06:35	16:00	07:54	07:55	00:01
02-Dec	06:36	15:59	07:54	07:55	00:01

Source: Mott MacDonald

B. WTG coordinates

Table B.1: WTG coordinates and elevation (Macedonian Gauss–Krüger grid, EPSG 6204)

WTG ID	Easting (m)	Northing (m)	Elevation ASL (m)	WTG ID	Easting (m)	Northing (m)	Elevation ASL (m)
1	600978	4618916	644	28	611253	4615483	710
2	601665	4618127	636	29	610915	4615117	672
3	602015	4618527	647	30	610569	4614220	635
4	603032	4618171	670	31	610104	4614120	639
5	602407	4616745	639	32	609634	4613564	651
6	603111	4616658	658	33	609553	4612876	654
7	603443	4616981	650	34	609577	4612244	641
8	604575	4616211	640	35	609752	4611693	641
9	602925	4615096	605	36	611468	4618928	884
10	603733	4615573	598	37	610846	4618985	971
11	604931	4615401	636	38	610500	4618685	966
12	605769	4615066	657	39	610679	4619885	872
13	606622	4614385	659	40	609253	4620879	832
14	606169	4615514	646	41	610670	4620891	843
15	607064	4616469	655	42	608879	4621492	895
16	607678	4616411	660	43	608707	4622129	846
17	608327	4616392	664	44	608533	4622785	840
18	609002	4616358	676	45	607510	4622867	803
19	609417	4616627	692	46	606958	4622754	770
20	609905	4616855	708	47	609149	4620396	856
21	610398	4617138	718	48	608129	4620965	831
22	611189	4617594	792	49	607321	4620867	786
23	611558	4617934	840	50	606304	4620473	737
24	612449	4617665	888	51	605450	4621643	705
25	612327	4617156	859	52	605546	4622114	698
26	611661	4616658	789	53	607239	4619014	705
27	611649	4615742	732	54	606652	4619010	696

Source: The Client

C. Meteorological data for the real case scenario

Table C.1: Mean daily sunshine hours statistics

Month	Mean daily sunshine hours		Average Bitola+Sofia	Additional 10% margin
	Bitola	Sofia		
January	2.48	2.65	2.57	2.82
February	3.65	3.45	3.55	3.91
March	4.98	4.43	4.71	5.18
April	6.43	5.67	6.05	6.66
May	7.97	6.78	7.38	8.11
June	9.87	7.93	8.90	9.79
July	10.58	9.06	9.82	10.80
August	9.93	8.68	9.31	10.24
September	7.86	7.44	7.65	8.42
October	5.63	5.37	5.50	6.05
November	3.76	3.24	3.50	3.85
December	2.60	2.31	2.46	2.70
Total annual sunshine hours	**2310**	**2044**	**2177**	**2394**

Source: Windpro, Mott MacDonald

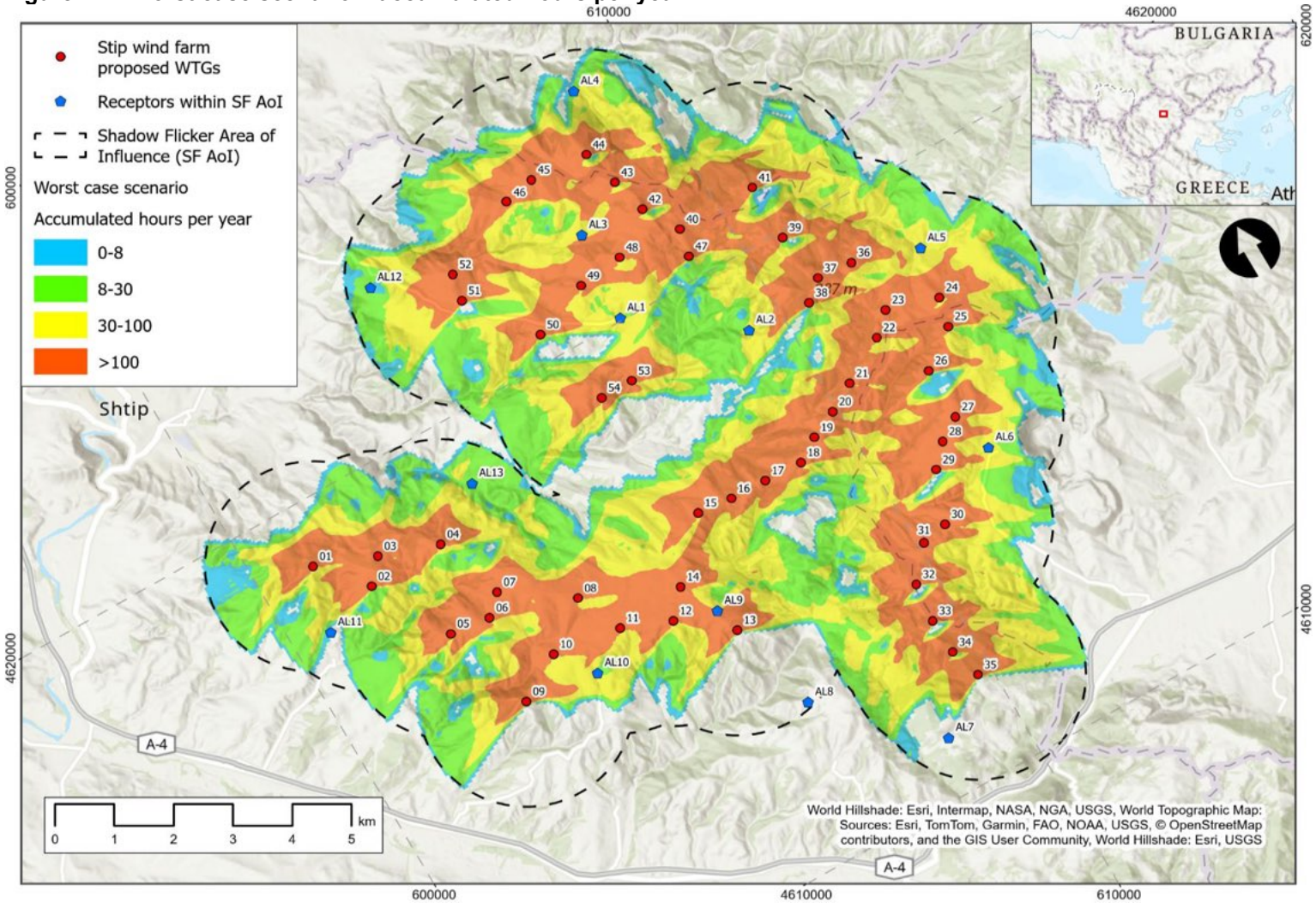
Table C.2: Wind rose – ERA5-100m Reanalysis data 2000-2024, Lat 41.6978º N, Lon 22.2802º E

Sector	Midpoint	Frequency	Annual hours
1	0°	8.9%	781
2	30°	4.3%	372
3	60°	3.1%	273
4	90°	4.0%	347
5	120°	19.8%	1735
6	150°	11.1%	974
7	180°	3.9%	343
8	210°	2.3%	204
9	240°	2.1%	187
10	270°	2.7%	238
11	300°	9.4%	824
12	330°	28.3%	2482
Total		**100.0%**	**8760**

Source: ECMWF, Windographer, Mott MacDonald

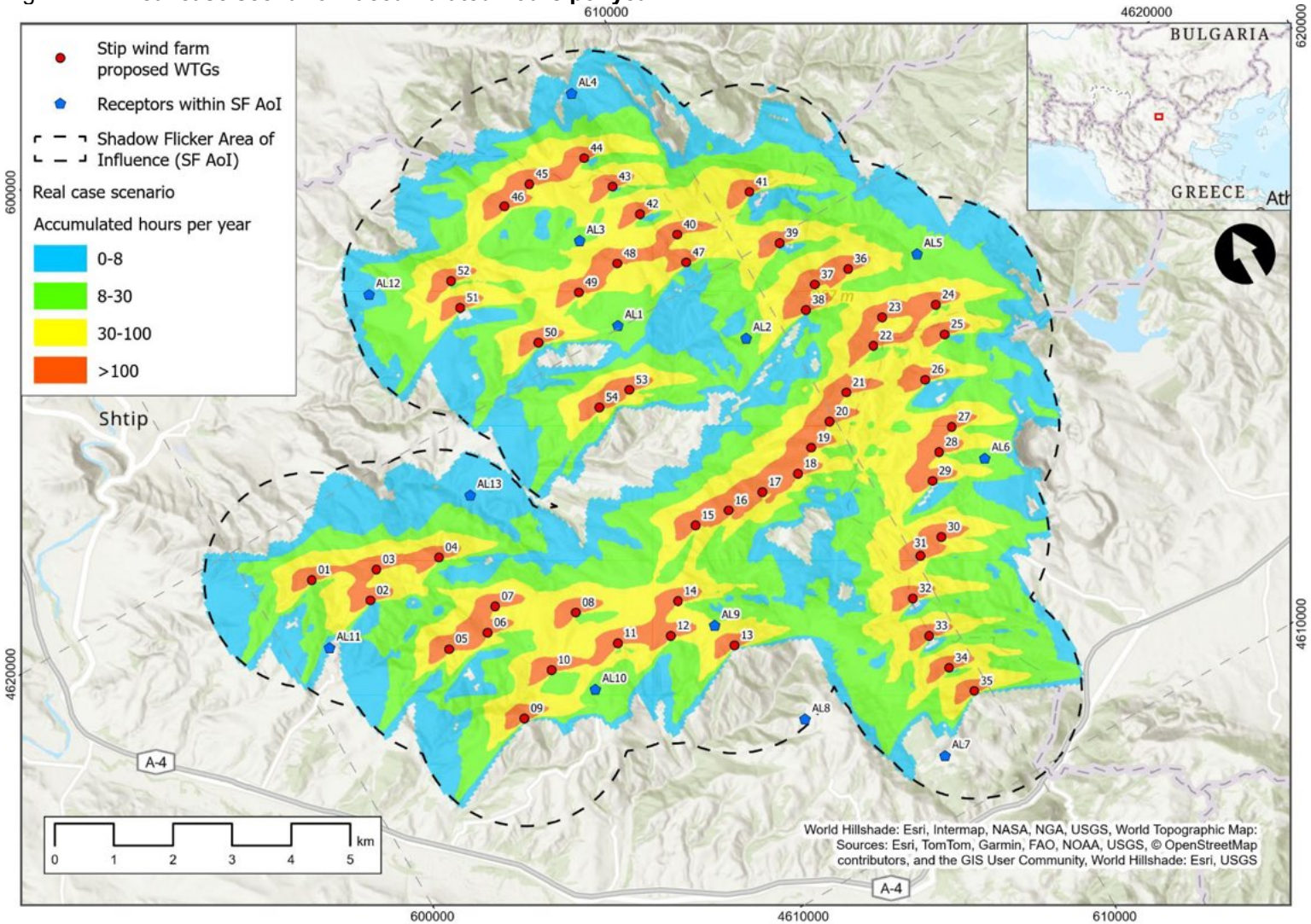
D. Shadow flicker maps

Figure D.4: Worst case scenario – accumulated hours per year



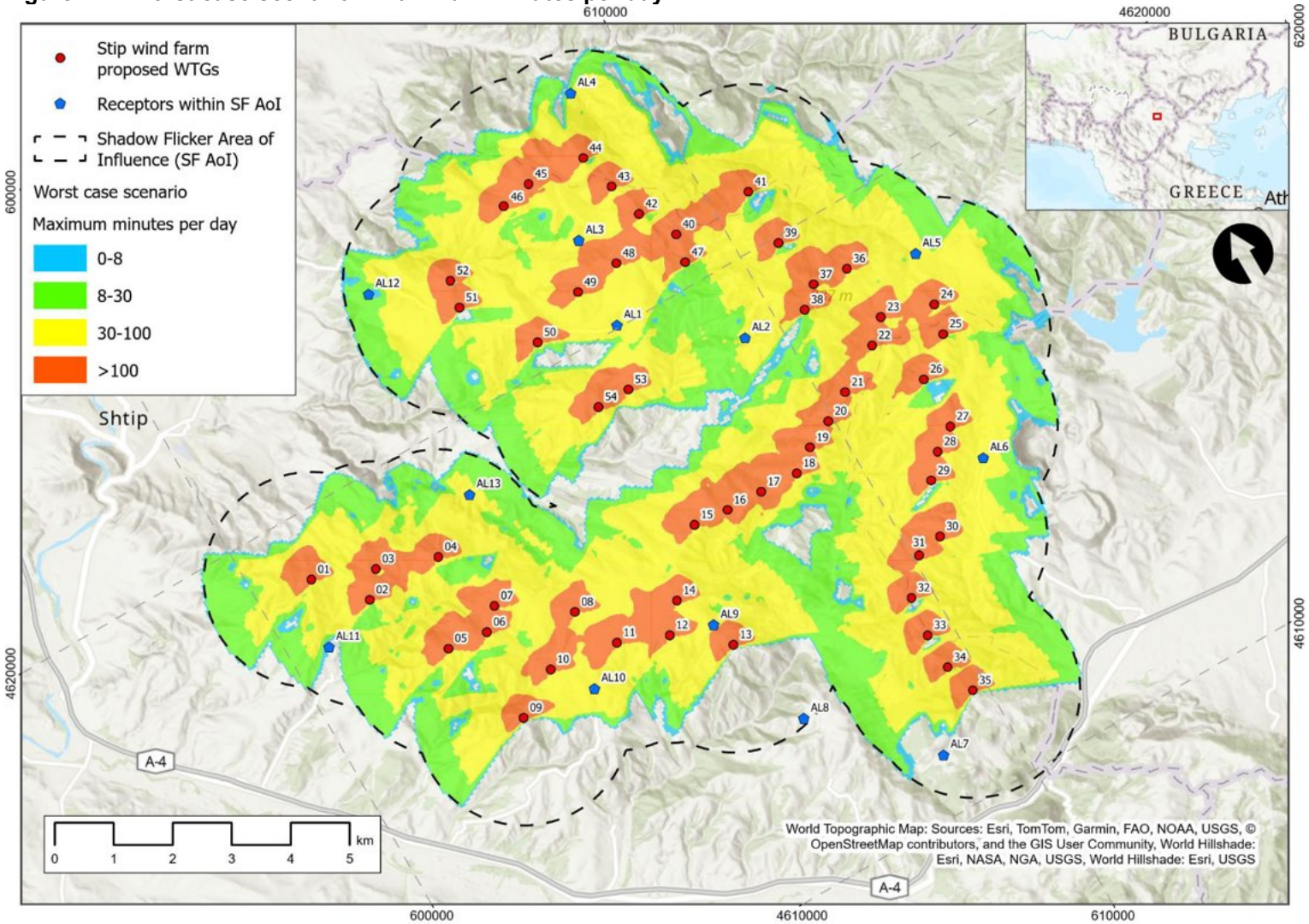
Source: ESRI ArcGIS, Mott MacDonald

Figure **D.1: Real case scenario – accumulated hours per year**



Source: ESRI ArcGIS, Mott MacDonald

Figure D.2: Worst case scenario – maximum minutes per day



Source: ESRI ArcGIS, Mott MacDonald

14 Landscape and visual

Issue and Revision Record

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14 Landscape and visual

14.1 Overview

This Landscape and Visual chapter describes the potential landscape and visual effects of the Project including all Project components such as the wind turbines (WTG), overhead transmission line (OHL), substation (SS), and internal and access roads.

The landscape and visual assessment identifies, predicts, and evaluates the potential landscape and visual effects likely to result from the Project during construction and in operation. In the absence of applicable country specific guidance and standards in respect to undertaking Landscape and Visual Impact Assessment in North Macedonia, the methodology used for assessing landscape and visual effects is based on the UK third edition of the Guidelines for Landscape and Visual Impact Assessment (GLVIA 3)[1]. GLVIA3 was published in collaboration with Institute of Environmental Management & Assessment (IEAM) and came into force on 17 April 2013 and sets out a framework to be followed when completing LVIAs.

The methodology is set out in full in Section 14.6 of this document.

14.1.1 Study area and area of influence

The study area is the extent of the assessment of landscape and visual effects within this chapter and has been set at 10km, which reflects the potential Area of (Visual) influence (AoI) of the Project.

The Area of (Visual) Influence (AoI) was established through a combination of desktop analysis and photography from the site visit, using key indicators that influence both the extent and likelihood of visual and landscape effects. The AoI includes the area from which the Project will theoretically be visible to a person with a viewer eye height of 1.6m above ground level.

The desktop review included the Zone of Theoretical Visibility (ZTV) modelling undertaken in Resoft WindFarm software, which identified the area from which turbines could theoretically be seen and informed the adoption of a 10km study area for both construction and operation. This was supplemented by analysis of settlement locations including Buchim, Ljuboten, Koshevo, Kalapetrovci, Shasavarlija and Nikoman. With each settlement lying within close proximity to proposed turbine locations or associated proposed access roads and infrastructure and therefore representing potential visual receptors. The desktop review also considered the location of existing access roads, landform patterns, woodland cover and existing land use (upland pasture, vineyards, arable fields, scrub, quarry land), all of which influence visibility and the extent of screening in the landscape. Site visits undertaken in October 2024 and July 2025, verified these land-use patterns, confirmed the degree of enclosure in the valley systems, and identified where intervening topography and vegetation would limit or block visibility despite ZTV predictions. Collectively, these findings provided the evidence base for defining a 10km AoI that captures settlements, walking routes, and landscape character areas with potential to experience effects.

[1] Guidelines for Landscape and Visual Impact Assessment Third Edition, Landscape Institute and Institute of Environmental Management and Assessment, London 2013.

14.1.2 Temporal scope

The assessment was carried out between August 2025 and September 2025. The site survey was carried out in October 2024 and July 2025, when trees were both in and out of leaf. Predicted effects during construction and operation during winter were assessed.

14.2 Applicable standards

14.2.1 International

The European Landscape Convention (ELC) is a convention of the Council of Europe (rather than the European Union) of which North Macedonia has been a member since November 1995. The ELC highlights the importance of all landscapes in Europe and defines landscape character as '...an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors'. The ELC encourages relevant authorities to adopt policies for the protection, management and planning of landscapes throughout Europe.

14.2.2 National

- Law on Environment ("Official Gazette of RM" No.53/05)
- Law on Nature Protection ("Official Gazette of RM" No. 67/2004)
- The third Environmental Performance Review (EPR) of North Macedonia (2019)
- Second National Environmental Action Plan (2016)

14.3 Methodology

14.3.1 Assessment of baseline conditions

The assessment of baseline conditions provides the reference point against which the extent and significance of predicted landscape and visual effects were assessed. The landscape character of the study area and the nature of existing views were established through desk-based research and field survey.

Key sources of information included online mapping, aerial photography, and published documents on North Macedonia Ministry of Environment and Physical Planning website[2].

14.3.2 Landscape baseline

The landscape baseline study considers the constituent elements, features and other factors that contribute to existing landscape character within the study area including:

- the physical influences on the landscape resource - including topography, geology, soils, microclimate, water bodies and water courses.
- the influence of human activity - including land use, open space, transport routes, public rights of way, national trails, historic green lanes, land management, the character of settlement and buildings and the pattern and type of fields and enclosure.
- the aesthetic and perceptual aspects of the landscape - including scale, complexity, openness, tranquillity, and wildness; and
- heritage features - including conservation areas, listed buildings, registered parks and gardens and other elements contributing to historic landscape character.

[2] National Strategies of the Ministry of Environment and Spatial Planning - Strategies - Documents - Ministry of Environment and Spatial Planning - Republic of North Macedonia

Key sources of information include appropriate mapping, aerial photography, and published documents on the local authority website. In accordance with the guidance in GLVIA 3, existing landscape character assessments and historic characterisation documents, where appropriate and up to date, have been used to inform the appraisal. The findings of the desk study were reviewed in conjunction with the site survey to identify local landscape character areas (LCA). These are broadly homogeneous units of distinct features and elements.

The value of each LCA was evaluated in accordance with the criteria set out in the table below:

Table 14.1: Landscape value

Value	Criteria for assessing landscape value
High	Designated landscape (such as a National Park or World Heritage Site). A landscape of high scenic quality with a distinctive combination of features, elements and characteristics, outstanding views, and a strong sense of place. A scarce or fragile landscape with cultural, historic, or ecological elements which make a major contribution to landscape character. No or very few landscape detractors. Has components which are difficult to replace (such as mature trees). A tranquil landscape in good condition, largely intact, with an unspoilt character.
Medium	Landscape locally designated (such as a regional park or an Important Plant Area) or locally valued (for its recreational facilities and footpath networks for instance). Some scenic quality and a moderate sense of place. A landscape with some distinctive features, elements, and characteristics. Some cultural, historic, or ecological elements which contribute to landscape character. Some high use areas, but overall medium tranquillity. Few landscape detractors.
Low	Undesignated landscape, not valued for its scenic quality, with a disparate combination of features, elements and characteristics and a weak sense of place. Mainly common features and few or no cultural, historic, or ecological elements that contribute to landscape character. Many landscape detractors. A landscape of low tranquillity.

Based on GLVIA 3 (LI and IEMA, 2013)

14.3.2.1 Assessment of landscape effects

The sensitivity of the landscape was evaluated by considering the existing value of the landscape and its susceptibility to the type of change arising from the Project. There can be a complex relationship between the value attached to the landscape and its susceptibility to change, especially if the change is within or close to a designated landscape. A designated landscape is likely to have a high susceptibility to change but, depending on the type of scheme, it might accommodate the change without detrimental effect on its key characteristics. In this case its susceptibility to change could be medium or even low. The evaluation of susceptibility to change was based on the criteria set out in the table below.

Table 14.2: Landscape susceptibility

Susceptibility	Criteria for assessing landscape susceptibility
High	The overall character and the valued landscape characteristics, elements and features have a low ability to tolerate the nature and scale of the change resulting from the Project without permanent serious adverse change to the baseline situation.
Medium	The overall character and the valued landscape characteristics, elements and features have a moderate ability to tolerate the nature and scale of the change resulting from the Project, with some adverse changes to the baseline situation.
Low	The overall character and the valued landscape characteristics, elements and features have a high ability to tolerate the nature and scale of the change resulting from the Project, with limited adverse changes to the baseline situation.

Based on GLVIA 3 (LI and IEMA, 2013)

A combined assessment of landscape value and susceptibility to change is undertaken to determine sensitivity, as set out in Table 14.3 and Table 14.4 below.

Table 14.3: Landscape sensitivity

Susceptibility	Value		
	High	Medium	Low
High	High	High	Medium
Medium	High	Medium	Low
Low	Medium	Low	Low

Based on GLVIA 3 (LI and IEMA, 2013)

Table 14.4: Landscape sensitivity (Criteria)

Sensitivity	Criteria for assessing landscape sensitivity
High	Landscape of high national importance, rarity, and value with distinctive features/elements with limited ability to accommodate change without incurring substantial loss/gain (i.e., designated areas, and areas with a strong sense of place). A high susceptibility to change due to the type of scheme proposed.
Medium	Landscape of medium value and local or regional recognition of importance, able to accommodate some change (i.e., with features worthy of conservation, some sense of place or value through use of perception). A medium susceptibility to change due to the type of scheme proposed.
Low	Undesignated landscape of low value, low to medium ability to accommodate change (i.e., non-designated or designated areas of local recognition or areas with little sense of place). A low susceptibility to change due to the type of scheme proposed.

Based on GLVIA 3 (LI and IEMA, 2013)

The magnitude of change to landscape character was determined by considering:

- The nature of an impact - whether the introduction of a Project will be of benefit or detriment to the existing landscape character.
- The scale of the change - extent of the loss of landscape elements, the degree to which aesthetic features or perceptual aspects of the landscape are altered (by the removal of hedgerows or introduction of new structures for example) and whether a key characteristic of the landscape is altered.
- The geographical extent of the area affected; and
- The duration of the change and its reversibility.

The evaluation of magnitude of change was based on the criteria set out in the table below.

Table 14.5: Magnitude of change to landscape character

Magnitude	Criteria for assessing magnitude of change
High	Total loss or substantial alteration to key elements/features/characteristics of the LCA and/or its setting. Addition of new elements which conflict with key characteristics of the existing landscape. Changes that alter a substantial proportion of the LCA. Introduction of long-term and/or irreversible changes to an LCA or its setting.
Medium	Partial loss or alteration to key elements/features/characteristics of the LCA and/or its setting. Addition of new elements or features that are prominent in the landscape, but which do not necessarily conflict with key characteristics of the existing landscape. Changes that alter part of an LCA or its immediate setting. Introduction of medium to long term and/or irreversible changes to part of an LCA or its setting.
Low	Slight loss or alteration to one or more key characteristics of the LCA and/or its setting. Addition of new elements or features that are largely characteristic of the existing LCA and/or its setting. Introduction of short to medium term changes to the LCA and/or irreversible changes to a small proportion of the LCA.
Negligible	No change to, or barely perceptible loss or alteration to key characteristics of the LCA and its setting. Addition of new elements or features that are characteristic of the existing LCA and/or its setting. Changes experienced close to the Project site at a very localised level.

Based on GLVIA 3 (LI and IEMA, 2013)

14.3.3 Visual baseline

Table 14.6: View values

View value	Criteria for assessing view value
High	A view in which attractive features are dominant or include attractive focal points and/or skyline features. Visual detractors may be present but are not strongly apparent in the composition of the view. A view in a high-quality landscape, designated or identified as of value in a guidebook or tourist literature. A view where the composition is a fundamental aspect of the design or function of a heritage asset and is integral to its setting.
Medium	An unremarkable view where neither attractive or discordant elements are dominant or form a clearly apparent part of its composition. A view that is undesignated and undocumented.
Low	A view where discordant or unattractive features are dominant or prevalent and/or where such features are focal points and/or skyline features. These views may contain some attractive features, but these are not strongly apparent in the composition of the view. A view that is undesignated and undocumented.

Based on GLVIA 3 (LI and IEMA, 2013)

14.3.3.1 Assessment of visual effects

The sensitivity of visual receptors was evaluated by considering the value attached to specific views and the susceptibility of visual receptor to changes to views and visual amenity. The susceptibility to change depends on the occupation or activity of the receptor and the extent to which their attention is focused on the view and visual amenity. The evaluation of susceptibility was based on the criteria set out in the table below.

Sensitivity is determined by applying professional judgement and is derived as a product of value and susceptibility to change, as set out above. Where more than one sensitivity outcome is possible for a given combination of value and susceptibility to change, professional judgement is applied to determine that which is most appropriate, on a case-by-case basis.

Table 14.7: Visual receptor susceptibility

Susceptibility	Criteria for assessing visual receptor susceptibility
High	Occupiers of residential properties, users of public rights of way, visitors to places whose attention is focussed on the landscape.
Medium	People working in or travelling through rural areas whose attention is partially on the landscape. People walking or cycling through urban areas whose views are partially focussed on their surroundings. Users of publicly accessible outdoor open space including cemeteries.
Low	People at work, at school and engaging in formal sport. People walking or cycling through urban areas whose attention is focussed on their destination rather than enjoying the scenery they are passing through. People travelling at high speed on roads or railways.

Based on GLVIA 3 (LI and IEMA, 2013)

A combined assessment of view value and susceptibility to change is undertaken to determine sensitivity, as set out in Tables 14.8 and 14.9 below.

Table 14.8: Visual receptor sensitivity

Susceptibility	Value		
	High	Medium	Low
High	High	High	Medium
Medium	High	Medium	Low
Low	Medium	Low	Low

Based on GLVIA 3 (LI and IEMA, 2013)

The evaluation of sensitivity was based on the criteria set out in the table below.

Table 14.9: Visual receptor sensitivity (Criteria)

Sensitivity	Criteria for assessing visual receptor susceptibility
High	A view of high scenic value. A view identified as of value on a tourist map or guidebook, or one recorded in art or literature of national significance. A view where the composition was a fundamental aspect of the design or function of a heritage asset and is an integral part of the setting of a heritage asset. A view with cultural associations, including landscapes known historically for their picturesque and landscape beauty, those which became subjects for paintings, and views which have otherwise become historically cherished and protected.
Medium	A view of medium scenic value. A view where existing adverse elements may form a noticeable part in the composition of the view. A typical and/or representative view. A view where the composition was a peripheral aspect of the design or function of a heritage asset.
Low	A view of low scenic value. An undistinguished or unremarkable view and / or a view where existing adverse element form a clearly apparent or dominant part of the view / composition of the view.

Based on GLVIA 3 (LI and IEMA, 2013)

The magnitude of change to views was determined by considering:

- The nature of an impact by judging whether the introduction of a Project would be of benefit or detriment to the existing view. The impact of a Project can be adverse or beneficial;
- The context of the existing view (e.g., whether it is across a natural landscape or an industrial site);
- The extent to which the view has been altered due to the loss/ addition of features and the proportion of the view the scheme will occupy;
- The scale and appearance of the Project and the degree of contrast/ integration with the existing view;
- The distance of the visual receptor from the scheme and the angle/ position of view;
- The duration and reversibility of the effect;
- The size and scale of the effect; and
- The geographical extent of the changes to the view.

The evaluation of the magnitude of change was based on the criteria set out in the table below.

Table 14.10: Magnitude of change to visual amenity

Magnitude	Criteria for assessing magnitude of change
High	Total loss or substantial alteration to key characteristics of the view. Addition of new features or components that are continuously highly visible across the majority of the view and incongruous with the existing view. Substantial changes in close proximity to the visual receptor and within the direct frame of view. Introduction of long term or permanent change uncharacteristic of the view.
Medium	Noticeable change or alteration to one or more key characteristics of the view. Addition of new features or components that may be continuously highly visible across much of the view but are largely characteristic of the existing view. Changes a relatively short distance from the receptor but viewed as one of a series of components in the middle ground of the view. Substantial change partially filtered by intervening vegetation and/or built form or viewed obliquely. Introduction of medium to long term change uncharacteristic of the view and/or permanent changes largely characteristic of the existing view or affecting a small proportion of the view.
Low	Slight loss or alteration to one or more characteristics of the view. Addition of new features or landscape components that may be continuously or intermittently visible in part of the view but are largely characteristic of the existing view from a receptor.

Magnitude	Criteria for assessing magnitude of change
	Changes within the background of the view, viewed as one of a series of components in the wider panoramic view from a receptor. Change largely filtered by intervening vegetation and/or built form or viewed obliquely. Introduction of short to medium term change uncharacteristic of the view and/or long term/permanent changes in a small proportion of the view.
Negligible	No change to, or barely perceptible loss or alteration in the view. Addition of new features or landscape components that are largely inconspicuous and characteristic of the existing view. Changes within the background of the view, viewed as an inconspicuous element within the wider panorama. Change almost entirely obscured by intervening vegetation and/or built form. Short term change affecting a small proportion of the view.

Based on GLVIA 3 (LI and IEMA, 2013)

14.3.4 Significance of landscape or visual effects

Effects may be adverse or beneficial. Professional judgement was used to determine the overall level of significance of effects on landscape and visual receptors in weighing the sensitivity of the receptors against the magnitude of change. The evaluation of the significance of effects was based on the criteria set out in the tables below.

Table 14.11: Significance of effects on landscape character

Magnitude	Sensitivity		
	High	Medium	Low
High	Major	Major/moderate	Moderate/minor
Medium	Major/moderate	Moderate	Moderate/minor
Low	Moderate/minor	Minor	Minor/negligible
Negligible	Minor/negligible	Negligible	Negligible

Table 14.12: Significance of effects on landscape character (Criteria)

Significance of effects	Criteria
Major beneficial	A clear improvement or enhancement of existing character. Restoration of characteristic features previously wholly or largely lost through inappropriate management or previous development.
Moderate beneficial	A noticeable improvement or enhancement of existing character. Restoration of valued characteristic features previously largely lost through inappropriate management or previous development.
Minor beneficial	A small improvement or enhancement of existing character. Restoration of valued characteristic features previously partly lost through inappropriate management or previous development.
Negligible	Maintenance of the existing character, sense of place and/or local distinctiveness of the landscape.
Minor adverse	A small deterioration in the existing character due to the loss of characteristic features and or the introduction of uncharacteristic features which detract from the sense of place or local distinctiveness. Effects may relate to a small proportion of the character area.
Moderate adverse	A noticeable deterioration in the existing character due to the loss of characteristic features or the introduction of uncharacteristic features or elements which detract from the sense of place or local distinctiveness. Effects may relate to a medium proportion of the character area.
Major adverse	A clear deterioration in the existing character due to the loss of key characteristic features or the introduction of uncharacteristic features or elements which detract from the sense of place or local distinctiveness. Effects may relate to all or a large proportion of the character area.

Based on GLVIA 3 (LI and IEMA, 2013)

Table 14.13: Significance of effects on visual amenity

Significance of effects	Criteria
Major beneficial	A substantial improvement, affecting a large extent of the view.
Moderate beneficial	A noticeable improvement, affecting part of the view.
Minor beneficial	A small improvement, affecting a small extent of the view.
Negligible	No discernible deterioration or improvement in the existing view.
Minor adverse	A small deterioration, affecting a small extent of the view.
Moderate adverse	A noticeable deterioration, affecting part of the view.
Major adverse	A substantial deterioration, affecting a large extent of the view.

Based on GLVIA 3 (LI and IEMA, 2013)

14.4 Baseline

14.4.1 Current conditions

The Project site is situated in the eastern part of North Macedonia, within the historical region of Shtip. This area forms the western foothills of the Malesevski mountain range and is characterised by its rugged terrain, with a mix of forested areas and open land.

The land use within the area surrounding the Project site consists of upland pasture, arable farmland including vineyards, solar farm and a large-scale quarry at Buchim.

The proposed wind turbines (Project) are roughly located in a horseshoe arrangement on the upland area that surrounds the Lipov Dol valley. This upland area is largely unoccupied but there a few village settlements within proximity to the Project, these being: Ljuboten, Buchin, Koshevo, Kalapetrovci, Shasavarlija and Nikoman.

14.4.2 Assumptions and limitations

- The baseline information used within this chapter has been summarised from a variety of desk-based sources available at the time of writing, which have been assumed to be correct and complete (as referenced).
- The assessment has been based on the Project description presented in Chapter 2 of this report.
- The assessment of landscape and visual effects is based on baseline information gathered on site by a local consultant, in North Macedonia. This includes the provision of country and area specific environmental planning policy and regulations. The assessment of impact and effects has subsequently been undertaken by a Chartered Landscape Architect in the UK, with long standing experience undertaking LVIA for major infrastructure.
- Viewpoint descriptions are based on the wirelines produced for this assessment. The wireline analysis has been undertaken without the benefit of corresponding photography, using bare earth data only, and as such does not account for intervening forestry or built form that may reduce visibility of some of the wind farms presented in the viewpoint wirelines, or those described in the baseline analysis and cumulative considerations presented in this report.
- Wirelines have been produced using Resoft WindFarm software and 25m resolution terrain data from Airbus. All wireline images show a field of view of 90 degrees, which is broadly consistent with that of human eyes. The coordinates provided for the wirelines are in Projected Coordinate System WGS 1984 UTM Zone 35N.
- The site study area was set at 10km offset from the geographic centre of the proposed turbine layout.

14.4.3 Designations

- UNESCO World Heritage Site (One in country – Not within study area)
- Strict Nature Reserve (None within the study area)
- National Parks (None within the study area)
- Monument of Nature (None within the study area)
- Nature Reserves (None in study area. Nearest is Babuna River NR)
- National Cycle Network (No national cycle network)
- National trails (None within the study area)

14.4.4 Landscape character

14.4.4.1 Local character assessments

The study area for the Project can be divided into two distinct areas, the upland areas where the wind turbines are proposed to be located, and the Lipov Dol/Shashavarlija valleys that lie beneath the horseshoe arrangement of wind turbines. An assessment of these two landscape character areas is provided in the table below.

Table 14.14: Local character areas

LCA 01 - Shtip Uplands		
Landscape characteristic	**Description of landscape characteristic**	**Assessed value of each characteristic**
Landscape Condition	A landscape that is largely made up of natural elements, including agriculture and forestry that sit well within the landscape. A few detrimental elements within the landscape such as the Buchim Mine.	Medium
Scenic Quality	A landscape that is not nationally recognised for its scenic beauty, but one that is valued locally for walking and cycling.	Medium
Cultural Heritage	A landscape with few heritage assets and without any designated heritage assets.	Low
Perceptual Value	A landscape that is largely without activity and settlement with high levels of tranquillity.	High
Associations	No known associations with artists or within literature.	Low
Rarity	A landscape that is not rare within North Macedonia.	Low
Overall Landscape Value ***Assessment of all characteristics above***	**Overall, a landscape that is valued locally, with few detracting elements, and a high level of tranquillity.**	**Medium**
Source: Mott MacDonald (2025)		
LCA 02 – Lipov Dol and Shashavarlija valleys		
Landscape characteristic	**Description of landscape characteristic**	**Assessed value of each characteristic**
Landscape Condition	Two steep-sided valleys with the town of Shtip at the mouth of each valley, and the villages of Lipov Dol and Shashavarlija at the head of each valley. Both valleys are largely made up of forestry plantations and natural woodland that sit well within the landscape.	Medium

Scenic Quality	A landscape that is not nationally recognised for its scenic beauty, but one that is valued locally for walking. The Lipov Pol has an active footpath within the valley that is well-used.	Medium
Cultural Heritage	A landscape with few heritage assets and without any designated heritage assets.	Low
Perceptual Value	A landscape that is largely without activity and settlement with high levels of tranquillity.	High
Associations	No known associations with artists or within literature.	Low
Rarity	A landscape that is not rare within North Macedonia.	Low
Overall Landscape Value ***Assessment of all characteristics above***	**Overall, a landscape that is valued locally, with few detracting elements, and a high level of tranquillity.**	**Medium**
Source: Mott MacDonald (2025)		

14.4.5 Visual amenity

The viewpoints were selected to provide a representative; proportionate and robust understanding of how the Project will be experienced across the defined 10 km study area. Viewpoints cover the full range of settlement edges, key public routes, and locally important recreational receptors identified during the desktop study and site visits. Locations were chosen to capture the points where visibility of turbines is most likely, including ridgelines, open valley slopes and routes that traverse changes in elevation. They also reflect GLVIA3 good-practice principles by including receptors with differing sensitivities (residential, recreational, and transitory users), a range of viewing distances (close, mid and long distance), and a spread of directions relative to the proposed turbine layout. Collectively, these viewpoints illustrate both worst-case and typical viewing conditions, ensuring that the assessment provides a balanced, evidence-based representation of potential visual effects

The location of representative viewpoints is shown on Viewpoint Location Plan in Appendix B. Photographs illustrating the view from each viewpoint are in Appendix C. The visual receptors and their existing views are described and evaluated in the Table 14.15 below. Approximate distances between the viewpoint and the nearest WTG are classified as follows:

- Close - up to 500m from the nearest WTG
- Mid-distance - between 500m and 1km from the nearest WTG; and
- Distant - More than 1km from the Project.

Table 14.15: Visual receptors

Viewpoint No.	Receptor	Existing View	Direction	Distance (Approx.)
VP01	Residents in Buchim	The village of Buchim is located on a flat area between the upland area to the north-west and the sizable Buchim mine to the east. A ridgeline runs approximately 500m to the north-west and views in this direction contain hillside pasture and natural scrub woodland. The town is located on the edge of the large Buchim mine (quarry), and the quarry dominates views from the village to the south and east.	Looking North and west	Mid-distance 0.75km to WTG 27, 28 and 29

		The views from the village in a northerly direction, have neither attractive (views across hills and open landscape) nor discordant elements (buildings in poor state of repair and farming waste/detritus) that are dominant.		
View Value		View Susceptibility	**Sensitivity**	
Medium		High	**Medium**	
Viewpoint No.	**Receptor**	**Existing View**	**Direction**	**Distance (Approx.)**
VP02	Residents in Ljuboten	The village of Ljuboten is located at the head of a small valley on an upland area immediately south of the proposed windfarm development. To the north of the village, views are available across vineyards and pasture. Scattered tree planting along field boundaries and adjacent to roads, screen some views from the village. The views from the village, have neither attractive (views across hills and open landscape) nor discordant elements (buildings in poor state of repair and farming waste/detritus) that are dominant.	Looking North	Mid-distance 0.75km to WTG 10
View Value		View Susceptibility	**Sensitivity**	
Medium		High	**Medium**	
Viewpoint No.	**Receptor**	**Existing View**	**Direction**	**Distance (Approx.)**
VP03	Residents in Koshevo	The village of Koshevo is located at the head of a small valley on an upland area immediately north and west of the proposed windfarm development. To the west of the village, the land rises to a ridgeline, and views are available across scrub, woodland and occasional arable fields. Scattered tree planting along the edge of village and on the upland slopes, screen selected views from the village. To the north of the village, views are much more constrained by the sides of the valley that runs down towards Shtip. Scattered tree planting occurs along the edge of the village and on the lower edges of the valley sides. The Crn Vrv mountain (996m) is located 1.7km to west of this village and dominates views in this direction. The views from the village, have neither attractive (views across hills and open landscape) nor discordant elements (buildings in poor state of repair and farming waste/detritus) that are dominant.	Looking North and West	Mid-distance 0.75km to WTG 24
View Value		View Susceptibility	**Sensitivity**	
Medium		High	**Medium**	

Viewpoint No.	**Receptor**	**Existing View**	**Direction**	**Distance (Approx.)**
VP04	Residents in Kalapetrovci	The village of Kalapetrovci is located on an upland area within the approximate centre of the proposed windfarm development. To	Looking North, east,	Distant 1km from

Viewpoint No.	Receptor	Existing View	Direction	Distance (Approx.)
VP05	Residents in Shasavarlija	The village of Shasavarlija is located on a flat area within the uplands landscape, within the horseshoe of the proposed windfarm development. The village sits within an area of pasture, arable fields, scrub and scattered trees. The Crn Vrv mountain ridge (996m) is located 3.5km to east of this village and dominates views in this direction. The Mal Gaber ridgeline is located 3km to the north and can be seen above a nearer ridgeline in views from the village. The views from the village have neither attractive (views across hills and open landscape) nor discordant elements (buildings in poor state of repair and farming waste/detritus) that are dominant. There are no views that are undesignated and undocumented.	Looking North	Mid-distance 0.75km from WTG 48 and 49
View Value		View Susceptibility	**Sensitivity**	
Medium		High	**Medium**	

		the north of the village, the land falls into a small valley that contains woodland before rising to a ridgeline. To the east, south and west, views are available across the upland landscape containing pasture, scrub and woodland. The Crn Vrv mountain ridge (996m) is located 1.5km to east of this village and dominates views in this direction. The views from the village, have neither attractive (views across hills and open landscape) nor discordant elements (buildings in poor state of repair and farming waste/detritus) that are dominant. There are no views that are undesignated and undocumented.	south and west	WTG 38
View Value		View Susceptibility	**Sensitivity**	
Medium		High	**Medium**	

Viewpoint No.	Receptor	Existing View	Direction	Distance (Approx.)
VP06	Residents in Nikoman	The village of Nikoman is located at the head of a small valley on an upland area within the horseshoe of the proposed windfarm development. Scattered tree planting along the edge of village and on the upland slopes, screen some views from the village.	Looking North	Mid-distance 0.75km to WTG 48

		To the west of the village, the land rises to the Golem Gaber ridgeline which is located 2km away. To the north-east of the village, the mountain Golemo Vardiste is not visible behind an intervening ridgeline. The views from the village, have neither attractive (views across hills and open landscape) nor discordant elements (buildings in poor state of repair and farming waste/detritus) that are dominant.		
View Value		View Susceptibility	**Sensitivity**	
Medium		High	**Medium**	

Viewpoint No.	**Receptor**	**Existing View**	**Direction**	**Distance (Approx.)**
VP07	Walkers on route between Shtip and Lipov Dol (Valley Walk)	Walkers along this route will have views that are initially screened by the valley sides but open up once the route reaches the return leg to Shtip and runs along the southern ridge of the valley. Within the valley the path runs south of the valley floor on slightly elevated ground, and views contain scattered villas, vineyards, scrub and scattered trees. The two ridges that form the northern and southern edge of the valley, screen views beyond. Once the route reaches Lipov Dol, it rises up onto the southern ridge where it follows the Ljuboten road back to Shtip. Views from this part of the walk are open and expansive, taking in much of the upland landscape of the area. The Crn Vrv (Црн Врв-Black Peak) mountain ridge (996m) is located 7km to east of this village and is noticeable in views in this direction. The views along the route, have neither attractive (views across hills and open landscape) nor discordant elements (buildings in poor state of repair and farming waste/detritus) that are dominant.	Looking North	Mid-distance 0.6km from WTG04
View Value		View Susceptibility	**Sensitivity**	
Medium		High	**Medium**	

Viewpoint No.	**Receptor**	**Existing View**	**Direction**	**Distance (Approx.)**
VP08	Walkers on route between Shtip and the Church of the Resurrection of Christ	Walkers along this route will have views that are initially screened by the valley sides but open up once the route reaches the return leg to Shtip and runs along the northern ridge of the valley. Within the valley the path runs along the valley floor with plantation woodland along the north valley slope and vineyards along the south valley slope. The two ridges that	Looking North	Distant 1.35km from WTG 51 and 52

		form the northern and southern edge of the valley, screen views beyond. Once the route reaches Church of the Resurrection of Christ, it rises up onto the northern ridge where it follows the Shasavarlija road back to Shtip. Views from this part of the walk are typically contained within plantation woodland. The views along the route, have neither attractive (views across hills and open landscape) nor discordant elements (buildings in poor state of repair and farming waste/detritus) that are dominant.		
View Value		View Susceptibility	**Sensitivity**	
Medium		Medium	**Medium**	

Viewpoint No.	**Receptor**	**Existing View**	**Direction**	**Distance (Approx.)**
VP09	Walkers on route between Golem Gaber and Mal Gaber	Golem Gaber is a small (possibly abandoned) village that is located below the northern edge of the Crn Vrv mountain. The steeply ascending Mal Gaber ridge rises slightly to the east of Crn Vrv, and this walk follows the ridge from the village to the high point of Mal Gaber before returning to Mal Gaber via a steep-edged valley that lies between Crn Vrv and Mal Gaber. The route up to Mal Gaber follows a path that is initially edged with trees before entering an area of scrub woodland. This woodland is patchy along the route, with occasional open spaces allowing views beyond. The return route is within the narrow valley, where views are limited by the steep valley sides. Scrub woodland within the valley, further screens views to the wider landscape. The views along the route, have neither attractive (views across hills and open landscape) nor discordant elements (buildings in poor state of repair and farming waste/detritus) that are dominant.	Looking North	Mid-distance 0.85km from WTG 42 and 43
View Value		View Susceptibility	**Sensitivity**	
Medium		Medium	**Medium**	

Viewpoint No.	**Receptor**	**Existing View**	**Direction**	**Distance (Approx.)**
VP10	Residents in Shtip	Views from the eastern edge of Shtip towards the proposed windfarm development, contain plantation woodland, vineyards, and pasture within the middle ground. The background of these views contains the expansive views of the upland landscape and ridgeline.	Looking East	Distant 4km from WTG 01, 03, 04, 51 and 51

		The views from the town have neither attractive (views across hills and open landscape) nor discordant elements (buildings in poor state of repair and farming waste/detritus) that are dominant. There are no views that are undesignated and undocumented.		
View Value		View Susceptibility	**Sensitivity**	
Medium		Medium	**Medium**	

14.5 Assessment of impacts

This section considers the impacts and effects of the Project on the landscape character and visual amenity during the construction and operation of the proposed windfarm development. The level of landscape and visual effects is derived by considering the sensitivity of the receptors and the magnitude of change resulting from the Project.

14.5.1 Construction impacts

Construction impacts may be short-term, medium-term, temporary, or permanent in nature. Potential impacts during construction include:

- Loss of vegetation, change of land use.
- Traffic management (increase, redirection, creation of temporary and permanent access roads).
- Pedestrian movement (temporary closure of pavement, temporary redirection of footpaths).
- Construction activities (view of machinery, compound activities, storage of spoil, lighting impact).
- Temporary site features (security fencing, construction lighting, scaffolding, site hoardings, signs).

It is acknowledged that construction noise, vehicle movements, etc. would provide a degree of increased disruption to the landscape and a temporary visual intrusion, especially to receptors close to the Project and construction compounds.

14.5.2 Operational impacts

Potential impacts once operational include:

- Long-term addition of wind turbines and associated elements in the landscape and views.
- Permanent change to landform.
- Permanent removal of vegetation.
- Long-term increase in noise and movement within the landscape.

14.5.3 Landscape assessment

The effects of each construction and operational impact described in sections 14.5.1 and 14.5.2 have been assessed against the sensitivity of each landscape character area. The table below provides a detailed summary of these assessments, highlighting the potential landscape effects resulting from the construction and operation of the windfarm.

For each landscape character area, the table outlines the specific construction and operational activities that will impact the landscape, such as visibility of construction works, removal of vegetation, creation of access roads, presence of temporary structures and machinery, noise

and activity, visibility of turbines, presence of permanent structures, noise and movement, and lighting.

The table also evaluates the significance of these effects based on the sensitivity of the landscape character area, considering factors such as scenic quality, tranquillity, and recreational value. The landscape assessment aims to provide a clear understanding of how the windfarm construction and operation will affect the landscape character areas, enabling informed decision-making and effective mitigation measures

Table 14.16: Landscape Character Effects

LCA 01 - Shtip Uplands		
Landscape Value	Landscape Susceptibility	**Landscape Sensitivity**
Medium	Medium	**Medium**
Description of effects in construction		
The Shtip Uplands are characterised by a mix of natural and man-made elements, including agriculture and forestry, which integrate well within the landscape. However, there are some detrimental elements, such as the Buchim Mine, that affect the overall scenic quality. The landscape is valued locally for its scenic quality and tranquillity, making it a popular area for walking and cycling. During the construction phase, several activities will impact the landscape: 1. **Visibility of Construction Works**: Given the open and expansive views from many parts of the upland landscape, it is likely that much of the construction works and the turbines themselves will be visible from numerous locations. This visibility will reduce the scenic quality and tranquillity of the landscape. 2. **Removal of Vegetation**: The construction activities will involve the removal of vegetation, which will alter the natural condition of the landscape. This removal will introduce more manufactured elements, such as roads and infrastructure, further reducing the scenic quality. 3. **Creation of Access Roads**: The creation of access roads will be necessary for the construction of the windfarm. These roads will introduce additional manufactured elements into the landscape, further reducing its natural condition and tranquillity. 4. **Temporary Structures and Machinery**: The presence of construction machinery, temporary structures, and storage areas will be visible and contribute to the reduction of the landscape's scenic quality and tranquillity. 5. **Noise and Activity**: The construction activities will generate noise and increased activity, which will disrupt the tranquillity of the landscape. This disruption will be particularly noticeable in areas valued for their peacefulness and recreational use. Overall, the construction of the windfarm will have a moderate adverse effect on the landscape character of the Shtip Uplands. The introduction of manufactured elements, removal of vegetation, and increased visibility of construction works will reduce the scenic quality and tranquillity of the landscape.		
Magnitude of change to landscape character in construction		Medium
Significance of effects on landscape character in construction		Moderate adverse
Description of effects in operation		
Once the construction activities have been completed and the turbines and infrastructure are in place, there will continue to be a reduction in tranquillity. The natural condition of the landscape will also continue to be reduced from the baseline. The open and expansive character of the upland will result in many of the turbines being visible together. During the operational phase, several activities will impact the landscape: 1. **Visibility of Turbines**: The open and expansive nature of the Shtip Uplands means that the turbines will be visible from numerous locations. This visibility will continue to reduce the scenic quality and tranquillity of the landscape. 2. **Permanent Structures**: The presence of the turbines, overhead transmission line and internal access roads will introduce permanent manufactured elements into the landscape. These elements will alter the natural condition of the landscape and reduce its scenic quality. 3. **Noise and Movement**: The operation of the windfarm will generate noise and movement, which will disrupt the tranquillity of the landscape. This disruption will be particularly noticeable in areas valued for their peacefulness and recreational use. For further information on areas subject to noise and movement, refer to Chapter 12. 4. **Lighting**: The turbines may require lighting for aviation safety, which will introduce additional visual elements into the landscape, particularly during the night. This lighting will further reduce the scenic quality and tranquillity of the landscape. Overall, the operation of the windfarm will have a moderate adverse effect on the landscape character of the Shtip Uplands. The introduction of permanent manufactured elements, increased visibility of the turbines, and ongoing noise and movement will reduce the scenic quality and tranquillity of the landscape		
Magnitude of change to landscape character in operation		Medium
Significance of effects on landscape character in operation		Moderate adverse
Source: Mott MacDonald (2025)		

LCA 02 - Lipov Dol and Shashavarlija valleys		
Landscape Value	Landscape Susceptibility	**Landscape Sensitivity**
Medium	Medium	**Medium**

Description of effects in construction

The Lipov Dol and Shashavarlija valleys are characterised by steep-sided valleys with forestry plantations and natural woodland that integrate well within the landscape. The valleys are valued locally for their scenic quality and tranquillity, making them popular areas for walking and cycling.

During the construction phase, several activities will impact the landscape:

1. **Visibility of Construction Works**: The valleys are much more enclosed than the upland landscape, and this will result in much of the construction activity being screened by intervening topography and vegetation. However, some construction works and the turbines themselves will still be visible from certain locations, reducing the scenic quality and tranquillity of the landscape.
2. **Removal of Vegetation**: The construction activities will involve the removal of vegetation, which will alter the natural condition of the landscape. This removal will introduce more manufactured elements, such as roads and infrastructure, further reducing the scenic quality.
3. **Creation of Access Roads**: The creation of access roads will be necessary for the construction of the windfarm. These roads will introduce additional manufactured elements into the landscape, further reducing its natural condition and tranquillity.
4. **Temporary Structures and Machinery**: The presence of construction machinery, temporary structures, and storage areas will be visible and contribute to the reduction of the landscape's scenic quality and tranquillity.
5. **Noise and Activity**: The construction activities will generate noise and increased activity, which will disrupt the tranquillity of the landscape. This disruption will be particularly noticeable in areas valued for their peacefulness and recreational use.

Overall, the construction of the windfarm will have a minor adverse effect on the landscape character of the Lipov Dol and Shashavarlija valleys. The introduction of manufactured elements, removal of vegetation, and increased visibility of construction works will reduce the scenic quality and tranquillity of the landscape.

Magnitude of change to landscape character in construction	Low
Significance of effects on landscape character in construction	Minor adverse

Description of effects in operation

Once the construction activities have been completed and the turbines and associated infrastructure are in place, there will continue to be a reduction in tranquillity. The natural condition of the landscape will also continue to be reduced from the baseline. The enclosed nature of the valley landscape will result in only a few turbines being visible within locations from each valley. During the operational phase, several activities will impact the landscape:

1. **Visibility of Turbines**: The enclosed nature of the Lipov Dol and Shashavarlija valleys means that only a few turbines will be visible from certain locations. This limited visibility will still reduce the scenic quality and tranquillity of the landscape.
2. **Permanent Structures**: The presence of the turbines, overhead transmission line and internal access roads will introduce permanent manufactured elements into the landscape. These elements will alter the natural condition of the landscape and reduce its scenic quality.
3. **Noise and Movement**: The operation of the windfarm will generate noise and movement, which will disrupt the tranquillity of the landscape. This disruption will be particularly noticeable in areas valued for their peacefulness and recreational use. For further information on areas subject to noise and movement, refer to Chapter 12.
4. **Lighting**: The turbines may require lighting for aviation safety, which will introduce additional visual elements into the landscape, particularly during the night. This lighting will further reduce the scenic quality and tranquillity of the landscape.

Overall, the operation of the windfarm will have a minor adverse effect on the landscape character of the Lipov Dol and Shashavarlija valleys. The introduction of permanent manufactured elements, limited visibility of the turbines, and ongoing noise and movement will reduce the scenic quality and tranquillity of the landscape

Magnitude of change to landscape character in operation	Low
Significance of effects on landscape character in operation	Minor adverse

Source: Mott MacDonald (2025)

14.5.4 Visual assessment

The sensitivity of the visual receptors and the impacts and effects of the Project on visual amenity are evaluated and described in Table 14.17 below.

Table 14.17: Visual effects during construction

Viewpoint No.	Receptor	Description of effects in construction	Sensitivity	Level of effect
VP01	Residents in Buchim	The installation of the turbines 25 to 35 will occur along the ridgeline on the western side of the valley across from the village of Buchim. The turbines will be constructed adjacent to the existing track that runs behind this ridgeline, and the track is not visible from the village. The construction activities will be visible from the village and, due to them occurring along the ridgeline, will result in a noticeable change or alteration to one or more key characteristics of the view.	Medium	Moderate adverse
VP02	Residents in Ljuboten	The installation of turbines 08,09,10 and 11 will occur within proximity to the northern edge of the village of Ljuboten. Turbines 09, 10 and 11 will require internal roads to be constructed, and these may be visible from the village. The construction activities will be visible from the village and, due to them occurring along the ridgeline, will result in a noticeable change or alteration to one or more key characteristics of the view.	Medium	Moderate adverse
VP03	Residents in Koshevo	The village of Koshevo sits within a wooded valley, with the proposed construction works occurring along the western edge of the valley. An existing access road runs along this ridgeline and the installation of the turbines will be adjacent to this road. Turbines 23, 24, 25 and 36 will occur in proximity to the village and turbine 38 is located on top of the Crn Vrv mountain. The construction activities will be intermittently screened from the village due to intervening tree planting, which will result in change that is largely filtered by intervening vegetation.	Low	Minor adverse
VP04	Residents in Kalapetrovci	The small hamlet of Kalapretrovci is located on the south edge of a wooded valley. The installation of turbines 37 and 39 to the north-east of the hamlet will occur in proximity and 38 is located on top of the Crn Vrv mountain. To the west of the hamlet, the construction of turbines 53 and 54, will occur along a horseshoe ridgeline.	Low	Minor adverse

		The construction activities will be intermittently screened from the village due to intervening tree planting, which will result in change that is largely filtered by intervening vegetation.		
VP05	Residents in Shasavarlija	The village of Shasavarlija is located at the head of valley that leads down to Shtip and is located approximately within the centre of the proposed windfarm development. The installation of turbines 48, 49, 50, 53 and 54 will occur within proximity to the village. Turbine 49 will require an internal road to be constructed close by, and this may be visible from the village. The construction activities will be visible from the village and, due to them occurring along the ridgeline, will result in a noticeable change or alteration to one or more key characteristics of the view.	Medium	Moderate adverse
VP06	Residents in Nikoman	The small hamlet of Nikoman is located on the head of a wooded valley leading to Shtip and is located within the centre of a proposed ring of turbines (42 to 49). The installation of turbines 42, 43, 44, 45, 46, 48 and 52 will occur within proximity to the village. Turbines 47, 51 and 52 will require internal roads to be constructed, and these may be visible from the village. The construction activities will be intermittently screened from the village due to intervening tree planting, which will result in change that is largely filtered by intervening vegetation.	Medium	Minor adverse
VP07	Walkers on route between Shtip and Lipov Dol (Valley Walk)	A transitory route that is initially screened by the valley sides but opens up once the route reaches the return leg to Shtip and runs along the southern ridge of the valley. The installation of turbines 04, and 05, will occur immediately adjacent to the footpath. Turbines 01 and 02 will require internal roads to be constructed, and these may be visible from the footpath route. The construction activities will be visible from the upland parts of the footpath route and, due to them occurring along the ridgeline, will result in a noticeable change or alteration to one or more key characteristics of the view.	Medium	Moderate adverse
VP08	Walkers on route between Shtip and the Church of the	A transitory route that is initially screened by the valley sides but opens up once the route reaches the return leg to Shtip and runs along the northern ridge of the valley.	Low	Minor adverse

	Resurrection of Christ	The installation of turbines 49, and 50, may be noticeable in views when looking east from the uppermost parts of the walk. The construction activities will be intermittently screened from the walking route due to intervening topography and tree planting, which will result in change that is largely filtered by intervening vegetation.		
VP09	Walkers on route between Golem Gaber and Mal Gaber	The route up to Mal Gaber follows a path that is initially edged with trees before entering an area of scrub woodland. This woodland is patchy along the route, with occasional open spaces allowing views beyond. The return route is within the narrow valley, where views are limited by the steep valley sides. The installation of turbines 40, 41, 42, 54, and 53, may be noticeable in views when reaching the top of Golem Gaber. The construction activities will be visible from the upland parts of the footpath route and, due to them occurring along the ridgeline, will result in a noticeable change or alteration to one or more key characteristics of the view.	Medium	Moderate adverse
VP10	Residents in Shtip	The town of Shtip is located on western edge of the foothills that make up the proposed windfarm site area. No turbine location is within proximity of the town, with the nearest turbines being approximately 4km to the west. The construction activities will be intermittently screened from the town due to intervening topography and tree planting, which will result in change that is largely filtered.	Low	Minor adverse

Table 14.18: Visual effects during operation

Viewpoint No.	Receptor	Description of effects in operation	Sensitivity	Level of effect
VP01	Residents in Buchim	Once the turbines are operational, there is potential for significant visual effects due to the proximity and direct line-of-sight to multiple turbines (notably turbines 27–29), with little intervening topography or vegetation. The magnitude of change is likely to be **high** due to the total loss or substantial alteration to key characteristics of the view. However, this will be somewhat mitigated by the presence of other detracting elements within views from the village (Buchim mine)	Medium	Moderate adverse
VP02	Residents in Ljuboten	Once the turbines have been constructed, there is potential for there to be moderate visual effects; several turbines (08, 11, 12, and 14) are located nearby along visible ridges, likely prominent in views from this location. The magnitude of change is likely to be **medium** due to noticeable change or alteration to one or more key characteristics of the view	Medium	Moderate adverse
VP03	Residents in Koshevo	Once the turbines have been constructed, there is potential for there to be moderate visual effects; visible cluster of turbines (23, 36, 37, 38 and 39) at varying distances may be partially screened by terrain but still form a noticeable feature on the skyline. The magnitude of change is likely to be **medium** due to noticeable change or alteration to one or more key characteristics of the view	Medium	Moderate adverse
VP04	Residents in Kalapetrovci	Once the turbines have been constructed, there is potential for there to be moderate visual effects: mid-range visibility of turbine groupings (1 to 15 and 53 and 54), with some screening from local hills possible. The magnitude of change is likely to be **medium** due to noticeable change or alteration to one or more key characteristics of the view	Medium	Moderate adverse
VP05	Residents in Shasavarlija	Once the turbines have been constructed, there is potential for there to be moderate visual effect: surrounded by several turbine clusters (53 and 54 are mid-distance, and 5 to 19 are located further away), likely resulting in broad views of operational turbines. The magnitude of change is likely to be **medium** due to noticeable change or alteration to one or more key characteristics of the view	Medium	Moderate adverse
VP06	Residents in Nikoman	Once the turbines have been constructed, there is potential for there to be major visual effects: centrally located among many turbine sites (48, 49 and 50 are prominent, and 4 to 7 further away), with minimal screening expected due to open terrain. The magnitude of change is likely to be **high** due to the total loss or substantial alteration to key characteristics of the view. However, this	Medium	Moderate adverse

		is somewhat mitigated by the very low population within the hamlet (circa 20).		
VP07	Walkers on route between Shtip and Lipov Dol (Valley Walk)	Once the turbines have been constructed, there is potential for there to be moderate visual effects: visible clusters of turbines along the distant skyline (13 to 50) may result in clear views toward several of these turbines but some local landform screening possible. The magnitude of change is likely to be **medium** due to noticeable change or alteration to one or more key characteristics of the view	Medium	Moderate adverse
VP08	Walkers on route between Shtip and the Church of the Resurrection of Christ	Once the turbines have been constructed, there is potential for there to be moderate visual effects: two turbines are prominent within a cluster of seven (51 and 52), and another cluster is further from this main turbine cluster (6 to 13). There may be distant views toward westernmost installations depending on elevation and vegetation cover. The magnitude of change is likely to be **medium** due to noticeable change or alteration to one or more key characteristics of the view	Medium	Moderate adverse
VP09	Walkers on route between Golem Gaber and Mal Gaber	Once the turbines have been constructed, there will be a cluster of turbines visible (40, 42, and 47 to 49) However, there is significant planting around this viewpoint that will screen views resulting in potential for there to be minor visual effects: The magnitude of change is likely to be **low** due to slight loss or alteration to one or more characteristics of the view	Low	Minor adverse
VP10	Residents in Shtip	Once the turbines have been constructed, there is potential for there to be minor visual effects: urban context providing some background clutter and distance reducing prominence of most turbines. The magnitude of change is likely to be **low** due to slight loss or alteration to one or more characteristics of the view	Low	Minor adverse

14.6 Mitigation and residual significance

14.6.1 Construction effects

During construction, the main contributors to landscape and visual impact relate to the visibility of construction activity on elevated ridgelines, the horseshoe arrangement of the Project, and the proximity of several villages and walking routes to turbine locations. Construction compounds, crane activity, vegetation removal and new internal roads increase the visibility and scale of change, particularly where ridgelines are open and expansive.

Key drivers during construction include:

- Elevated ridgeline works: Construction activity (cranes, turbine sections, vehicle movements) on open ridgelines results in high visibility and noticeable change to upland views.
- Horseshoe layout: Construction around multiple sides of the central valleys creates multi-directional visibility for receptors within the horseshoe.
- Proximity of villages: Buchim, Ljuboten, Shasavarlija and parts of Nikoman have clear views toward nearby construction areas; Koshevo and Kalapetrovci experience more screening due to landform and vegetation.
- Valley orientation and screening: The enclosed form of Lipov Dol and Shashavarlija provides significant screening, reducing construction visibility for many receptors except on elevated footpaths or valley rims.
- Receptors with higher levels of construction impact:
  - **Moderate adverse**: Buchim (VP01), Ljuboten (VP02), Shasavarlija (VP05), Valley Walk (VP07), and upland sections of the Golem Gaber/Mal Gaber route (VP09).
  - **Minor adverse**: Koshevo (VP03), Kalapetrovci (VP04), Nikoman (VP06), Church Route (VP08), Shtip (VP10).

Overall, construction impacts on landscape character range from moderate adverse in the Shtip Uplands to minor adverse within the valleys due to greater enclosure and screening. Visual effects follow similar patterns, with elevated locations and ridgeline works being the key determining factors.

14.6.2 Operational effects

Once operational, impacts are driven primarily by the permanent presence of turbines along ridgelines, the layout enclosing the valleys, and the differing levels of screening and settlement proximity. Turbines become long-term features in views, with prominence varying according to elevation, distance and extent of screening.

Key drivers during operation include:

- Ridgeline turbine locations: Turbines remain visible from wide areas of the Shtip Uplands and from elevated routes, forming prominent skyline features and altering the open character of the landscape.
- Horseshoe configuration: The layout increases the potential for receptors within the central valleys and surrounding uplands to experience turbines from several directions.
- Proximity of settlements.
- Higher-significance operational visual effects occur at Buchim (VP01), Ljuboten (VP02), Shasavarlija (VP05), and along the Valley Walk (VP07).
- Nikoman (VP06) experiences notable visibility due to its central location, though screening and population size reduce the overall significance to moderate adverse.

- Valley orientation and natural screening: The valleys' containment restricts visibility to only a limited set of turbines from most locations, resulting in minor adverse landscape and visual effects in Lipov Dol and Shashavarlija.
- Effect on landscape character:

– **Shtip Uplands**: moderate adverse due to sustained turbine visibility, noise and movement.
– **Valleys**: minor adverse because visibility is limited to a small number of turbines and mitigated by topography and vegetation.

14.6.3 Summary

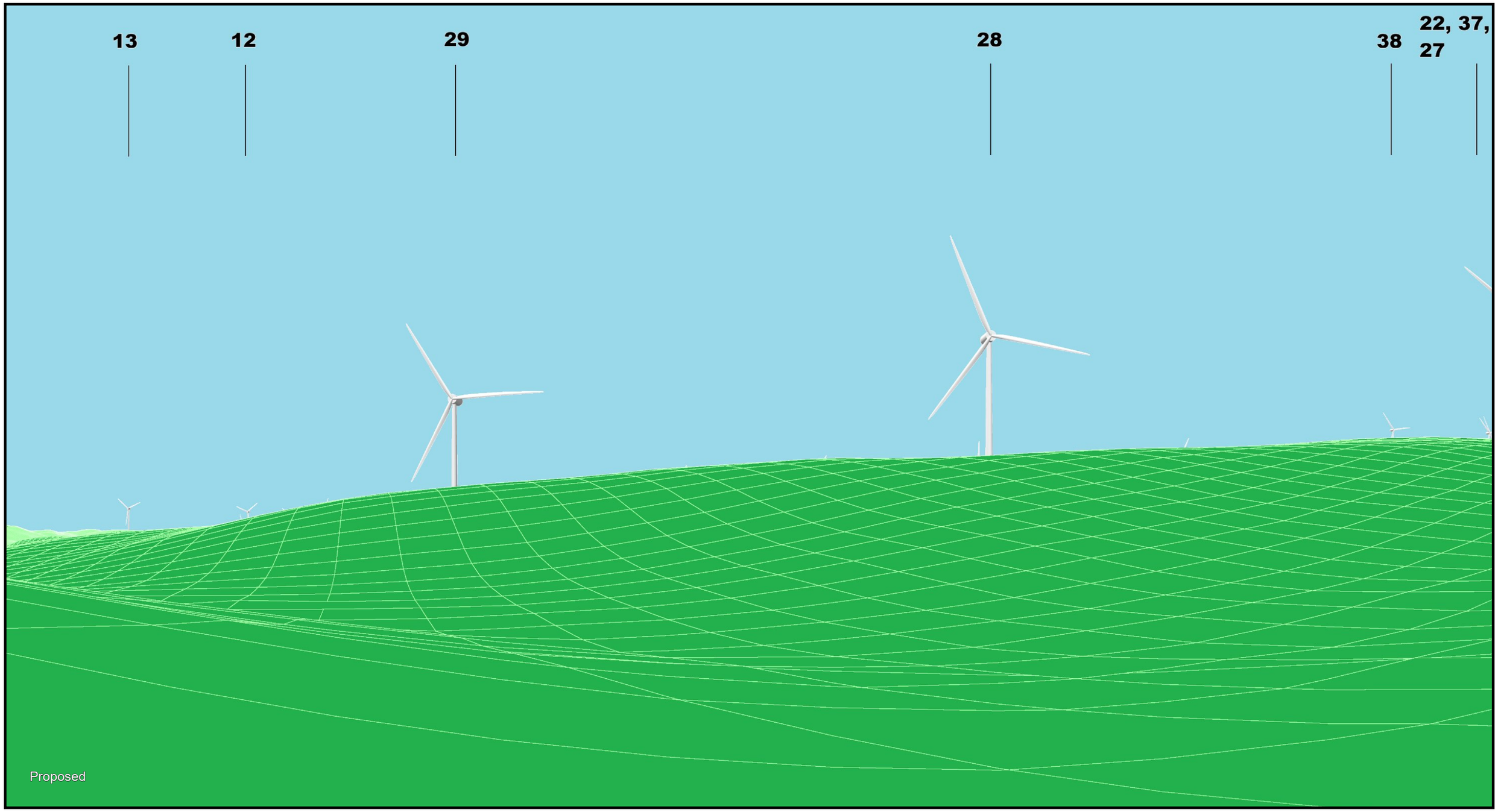
Across the 10 km study area, landscape effects are driven primarily by turbine prominence on ridgelines, while visual effects vary according to settlement proximity, screening, and orientation. The Shtip Uplands experience moderate adverse effects due to openness and intervisibility, whereas the Lipov Dol and Shashavarlija valleys experience minor adverse effects because of strong valley enclosure and vegetation screening.

No sensitive or designated viewpoints experience high significance effects, and no cumulative visual effects are anticipated given the distance to other wind farms.

Appendices

A. Wireline visualisations 27
B. Viewpoints and landscape character areas 29
C. Representative photography 31

A. Wireline visualisations



Stip Windfarm Indicative Wirelines

Viewpoint 1

Viewpoint 1 details

Grid Reference: 611816, 4614890 (CRS: EPSG 6204 Macedonia state coordinate system)

Elevation: 662.5m above ground level

Viewer Height: 2m (view elevation = 664.5m)

View direction to Site Centre: 302.9°

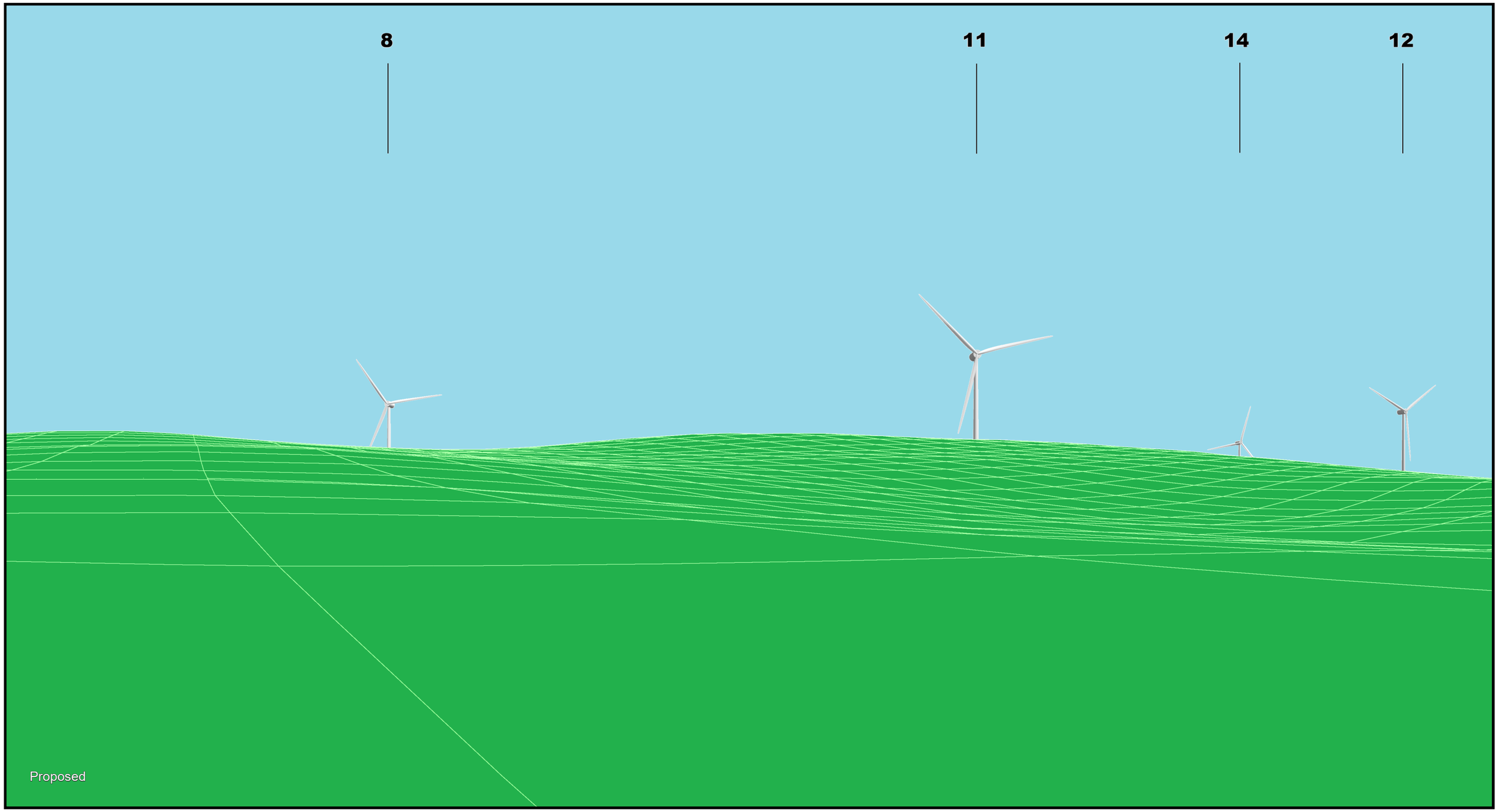
Field of View: 90°

Pitch: 0°

Drawing Number	Rev	Drafted Date	Drawn	Description	Checked	Approved
119825-MMD-00-XX-DR-Z-TBC	01	05/09/2025	RS	First Issue	MH	PW

MOTT MACDONALD

Contains DEM data from ASTER & Shuttle Radar Topography Mission (SRTM), produced by NASA, NIMA, DLR, & ASI.



Stip Windfarm Indicative Wirelines

Viewpoint 2

Viewpoint 2 details

Grid reference: 604064, 4614805 (CRS: EPSG 6204 Macedonia state coordinate system)

Elevation: 561.0m above ground level

Viewer Height: 2m (view elevation = 563.0m)

View direction to Site Centre: 42.6°

Field of View: 90°

Pitch: 0°

Drawing Number	Rev	Drafted Date	Drawn	Description	Checked	Approved
119825-MMD-00-XX-DR-Z-TBC	01	05/09/2025	RS	First Issue	MH	PW

MOTT MACDONALD

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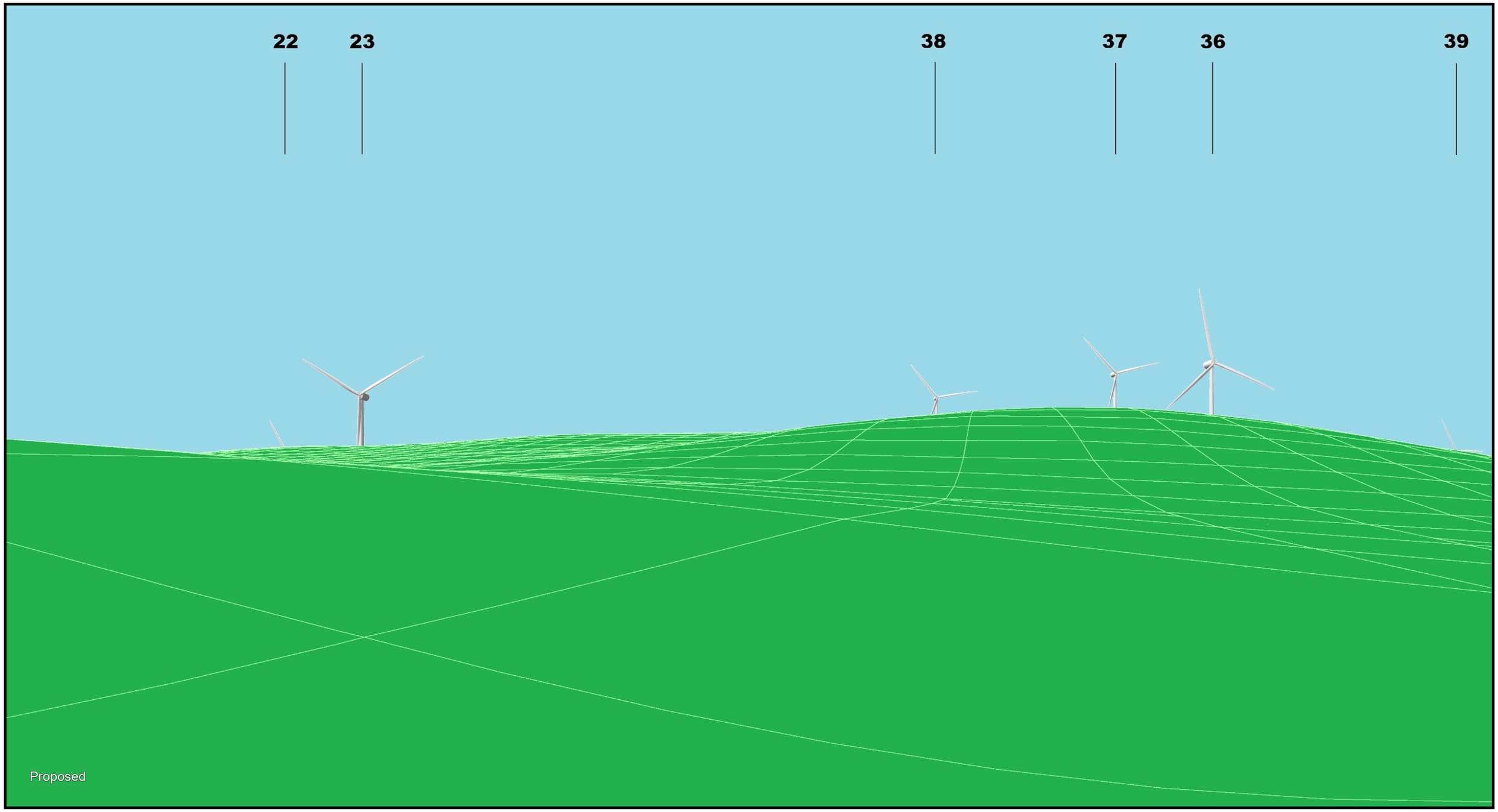

Stip Windfarm Indicative Wirelines

Viewpoint 3

Viewpoint 3 details

Grid reference: 612547, 4618492 (CRS: EPSG 6204 Macedonia state coordinate system)

Elevation: 798.8m above ground level

Viewer Height: 2m (view elevation = 800.8m)

View direction to Site Centre: 264.9°

Field of View: 90°

Pitch: 0°

Drawing Number	Rev	Drafted Date	Drawn	Description	Checked	Approved
119825-MMD-00-XX-DR-Z-TBC	01	05/09/2025	RS	First Issue	MH	PW

MOTT MACDONALD

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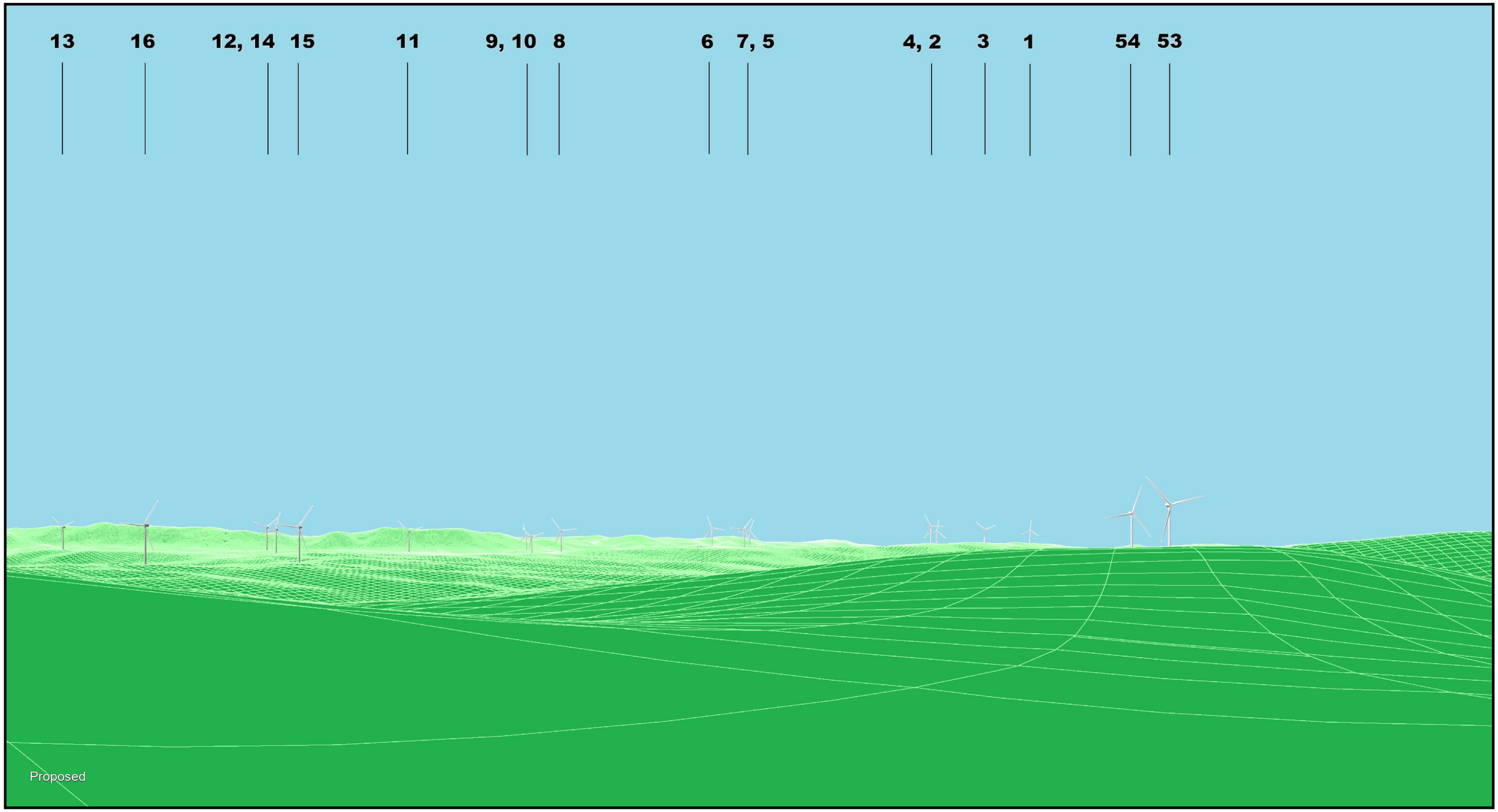

Stip Windfarm Indicative Wirelines

Viewpoint 4

Viewpoint 4 details

Grid reference: 609431, 4618606 (CRS: EPSG 6204 Macedonia state coordinate system)

Elevation: 766.0m above ground level

Viewer Height: 2m (view elevation = 768.0m)

View direction to Site Centre: 256.0°

Field of View: 90°

Pitch: 0°

Drawing Number	Rev	Drafted Date	Drawn	Description	Checked	Approved
119825-MMD-00-XX-DR-Z-TBC	01	05/09/2025	RS	First Issue	MH	PW

MOTT MACDONALD

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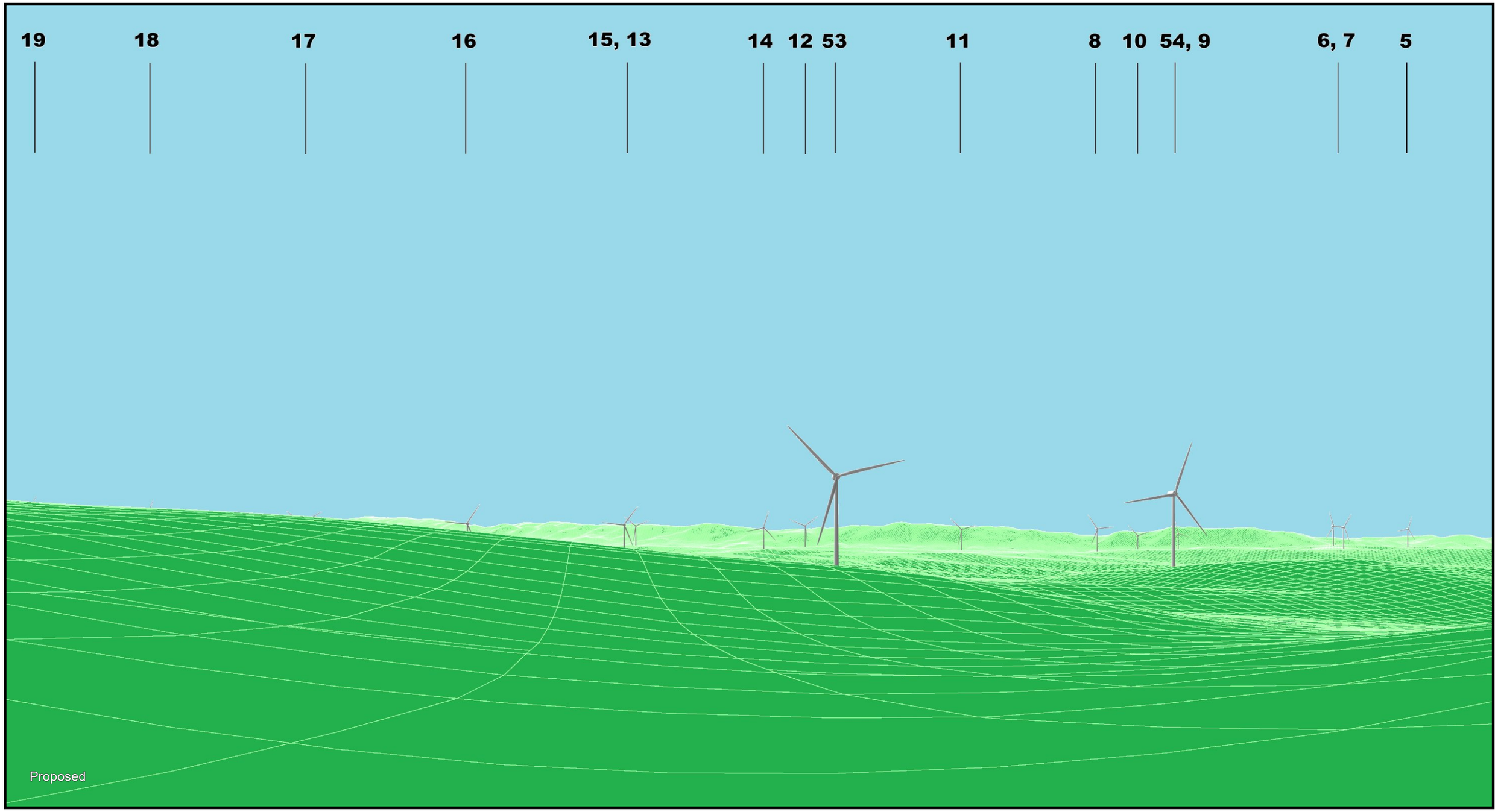

Stip Windfarm Indicative Wirelines

Viewpoint 5

Viewpoint 5 details

Grid reference: 607714, 4620140 (CRS: EPSG 6204 Macedonia state coordinate system)

Elevation: 755.7m above ground level

Viewer Height: 2m (view elevation = 757.7m)

View direction to Site Centre: 198.4°

Field of View: 90°

Pitch: 0°

Drawing Number	Rev	Drafted Date	Drawn	Description	Checked	Approved
119825-MMD-00-XX-DR-Z-TBC	01	05/09/2025	RS	First Issue	MH	PW

MOTT MACDONALD

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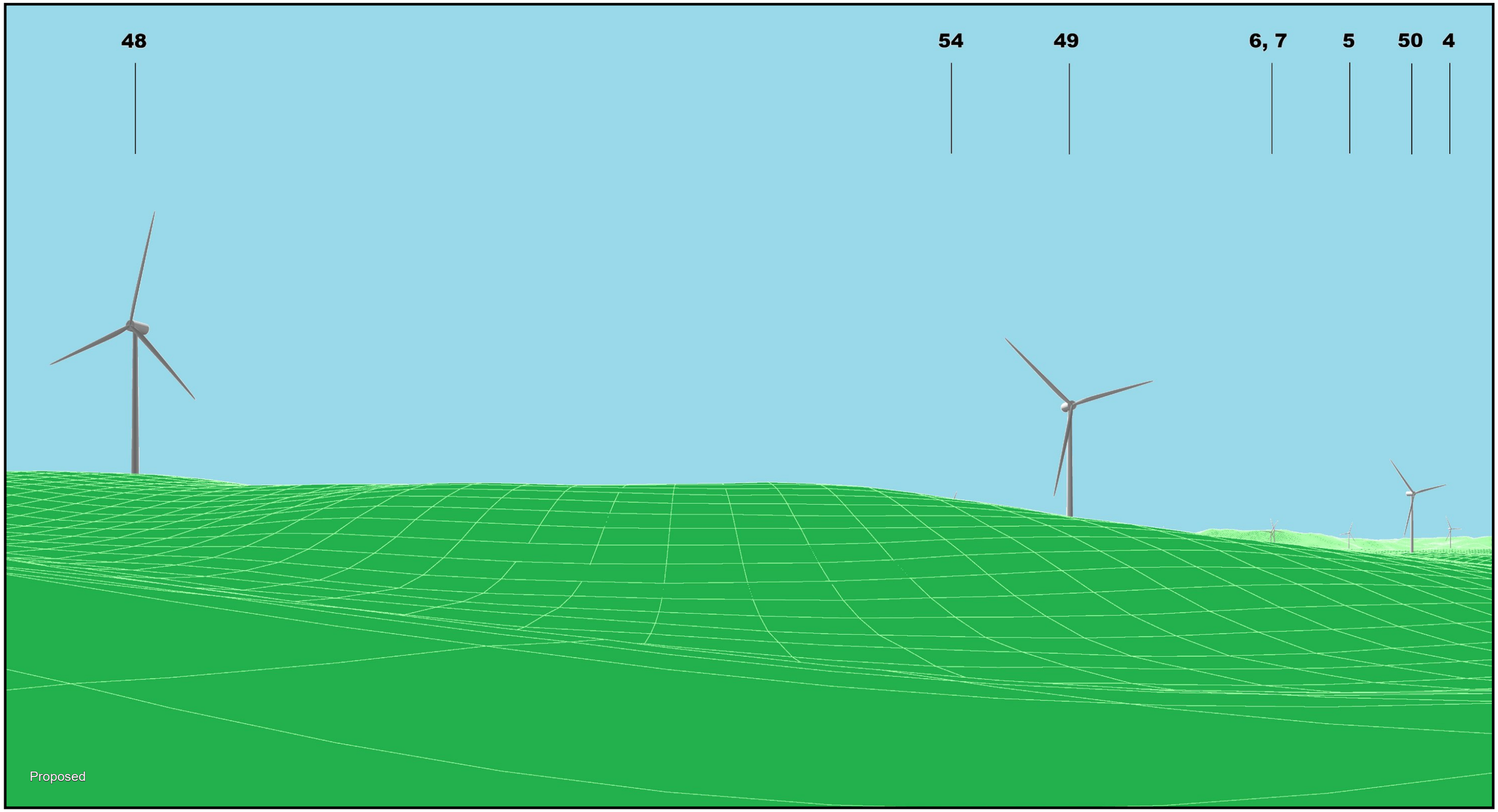

Stip Windfarm Indicative Wirelines

Viewpoint 6

Viewpoint 6 details

Grid reference: 607794, 4621661 (CRS: EPSG 6204 Macedonia state coordinate system)

Elevation: 783.8m above ground level

Viewer Height: 2m (view elevation = 785.8m)

View direction to Site Centre: 192.2°

Field of View: 90°

Pitch: 0°

Drawing Number	Rev	Drafted Date	Drawn	Description	Checked	Approved
119825-MMD-00-XX-DR-Z-TBC	01	05/09/2025	RS	First Issue	MH	PW

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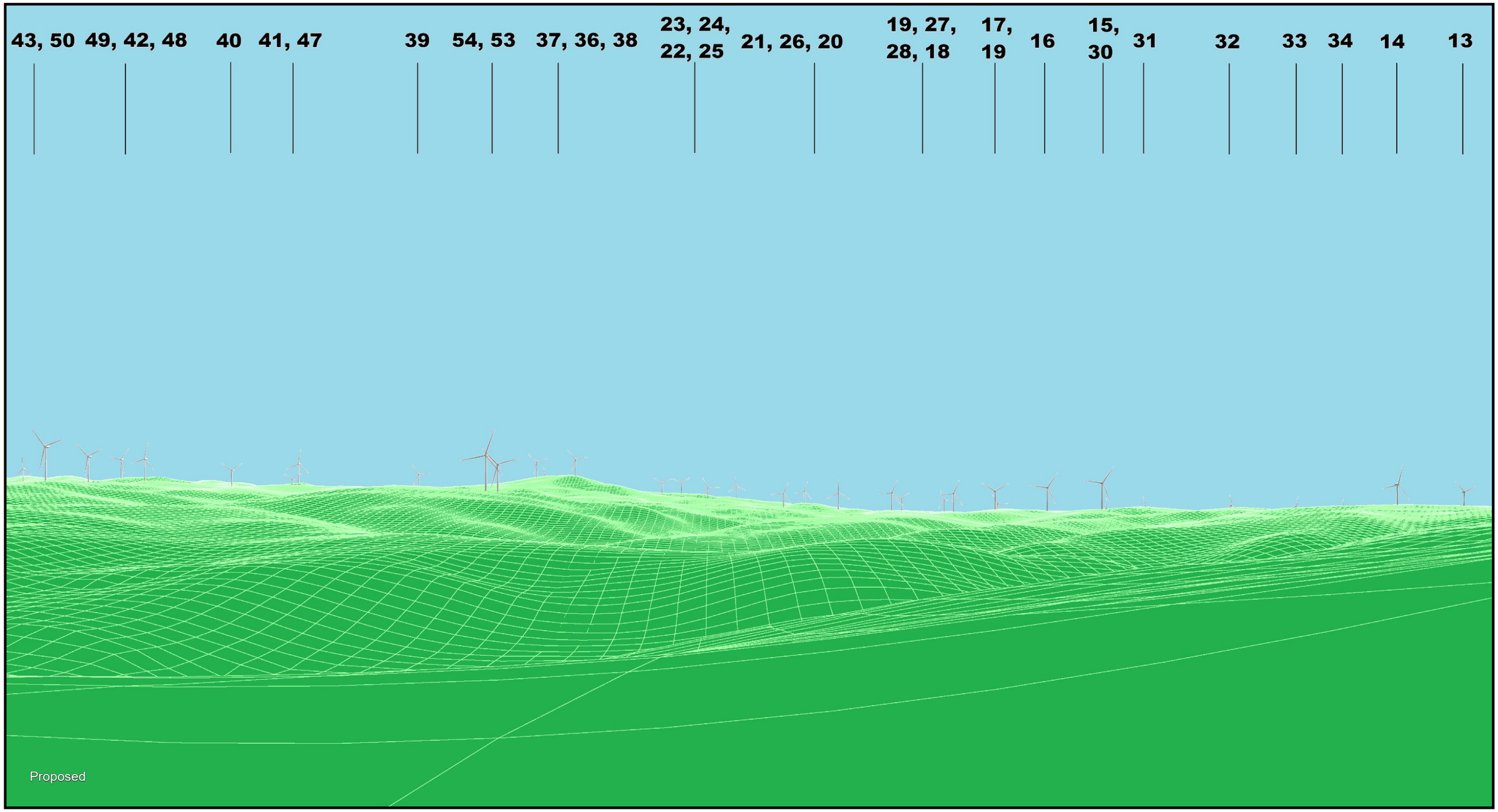

Stip Windfarm Indicative Wirelines

Viewpoint 7

Viewpoint 7 details

Grid reference: 603475, 4618729 (CRS: EPSG 6204 Macedonia state coordinate system)

Elevation: 565.2m above ground level

Viewer Height: 2m (view elevation = 567.2m)

View direction to Site Centre: 101.7°

Field of View: 90°

Pitch: 0°

Drawing Number	Rev	Drafted Date	Drawn	Description	Checked	Approved
119825-MMD-00-XX-DR-Z-TBC	01	05/09/2025	RS	First Issue	MH	PW

MOTT MACDONALD

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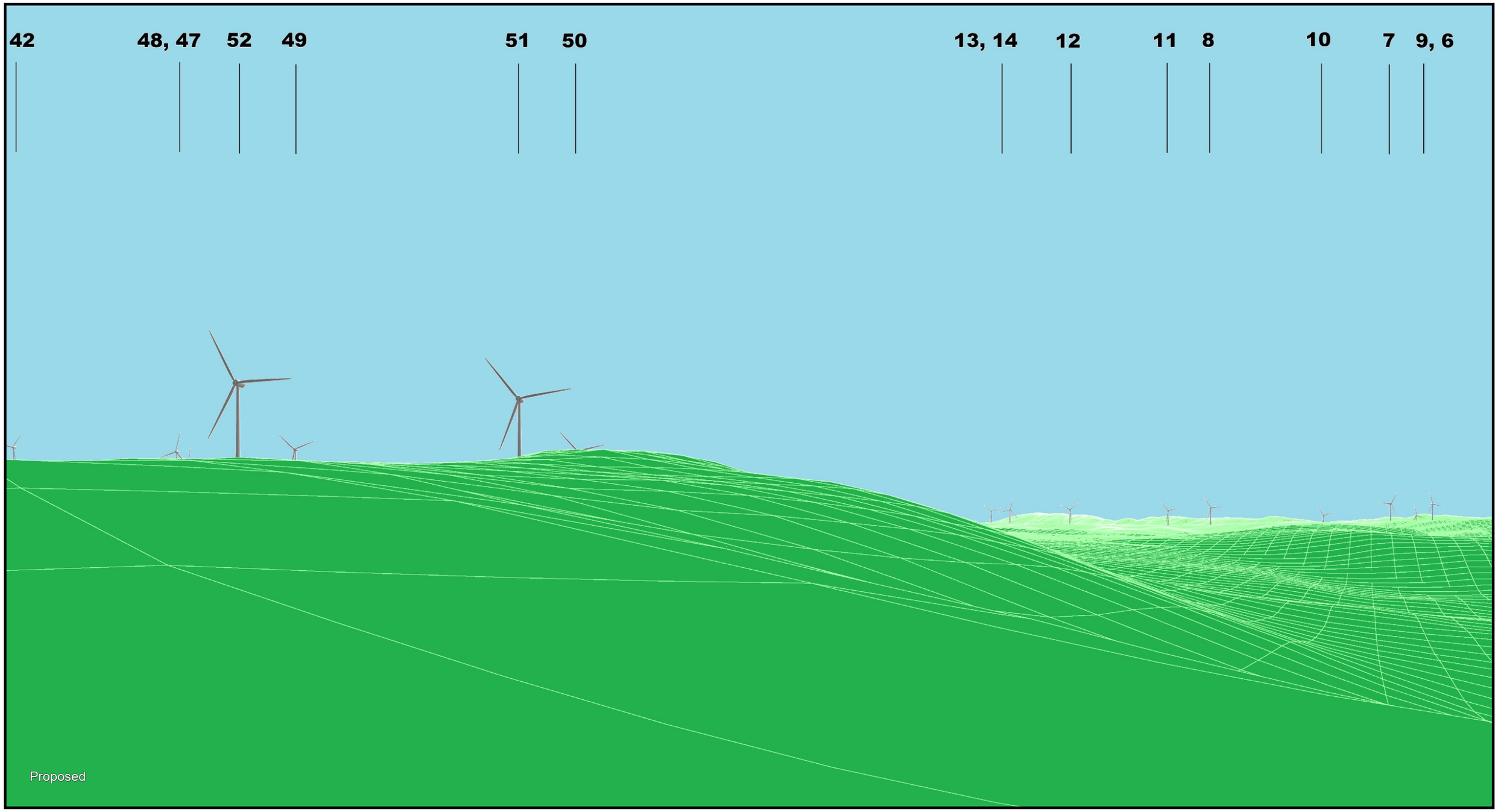

Stip Windfarm Indicative Wirelines

Viewpoint 8

Viewpoint 8 details

Grid reference: 604375, 4622776 (CRS: EPSG 6204 Macedonia state coordinate system)

Elevation: 608.6m above ground level

Viewer Height: 2m (view elevation = 610.6m)

View direction to Site Centre: 151.2°

Field of View: 90°

Pitch: 0°

Drawing Number	Rev	Drafted Date	Drawn	Description	Checked	Approved
119825-MMD-00-XX-DR-Z-TBC	01	05/09/2025	RS	First Issue	MH	PW

MOTT MACDONALD

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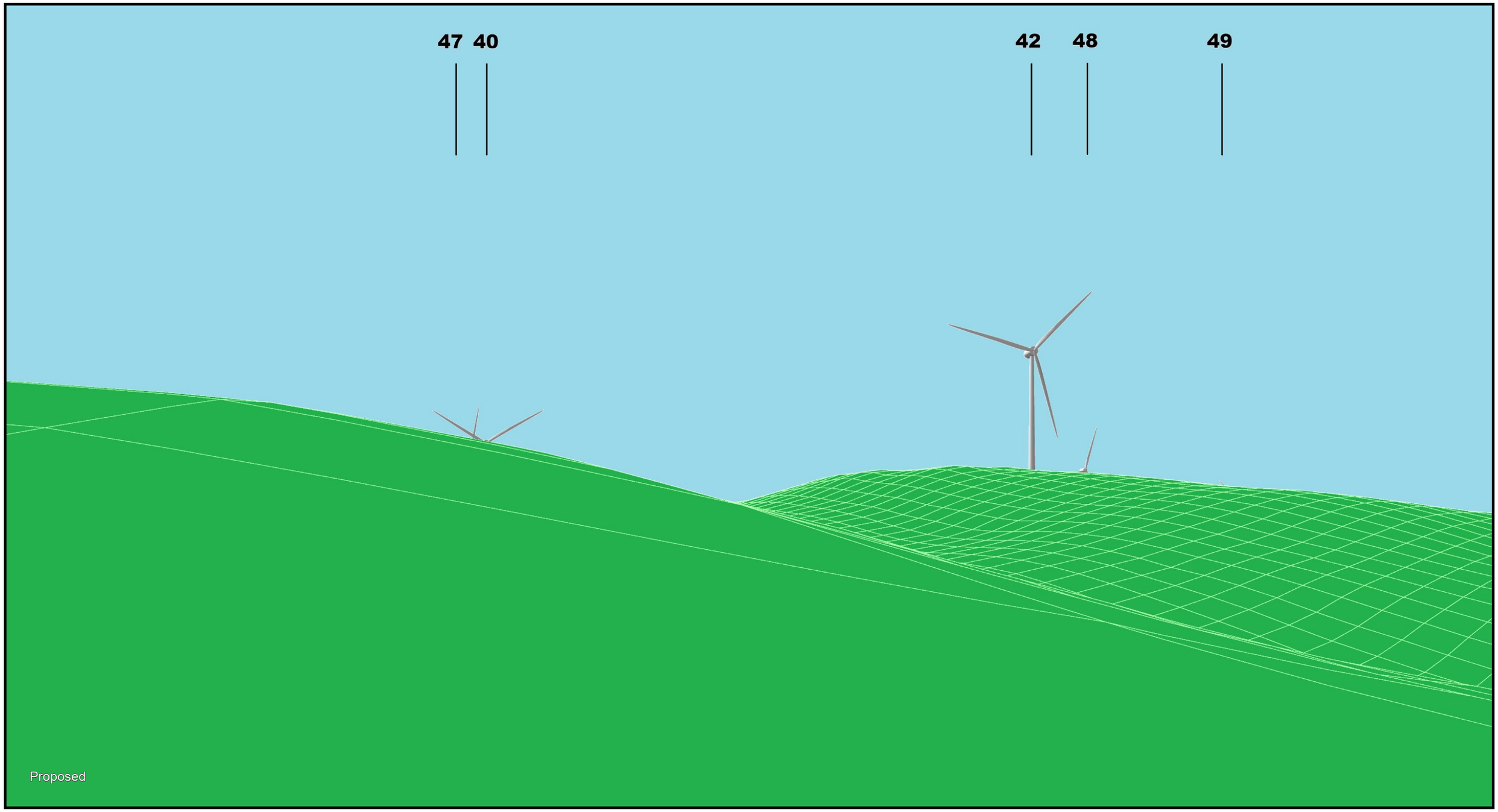

Stip Windfarm Indicative Wirelines

Viewpoint 9

Viewpoint 9 details

Grid reference: 609600, 4622133 (CRS: EPSG 6204 Macedonia state coordinate system)

Elevation: 832.8m above ground level

Viewer Height: 2m (view elevation = 834.8m)

View direction to Site Centre: 212.2°

Field of View: 90°

Pitch: 0°

Drawing Number	Rev	Drafted Date	Drawn	Description	Checked	Approved
119825-MMD-00-XX-DR-Z-TBC	01	05/09/2025	RS	First Issue	MH	PW

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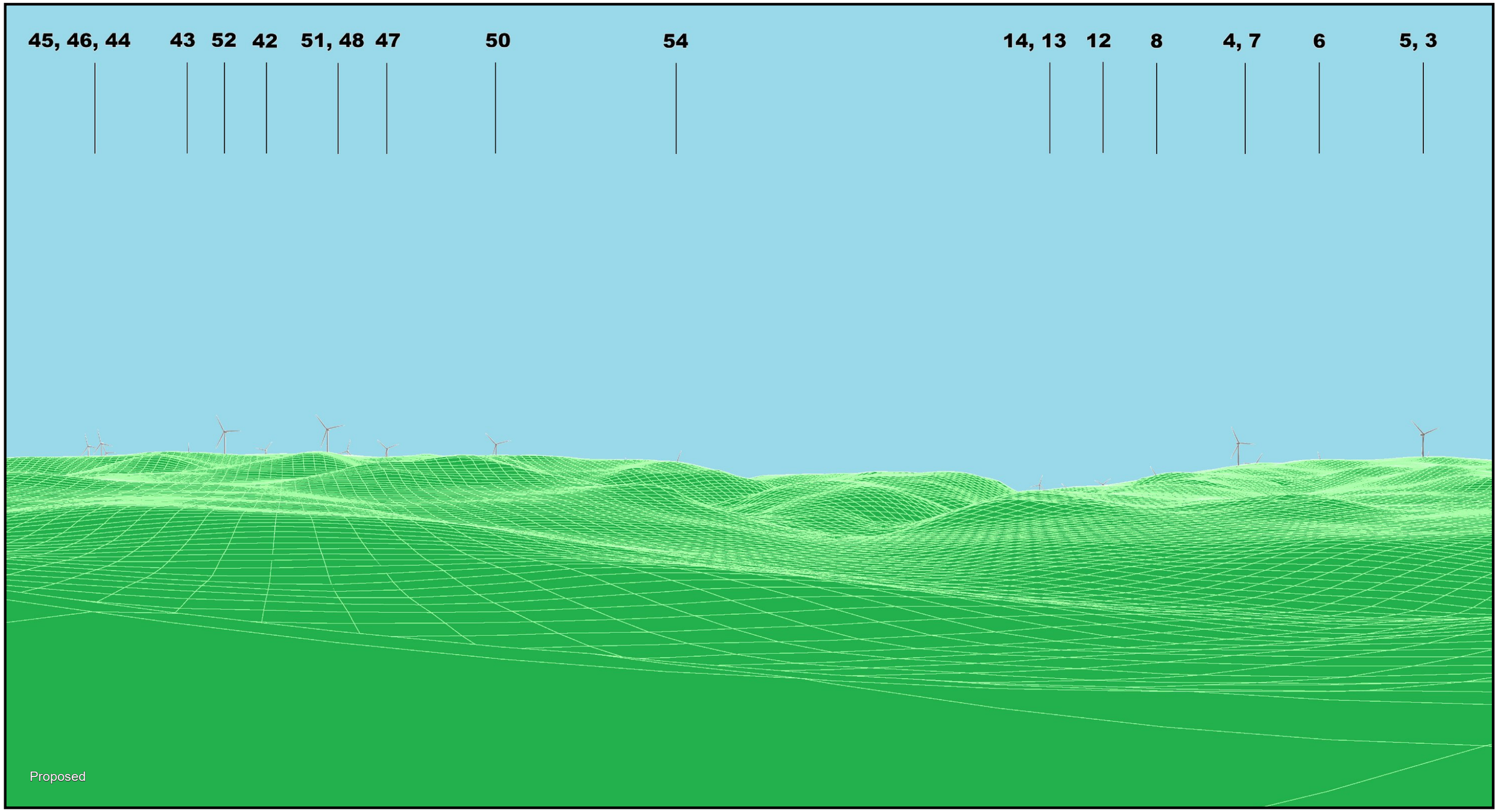

Stip Windfarm Indicative Wirelines

Viewpoint 10

Viewpoint 10 details

Grid reference: 601122, 4622491 (CRS: EPSG 6204 Macedonia state coordinate system)

Elevation: 357.6m above ground level

Viewer Height: 2m (view elevation = 359.6m)

View direction to Site Centre: 127.4°

Field of View: 90°

Pitch: 0°

Drawing Number	Rev	Drafted Date	Drawn	Description	Checked	Approved
119825-MMD-00-XX-DR-Z-TBC	01	05/09/2025	RS	First Issue	MH	PW

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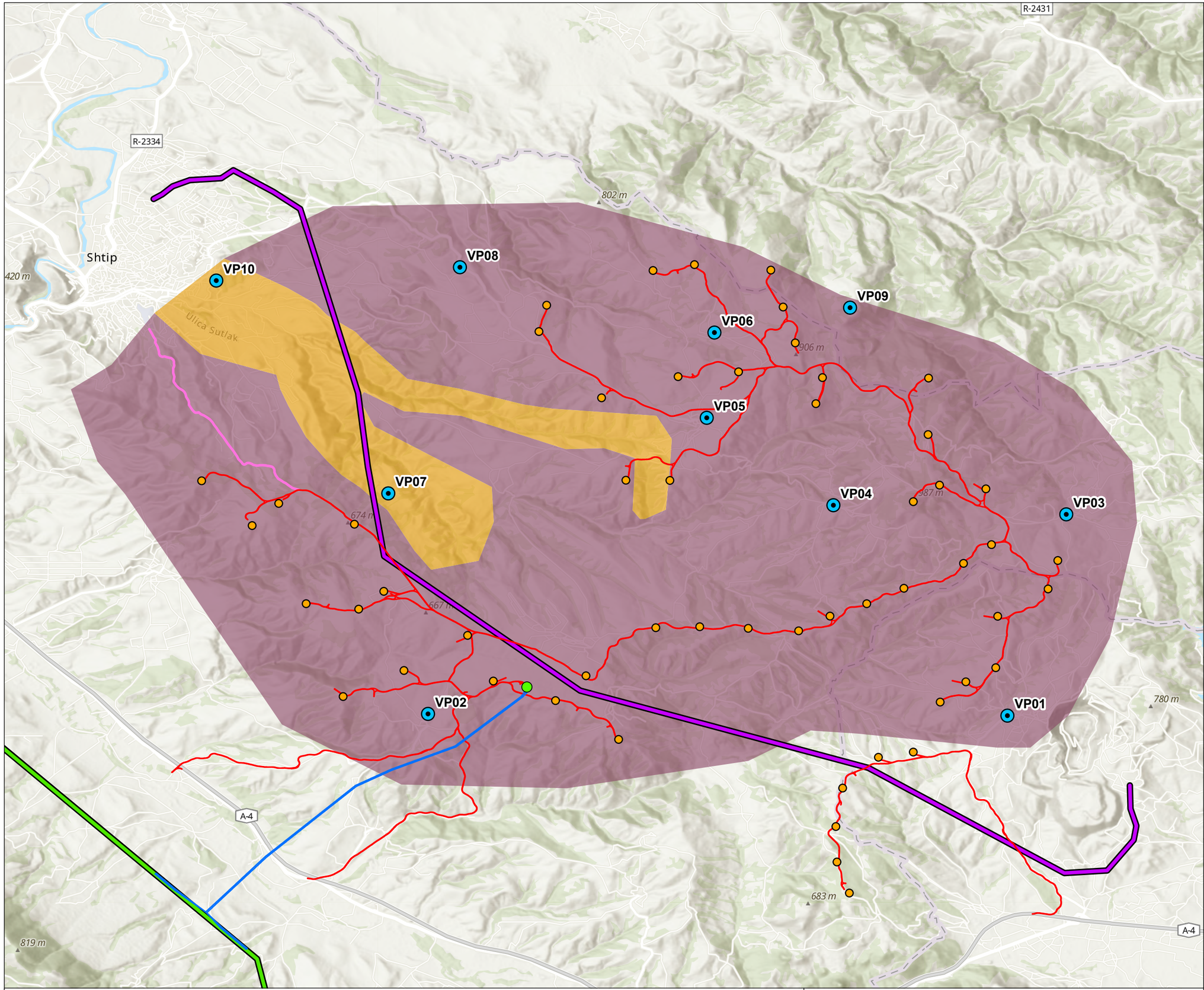
Contains DEM data from ASTER & Shuttle Radar Topography Mission (SRTM), produced by NASA, NIMA, DLR, & ASI.

B. Viewpoints and landscape character areas



Project components
- Wind turbine
- Substation
- Overhead line
- Internal road
- Service road

Existing infrastructure
- Existing OHL
- Existing 400Kv OHL
- Viewpoint

Landscape Character Area (LCA)
- LCA1
- LCA2

Coordinate system: GCS WGS 1984; Datum: WGS 1984

Data sources: Project components and existing infrastructure: Alcazar Energy, 2025; Viewpoints and LCAs: Mott MacDonald, 2025.

Esri, Intermap, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

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ALCAZAR ENERGY

Stip Wind Farm North Macedonia

Viewpoints and Landscape Character Areas

Drawn	GIS Checked	Checked	Approved
K Vahakuopus	P Wyeth	O Judge	P Wyeth
Scale at A3	Status	Revision	Security
1:65,000	INF	01	STD

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0 1 2 3 4 km

Landscape Character Areas and Viewpoints

C. Representative photography

STIP Windfarm ESIA

Landscape and Visual Impact Assessment

Representative Photography

January 2026
APPENDIX C

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Revision record

Revision	Date	Originator	Checker	Approver	Description
P01	21/01/26	P Wyeth	O Judge	A D Mut	First Issue

Purpose of this document

Landscape and Visual Appraisal

This document provides **technical visualisations**, which are intended to form part of the Landscape and Visual Impact (Chapter 14) for the STIP Macedonia windfarm project.

Technical visualisations can take a variety of static forms, including photographs (Type 1), wirelines (Type 2), photomontages (Type 3) and scale-verifiable photomontages (Type 4).

This document contains Type 1 visualisations only.

These visualisations are intended to provide an illustration of the baseline conditions from sensitive receptors when visibility is at its best. Descriptions of each sensitive receptor are provided in **Chapter 14 of the ESIA report** and the location of each representative viewpoint is provided in **Appendix B**

This document should be read alongside both the ESIA report and the associated figures.

Methodology

All images within this document have been taken in accordance with Technical Guidance Note (TGN) 06/19 Visual Representation of development proposals, published by the Landscape Institute in 2019.

Selection of Viewpoints

The locations of representative views within this document, have been selected to provide a representation of the landscape and views from the viewpoints described in Chapter 14 - Landscape and Visual Impacts. However, the locations of the images in this appendix are not exact matches for viewpoints.

Methodology for recording representative photography

The representative photography within this document are defined within TGN 06/19, as "Type 1" visualisations. These being, annoted viewpoint photographs used to represent context and outline or extent of the development and of key features of the view.

Photographs were recorded during spring, to represent the character of the landscape and existing views when trees are in leaf.

Methodology for viewing representative images

Photographs are labelled with the indicative extents of the Proposed Development Site or, where the viewpoint is at more of a distance from the Proposed Development Site or behind other elements in the view, the indicative location of the Proposed Development Site.

100% Reference Images: A `mathematically correct' representation of a view is established when the recorded photograph is printed at a size of 390mm x 260mm on an A3 sheet, and held 542mm (arms length) from the eye. Photographs recorded with our equipment and printed at this size will have a Horizontal Field of View (HFoV) of 39.6°.

As a standard methodology, we have used **100% Reference Images** for our representative photography unless otherwise stated within the information on individual image pages.

Viewpoint 01 - Residents in Buchim

Visibility	Good	**Date and time of photography**	25/04/23 10:17	**Visualisation type**	Type 1
Weather conditions	Clear with light cloud	**Direction of view**	North east	**Projection**	Planar
				Enlargement factor	100% at A3
				Horizontal Field of View	39.6°

Viewpoint 02 - Residents in Ljuboten

Visibility	Good	**Date and time of photography**	25/04/25 13:31	**Visualisation type**	Type 1
Weather conditions	Clear with light cloud	**Direction of view**	North east	**Projection**	Planar
				Enlargement factor	100% at A3
				Horizontal Field of View	39.6°

Viewpoint 03 - Residents in Koshevo

NO PHOTOGRAPH RECORDED FOR THIS RECEPTOR

Viewpoint 04 - Residents in Kalapetrovci

Visibility	Good	**Date and time of photography**	25/04/23 10:20	**Visualisation type**	Type 1
Weather conditions	Clear with light cloud	**Direction of view**	South west	**Projection**	Planar
				Enlargement factor	100% at A3
				Horizontal Field of View	39.6°

Viewpoint 05 - Residents in Shasavarlija

Visibility	Good	**Date and time of photography**	25/04/23 14:01	**Visualisation type**	Type 1
Weather conditions	Clear with light cloud	**Direction of view**	South west	**Projection**	Planar
				Enlargement factor	100% at A3
				Horizontal Field of View	39.6°

Viewpoint 06 - Residents in Nikoman

NO PHOTOGRAPH RECORDED FOR THIS RECEPTOR

Viewpoint 07 - Walkers on route between Shtip and Lipov Dol (Valley Walk)

Visibility	Good	**Date and time of photography**	25/04/23 09:26	**Visualisation type**	Type 1
Weather conditions	Clear with light cloud	**Direction of view**	South west	**Projection**	Planar
				Enlargement factor	100% at A3
				Horizontal Field of View	39.6°

Viewpoint 08 - Walkers on route between Shtip and the Church of the Resurrection of Christ

Visibility	Good	**Date and time of photography**	25/04/23 14:25	**Visualisation type**	Type 1
Weather conditions	Clear with light cloud	**Direction of view**	North west	**Projection**	Planar
				Enlargement factor	100% at A3
				Horizontal Field of View	39.6°

Viewpoint 09 - Walkers on route between Golem Gaber and Mal Gaber

Visibility	Good	**Date and time of photography**	25/04/23 13:57	**Visualisation type**	Type 1
Weather conditions	Clear with light cloud	**Direction of view**	North east	**Projection**	Planar
				Enlargement factor	100% at A3
				Horizontal Field of View	39.6°

Viewpoint 10 - Residents in Shtip

NO PHOTOGRAPH RECORDED FOR THIS RECEPTOR

15 Waste and materials

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
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15 Waste and materials

15.1 Overview

This chapter outlines the key sources and types of waste and material management likely to arise during the construction, operation and decommissioning phases of the Project. This chapter identifies and assesses potential significant adverse impacts of waste generated by the Project on the environment and receptors, before defining appropriate mitigation measures that will be implemented as part of the Project.

Considering the consumption of materials, including their receipt, handling and storage, as well as the subsequent management and disposal of Project related wastes, the spatial scope of the Project encompasses all of the areas and component sites described in the Chapter 2 (Project Description). As construction techniques and requirements may vary once the BOP Contractor(s) are appointed and detailed method statements are finalised, this chapter takes a conservative approach on the waste and materials that may be generated and their management and handling procedures.

15.2 Methodology

After identifying and, where possible, quantifying the potential sources of waste, the assessment focuses on measures to reduce, reuse and recycle, as well as the solutions available for waste disposal. The assessment approach taken included a desktop study of readily available information regarding waste management in North Macedonia, and a site visit to the Project site and surroundings.

Poor waste management on an onshore wind Project can lead to a range of environmental and community impacts. Therefore, the assessment of materials and waste handling is centred on identifying all expected waste streams and applying good international industry practice (GIIP) and following all relevant national and regional waste management requirements. GIIP prioritises preventing waste generation wherever possible, rather than simply reducing impacts after waste has been created. Because of this prevention-focused approach, applying a traditional sensitivity and magnitude assessment method (as per Chapter 6 of this ESIA) is not considered suitable for this chapter.

Instead, the assessment describes the expected outcomes and potential impacts for scenarios involving both inadequate waste management and the implementation of robust and proportionate waste management practices. Following the identification of waste sources for each phase of the Project, the chapter outlines practical measures for reducing, reusing, and recycling materials, along with appropriate disposal methods for the remaining waste.

15.2.1 Limitations and assumptions

As detailed information on construction methodologies, procurement strategies, and balance of plant (BOP) contractor-specific practices are being confirmed, there is a level of uncertainty regarding the types, volumes, and characteristics of waste streams that may be generated by the Project.

Therefore, in line with GIIP for impact assessment, following a conservative approach is preferred to ensure that most types of wastes and higher volumes are estimated and assessed, rather than underestimating them. This conservative approach aligns with the precautionary principle to ensure that environmental risk and impacts associated with waste handling, storage, transport, and disposal are not overlooked and that appropriate mitigation measures are

defined. The Project acknowledges that the conservative assumptions applied at this stage may be reviewed once detailed construction information becomes available.

The following key assumptions and limitations apply to this chapter:

- All hazardous and non-hazardous material and waste streams described are based on information currently available for the Project. These may change once the final construction methodology is confirmed.
- Estimated waste quantities will be further refined in subsequent phases of the Project construction and later during the operations phase, prior to the commencement of each phase. These refinements will assist the contractor in determining the required waste storage areas and their respective capacities. Actual waste quantities will be recorded throughout the construction and operation phases and will be systematically tracked as part of the Project's monitoring program.
- The sources of materials and the final waste management locations are currently being defined.
- Professional judgement has been applied throughout to minimise subjectivity where possible.

Although some details, such as quantities may change as the Project progresses, the main waste streams are expected to remain consistent. Therefore, the waste management principles and procedures outlined in this chapter are not anticipated to require significant revision, even if adjustments occur in the exact types or quantities of waste ultimately generated.

15.3 Baseline

15.3.1 National waste management

The establishment of legal provisions for regulating solid waste management in North Macedonia falls under the responsibility of the Ministry for Environment and Physical Planning, specifically the Directorate for Environment – Waste Management Department. Operationally, waste management is organised at both the regional and local levels. The national Waste Management Strategy defines six regions, plus the City of Skopje, as the strategic framework for managing the collection, transport, and disposal of municipal waste. Each of the six regions are planned to develop a new sanitary landfill with the required supporting infrastructure (such as collection and transfer stations, trucks, and containers); however, none of these regional landfills are currently operational. In contrast, the City of Skopje, which is treated as a separate legal entity within the strategy, already operates a landfill that is considered 'almost sanitary,' supported by relatively adequate infrastructure. At the local (municipal) level, municipalities and their public utility enterprises provide a range of waste management services, including waste collection, transport, and disposal. Additionally, there are several specialised private companies that provide different services (collection, transport, recycling, export, disposal) for specific hazardous waste.

National legal and strategic provisions set regional solid waste management standards and procedures in the country, with the latest efforts focusing to establish an efficient regional system connecting the eastern and northeastern areas into a single regional waste management system.

A regional municipal waste management plan has been prepared for the Eastern region[1], (where Stip and the Project are located (see Figure 15.1) which is currently under revision. The aim of this plan is to contribute to the establishment of an efficient regional waste management system

[1] 2014, ENVIROPLAN SA (Leader) – C&E GmbH – BT Engineering Ltd", "Preparation of Regional Waste Management Plans and Strategic Environmental Assessment for the Eastern and North-Eastern Region", EuropeAid/130400/D/SER/MK

aligned with national policies and objectives. According to the plan, a regional centre for municipal waste is envisaged in the municipality of Sveti Nikole (territory of the village of Mechkuevci) which will include the construction of a regional landfill where waste from the municipalities in the Eastern and Northeastern regions will be collected, deposited and processed. Sveti Nikole is located on the main highway A3 between Skopje and Stip, approximately 28km north of Stip, however, the exact date as to when this facility will be commissioned is currently unknown.

Regarding the regional institutional capacities for waste management, after long deliberations, the inter-municipal waste management board for the eastern planning region has been established and three sessions have been held so far. It is expected that in the near future, actions will be taken to strengthen regional management capacities through an EU funded Project for this region[2].

15.3.2 Waste generation, segregation, collection and transportation

According to the data of the State Statistical Office, the total amount of collected municipal waste in the Republic of Macedonia in 2023 amounted to approximately 621,686 tons and 637,471 tons in 2024, which is an average increase of 2.5% annually (data from 2025 is not yet available), mainly due to the increase in number of settlements and houses forming part of the collective waste collection system. The largest amount of collected municipal waste was recorded in the Skopje Region with 169,515 tons or 27.3% of the total amount collected. Of the total amount of collected municipal waste, 507,138 tons or 82% were collected from households, and the remaining 18% from legal entities and individuals (commercial waste).

According to the types of waste, the largest amount of collected waste is mixed municipal waste (531,033 tons or 85.4%) and the smallest amount is rubber waste (1,301 tons or 0.2% of the total amount of collected municipal waste).

The most populous municipality near the Project site is Stip and accounts for 23.6% of the total waste generation in the Eastern region of North Macedonia. The rural municipalities in the region, such as Karbinci and Radovic have lower waste production than the urban areas resulting in small participation in regional waste production.

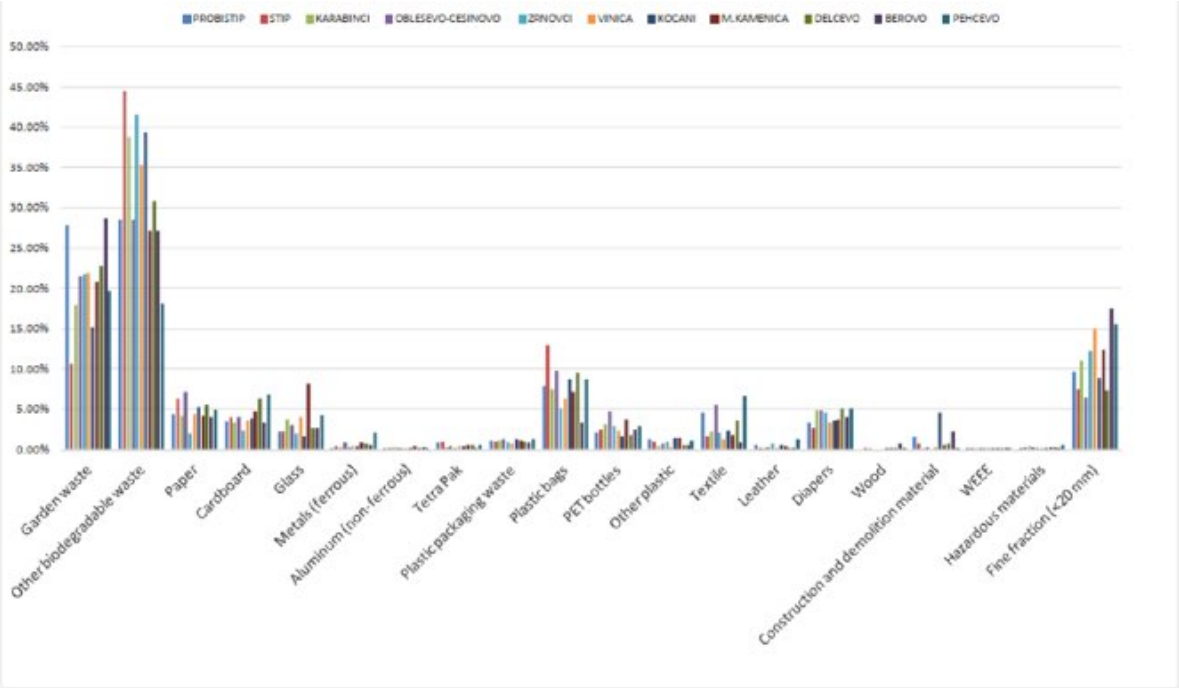
The municipal waste collection services in the municipality of Stip covers approximately 95% of the territory (some remote rural areas are not covered with the waste collection services). The average amount of waste generated in the municipality of Stip is around 30,000 tons, annually. The average composition of waste is as follows:

- 10.58% garden waste
- 44.47% other biodegradable waste
- 6.35% paper
- 4.09% cardboard
- 2.28% glass
- 0.64% metal waste
- 1.05% tetra pack
- 1% plastic packaging
- 12.98% plastic bags
- 2.49% PET bottles
- 0.96% other plastics
- 1.66% textiles

[2] "Support to the implementation of regional waste management systems in the Eastern and North-Eastern Region NEAR/SKP/2022/EA-RP/0137"

- 0.07% leather
- 2.66% diapers
- 0.03% wood
- 0.7% construction debris and waste.

Figure 15.1: Comparison of waste composition in all municipalities in the Eastern region (Stip) region



Source: East Region – Regional Waste Management Plan, April 2014.

The disposal of solid municipal waste is one of the more challenging problems in the municipality of Stip and it is currently deposited at the city's non-compliant landfill located at the Treštena Skala site, approximately 4 km from Stip. In the city of Stip, waste collection is handled by the municipal licensed enterprise JKP 'Isar' which is equipped with three special garbage vehicles, three container lift trucks and four tractors.

There are no special systems in place for the treatment of agricultural and biodegradable waste in the municipality, this waste is also disposed of at the Treshtena Skala site.

The annual generation of construction waste and rubble largely depends on construction activities in the public and private sectors. The official statistical office of North Macedonia, for collection and processing of statistical data, does not collect information on the forementioned waste, instead, an estimated quantity is considered based on experiences from other countries. The range of generated construction waste varies from 230 to 250 kg/capita/year, which will give an estimated average annual quantity of generated construction waste and rubble of approximately 16,500 tons/year.

15.3.3 Existing waste processes and management in the Project area

Local regulations, based on a decision of the Municipal Council of Stip (April 2004, Decision 7), requires that all inert waste be disposed of at the non-compliant Krstot landfill on the outskirts of Stip. The site is located near the settlement of Prebeg, above the Kežovica recreational centre, covering approximately 5ha. Its total capacity is estimated at 200,000 m³, although no information is available on current remaining capacity.

Waste processing and recycling activities for packaging waste, batteries and accumulators, and electrical and electronic equipment are regulated through North Macedonia's Producer Extended Responsibility (PER) system, which assigns producers responsibility for the full lifecycle of their products, including end-of-life recycling and disposal. This system aligns with the EU Waste Framework Directive (2008/98/EC), which establishes the waste hierarchy, the polluter-pays principle, and sets the overarching legal framework for waste management in the EU. As a candidate for EU membership, North Macedonia is progressively harmonising its national PER framework with these EU requirements.

The PER framework also supports national commitments under the country's Circular Economy Package, which includes the target to limit municipal waste disposal to landfills to 65% by 2034, encouraging greater recycling, recovery, and re-use of materials. This approach is consistent with long-term EU goals to reduce landfilling and increase resource recovery, as reflected in EU waste legislation and waste-prevention strategies.

In line with these principles, the PER framework restricts the types and quantities of waste that can be landfilled and obligates waste generators to classify, sort, treat, or transfer waste to a licensed entity holding a valid waste-management permit. The system currently covers several regulated waste streams, including:

- Packaging waste, aligned with EU Packaging and Packaging Waste Directive principles (e.g., material-specific reduction and recovery targets).
- Waste Electrical and Electronic Equipment (WEEE), consistent with EU WEEE Directive requirements on collection and proper treatment.
- Batteries and accumulators, reflecting EU battery-management obligations applicable across Member States.
- Emerging waste streams, including textiles, tyres, used vehicles, and waste oils, which are currently undergoing regulatory development in alignment with ongoing EU revisions.

Businesses operating in North Macedonia must comply with PER obligations by either joining a licensed Producer Responsibility Organisation (PRO) or establishing an individual compliance system. All producers must also register with the National Register of Producers with Extended Responsibility under the competent environmental authority, consistent with EU expectations for traceability and enforcement under the Waste Framework Directive's extended producer responsibility provisions

In the municipality of Stip, there are licenced private authorized waste handlers that collect, transport and treat industrial waste oils, waste from electrical and electronic equipment and waste batteries. The identified licensed companies operating in Stip are:

- MINOL – for industrial waste oils (hazardous waste) providing collection and transportation
- IVAL TRADE DOO-Stip – for electrical and electronic wastes, providing collection, treatment and processing.
- IVAL TRADE LLC – for batteries and accumulators, providing collection, treatment and processing.

Medical waste is generally managed by the local medical services.

As mentioned above the rural areas are not well served by the public and private waste handlers, which is why the majority of wastes are dumped illegally in make-shift non-compliant landfills at various locations across the municipality. Five non-licensed landfills have been identified on the territory of the municipality of Stip:

- Village Vrshakovo, Reka locality
- Village Dragoevo, Gladno Pole locality
- Village Lakavica, Lakavica River locality

- Village Chardaklija, locality by the Bregalnica river
- Village Selce

Waste collection and transportation services in the urban part of Radovic are fully provided by the public company 'Plavaja – Radoviš', while for the rural area, similar to Stip there is no such service. With approximately 9,663 households and 28,988 inhabitants, the municipality of Radovic generates on average 6,860 tons of waste per year and only 4,070 tons of this waste is collected (the rest remaining uncollected).

The waste is deposited at the city landfill, which is located 2.5 km from the city centre, and covers an area of approximately 11,000 m².

In the Municipality of Karbinci, waste management is carried out by the municipal public company 'Karbinci', which is responsible for the collection, transport and disposal of waste, as well as for the maintenance of public areas. According to the existing regional waste management plan[3], the collection coverage in the Karbinci is 79% of the population. The waste is disposed at a non-compliant landfill 'Bel Breg' that covers an area of 4,225 m². Annually, around 450tn of communal waste is collected in Karbinci on average.

In the Eastern region, especially in Stip, there are several companies and institutions engaged in waste recycling. The main operator for managing packaging waste in the country is the company Pakomak DOO Skopje. In Stip, Pakomak has developed infrastructure that includes yellow containers for plastic and metal cans, glass collection points, and vending machines for value-based waste sorting. In cooperation with the municipality and the public enterprise "Isar," a line for secondary sorting and processing of plastic and paper waste was introduced as early as 2015. Citizens of Stip actively use the vending machines, which allow them to earn "green points" through the EcoMak app, which can be exchanged for vouchers and services. In 2024, over 18,000 kilograms of packaging waste were collected through this initiative.

The public enterprise "Isar" is a local partner cooperating with Pakomak and manages the infrastructure for sorting and processing waste in Stip. In the field of textiles, this waste is collected by the company Eco-Text Group, which recycles part of the waste and part of it is incinerated as an energy resource, thus enabling effective management of textile waste and preventing pollution.

Other recycling companies that are operating across the country for collection and treatment of different types of waste include: Grintech (plastics), Zero Waste (WEEE and batteries), Evrosurovina (scrap metals and rubber), EkoCentar 97 (scrap metals, WEEE and end-of-life vehicles) etc.

15.4 Assessment of impacts

15.4.1 Receptor identification

The main receptors associated with the mismanagement of waste and materials are:

- Receiving environments (i.e. terrestrial environment/biodiversity, groundwater and soils).
- Local community.
- Finite natural resources, particularly landfill capacity and raw materials used during the Project.

Waste will be generated by the Project but if properly managed, the area potentially impacted will not go beyond the Project site limits. However, if any hazardous substances or spoil/excavated materials require special disposal treatment offsite or are not handled and

[3] Preparation of regional waste management plans and strategic environmental assessments for east and north-east regions" (EuropeAid/130400/D/SER/MK) East Region –Final Draft Regional Waste Management Plan

stored properly, there is potential that soil, groundwater, and local communities may be impacted.

15.4.2 Analysis of construction phase impacts

This section aims to characterise the waste streams and their impacts which are envisaged to arise from construction activities.

15.4.2.1 Material use

Materials used during construction will principally comprise the items of equipment for the Project, as well as materials used for site preparation such as concrete for foundations and auxiliary structures, steel for office buildings and materials for fitting out the interiors of building, among others.

Smaller quantities of other materials will be used throughout construction including lubricants, oils, fuel (diesel), paint, plastics, packaging materials (paper, cardboard, timber) and food. The exact quantities of these materials are not possible to quantify.

The principal potential impacts which can arise from the generation of waste from all phases of the Project are as follows:

- Use of potentially finite and/or scarce resources – such as landfills in Stip and Radovic
- Ineffective spoil/excavated material handling, storage and disposal causing contamination of the environment
- Contamination of environments (groundwater and soils) due to leakage and spillage of materials (such as fuel, oils and chemicals) from poor handling and storage arrangements
- Occupational health and safety from exposure to hazardous waste

15.4.2.2 Waste generation

There are three general classifications of wastes, namely non-hazardous wastes, hazardous wastes and inert construction wastes. Each waste stream has been identified as belonging to one of the following classifications:

- Inert construction wastes are solid materials that, once disposed of, are not expected to undergo physical, chemical, or biological changes that could create harmful substances. Examples include excavated soil, concrete, glass, ceramics, unpainted scrap metal, and dry or untreated timber.
- Non-hazardous wastes include all wastes that are neither hazardous nor classified as inert construction waste. This category covers general household-type waste, office waste, combustible construction materials such as cardboard boxes, and treated sewage effluent and sludge.
- Hazardous wastes are materials that meet one or more of the following characteristics or are otherwise defined as hazardous: explosive, flammable, capable of spontaneous combustion, oxidising, toxic, or corrosive.

Table 15.1 summarises the waste streams which are anticipated to be generated as part of the construction phase of the Project, as well as their potential impacts, and how wastes will be handled and stored, and the method of disposal for each waste stream.

Table 15.1: Analysis of waste streams during construction

Waste type	European waste catalogue (EWC)[4]	Potential unmitigated impact	Proposed management method
Inert construction wastes			
Excavation materials/site levelling for hardstanding	• 17 05 04	• Contamination of receiving environments such as sedimentation, groundwater, among others • Fugitive dust emissions • Disposal of hardstanding materials and spoil which results in land take	• Excavated materials and spoil needs to be reused on-site wherever feasible. Where reuse is not possible, excess inert spoil needs to be transported to a licensed inert-waste disposal facility. All spoil needs to be stored in compact, covered stockpiles prior to reuse or disposal, and surface-lining measures will be implemented to prevent runoff and sedimentation.
Concrete	• 17 01 01	• Fugitive emissions • Additional pressure on the use of existing landfill, where waste re-use or recovery is not feasible • Increased 'waste-miles' from transporting waste materials from the Project site to Stip or Radovic landfills	• To be segregated and suitably stored on a temporary basis in a designated waste management area. • Reuse in other work locations (e.g., as an aggregate) or returning unused cement to the vendor can minimise the volume of waste. • Landfill as a last option
Concrete washings (if any a concrete batching plant on site is to be installed)	• 17 01 06	• Contamination of receiving environments (for example sedimentation, land contamination, ground water).	• Concrete washing's water and residues are to be managed using clearly defined controls to prevent contamination of soil and water resources. All washing activities need to take place in designated, impermeable, and clearly marked washout areas located away from drainage systems and sensitive environments. Wash water needs to be captured in lined containers or pits, allowed to settle, and treated if needed, while hardened residues will be collected for disposal or recycling at a licensed facility. Workers need to be trained in proper washout procedures, and regular site supervision

[4] EWC is a EU-standardised system for classifying waste using six-digit EWC (or LoW – List of Waste) codes.

Waste type	European waste catalogue (EWC)[4]	Potential unmitigated impact	Proposed management method
			needs to be done to ensure compliance with these measures. ● In case of a concrete batching plant on site, the wash water which cannot be immediately reused is to be stored in an open lined pit or open tanks so as to aid sedimentation or other on-site treatment as appropriate.
Non-hazardous construction wastes			
Iron and steel scrap Non-ferrous scrap Paper and cardboard Timber Bricks and tiles Pallets Glass	● 17 04 05 ● 17 04 02 ● 17 02 01 ● 20 01 01 ● 15 01 02	● The use of landfill, where waste re-use or recovery is not feasible ● Increased impact from transporting waste materials from the Project site, as above	● Segregated and suitably stored on a temporary basis in a designated waste management area at the site (various locations on site) ● Collected by a competent carrier for recycling/reuse (where available) – as identified in section 15.3 above. ● Scrap metal may be sold for recycling, as appropriate.
General domestic waste	● 20 03 01	● The use of landfill, where waste re-use or recovery is not feasible ● Windblown litter and potential odour and health risks by attracting pests ● Increased waste miles from transporting waste materials from the Project site ● Potential odour impacts from the storage of putrescible wastes	● Waste needs to be segregated, stored in covered, labelled containers, and removed regularly by licensed municipal or recycling contractors. Recyclables will be sent to authorised facilities; non-recyclables to landfill. Food waste may be separated for approved off-site composting ● Appropriately handled and disposed of in accordance with the relevant international and local requirements to maximise recycling rates.
Plastics and packaging Drums, barrels and containers from non-hazardous materials	● 15 02 02	● The use of landfill, where waste re-use or recovery is not feasible ● Increased waste miles from transporting waste materials from the Project site.	● To be segregated and suitably stored on a temporary basis in a waste management area. ● Collected by or delivered to local vendors for recycling (where available) – as identified in section 15.3 above. ● Drums and barrels may be disposed of by

Waste type	European waste catalogue (EWC)[4]	Potential unmitigated impact	Proposed management method
			returning to the vendor for reuse – or clean barrels may be donated to the local community if requested.
Hazardous construction wastes			
Oils and lubricants and contaminated cloths	• 15 02 02	• Contamination of receiving environments • Additional pressure on the use of landfill, where waste re-use or recovery is not feasible	• Installation of tank trays, which function as secondary containment systems designed to capture and hold chemicals in the event of a tank failure, leakage, or any other accidental release. • Collected by a competent and licensed carrier – as identified in section 15.3 above. • Where recovery and re-use is not feasible then disposal in an approved waste treatment facility. •
Batteries, paints and chemicals	• 16 06 01	• Contamination of receiving environments • Additional pressure on the use of landfill, where waste re-use or recovery is not feasible	• Waste will be segregated according to waste code and suitably stored in a waste management area. • Collected by a competent carrier to be disposed of in a licensed waste facility in consultation with the competent authorities (as identified in section 15.3 above).
Medical waste including contaminated PPE	• 18 01 03	• Contamination of receiving environments • Health and safety: risk of infection and exposure to diseases • Increased pressure on limited waste management facilities	• Colour coded medical waste storage to be provided • Containers to be puncture-proof (usually made of metal or high-density plastic) and fitted with covers and stored in locked containers • Bags and containers for infectious waste to be marked with the international infectious substance symbol • Transported (onsite ambulance) to a medical facility for waste incineration
Contaminated material Oily debris from sumps and spill clean-ups	• 15 02 02	• Discharge of untreated wastewater at construction site resulting in land contamination	• Collected and stored on an impermeable bunded area and appropriately

Waste type	European waste catalogue (EWC)[4]	Potential unmitigated impact	Proposed management method
		• Accidental spillage and leakage of chemicals including fuel, oil and lubricant from on-site fuel storage tanks and equipment maintenance	covered for storage and for transportation • Collected by a competent and licensed carrier to be disposed of in a licensed waste facility in consultation with the competent authorities (as identified in section 15.3 above).
Sewage Sanitary chemicals containing hazardous substances	• 20 03 04 • 20 01 29	• Contamination of receiving environments (soil, and from OHS perspective) • Discharge of untreated wastewater at construction site impacting ground water	• Domestic sewage and greywater needs to be collected in sealed septic tanks or mobile units and emptied regularly by a licensed wastewater contractor. • Any sanitary chemicals or wastewater contaminated with oils, fuels, or other hazardous substances needs to be segregated, stored in clearly labelled, leak-proof containers, and removed by a licensed hazardous-waste contractor. • Prevent any discharge of untreated wastewater to soil, drains, or the wider environment. • Routine inspections needs to be undertaken to ensure facility integrity, correct segregation, and compliance with disposal requirements. • Collected by a competent carrier to be disposed of in a licensed waste facility in consultation with the competent authorities (as identified in section 15.3 above).
General waste			
All wastes	• Various	• Construction debris / litter could potentially cause injury to workers from contact with sharp materials	• Appropriate storage of waste in suitable receptacles, which are labelled.

Source: Mott MacDonald

15.4.3 Analysis of operational phase impacts

15.4.3.1 Materials use

During the operation phase there will be significantly less materials used, therefore the impacts are minimal compared to the construction phase. The primary environmental impacts associated with operations are:

- Potential contamination of environments (particularly groundwater and soils) due to leakage and spillage of materials (such as fuel, oils and chemicals) from poor handling and storage arrangements.
- Surplus materials requiring disposal i.e. out of date, excess to requirement, damaged.
- Disposal of packaging waste.
- Occupational health and safety from exposure to hazardous materials.

15.4.3.2 Waste generation

Waste streams that will arise during operation will include:

- Lubricating and auxiliary oils
- Oily contaminated materials, such as oily rags
- Empty reagent/chemical containers
- Diesel generator filters
- Delivery packaging/pallets
- Waste clean-up collected as a result of spills, leakages and/or accidental discharge.
- Sanitary waste
- Domestic/kitchen waste generated by workers

It is expected that waste material will be generated as a result of preventive and corrective maintenance. The exact type and quantity of the waste arising will be dependent upon the nature and scale of the activities associated with the WTGs, substation and OHL line. Waste streams associated with major maintenance activities for wind farms are generally higher than the waste typically generated during normal operations. Provision for the suitable management for these waste streams will be required prior to any significant outage/maintenance activities being carried out.

Table 15.2 sets out the potential impacts that may be caused by operational waste generated by the Project if not adequately managed. Waste streams that will arise from the operation of the Project will require adequate handling and disposal procedures to ensure adverse environmental impacts are kept to a minimum.

Table 15.2: Analysis of waste streams during operation

Waste type	European waste catalogue (EWC)[5]	Potential unmitigated impact	Proposed management method
Sewage sludge and sanitary chemicals	● 20 03 04	● Contamination of receiving environments ● Discharge of untreated wastewater at main offices (substation) site	● Sewage to be discharged to the municipal sewer system where available. If not available, sewage needs to be collected in sealed tanks and transported by a licensed contractor to

[5] EWC is a EU-standardised system for classifying waste using six-digit EWC (or LoW – List of Waste) codes.

Waste type	European waste catalogue (EWC)[5]	Potential unmitigated impact	Proposed management method
			an authorised municipal treatment facility.
Contaminated packaging, oily contaminated materials, such as oily rags, lubricating and auxiliary oils, empty chemical containers	• 15 02 02	• Contamination of receiving environments	• Installation of tank trays, which function as secondary containment systems designed to capture and hold chemicals in the event of a tank failure, leakage, or any other accidental release. • Appropriately handled and disposed of in accordance with the relevant and local requirements and GIIP.
Waste collected as a result of spills, leakages and/or accidental damage	• 15 02 02	• Contamination of receiving environments	• Collected and stored in an appropriate container. • Appropriately handled and disposed of in accordance with the relevant and local requirements and GIIP.
Waste Electronics and Electrical Equipment (WEEE)	• 16 06 01	• Potential contamination of receiving environment • May contain heavy metals that can cause potential contamination to soil or groundwater	• Recycling options to be fully explored. Collected by a competent licensed carrier. Where recycling is not feasible then disposal in accordance with consultation of the competent authorities.
General domestic waste	• 20 03 01	• Potential contamination of receiving environment • Visual amenity impacts • Use of finite landfill resource	• Recyclable components to be fully segregated (see the following rows). Residual waste to be disposed of to landfill.
Paper and cardboard Plastic Glass	• 20 01 01 • 20 01 39 • 20 01 02	• Potential litter/visual amenity impacts	• Collected by a competent carrier for recovery and re-use.
Iron and steel scrap Non-ferrous scrap	• 17 04 05 • 17 04 02	• Potential contamination of receiving environment. • Visual amenity impacts. • Recycling potential.	• Collected by a competent carrier for recovery and re-use.

Source: Mott MacDonald

15.4.4 Analysis of decommissioning phase impact

Decommissioning of the Project will involve the full removal of all wind farm infrastructure and the reinstatement of the land to its pre-Project condition. As part of this process, detailed advance planning will be required to identify and categorise all waste streams expected to arise, and to determine the most suitable re-use, recovery, recycling, or where unavoidable disposal pathways.

The types of waste generated during decommissioning are expected to be broadly similar to those produced during construction, including concrete, scrap metal, cables, packaging waste, oils and lubricants, and general construction and demolition waste. In addition, the decommissioning phase will generate end-of-life turbine components, such as towers, nacelles, generators, and rotor blades. While steel and other metals can typically be recovered and recycled through facilities available within the wider region, composite turbine blades and certain specialised components may require treatment at dedicated recycling or re-processing facilities, potentially outside the immediate Project area due to limited local capacity.

Prior to the commencement of decommissioning, a Decommissioning Environmental Management Plan (DEMP) will be prepared. This will set out the best-practice approach to managing decommissioning activities, including a dedicated waste management section. The DEMP will detail the environmental protection measures to be implemented, the arrangements for safe storage and handling of each waste type, and the identified regional or national pathways for recovery, re-use, and recycling. For waste streams that cannot be recovered or re-used, the DEMP will identify the most appropriate licensed disposal options available within the region. The plan will also specify the management approach for end-of-life turbine components, including the handling and recycling of metals and the selected route for the processing or disposal of composite blade materials.

15.5 Mitigation and enhancement measures

Potential impacts are not expected to be significant provided GIIP for materials handling and storage and waste management and disposal is adhered to throughout the construction and operation phases of the Project as specified below. Moreover, as mentioned above, there are licensed waste contractors in Stip and with the potential commissioning of the Sveti Nikole landfill facility, if properly managed the impacts due to waste and materials can be kept to a minimum.

Materials and waste management will be managed for the construction and operational phases as follows:

- Detailed Waste and materials management and handling plans (WMMHP) will be required to be developed by the BOP Contactor.
- A Spill prevention and response plan will also be required to be developed by each contractor.

Waste and materials management plan (WMMHP)

For each phase, the WMMHP should identify predicted waste streams, appropriate handling, reuse and recycle opportunities and, as a last resort, disposal methods. Each WMMHP should be prepared in accordance North Macedonia national waste regulations and the IFC General EHS Guidelines.

The WMMHP should include the following key aspects, as well as mitigation measures in the below sections as a minimum:

- Identify who is responsible for each key stage and inform individuals of their responsibilities. They will be required to hold sufficient authority to ensure compliance with the WMMHP by other site operatives.
- Identify the types and quantities of waste - all waste streams that will be produced during construction, operation and decommissioning require to be identified.
- Identify waste management options - where hazardous wastes are being generated, particular attention to the arrangements for identifying and managing such waste will need to be addressed and procedures put in place.

- Use licensed waste disposal contractors that comply with the environmental legislative requirements of the local and national area and ensure wastes are properly disposed of at licensed landfills/waste treatment plant by requesting waste transfer certificates.
- Training - all staff must be trained to ensure they understand the requirements of the WMMHP.
- Measure - the quantities of wastes produced should be recorded on monthly basis, and where possible measures taken to re-use, reduce or recycle waste as appropriate.
- Monitor - throughout the Project life cycle, waste management on site should be monitored, to ensure compliance with the WMMHP.
- Hazardous – hazardous wastes should be classified and treated according to national requirements.
- Identify waste management options - a waste hierarchy of reduce, reuse, and recycle and needs to be considered and prepared. Where hazardous wastes are being generated, particular attention to the arrangements for identifying and managing such waste will need to be addressed and procedures put in place.

Mitigation and enhancement measures are outlined in Table 15.3.

Table 15.3: Mitigation and enhancement measures

Type of measure	Mitigation/ enhancement measure	Details of mitigation/enhancement measures
Embedded mitigation / design measures – mitigation which is built into Project during the design and procurement process	Identification of disposal facilities	● Identification of appropriate waste facilities (including for hazardous waste) as described in section 15.3 above.
	On site concrete production	Production of concrete on site. Concrete mixing plant located at construction site limiting traffic movements associated with concrete delivery to site access roads.
Mitigation of significant and non-significant effects	Material Use	● Re-using materials on site wherever possible; the most significant opportunity in the construction phase is with respect to excavated spoil. ● Instituting good housekeeping and operating practices, including inventory control to reduce the amount of waste resulting from materials that are out-of-date, off specification, contaminated, damaged, or excess to needs. ● Instituting procurement measures that recognise opportunities such as ordering the correct number of materials to be delivered when needed and establishing a take back system with suppliers. ● Major supply requirements, outside of what is sourced on-site (e.g. stone, concrete) should be sourced from certified sources or local sources. ● Substituting raw materials or inputs with less hazardous or toxic materials wherever economically and technically feasible.
	Waste segregation	● Wastes to be appropriately segregated in designated storage areas, such that hazardous and non-hazardous wastes are not mixed and to allow for recycling and reuse where appropriate. Although temporary locations around the site may be conditioned, best practice is to have waste in one centralised area. ● Hazardous waste (such as oils, lubricants, batteries, chemicals and medical waste) will be segregated from other waste types to avoid cross contamination.
	Storage measures	● Wastes generated shall be correctly identified and stored pending collection/transfer for reuse, recovery, recycling or disposal in an environmentally sound manner.

Type of measure	Mitigation/ enhancement measure	Details of mitigation/enhancement measures
		● The waste storage areas will be located on hard standing or similar to prevent leaching of any contaminants should spillage or leakage occur, along with material safety datasheet (MSDS). ● All skips to be suitably covered (to avoid dispersion of light materials by wind or filling of skip with rain). ● Liquid wastes/oil/chemicals to be stored in tanks or drums located in bunded areas which can hold 110% of the capacity of the largest tank or drum or, for multiple drum storage, 25% of the total volume of material stored. ● Spill kits located at strategic locations around the site. ● Store hazardous waste in closed and locked containers away from direct sunlight, wind and rain in designated storage areas. Locate storage area away from sensitive receptors. ● Provide adequate ventilation where any volatile wastes are stored. ● Provide readily available information on chemical compatibility to workers including labelling each container, demarcation of the area (e.g. on a facility map/site plan).
	Handling measures	● Handling and storage shall be carried out by trained staff. ● Spill response equipment will be made available and maintained in areas where hazardous wastes may be spilt and an appropriate number of site personnel will be trained in spill response techniques. ● Prepare and implement spill prevention and response plan and emergency preparedness and response plan to address any accidental release and leakage. ● Each waste transport will be appropriately tracked and a register kept for recording all waste transports leaving the site and their disposal location. ● Waste transfer certificates to be requested for all waste consignments from the construction/operation site to the disposal destination. ● Periodic spot checks as appropriate to follow waste transports to their destination.
	Disposal measures	● Waste disposal shall be conducted in a controlled manner, fully complying with regulations, and no waste shall be dumped illegally or burned on-site. ● Offsite waste treatment or disposal facilities used will be appropriately permitted, or if not available based on the most suitable site in consultation with authorities. ● Disposal of any medical waste must be undertaken at licensed facilities/hospitals.

15.6 Monitoring

Monitoring will be undertaken to evaluate the effectiveness of mitigation and enhancement measures and to identify any issues requiring corrective action. The Project will establish a material-usage and waste-management monitoring programme covering construction, operation, and decommissioning activities. All monitoring procedures will be incorporated into the WMMHP.

Monitoring actions may include:

- Maintaining comprehensive records of waste generation, storage, treatment, and disposal activities, including any incidents such as spills and the corrective actions taken.
- Conducting regular visual inspections of waste-storage areas to assess:
  - Correct waste segregation and labelling
  - Condition, integrity, and capacity of containers and storage infrastructure
  - Implementation of waste-minimisation, reuse, and recycling measures.

- Performing periodic compliance audits against the WMMHP, including audits of third-party waste contractors and verification of their licences and authorisations.

To strengthen monitoring, the Project will adopt a set of measurable Key Performance Indicators (KPIs), which may include:

- Waste generated by type (tons/month)
- Percentage of waste reused, recycled, or recovered
- Number of spills or waste-related incidents reported per month/quarter
- Number of contractor compliance checks undertaken
- Percentage of non-compliances closed out within required timeframes

Monitoring will be carried out by trained personnel following defined procedures, with data reviewed regularly and compared against established targets and applicable standards to ensure timely implementation of corrective measures.

15.7 Residual impacts

The mitigation measures identified in the section 15.5 will ensure that wastes generated as a result of the Project will be managed according to environmental best practice and the risk to the environment is reduced to a minimum. There are licensed waste contractors in Stip and with the potential commissioning of the Sveti Nikole landfill facilities, if properly managed residual impacts due to waste and materials can be kept to a minimum.

16 Climate risk and vulnerability assessment

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Executive summary

This Climate Change and Vulnerability Assessment (CRVA) was conducted for the Project. The assessment aligns with Equator Principles (EP4) and the European Bank for Reconstruction and Development (EBRD) requirements, focusing on physical climate-related risks over the Project's 25-year operational life (2028-2053[1]).

The Project is located near the city of Stip, East of North Macedonia, and is composed by 54 wind turbines with a total installed capacity of up to 396 MW. The estimated annual output is around 808,000 MWh, excluding turbine availability and blade degradation losses.

According to the climate benefits quantified for the Project, 674,644 tCO_2e will be saved annually, based on the energy output and North Macedonia's grid emission factor. It supports national goals for renewable energy expansion.

The assessment scope is based on a 1995-2014 period and considers current climate and two future scenarios: SSP2-4.5 (moderate) and SSP5-8.5 (high emissions). Current and future climate data was sourced from international recognised databases, such as the World Bank Climate Change Knowledge Portal and the IPCC Atlas. The time horizon used for the assessment is 2040-2059, in alignment with the Project's design life.

The climate trends show a temperature Projected to rise, especially in summer season, and an increasing precipitation in winter, having a significant decrease in summer and autumn. Wind speed is expected to decrease with global warming. Extreme events are Projected to increase in frequency and intensity. These trends are more intense in the SSP5-8.5 scenario.

Extreme heat, heavy rain and floods, landslides, wildfires and wind variability were included into the assessment. To calculate the risk scoring, exposure and vulnerability levels were considered. As result, 60 risks were identified (20 per scenario, including current and future scenarios). From the 60 risks, half of them were scored as low, 20 risks were scored as moderate, 8 risks were scored as high and 2 were classified as very high risks. The risks with the highest score are:

- Wildfire, causing structural damage, sensor malfunctions and operational disruption.
- Increases in mean temperature and increased extreme high temperatures, leading to energy losses, fatigue and degradation of materials/components, and negative impact on staff health and infrastructure durability.
- Landslide, undermining or displacing the Project's components.
- Heavy precipitation and flooding, causing electrical damage, short circuits, materials/components degradation and health and safety negative impact.
- Increase in wind speed, which leads to turbine shutdowns when the cut-out speed is exceeded.

Adaptation measures include actions such as use of heat-resistant materials and SCADA systems integration, improved drainage and soil retention, vegetation management for wildfire defence, and flexible and adapted infrastructure design.

As conclusion, with the inclusion of the recommended adaptation measures, it is considered that climate change risks are manageable for the Project. Key risks can be mitigated through

[1] Although the projected data for operation end is 2053, the assessment has rounded up this period, since realistically construction phase could be delayed or operational phase could be stretched out. Therefore, the time horizon considered for this is 2050.

design adaptations and operational strategies. As climate Projections evolve, continuous monitoring and updates to the CRVA will be essential to ensure resilience throughout the Project's lifecycle.

Glossary[2]

Climate change	Change that persists for an extended period, typically decades or longer
Climate change adaptation	Process of adjustment to actual or expected climate and its effects.
Climate Projection	Simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases and aerosols, generally derived using climate models.
Exposure	Presence of people, livelihoods, species or ecosystems, environmental functions, services, resources, infrastructure, or economic, social or cultural assets in places and setting that could be affected.
Impact	Effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services and infrastructure due to the interaction of climate change or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system.
Hazard	Potential occurrence of a natural or human-induced physical event or trend, that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision and environmental resources.
Risk	Effect of uncertainty. An effect can be a positive, negative, or both, deviation from the expected, as result of a response, or failure to respond, to an opportunity or to a threat related to objectives.
Sensitivity	Degree to which a system or species are affected, either adversely or beneficially, by climate variability or change.
Vulnerability	Propensity or predisposition to be adversely affected. Vulnerability comprises a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

[2] Definitions based on the Guidance Note on Climate Change Risk Assessment of the Equator Principles and the ISO 14091:2021.

Acronyms

CRVA	Climate Risk and Vulnerability Assessment.
EBRD	European Bank of Reconstruction and Development (EBRD).
EP4	Equator Principles version 4 (July 2020).
ESIA	Environmental and Social Impact Assessment (ESIA).
GCF	Green Climate Fund.
GHG	Greenhouse gas.
GWh	Gigawatt-hour
Ha	Hectares.
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change.
MW	Megawatt.
MWh	Megawatt-hour.
NbS	Nature-based solutions
NCC	National Climate Commitment.
NDC	National Determined Contribution.
NECP	National Energy and Climate Plan.
O&M	Operations and Maintenance
OHL	Overhead Line.
SSP	Shared Socioeconomic Pathway.
SUDS	Sustainable Urban Drainage Systems.
TCFD	Task force on Climate-Related Financial Disclosures.
tCO_2e	tonnes of carbon dioxide equivalent.

WTG	Wind turbine generator.

16 Climate risk and vulnerability assessment

16.1 Introduction

16.1.1 Overview

The Project Proponent requires the adherence to the Equator Principles version 4 (EP4)[3], which stipulates the assessment of climate change risks as part of the ESIA. The Guidance Note on Climate Change Risk Assessment[4] of EP4 supports the implementation of the EP4 requirements regarding climate change risks identification and assessment. It is also aligned with the Performance Standard (PS) 1 of the International Finance Corporation (IFC), which states the inclusion of climate change risks and adaptation opportunities into the risks and impacts identification process.

In accordance with the EP4 Guidance Note on Climate Change Risk Assessment, a transition risks assessment is only required when combined Scope 1 and 2 CO_2e emissions exceed 100,000 tCO_2e annually. Given this Project will generate energy from renewable and clean sources, it is expected that the Project will not exceed this emissions threshold. On the contrary, energy generation from renewable sources will be translated as a positive impact on climate change, as outlined in section 16.1.6. Therefore, this CRVA is focused on physical climate-related risks and transition risks are scoped out from this chapter.

16.1.1.1 Aims and objectives

As outlined in the EP4 and its Guidance Note on CCRA, Principle 2[5] require the identification and assessment of the climate change risks. In addition, The Environmental and Social Policy[6] of the European Bank of Reconstruction and Development (EBRD) requires the assessment of the vulnerability of the Project to risks caused by climate change and the identification of appropriate climate resilience and adaptation measures to be integrated into the Project design.

To align with these requirements, this Climate Risk and Vulnerability Assessment (CRVA) aims to identify the following for the Project:

- Current and anticipated physical-climate related risks facing the Project's operations over its design life of 25 years.
- Adaptation and resilience measures appropriate to managing those risks.
- Potential climate benefits from the Project.

[3] Equator Principles version 4 (EP4), 2022 [online] Available at: The Equator Principles_EP4_July2020 [Accessed 16 January 2026].

[4] Guidance Note on Climate Change Risk Assessment, Equator Principles, 2023 [online] Available at Guidance CCRA_May 2023 [Accessed 16 January 2026].

[5] Based on Principle 2, projects should "(…) include assessments of potential adverse (…) climate change risks as part of the ESIA or other Assessment" and this should be aligned with the TCFD categories. Principle 10 states that for all Category A and, as appropriate, Category B projects, the project should "(…) ensure that, at a minimum, a summary of the ESIA is accessible and available online and that it includes a summary of (…) climate change risks and impacts when relevant.".

[6] Environmental and Social Policy (ESP), European Bank for Reconstruction and Development (EBRD), 2024 [online] Available at: Environmental and Social Policy 2024 [Accessed 16 January 2026].

This CRVA considers both the chronic and acute risks[7] of climate change and their impacts on the Project components, including impacts to physical assets and operations. The time period covered by the assessment considers risks up until 2050, as approximate date of operation end. As mentioned above, this is Projected in accordance with the anticipated operating period of 25 years following the end of construction phase in 2028. The key steps of the assessment, include:

- Development of climate change scenarios:
  - An assessment of the current baseline climate (see Section 3.1).
  - An assessment of future climate change Projections for North Macedonia (see Section 3.2) for two greenhouse gas (GHG) emissions scenarios.
- Identification of climate vulnerability of Project components (see Section 4.2).
- A high-level review of potential adaptation and resilience options (see Section 4.2).
- Identification of potential climate benefits of the Project (see Section 5).

The risk and vulnerability assessment is based on Project information and public available data sources. No additional modelling was conducted as part of the high-level review. For full Project description please refer to Chapter 2 of this ESIA.

16.1.1.2 Chapter structure

The CRVA is structured as follows:

- Section 1 outlines the aims and objectives of the CRVA and Project background.
- Section 2 provides the policy context and background literature review for the physical risk assessment.
- Section 3 describes the current baseline and future climate scenarios.
- Section 4 contains the physical climate-related risks deeming the effects of acute and chronic impacts of the climate change over the Project's infrastructure and operation.
- Section 5 estimates the potential benefits of the Project.

16.1.2 Policy context and literature review

16.1.2.1 Nationally determined contribution[8]

As part of the enhanced Nationally Determined Contribution of the Republic of North Macedonia in 2021, the importance of adapting to climate change is acknowledged and the creation of a National Adaptation Plan of the country is one of the commitments to climate adaptation.

This new Adaptation Plan will include cross-sectorial and sector-specific adaptation measures, that will be aligned with the Disaster Risk Reduction Strategy. North Macedonia will include the adaptation component in the subsequent National Determined Contribution (NDC). Currently, the National Adaptation Plan is being developed through finance from the Green Climate Fund (GCF)[9].

[7] Physical risks are classified by the Taskforce on Climate related Financial Disclosures (TCFD), and within EP4, as: acute risks (event-driven, e.g. flood, hurricane) and chronic (longer-term shifts in precipitation and temperature and increase variability in weather patterns, e.g. sea level rise).

[8] The Republic of North Macedonia First NDC (Updated submission), United Nations, 2021 [online] Available at: The Republic of North Macedonia First NDC (Updated submission) | UNFCCC [Accessed 16 January 2026].

[9] 'Improving resilience in the Republic of North Macedonia by integrating adaptation into planning processes', 2026 [online] Available at: https://www.adaptation-undp.org/projects/improving-resilience-republic-north-macedonia-integrating-adaptation-planning-processes [Accessed 13 January 2026].

16.1.2.2 Long-term strategy on climate action and action plan[10]

The Ministry of Environment and Physical Planning launched in 2021 the Long-Term Strategy on Climate Action and Action Plan, which aims to achieve a low-carbon economy that is climate resilient.

The strategic objectives of this plan include strengthen resilience to climate impacts, particularly in vulnerable sectors such as infrastructure. The strategy captures adaptation measures, including risk-based planning, Nature-based Solutions (NbS), infrastructure resilience, early warning systems and empowering of local communities and municipalities. This will be accompanied by transparency, stakeholder engagement and policy coherence.

16.1.2.3 National energy and climate plan[11]

The National Energy and Climate Plan (NECP)(2023) of Norh Macedonia outlines the roadmap to 2030 for reducing greenhouse gas (GHG) emissions, increasing renewable energy, improving energy efficiency and ensuring energy security and affordability, in alignment with the EU Energy Union objectives and the European Green Deal[12]. The expansion of solar, wind and hydropower energy sources is part of the energy measures to be implemented towards the replacement of a coal-dependent energy system for the deployment of renewable energy generation by 2030[13]. .

In this plan, adaptation is treated as a cross-cutting issue, especially in energy infrastructure, water resources and agriculture. Diversification of energy sources is valuable to reduce energy vulnerability to climate impacts from a national insight.

Energy planning should integrate risk assessments and early warning systems, as well as emergency preparedness and NbS, to increase adaptive capacity against the effects of climate change.

16.1.2.4 Physical risks to wind farms based on literature

Based on the Country Climate and Development Report[14] issued by the World Bank, North Macedonia is exposed to several natural hazards, such as floods, extreme heat, wildfires, landslides, water scarcity and earthquakes, depending on the geographical location and geological variables. With exception of earthquakes[15], these natural hazards are anticipated to be exacerbated by climate change, generating increased frequency of extreme precipitation events, intensifying extreme heat and increasing wildfire frequency and severity.

Wind energy plays an important role as clean energy generation and enabler of a low-carbon transition and is therefore strategically important energy infrastructure. Wind energy assets are

[10] Long Term Strategy on Climate Action and Action Plan, Ministry of Environment and Physical Planning 2021 [online] Available at: UNDP 9th Brochure ENG WEB [Accessed 16 January 2026].

[11] National Energy and Climate Plan of The Republic of North Macedonia, Ministry of Economy, 2022 [online] Available at: https://www.energy-community.org/dam/jcr:0de834a6-d2da-4dbb-8e2e-d91c5e15bee8/Official%20NECP%20-%20EN%20version.pdf [Accessed 16 January 2026].

[12] European Green Deal, European Commission, 2019 [online] Available at: The European Green Deal - European Commission [Accessed 16 January 2026].

[13] 'North Macedonia launches just energy transition investment platform at COP28', European Bank for Reconstruction and Development (EBRD), 2023 [online] Available at: https://www.ebrd.com/home/news-and-events/news/2023/north-macedonia-launches-just-energy-transition-investment-platform-at-cop28.html [Accessed 13 January 2026].

[14] Western Balkans 6 – North Macedonia Country Compendium – Country Climate and Development Report, 2024 [online] Available at: World Bank Document [Accessed 16 January 2026].

[15] The IPCC Sixth Assessment Report does not include earthquakes as part of climate-related events (Chapter 11: Weather and Climate Extreme Events in a Changing Climate | Climate Change 2021: The Physical Science Basis). Earthquakes are caused by tectonic processes, rather than atmospheric and oceanic processes related to greenhouse gas emissions.

affected by the physical impacts of climate change and therefore should be adapted with the aim of reducing damage, operational downtime and health and safety risks, compared to a "Non-action" scenario.

The following are the documented main ways in which climate change can impact negatively the wind power generation:

- Since wind power depends on wind speed and direction, changes in wind patterns could lead to deficiencies in forecasting wind availability, affecting planning, grid stability and supply. This includes operations impact due to cut-out level exceedance (>25m/s of wind speed) and corresponding shut down activation to avoid system damage, which would lead to a decreased electricity generation possible. In case of lower wind speed, it is expected a decreased electricity generation.
- Increase in air temperature reduces air density, and therefore, less energy is generated by the WTGs due to lower energy extraction rates.
- More frequent and intense extreme precipitation could lead to storm events which could damage turbines and infrastructure and may lead to decrease of aerodynamic efficiency; insulation degradation in transformers and switchgear and increase of corrosion. As consequence, the windfarm could materialise the risk of disrupted / decreased electricity generation, as well as risks related with health and safety of staff (e.g. increased risk of electrocution).
- Exacerbation of extreme precipitation could lead to landslides depending on geological conditions, affecting the wind turbines foundations. In addition, soil erosion could be increased by changes in precipitations and wind patterns.

Projection of changes in climate extremes depend on quality and availability of observational data, the challenge of distinguishing long-term trends from natural variability, and spatial resolution limitations inherent in current models. This is particularly true for indicators of wind speeds. Hence, climate models currently exhibit limited precision in simulating changes, including both mean and extreme wind speeds. As a result, their capacity to Project future variations in frequency and intensity of such events remains constrained.

Further sections identify the physical climate-related risks associated with the Project, assess their vulnerability and exposure, and quantify the risk level for each Project component that could be affected.

16.1.3 Baseline

To understand the climate change impacts, current and Projections climate conditions under two future scenarios was established. In alignment with the Guidance Note on Climate Change Risk Assessment of EP4, the current and Projected future climate have been based on analysis of robust climate data and Projections throughout a range of current and future scenarios.

This baseline includes a current baseline based on historic and observed data in the time period between 1995-2014, and two future climate scenarios referred to as Shared Socio-economic Pathways (SSPs)[16]:

- SSP2-4.5 "Middle of the Road" scenario: pathway that assumes a moderate development trajectory and moderate mitigation efforts. Global warming is Projected to reach around 3ºC by 2100.

[16] Based on the IPCC AR6, the SSP (Shared Socioeconomic Pathways) are climate change scenarios of projected socioeconomic global changes up to 2100. In the SSP labels, the first number refers to the assumed shared socio-economic pathway, and the second refers to the approximate global effective radiative forcing (ERF) in 2100." Available at Chapter 4 | Climate Change 2021: The Physical Science Basis [Accessed 16 January 2026].

- SSP5-8.5 “Business-as-usual” scenario: pathway that considers a rapid economic growth based on intensive fossil fuel consumption. Global warming is Projected to reach around 4ºC by 2100.

Data for the climate under each of these scenarios has been obtained from the Climate Change Knowledge Portal of the World Bank Group[17] (WBCCKP), which provides not only the climate context for the current climatology[18] of North Macedonia, but also the climate Projections modelled from the global climate model compilations of the sixth phase of the Coupled Model Intercomparison Project (CMIP6), the latest available climate Projections data.

The time horizon used for climate Projections is the 2050s (2040-2059), since the Project has a lifespan of 25 years and will be operating until approximately 2050. The 10th, 50th and 90th[19] percentile range was used for this assessment, to include variability of data into Projections and account for uncertainty within future climate conditions.

16.1.3.1 Current baseline

North Macedonia’s climate is shaped by a combination of Mediterranean and continental influences, resulting in hot summers and cold wet winters. This section described three key aspects of North Macedonia’s current climate: temperature trends, precipitation patterns and registered extreme weather events. These insights are based on the most recent climatological data and assessments from international and national information sources, such as the WBCCKP and the 4th National Communication on Climate Change of North Macedonia[20].

Temperature

Monthly average temperature in the East region of North Macedonia ranges from -0.31ºC to 6.4ºC in winter months (December to March) to 17.35ºC to 22.2ºC in summer months (June to September). This demonstrates high annual temperature variability, with a significant difference between mean temperatures recorded in winter compared to temperatures in summer. Average maximum daily temperature achieves maximum record in August (Summer), with 28.5ºC, whilst average minimum temperature presents the lowest values in January (Winter), with -3.9ºC, reflecting the coldest time of the year. In accordance with this data, the East region shows distinct seasonal contrasts, indicating a continental climate influence with cold winters and warm to hot summers.

Precipitation

The first three months of the year show moderate precipitation levels, with January and February being relatively similar (around 58mm) and March slightly wetter (around 68mm), which indicates a transition toward wetter spring conditions. Summer season presents precipitation fluctuation, having the highest levels in June (87.65mm) and the lowest precipitation levels in September (38.93mm). Therefore, there is clearly a wet period (April – June) and a dry period (July-September).

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[17] Climate Change Knowledge Portal for Development Practitioners and Policy Makers, World Bank Group, 2021 [online] Available at: Home | Climate Change Knowledge Portal [Accessed 16 January 2026].

[18] Observed, historical data produced by the University of East Anglia [Climatic Research Unit].

[19] The 10th, 50th and 90th percentiles are statistical measures used to describe the rage of results from several climate models. 10% of the model simulations project a value less than or equal to this point. 50% of the model is the central estimate and 90% of the model simulations project a value less than or equal to this point.

[20] Disaster Risk Reduction Report – 4th National Communication on Climate Change, Vasko Popovski, M.A., 2021 [online] Available at: c6dc3a754d4b3fcad7f2366744d3c3c09db26e621e47ed8cc99391478e597b5f.pdf [Accessed 16 January 2026].

In general, the East region presents a low interannual variability, since data shows low variability in monthly precipitation throughout the year (Figure 16-1).

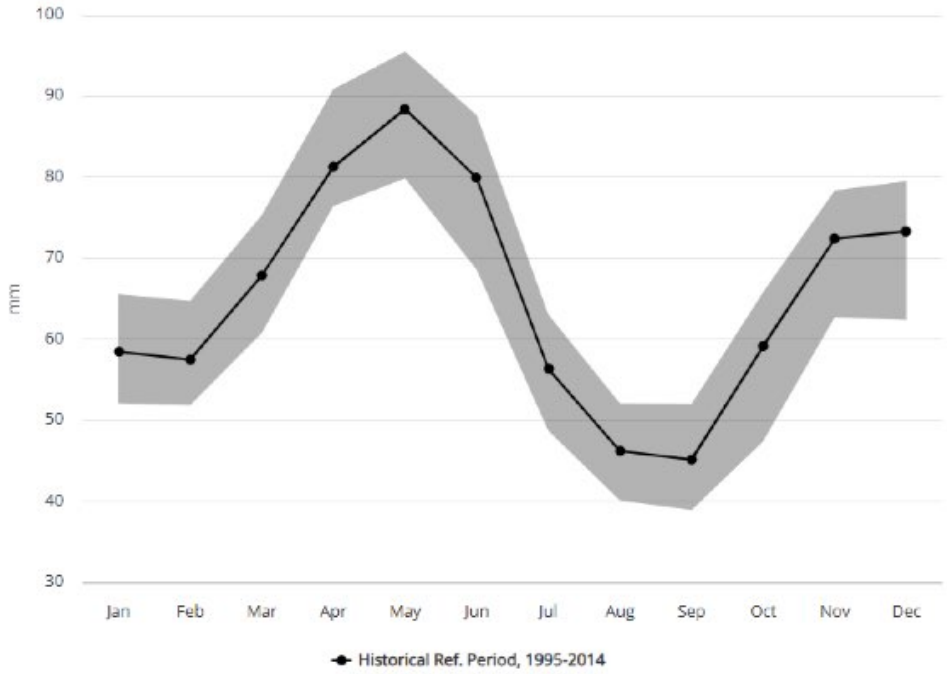


Figure 16-1 Historical precipitation (1995-2014) (Source: WBCCKP)

Regarding snowfall, it is occasional and accumulation is usually minimal. Since it is not significant in the current baseline, neither in the IPCC Projected scenarios, it was scoped out.

Extreme weather events and other climate hazards

North Macedonia has suffered more frequent and intense floods, wildfires and extreme temperatures, affecting the whole country. In the period 1995-2021, 14 flood events, 8 wildfires and 6 extreme temperature episodes[21] took place over the country.

Wildfires became more frequent and intense during summer, particularly in forested and rural areas and during dry summers. Nonetheless, floods are the most frequent and damaging hazard. Both hazards have triggered the increase of landslides in the East region.

Regarding extreme heat, events were registered in 2001, 2004, 2007 and 2014, showing a rising trend in heat-related stress and mortality. Nonetheless, on the regional level, there are some differences in exposure and vulnerability against these extreme weather events.

Based on the Think Hazard Tool of the Global Facility for Disaster Reduction and Recovery (GFDRR)[22], the river flood, urban flood and wildfire hazards are classified as “high”. This means that these potentially damaging hazards are expected to occur at least once in the next 10 years, according to Projections. Although the country is located over steep hillslopes combined with soft rocks, erodible soils and sparse vegetation cover, which gives a high potential for landslides, The Think Hazard Tool classified this hazard as low, meaning the landslides are

[21] Disaster Risk Reduction Report – 4th National Communication on Climate Change, Vasko Popovski, M.A., 2021 [online] Available at: c6dc3a754d4b3fcad7f2366744d3c3c09db26e621e47ed8cc99391478e597b5f.pdf [Accessed 8 January 2026].

[22] Think Hazard, Global Facility for Disaster Reduction and Recovery (GFDRR), 2025 [online] Available at: Think Hazard [Accessed 16 January 2026].

uncommon but not unlikely. Other hazards such as tornadoes, cyclones and coastal flood, were not considered according to the Project location.

According to the Global Wind Atlas of the World Bank Group[23], mean wind speed at 100m height typically ranges from 5.5 m/s to 7.5 m/s in the most promising areas, which usually are elevated and open areas. Although this range is not extreme, the country can experience the indirect effects of Mediterranean cyclones.

16.1.3.2 Future baseline

North Macedonia has experienced noticeable shifts in climate patterns over recent decades, including rising average temperatures, altered precipitation cycles and an increase in the frequency and intensity of extreme weather events.

As global temperature continues to rise, the country is expected to phase increasingly complex climate challenges. This section provides an analysis of Projected trends in temperature, precipitation and extreme weather events in North Macedonia. The WBCCKP has been used to obtain the future temperature and precipitation Projections, whilst the Country Climate and Development Report[24] of the World Bank Group and the IPCC Atlas[25], were used as source for the Projected extreme events in the future.

Temperature

According to the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report[26], global surface temperatures are Projected to continue rising throughout the 21st century under all emission scenarios, including those selected for this assessment. For regions like the Balkans, including North Macedonia, the warming is expected to be significant, particularly during the summer months.

SSP2-4.5

Mean temperature

For SPP2-4.5 an overall warming is observed for average mean surface air temperature, since every month shows a Projected increase in the average temperature compared to the historical baseline. In the period June-August is Projected to experience the most significant warming, with average temperatures rising by approximately 2.5-3.5ºC. Winter months are not exempt from temperature increase, since from December until February winter temperatures are expected to rise by 1.5ºC-2.5ºC.

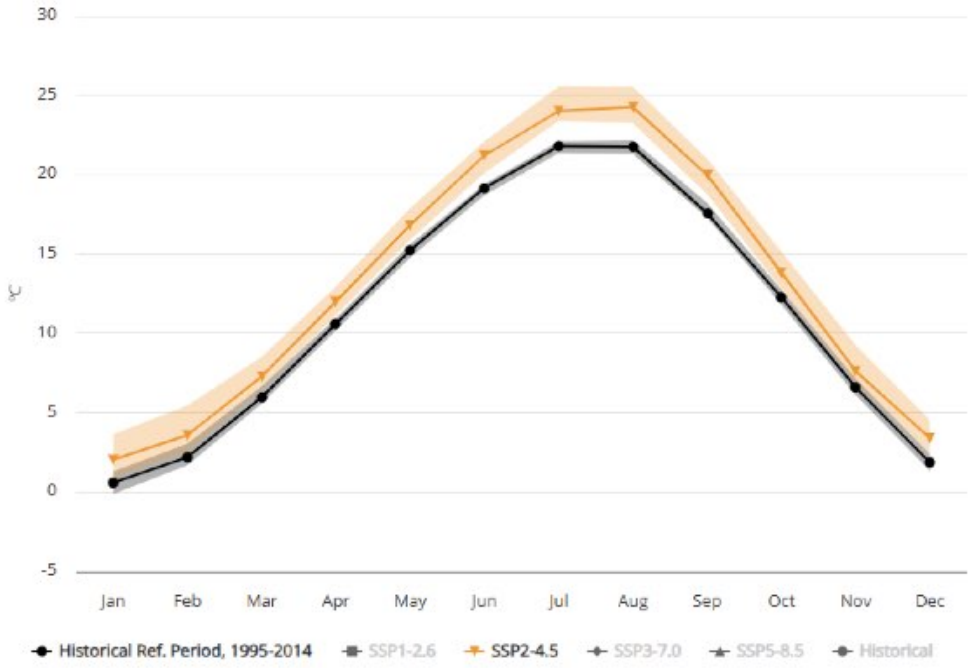
[23] Global Wind Atlas, Global Solar Atlas World Bank Group, 2025 [online] Available at: Global Wind Atlas [Accessed 16 January 2026].

[24] Western Balkans 6, North Macedonia Country Compendium, Country Climate and Development Report, World Bank Group, 2024 [online] Available at: World Bank Document [Accessed 16 January 2026].

[25] IPCC WGI Interactive Atlas: Regional Information (Advanced), Intergovernmental Panel on Climate Change (IPCC), 2025 [online] Available at: IPCC WGI Interactive Atlas [Accessed 16 January 2026].

[26] Chapter 4: Future Global Climate: Scenario-based Projections and Near-terms Information, IPCC, 2021 [online] Available at: Chapter 4 | Climate Change 2021: The Physical Science Basis [Accessed 16 January 2025].

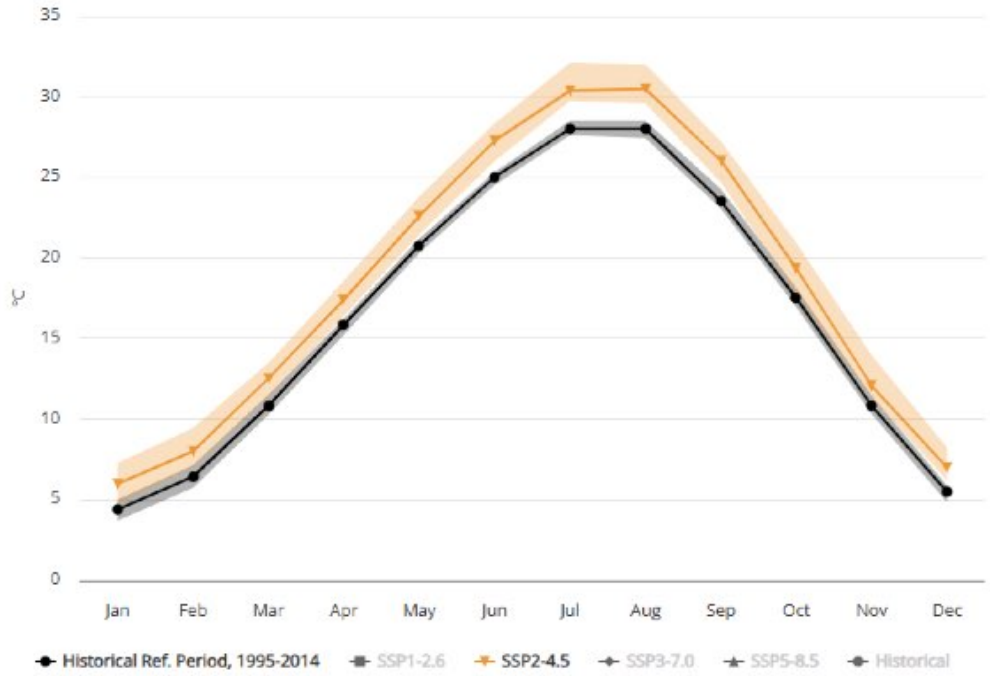
Figure 16-2 Projected average mean surface air temperature. SSP2-4.5 (Source: WBCCKP).



Maximum temperature

Maximum temperatures are Projected to increase in approximately 1.5ºC-3.5ºC, being August the hottest month with 32ºC at the upper end (90th percentile range). During winter, maximum temperatures are Projected to rise 4.4ºC-6.4ºC, reaching a maximum of 9.5ºC (90th percentile).

Figure 16-3 Projected average mean surface air temperature. SSP2-4.5 (Source: WBCCKP).

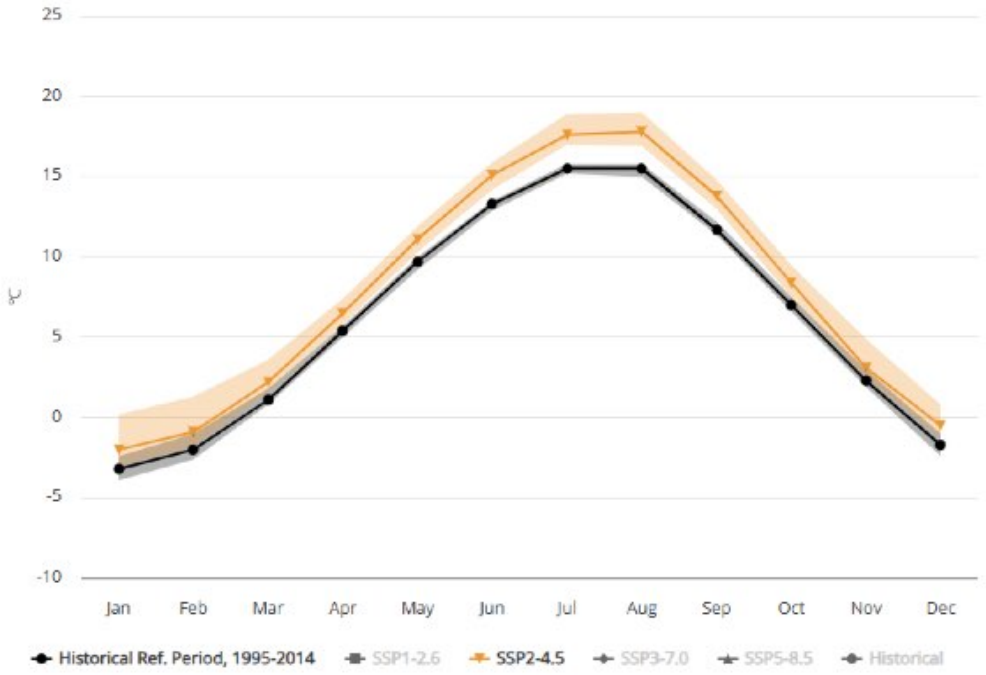


Minimum temperature

Both January and February show a notable increase in minimum, reducing the frequency and intensity of freezing conditions. The Projected minimums suggest fewer days at or near freezing, with January potentially presenting temperatures above freezing at the upper end of the range.

Overall, minimum temperatures are Projected to rise across all months, with winter months warming by 1ºC-2ºC and summer months by 2ºC-3ºC. Resultantly, August minimum temperatures could be as high as 18ºC (90th percentile).

Figure 16-4 Average minimum surface air temperature. SPP2-4.5. (Source: WBCCKP).

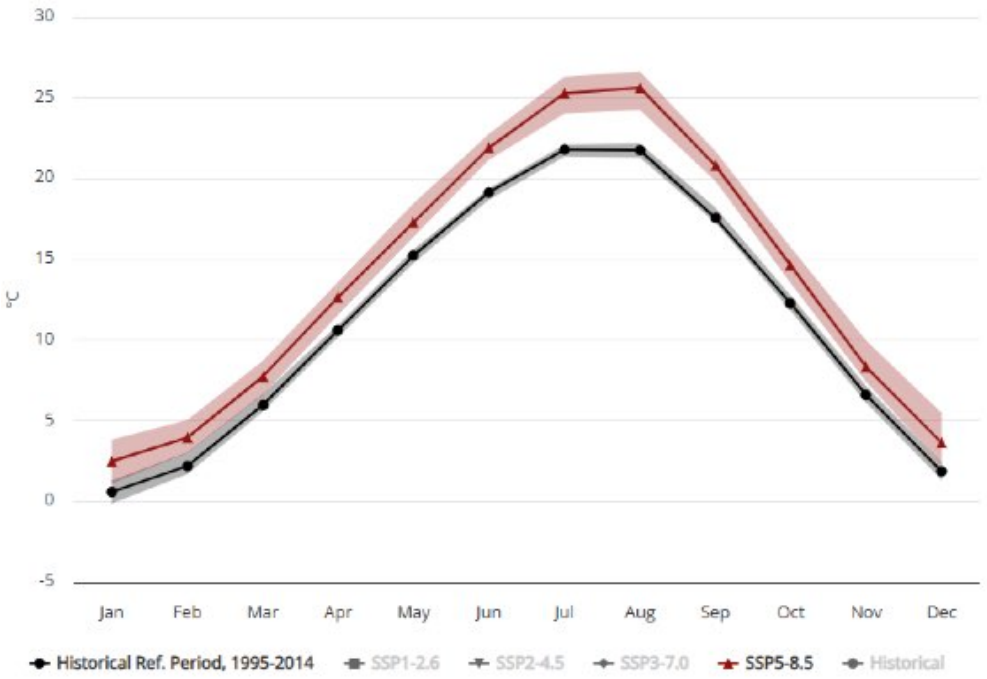


SSP5-8.5

Mean temperature

Under the SSP5-8.5 scenario, a significant increase in average temperature compared to the historical baseline was observed. July and August are Projected to be the hottest months, with average temperatures exceeding 24ºC-26ºC. The coldest months (January and February) show warming of 2-3ºC, with upper bounds nearing 4-5ºC (90th percentile).

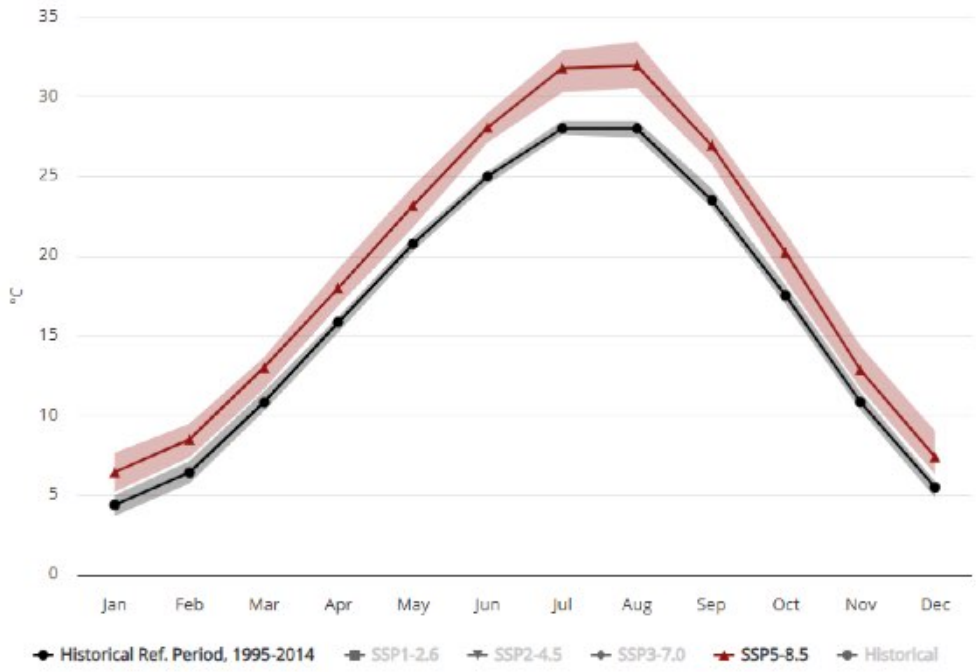
Figure 16-5 Average mean surface air temperature. SPP5-8.5. (Source: WBCCKP).



Maximum temperature

Both January and February show a significant increase of over 2ºC in maximum temperatures compared to the historical period. The upper bounds (90th percentile) suggest that the extreme warm days in winter could reach nearly 7.7ºC in January and 9.5ºC in February. During June, July and August, there is an increase in maximum summer temperatures, indicating hotter and potentially more extreme summer climate, with maximum temperatures exceeding 32ºC.

Figure 16-6 Average maximum surface wind temperature. SSP5-8.5. (Source: WBCCKP).



Minimum temperature

Every month shows a clear increase in minimum temperatures with the most significant warming in winter and early spring. January and February show increased on 1.5ºC-1.6ºC, with Projected minimums exceeding 0ºC, reducing frost and snow cover.

March and April warm by 1.5ºC-2.5ºC, potentially advancing the start of the warm season. July and August minimums rise by 3.2ºC-3.7ºC, with Projected lows nearing 20ºC. End of summer

and start or autumn remain warmer longer.

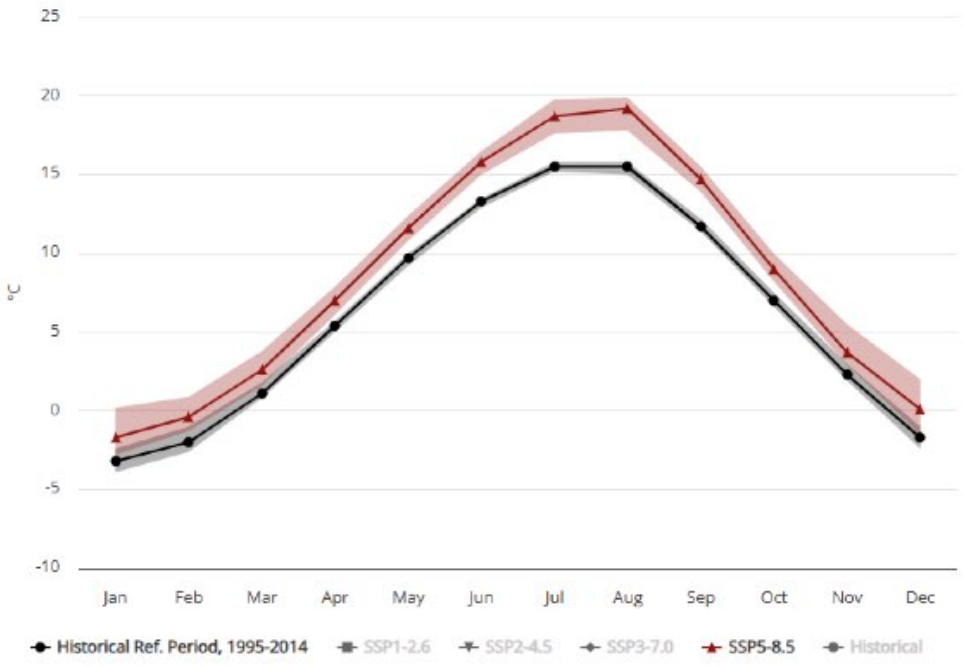


Figure 16-7 Average minimum surface air temperature. SSP5-8.5. (Source: WBCCKP).

16.1.3.3 Precipitation

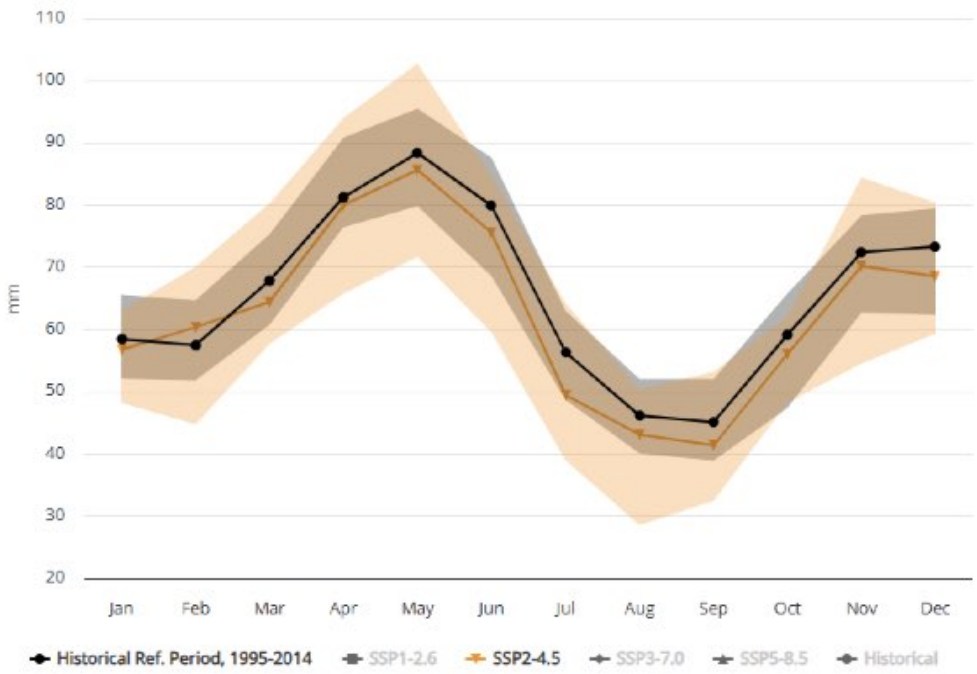
SSP2-4.5

Projected climate data presents modest changes in precipitation compared to historical data, with an overall slight drying trend across the majority of the year. Only February showing a small increase from 57.51mm to 60.42mm under the 50th percentile. All other months demonstrate a small drying trend, of between 56 mm (July) and 49mm (August). However, there is relatively high uncertainty in future rainfall, with the 10th to 90th percentile range being larger under SSP2-4.5 than the historic reference period (current day).

Rainy season remains being spring, staring in March and having a peak in May. Snowfall is not Projected to be significant in this scenario (0.1 mm/day for 90th percentile), according to the IPCC Atlas[27].

Figure 16-8 Projected precipitation. SSP2-4.5. (Source: WBCCKP).

[27] IPCC Atlas [online] Available at: IPCC WGI Interactive Atlas [Accessed 16 January 2026].



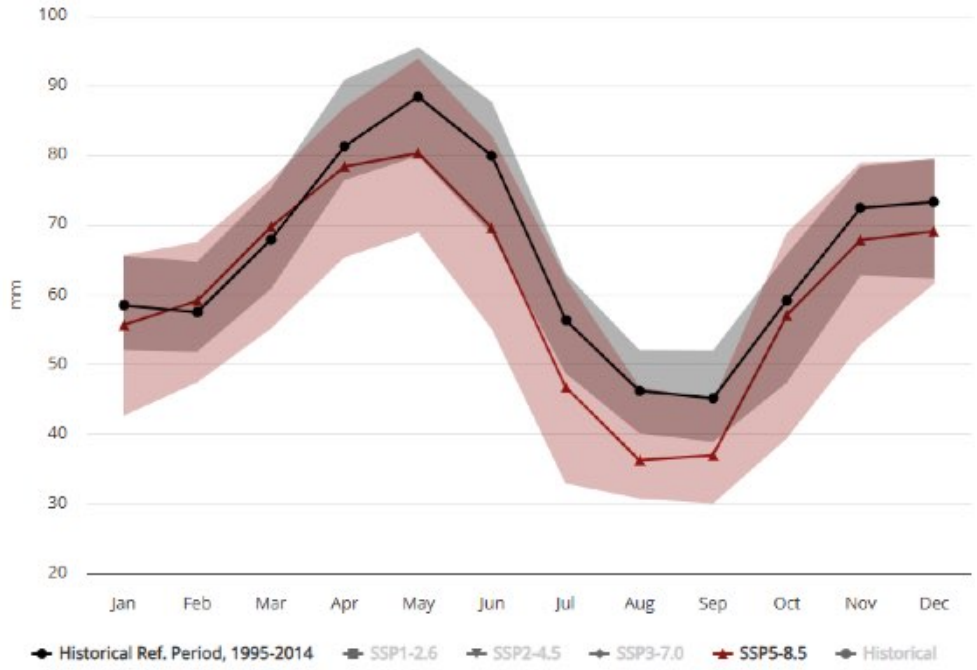
SSP5-8.5

There is Projected to be an overall small drying trend across months, except February. Decrease in precipitations is expected to happen in summer and autumn. Notable decreases were identified in May (decrease of 17.87mm), June (decrease 10.39mm), July (9.64mm), August (9.95mm), September (8.17mm) and October (decrease of 11.76mm).

Snowfall is not Projected to be significant in this scenario (0.1 mm/day for 90th percentile), according to the IPCC Atlas[28].

Figure 16-9 Projected precipitation. SSP5-8.5. (Source: WBCCKP).

[28] IPCC Atlas [online] Available at: IPCC WGI Interactive Atlas [Accessed 16 January 2026].



16.1.3.4 Extreme weather events and other climate hazards

In accordance with the Country Climate and Development Report[29] of the World Bank Group for North Macedonia, it is expected to have floods as the major hazard, with increasing frequency of flash floods due to more intense and irregular rainfall, especially in mountainous and urban areas such as the Project site.

The probability of severe droughts is Projected to raise significantly, with estimates ranging from 25% to 37% annually by 2060, and heatwaves will be more intense due to increase in mean temperature. Rising temperatures and reduced precipitations are expected to increase wildfire frequency and intensity.

The East region is particularly vulnerable to droughts and heatwaves, particularly in summer. Landslides could be triggered by heavy rainfall and floods, especially in mountainous areas.

Based on the IPCC Atlas[30], surface wind speed will present a decrease of 1.4% in the medium term (2041-2060), having 4.3m/s as median value in the SSP2-4.5 scenario. The reduction in wind speed is expected to be higher in the SSP5-8.5 scenario, since the median is Projected around 4.2m/s.

[29] Western Balkans 6, North Macedonia Country Compendium, Country Climate and Development Report, World Bank Group, 2024 [online] Available at: World Bank Document [Accessed 16 January 2026].

[30] IPCC WGI Interactive Atlas: Regional Information (Advanced), Intergovernmental Panel on Climate Change (IPCC), 2025 [online] Available at: IPCC WGI Interactive Atlas [Accessed 16 January 2026].

16.1.4 Physical climate change risk assessment

16.1.4.1 Methodology

The following qualitative methodology is used to determine the level of risk associated with current and future climate impacts to the Project. As stated by EP4, physical risk is defined as:

*Physical risk = Hazard * Exposure * Vulnerability*

A hazard is understood as the potential occurrence of a natural or human-induced physical event or trend, that may cause loss of life, injury, or other health impacts, as well as damage and loss of property, infrastructure, livelihoods, service provision and environmental resources.

Exposure should be measured based on the presence of people, livelihoods, species or ecosystems, environmental functions, services, resources, infrastructure, or economic, social or cultural assets in places and settings that could be affected.

Vulnerability could vary depending on the propensity or predisposition to be adversely affected and includes sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

In accordance with these definitions, the following sections outline the methodology used to estimate hazard, exposure and vulnerability for the Project.

16.1.4.2 Hazard

The range of hazards to be comprised in this assessment were screened based on the Project location and the climate baseline. The Project is mainly located within the municipality of Stip and Radovic and a minor part is in the municipality of Karbinci, and at between 500m and 900m above the sea level.

Based on the Project location and altitude, snowfall and ice have been scoped out from this assessment. Although these hazards can be problematic for windfarms and their infrastructure, the climate is such that it is not a significant hazard currently and, in the future, (considering expected warming and ice prevention systems). The Project is in an earthquake area; nonetheless, earthquake risk is not considered into this assessment as is it not classified as a climate-related risk and the risk level is not expected to change in the future due to climate change. Although some tornadoes have taken place in few points of North Macedonia, there is no register on tornadoes in the Project region, therefore these are scoped out from this assessment.

Therefore, the hazards considered for this assessment include wildfire, landslide, extreme heat and flooding, as screened in the Think Hazard Tool[31] of the Global Facility for Disaster Reduction and Recovery (GFDRR). Table 16-1 contains the classification of these climate physical risks in accordance with EP4 Guidance Note on CCRA. A risk is considered as “acute” when it has a short duration and can cause immediate and severe impacts, whilst a “chronic” risk is a long-term risk and is featured by gradual changes in climate variables that persist over time.

Table 16-1 Hazards classification based on EP4 categories.

Climate hazard category	Acute hazards	Chronic hazards
Temperature related	Extreme heat	Mean temperature change
Water related	Flood	Mean precipitation change

[31] Think Hazard Tool, Global Facility for Disaster Reduction and Recovery (GFDRR), 2025 [online] Available at: Think Hazard [Accessed 16 January 2026].

Climate hazard category	Acute hazards	Chronic hazards
	Heavy rainfall event, hail and ice	
Solid mass related	Landslide	N.A.
Wildfire	Wildfire	
Wind-related	Maximum windspeeds Windblow debris	Changes in average wind speeds

16.1.4.3 Exposure

For the climate hazards identified above, exposure scores were identified based on the climate Projections chosen (see section 16.1.3.2). The scale presented in Table 16-2 was developed in accordance with professional judgement. No quantitative scale was developed to determine the exposure scores.

Table 16-2 Exposure of the Project to the likely hazards

Exposure	Score
Very high (5)	The receptor is frequently exposed to climate hazard (every 1-3 years) which exceeds its design or performance thresholds and could lead to either asset failure, considerable damage, a reduced lifespan, or major service disruption.
High (4)	Hazard affects assets roughly every 5 years
Moderate (3)	The receptor is exposed to climate hazards which could exceed design parameters or could cause damage, failure or reduced lifespan several times over its design life (once every 10 years).
Low (2)	Hazard may affect assets once in its design life.
Very low (1)	The receptor has negligeable exposure to a climate hazard and such a climate hazard is unlikely to affect the receptor in a way which exceeds design parameters or could cause damage, failure or reduced lifespan.

Source: Mott MacDonald

16.1.4.4 Vulnerability

For the Project's receptors, vulnerability was identified considering the sensitivity of the Project components and its adaptive capacity to respond. The sensitivity and adaptive capacity (embedded mitigation) were identified in accordance with the information from the Project.

The adaptive capacity helps to moderate the vulnerability of a component and is estimated based on the allowances or confirmed adaptations of the current design of the Project. Details of the adaptive capacity measures are detailed in Section 16.1.5

Table 16-3: Vulnerability scoring for the Project

Vulnerability	Definition
Very high (5)	Extremely sensitive to climate impacts with minimal ability to adapt. Susceptible to high level of damage / failure or reduced lifespan as a result of climate hazard impacts.
High (4)	Receptor is highly vulnerable with the potential for extensive damage.
Moderate (3)	Receptor is of a moderate vulnerability with limited, measurable adverse impacts to condition.
Low (2)	Receptor is of low vulnerability with minor, short-term change in feature condition.
Very low (1)	Low sensitivity and strong adaptive capacity. Asset/ activity very unlikely to suffer damage or reduced lifespan as a result of impacts of climate hazard.

Source: Mott MacDonald

16.1.4.5 Risk

The CCRA was conducted considering the operational lifetime of the Project, which is stated as 25 years from 2028, when the construction works are planned to be completed. Therefore, the climate time horizon chosen for this assessment is the 2050s (2040-2059), taking 1995-2014 as reference period. The risk to the assets of the Project was identified through the risk matrix in Table 16-4 below, which categorises the level of risk as low, medium, high, or extreme.

Table 16-4 Risk scoring matrix

		Exposure				
		Very low	Low	Moderate	High	Very high
Vulnerability	Very Low	1	2	3	4	5
	Low	2	4	6	8	10
	Moderate	3	6	9	12	15
	High	4	8	12	16	20
	Very high	5	10	15	20	25

Source: Mott MacDonald

Adaptation measures were proposed for all the risks identified. Some of the recommended adaptation actions represent additional that should be considered by designers, operators and O&M contractors as part of their ongoing planning and operational strategies.

16.1.5 Physical climate change risk assessment

The physical climate change risk assessment carried out for the Project is presented in Table 16-5 and has been developed in line with the methodology outlined in section 16.1.4.1. It compiles the potential impacts to the Project based on the vulnerabilities of the Project components and integrates a risk rating to each potential impact.

Recommended adaptation actions are identified which should be applied as part of detailed design, in line with all relevant applicable codes, standards and certifications, as well as through robust and proactive maintenance and best practice Operational and Maintenance (O&M) procedures. By applying these resilience measures this should help to mitigate the risks of the climate hazards throughout the Projects design life. The CRVA should be reviewed and considered within detailed design and within setting O&M requirements / contractor. Assumptions and exclusions for this assessment are outlined in Appendix A.2.

In summary, the CCRA has identified 60 risks (20 risks per current and each of the two future scenario – 3 scenarios in total), of which 0 are very low, 26 are identified to be of a low rating, 24 risks are of a moderate rating, 8 have high rating and 2 have a very high score, as shown in Figure 16-10.

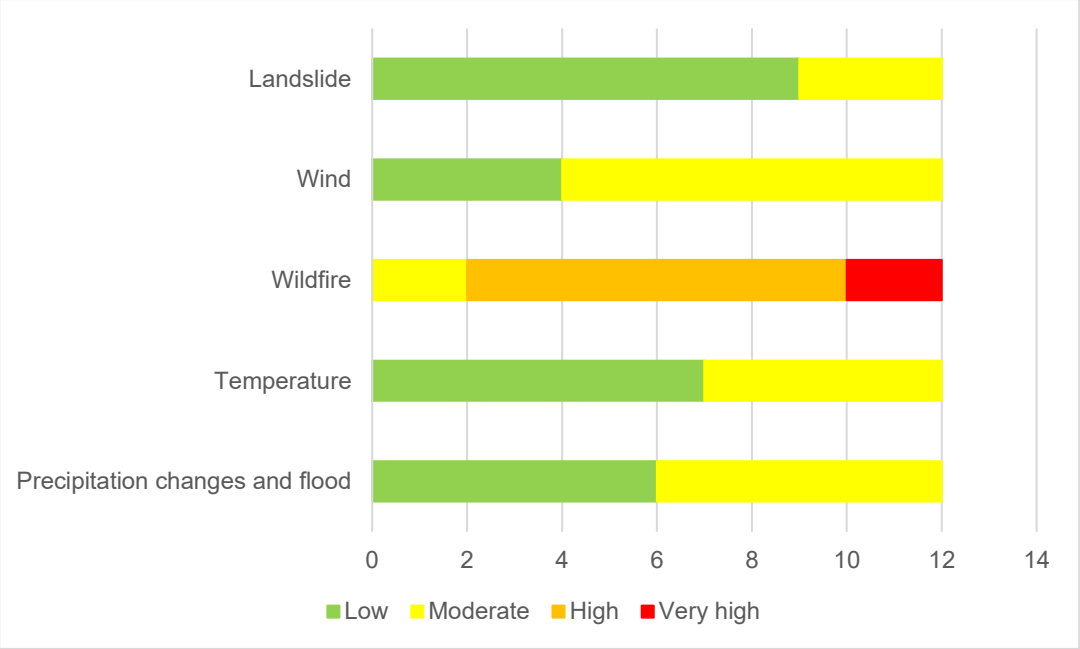


Figure 16-10 Number of risks by risk level.

Table 16-5 Physical Climate Change Risk Assessment of the Project.

Risk ID	Receptor	Climate hazard	Potential impacts of climate change on receptor	Adaptive capacity (Allowances for future climate change within current design)	Current			SSP2-4.5			SSP5-8.5			Recommended adaptation action(s)
					Exposure	Vulnerability	Overall risk	Exposure score	Vulnerability	Overall risk	Exposure	Vulnerability	Overall risk	
WTG 1 Medium voltage collector system 1	WTGs and Medium voltage collector system	Temperature (increases in mean temperature and increased extreme high temperatures)	The average operational temperature range for WTG typically falls between -20ºC and 40ºC. If the maximum threshold was exceeded, high temperatures could affect the WTG, during a period of full load generation, contributing to energy losses. Fatigue and degradation of the turbines and buried cables as result of extreme heat.	WTGs have a cooling system and heat-resistant materials to prevent overheating of components like generators and power electronics.	2	2	4	2	2	4	3	2	6	Apply protective coatings to blades and towers to reduce material degradation. Use thermal sensors and SCADA data to anticipate component stress and schedule preventive maintenance. Consider depth of cables to buffer against surface temperature extremes. Use post-installation soil compaction to reduce air gaps. Monitoring and proactive maintenance.
WTG 2 Medium voltage collector system 2		Wind (increase in speed)	Extreme wind beyond rated speed increases load on blades, gearboxes and towers, accelerating wear and fatigue of these components. Too high wind speed makes harder to regulate rotor speed and direction, increasing wear and energy consumption. Cable exposures due to soil removal Debris striking cables and blades.	If the cut-out speed (usually around 25m/s) is exceeded, the turbine shuts down to prevent damage. The pitch can be controlled to adjust blade angles to reduce lift and slow the rotor.	2	3	6	2	3	6	2	3	6	Integrate SCADA-based system to derate or shut down turbines. Check for soil displacement, exposure or damage after high-wind events.

WTG 3 Medium voltage collector system 3		Precipitation changes (increase in extreme precipitation events, uncertain changes in annual average precipitation) and flood	Increased water infiltration and soil erosion, affecting buried cables and WGTs foundations. Moisture increase and water ingress in electrical systems that could damage control systems, transformers and switchgear, could happen due to damaged sheathing or joints	Modern ETGs are designed with sealed nacelles and control cabinets to avoid moisture ingress. Materials are corrosion-resistant, and SCADA systems allow the monitoring of moisture levels, vibration anomalies and electrical faults. Buried cables are sheathed cables to resist mechanical damage and water ingress. Integration on drainage system.	2	2	4	2	2	4	3	2	6	Use of corrosion-resistant materials. Implement drainage systems around turbine foundations to prevent water pooling and erosion, in line with international standards, codes and relevant hydrological and flood risk assessments developed for the Project. Scada integration for early detection of water-related faults. Consider burial of cables in areas prone to flooding. Flexible joints and slack loops to accommodate soil movement. Develop protocols for rapid inspection and repair after extreme weather events as part of O&M.
WTG 4 Medium voltage collector system 4		Landslide	Undermining or displacement of foundations and buried cables, causing tilting and/or cracking of foundations and exposure and/or stretch of buried cables. Ground movement could cause water ingress to WTGs and buried cables, leading to insulation failure or conductor damage.	Slope stability and soil assessments are being undertaken to identify and avoid as much as possible landslide-prone areas within design.	2	2	4	2	2	4	2	2	4	Consider deep pile foundations and flexible foundation designsif required based on local soil conditions.. Implement surface water management systems to reduce soil saturation. Plant vegetation that helps with water retention and soil stability.
WTG 5 Medium voltage collector system 5		Wildfire	Structural damage, affecting paint and coating and tower integrity if exposed to prolonged heat, as well as burried cables. Infiltration of smoke and soot causing sensor malfunctions and reducing cooling efficiency. Operational disruption for preemptive shut down due to grid instability.	The structural design of WTGs has composites that can resist moderate heat. SCADA system allows remote shutdown and monitoring during wildfire events. Cables are buried and insulated.	4	2	8	4	2	8	5	2	10	Clear vegetation within a determined radius around each WTG to create a defensible space. Enable safe turbine shutdown during fire alerts. Implement an emergency response plan, that includes fire response and evacuation, as well as coordination with local fire services (e.g. Civil Defence). Prefer fire-resistant cable insulation and bury cables deeper in fire-prone areas to reduce thermal exposure, when required.

Substation 1 Control building 1	Substation and control building	Temperature (increases in mean temperature and increased extreme high temperatures)	Reduction of transformer efficiency and increase in cooling demand due to overheating. Misalignment of components due to expansion of materials in extreme high temperature. Negative impact on personnel health and productivity, particularly in the control building.	SCADA system allows the thermal monitoring. The substation and control building have a cooling system.	2	2	4	2	2	4	3	2	6	Ensure SCADA integration for remote diagnostics and preventive maintenance. Prioritise reflective or cool roofing materials to minimise solar absorption. Prioritise remote operation capabilities to reduce on-site personnel exposure. Implement landscaping with shade trees or green roofs to reduce building heat load.
Substation 2 Control building 2		Wind (increase in speed)	High winds can damage equipment, specially if debris is blown into the equipment. Support structure fatigue and wear. Severe wind events may trigger automatic shutdown.	Weatherproof housings for sensitive components and sealed cable entries. SCADA integration for remote diagnostics and control	2	2	4	2	2	4	1	2	2	Use of reinforced structures and wind-rated enclosures. Installation of windbreaks or protective barriers around sensitive equipment. Design of relevant backup systems to maintain operation during partial failures. Regular inspections and reinforcement of vulnerable components as part of O&M. Prefer remote operation to reduce on-site personnel. Monitoring and preventive maintenance.
Substation 3 Control building 3		Precipitation changes (increase in extreme precipitation events, uncertain changes in annual average precipitation) and flood	Rain can penetrate through small openings (windows, roof) leading to water damage and electrical hazards such as short circuits and flashover. Persistent dampness can degrade building materials and electrical components, for example speeding up corrosion of metal parts.	Implementation of drainage system to manage runoff and prevent pooling. Use of corrosion-resistant materials.	2	3	6	2	3	6	4	2	8	Elevation of backup systems to avoid power outages. Implement drainage systems have the capacity for extreme rainfall, including appropriate allowance for climate change where relevant. Review and implement waterproofing and sealing, specially in cable entries and joints, according to applicable codes and standards. Monitoring and preventive maintenance.

Substation 4 Control building 4		Landslide	Collapse foundations of transformers, switchgear and support structures. Break grounding connections with the substation and control building.	Slope stability and soil assessments to avoid as much as possible landslide-prone areas.	2	2	4	2	2	4	2	2	4	Implement terracing and/or vegetation to increase soil retention. L Integrate alerts into SCADA system for real-time response. Train staff on landslide risk awareness and response protocols.
Substation 5 Control building 5		Wildfire	High temperatures can cause thermal damage in components of substation and control building. Fire-damaged transformers or switchgear can lead to outages. Reduction of air quality for staff due to smoke infiltration.	Remote monitoring.	4	3	12	4	3	12	5	3	15	Integrate wildfire detection systems into SCADA when feasible. Train staff in wildfire response and evacuation procedures. Coordinate with local fire services (e.g. Civil Defence) for rapid response.
OHL 1	Overhead Line (OHL)	Temperature (increases in mean temperature and increased extreme high temperatures)	Thermal expansion and sag of conductors, as well as faster degradation. Reduction of current-carrying capacity (ampacity) and increase of energy losses during transmission.	Average conductors are able of resisting very high temperatures with sufficient capacity to handle additional temperature variations expected due to climate change.	2	2	4	2	2	4	3	2	6	Real-time monitoring of weather and line conditions to optimise power flow based on actual capacity.

OHL 2		Wind (increase in speed)	Increased tension and oscillation in overhead lines can lead to materials fatigue, and conductor snapping. Windborne debris can strike and damage infrastructure.	No adaptive capacity in place.	2	3	6	2	3	6	21	3	6	Verify structural reinforcement to withstand higher wind loads, if required. Install vibration dampers to reduce aeolian vibration. Use smart grid technologies to detect and respond to faults quickly. Remove potential windborne debris near lines.
OHL 3		Precipitation changes (increase in extreme precipitation events, uncertain changes in annual average precipitation) and flood	Erosion of foundations of towers, leading to potential instability. Corrosion of metal components and degradation of insulators. Short circuits due to water accumulation. Muddy terrain that can delay repair crews and increase outage duration.	Integration of drainage system including climate change allowance where relevant.	2	2	4	2	2	4	3	2	6	Implement drainage systems to include appropriate allowance for climate change. Prefer hydrophobic insulators that resist water accumulation. Implement regular inspection and maintenance schedules to prevent damage. Use of protective coating/insulators and galvanised components to prevent corrosion.
OHL 4		Landslide	Undermining or displacement of tower foundations, causing towers to tilt, shift or collapse. Ground movement can snap or overstretch conductors.	Slope stability and soil assessments to avoid as much as possible landslide-prone areas and inform design parameters.	2	3	6	2	3	6	2	3	6	Implement retaining walls with sufficient strength to withstand maximal pressure from landslide risk, terracing or soil nailing to stabilise slopes. Use vegetative cover to increase soil retention. Develop rapid response protocols/plans. Collaborate with communities and governmental authorities to report early signs of slope instability.

OHL 5		Wildfire	Direct flame damage of conductors and insulators. Deformation of metal components and collapse of towers. High temperatures from fire can increase conductor sag, causing contact with the ground.	No adaptive capacity in place.	4	4	16	4	4	16	5	4	20	Use fire-resistant insulators and coatings, if possible. Enforce clearance zones around OHL in alignment with the applicable rulebook / design requirements. Use real-time weather and fire risk data to adjust operations. Collaborate with fire agencies and local governments to assist wildfire emergencies.
Roads 1	Roads	Temperature (increases in mean temperature and increased extreme high temperatures)	Asphalt and concrete softening, rutting (permanent deformation from vehicle loads), cracking, joint failure and/or buckling.	No adaptive capacity in place.	2	2	4	2	3	6	3	3	9	Implement preventive maintenance programs to seal cracks and resurface roads before major damage occurs. Monitoring and preventive maintenance.

Roads 2		Wind (increase in speed)	Destabilisation of high-profile vehicles and loss of control. Blow of trees, branches, signage and debris onto roads, obstructing traffic and causing accidents. Damage of signage.	No adaptive capacity in place.	2	3	6	2	3	6	1	3	3	New signage as per codes and standards, and barriers to withstand higher wind loads. Regularly trim trees and remove weak branches near roads. State wind-speed thresholds for restricting high-profile vehicles.
Roads 3		Precipitation changes (increase in extreme precipitation events, uncertain changes in annual average precipitation) and flood	Very high rainfall can lead to floods in roads, which can delay maintenance and emergency response. Prolonged water exposure can weaken pavement layers, leading to potholes and structural failure. In hilly and/or unpaved areas, embankment collapse and road washouts could appear. Electrocution and /or physical injury of staff	Drainage system implementation.	2	2	4	2	2	4	3	2	6	Review drainage system to check its capacity to handle higher flow volumes. Regularly inspect and clean drainage system. Develop emergency response plans.

Roads 4		Landslide	Block or destroy access and internal roads, cutting off access and making difficult to perform the repairs and implement other emergency measures.	Slope stability and soil assessments to avoid as much as possible landslide-prone areas.	2	2	4	2	2	4	2	2	4	Stabilise slopes and embankments with retaining walls that are designed to withstand reasonable landslide risk (as informed by soil assessment), geotextiles and vegetative cover.
Roads 5		Wildfire	Access roads may be compromised during fires, affecting response time, and also increased risk of asphalt melting and debris damage to roads and road drainage.	No adaptive capacity in place.	4	4	16	4	4	16	5	4	20	Maintain access roads, ensuring they are wide, clear and accessible for emergency vehicles. Explore alternative roads to access, especially for emergency access.

16.1.6 Climate benefits from the Project

The identification and assessment of climate-physical risks associated with the Project, alongside the implementation of adaptation measures to increase resilience against these risks, reduces the likelihood of failing during climate hazard events, reducing environment, health and safety damage from WGTs breakdowns.

In addition, as outlined in section 16.1.1, this Project will generate energy from renewable and clean sources. Therefore, it is expected that the Project will not generate significant carbon emissions during its operational phase. On the contrary, the windfarm operation will be translated into carbon savings, which significantly contributes to climate change mitigation in line with nationally determined contributions.

Through the assessment of the net GHG emission savings from the Project, positive benefit can be estimated. Applying the International Finance Institution (IFI) GHG Accounting for Grid Connected Renewable Energy Projects[32] approach, the scope of GHG emissions quantified excludes Project construction emissions and focuses only on the net GHG emission benefit from the renewable energy generated by the Project in operational phase. This estimate will inevitably be subject to change over the useful life of the Project, depending on the variable yields, rate of future grid decarbonisation and other influencing parameters.

The net GHG emissions benefit is calculated based on the principle that electricity generated from renewable sources and supplied to the electricity grid, will avoid emissions that would otherwise be generated from the mix of energy generation sources that make up the grid (including carbon intensive fossil fuel plants).

In the calculation, the annual electricity output from the Project is multiplied by the relevant GHG emission factor for the grid. In this case, the IFI combined margin grid emission factor applicable to intermittent energy generation in North Macedonia for 2021[33] has been used.

The assumptions for the Project energy output are based on the provided information in the email “RE: MKD STIP Macedonia Climate Resilience and Adaptation Chapter”. This declares an annual energy production of 808 GWh (active energy injected to the grid).

Based on the estimated Project energy production of 808,000 MWh per year and the combined margin grid emission factor of 743 gCO_2/kWh, the estimated annual net GHG emission benefit for the Project would be 674,644 tonnes of CO_2e per year.

As conclusion, the Project will not only contribute to increase the installed capacity and renewable electricity generation in North Macedonia, but also to create a positive outcome since it supports the decarbonisation of the energy sector and the transition to a low-carbon economy.

[32] GHG Accounting for Grid Connected Renewable Energy Projects, IFI TWG-AHSA-001, International Financial Institutions Technical Working Group on Greenhouse Gas Accounting [online] Available at: Renewable Energy_GHG accounting approach.pdf [Accessed 16 January 2026].

[33] The IFI Dataset of Default Grid Factors v3.1, United Nations Framework Convention on Climate Change, 2022 [online] Available at: https://unfccc.int/sites/default/files/resource/IFI%20Default%20Grid%20Factors%202021%20v3.1_unfccc.xlsx [Accessed 16 January 2026].

Appendices

A. <Insert first appendix heading> **Error! Bookmark not defined.**

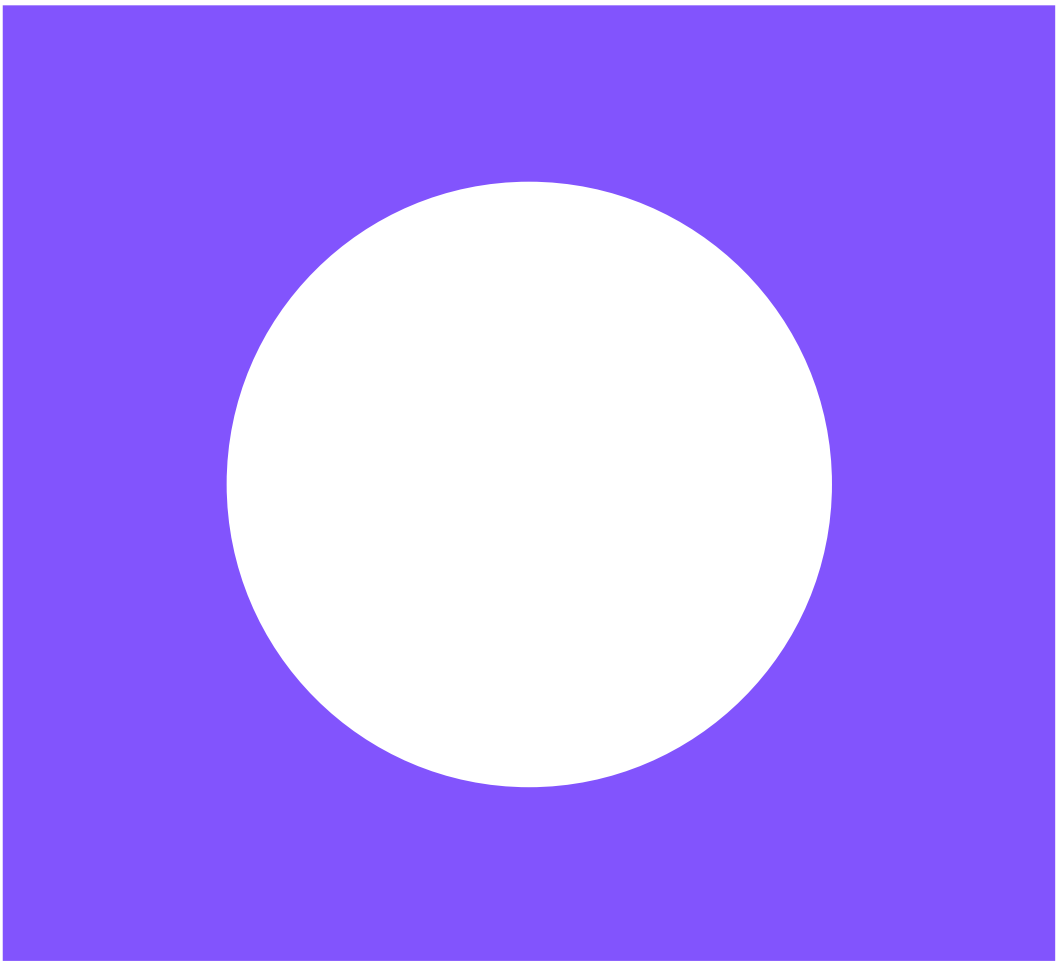
A. Climate change limitations disclaimer

This is a high-level CRVA. Climate data for this assessment was obtained from freely available information available from credible third parties for reporting purposes. This included observational data from local weather stations, freely available climate change Projections and a range of climate change datasets and literature. The following limitations and disclaimers are noted:

- Climate change Projections: climate Projections are not predictions or forecasts but simulations of potential scenarios of future climate under a range of hypothetical emissions scenarios and assumptions. The Projections from climate models cannot be treated as exact or factual, but Projection only. They represent internally consistent representations of how the climate may evolve in response to a range of potential forcing scenarios and their reliability varies between climate variables. For a single emission scenario, Projections can vary significantly as a function of the model used and how it is applied, so that there is a wide uncertainty within the results. Scenarios exclude outlying “surprise” or “disaster” scenarios in the literature and any scenario necessarily includes subjective elements and is open to various interpretations. Regional Projections are generally more certain than global, and temperature Projections more certain than those for precipitation. Furthermore, the degree of uncertainty associated with all climate change Projections increases for Projections further into the future. Climate models and associated Projections are updated on a regular basis, implying changes in the forecasted future climate. Climate modelling and downscaling of the climate models to a site-specific detail is beyond the scope of this Project.
- Validation of information: the climate observational and Projection data used for this assessment was considered to be the best freely available climate data. However, Mott MacDonald did not independently verify the climate observational or Projection data and does not accept responsibility or liability for any inaccuracies or shortcomings in this information. Should these information sources be modified by third parties, Mott MacDonald assumes no responsibility for any of the resulting inaccuracies in our report. Issued reports are relevant to the Project information provided and are not intended to address changes in Project configuration or modifications which occur over time. The data is obtained to provide a general ‘sense check’ on the published literature on existing observational and climate Projections for the region.
- Mott MacDonald did not undertake any climate modelling and this assessment was based on freely available data on climate Projections in this region. Accordingly, any further research, analysis or decision-making should take account of the nature of the data sources and climate Projections and should consider the range of literature, additional observational data, evidence and research available - and any recent developments in these.
- Application of information: climate Projections are used in climate impact assessment modelling, whose results therefore carry the uncertainty associated with the input data. In addition, any environmental modelling exercise is an approximation of the real natural processes and has its own uncertainty related to the choice of model and its configuration, its spatial and temporal resolution, and the information used for its calibration. Mott MacDonald followed accepted procedures in providing this assessment, but results must be interpreted in light of the related overall uncertainty.
- Detailed information on the Project design and other requests for information were not available at the time of writing as the Project is at an early stage. Additional information will be made available as the Project progresses.

- As the embedded climate allowance measures have not yet been confirmed for this Project, the CVRA should be read with caution. It is recommended that these measures are reviewed and considered within the design to contribute to the Project's resilience to future climate change. The CVRA should then be reviewed and scored appropriately in line with the measures considered.
- Exposure scores were identified based on the climate Projections and were scored based on a five-point scale from very low to very high exposure. Quantitative criteria for determining the exposure scores were not defined and were based on professional judgement.

B. Assumptions and exclusions

The assessment has been conducted based on design maturity level and design information available at the time of writing. Assumptions have been made based on best practice or based on how climate change is accounted for within relevant design standards. Any assumptions regarding these resilience measures are outlined within the risk table.

It is recommended that the CRVA is reviewed as part of future design stages and that resilience measures outlined within this report are confirmed to be embedded within each future Project stage including detailed design and operational management.